

Self-Transcendence and Self-Determination:
Possibilities of Why and When Nature is Beneficial

by

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B.A. (Honours), Carleton University, 2010
M.Sc., University of Victoria, 2013

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Abstract

Nature's salutary effects are well-established. A psychological connection to nature and exposure to nature are both associated with a variety of well-being indicators. Attempts to explain why these benefits occur are often from the perspective of why nature reduces ill-being. This leaves a lack of understanding of why nature increases well-being (e.g., hedonic and eudaimonic well-being). Self-transcendence is proposed as a mechanism that is activated by nature and explains why people feel greater well-being from engaging with it. In addition to understanding why nature is beneficial, we need to understand when—under what conditions—it is beneficial. The benefits of nature vary based upon conditions such as the amount of biodiversity in the area and personality of the person in nature. Motivation to engage with nature is implicated as an important factor for whether or not nature is beneficial. Two multi-study manuscripts address these questions: (1) does self-transcendence explain why nature is beneficial and (2) does nature engagement motivation affect whether nature is beneficial?

Keywords: nature, natural, well-being, happiness, self-transcendence, motivation

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Dedication

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Self-Transcendence and Self-Determination:

Possibilities of Why and When Nature is Beneficial

The natural environment is beautiful, powerful, and can significantly impact human life for better or worse. The modern world has shifted away from nature with a vast majority of people in industrialized nations living in urban centres. Most jobs in urban centres involve little to no interaction with the natural world. In addition, use of electronic devices has increased. People are on social media, reading news, and playing games—potentially at the cost of reduced time in nature. Why does it matter? Because nature can benefit people. A psychological connection to nature is associated with greater happiness (Capaldi, Dopko, & Zelenski, 2014). Exposure to nature is even more beneficial to happiness (McMahan & Estes, 2015). Physical health may also benefit from exposure to nature (Bowler, Buyung-Ali, Knight, & Pullin, 2010). The benefits of nature have strong implications. For example, one study projects that the prevalence of mental health issues, and their respective societal costs, could be significantly decreased if people spent 30 minutes or more in nature each week (Shanahan et al., 2016). Considering the personal and societal benefits, many pertinent questions remain in this area. Two that are the focus of this dissertation are: (1) why does nature benefit human well-being and (2) what conditions are necessary for nature to benefit human well-being?

To address why and when nature is beneficial, a review of the well-being benefits associated with nature is first offered. Explanations of why these benefits occur are subsequently reviewed. I note that most of these explanations address why nature reduces ill-being (e.g., stress), but not why nature increases well-being (e.g., hedonic and eudaimonic well-being). To address this gap, I propose self-transcendence as an explanation of why nature increases well-being. The benefits of nature are then discussed from the perspective of what conditions are

necessary for them to occur. Specifically, several endogenous (characteristics about a person) and exogenous (characteristics about the situation) conditions that can affect the benefits of nature are discussed. An endogenous condition that is related to well-being in a variety of other domains is motivation. Autonomous versus controlled motivation is proposed as a condition that is necessary for nature to increase people's well-being.

Nature and Well-Being

There are many benefits of natural settings for well-being. Experimental studies that test these effects use a variety of operationalizations such as the presence of plants in a room, showing videos of nature, or walking in natural settings. Moreover, the natural world is diverse. There are numerous different biospheres from tundras to mountains to coastlines; each includes different flora and fauna. Due to the variety of operationalizations and the diversity of the natural world, a conceptualization of nature is necessary. In this dissertation, I refer to nature “as environments and physical features of nonhuman origins, ranging from plants to non-built landscapes” (Capaldi, Passmore, Nisbet, Zelenski, & Dopko, 2015, p. 1).

A distinction is made between different types of well-being in this dissertation. Ill-being refers to negative psychological experiences such as depression, stress, and anxiety. Well-being is a general term used to indicate relative lack of ill-being and relative abundance of positive psychological experiences. Positive psychologists refer to this positive side of well-being as the ‘life above zero’ (Baumgardner & Crothers, 2008) and it is often subdivided into hedonic and eudaimonic well-being. Hedonic well-being is concerned with attainment of maximum pleasure and avoidance of displeasure or pain (Ryan & Deci, 2001). Eudaimonic well-being, on the other hand, is focused towards fulfilling one's true potential by living according to one's authentic self (Ryff, 1995). Personal expressiveness of one's authentic self is of utmost concern for eudaimonic

well-being (Waterman, 1993; Waterman et al., 2010). Hedonic and eudaimonic well-being are the focus of the current research. Their relations with connection to nature and nature exposure are discussed.

Psychological Connection to Nature

The evolutionary history of humans involves centuries of direct contact with nature and complete reliance upon it. This evolutionary heritage is the foundation of the biophilia hypothesis which suggests that humans have an inherent connection to nature and therefore benefit from engaging with it (Kellert & Wilson, 1993; Wilson, 1984). Such a connection to nature has been examined as a psychological feeling of community with nature (Mayer & Frantz, 2004), an affective, cognitive, and physical relationship with nature (Nisbet, Zelenski, & Murphy, 2009), and an implicit part of identity (Schultz, Shriver, Tabanico, & Khazian, 2004). Each of these are positively related with hedonic well-being (Capaldi et al., 2014). There is also evidence that they are related with eudaimonic well-being (Cervinka, Röderer, & Hefler, 2012; Howell, Dopko, Passmore, & Buro, 2011; Nisbet, Zelenski, & Murphy, 2011; Trigwell, Francis, & Bagot, 2014; Zelenski & Nisbet, 2014).

Exposure to Nature

Exposure to nature can range from having a plant in an office (Weinstein, Przybylski, & Ryan, 2009) to spending multiple days on a back-country camping trip (Løvoll, Vittersø, & Wold, 2016). Virtual or simulated nature is also included within the conception of exposure to nature. Virtual nature includes pictures (Ulrich, 1979), videos (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009), sounds (Alvarsson, Wiens, & Nilsson, 2010; Hedblom, Heyman, Antonsson, Gunnarsson, 2014) and virtual reality (Annerstedt et al., 2013). All of these types of exposure have a positive relationship with hedonic well-being (McMahan & Estes, 2015). As

expected, there is a gradient of influence whereby exposure to actual nature has a stronger effect than exposure to virtual nature upon well-being (Kjellgren & Buhrkall, 2010; Mayer et al., 2009; McMahan & Estes, 2015).

Effects of exposure to nature upon eudaimonic well-being have received much less attention. A major issue in this area is the variety of ways eudaimonic well-being has been operationalized. The most common assessment tool is Ryff's (1989, 1995) psychological well-being scale which is loosely based in eudaimonist philosophy and contains six subscales spanning self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth. Only personal growth has been found to relate to self-reported nature exposure (Herzog & Strevey, 2008). Other assessments of eudaimonic well-being include single items such as a question about how worthwhile things are in one's life (White, Pahl, Wheeler, Depledge, & Fleming, 2017) or creativity and vigor (Korpela et al., 2017), which have been found to relate with nature exposure. Meaning in life often serves as an indicator of eudaimonic well-being, but no support has been found for its relation with nature exposure (Passmore & Holder, 2017; Passmore & Howell, 2014).

Other than psychological well-being, most indicators of eudaimonic well-being focus on isolated concepts such as feelings of interest, engagement, or enthusiasm (Løvoll et al., 2016). Instead, a holistic, theoretically-grounded conceptualization may better serve assessment, such as the Questionnaire for Eudaimonic Well-Being (Waterman et al., 2010). This measure was used by Webber, Hinds, and Camic (2015), who found that time spent in a gardening plot (also known as allotment garden) was related with eudaimonic well-being. However, it is unknown whether these findings are limited to gardening or broadly applicable to all nature activities. Thus, the relation between nature and eudaimonic well-being requires further inquiry.

Subjective vitality, which refers to feelings of energy or aliveness (Ryan & Frederick, 1997) is associated with immersive nature exposure (Ryan, Weinstein, et al., 2010). This finding has been interpreted as evidence of a relation between nature exposure and eudaimonic well-being (Capaldi et al., 2015). However, this interpretation is problematic because eudaimonist philosophy contains no mention of feelings of energy or aliveness, nor is eudaimonia mentioned in Ryan and Frederick's (1997) cardinal article on subjective vitality. Although energy is required for eudaimonic pursuits, this does not justify equating these concepts. Rather, they are best treated as separate, but related concepts (Huta & Ryan, 2010; Ryan, Huta, & Deci, 2008).

Explanations of the Benefits of Nature

The reasons that nature is beneficial for physical health seem easy to intuit. For instance, air quality—as indicated by large amounts of oxygen and low amounts of pollutants—is good for a number of health outcomes including the respiratory system (Kuo, 2015). However, the reasons that nature is beneficial for mental well-being are not as easy to intuit or assess. This difficulty has led to a variety of explanations.

As previously mentioned, there is a recognition of human connection to nature based on our evolutionary heritage. This forms the basis for most understandings of why nature is beneficial for well-being including the biophilia hypothesis, stress-reduction theory, attention restoration theory, and the reasonable person model. Some other explanations of the benefits of nature rely on biological aspects of the environment interacting with human functioning. Finally, a proposition of the role of self-transcendence is offered as an additional explanation.

Early Theories

The biophilia hypothesis, as mentioned previously, suggests that humans have an affinity for nature as a result of an ancestral connection to it (Kellert & Wilson, 1993; Wilson, 1984).

This connection is especially prevalent when considering that humans are animals. There is a long history of trying to separate humans from animals (Philalethes, 1864), but the distinction is more continuous than categorical. Wilson (1984) argues that a human connection to nature includes animals—humans and animals are as inherently connected as humans and natural landscapes. The biophilia hypothesis evolved from addressing a relationship between humans and animals to the current conceptualization that humans have an inherent connection to natural settings. The result of this inherent connection to nature is a preference for natural settings over non-natural settings and benefits from engaging with them (Kardan et al., 2015). However, preference does not necessarily explain the salutary effects.

Stress-reduction theory was proposed as an attempt to address the environmental situations that help to reduce stress rather than increase it (Ulrich et al., 1991). For example, a crowded, bustling city may increase physiological and psychological experiences of stress, but a calm nature setting may reduce stress. Findings from several lines of research show that natural settings are, in fact, effective at reducing stress levels (Bratman, Hamilton, & Daily, 2012). However, the theory does not adequately explain what processes are involved.

Attention Restoration Theory and the Reasonable Person Model

Attention restoration theory also rests upon the foundation of an ancestral connection to nature, but extends stress-reduction theory by specifying the types of environments that are beneficial for reducing stress (S. Kaplan, 1995). Similar to stress-reduction theory, attention restoration theory explains how nature reduces ill-being such as stress. The theory posits that human attentional resources are exhausted by anything that requires directed attention. Depleted attentional resources are best restored by sleep but can potentially be restored through other experiences that do not require directed attention. There are many activities that do not require

directed attention but do not restore attentional resources (e.g., absorption while watching TV). Fascination is posited as a core quality of restorative experiences. Experiences that draw one's attention because they are fascinating have the potential to restore attentional resources, but fascination alone is insufficient to restore. Two different types of fascination can be distinguished: hard and soft. Hard fascination requires attentional resources, whereas soft fascination draws attention but leaves sufficient mental capacity for reducing cognitive experiences that may be draining (Basu, Duvall, & Kaplan, 2018). Kaplan (1995) suggests that natural settings generally offer opportunities for soft fascination. He also notes that for an environment to be restorative it must provide a sense of being away from one's regular experience, it must be isolated and represent a whole other world that is different from what one is normally used to, and it must be compatible with one's abilities and desires.

Attention restoration theory provides a framework for understanding how natural environments can reduce experiences of ill-being (i.e., stress, depression, and anxiety) but does not directly explain how nature can increase well-being (i.e., hedonic and eudaimonic well-being). A potential indirect mechanism is that the restored attentional resources which reduce negative affect leads to increased positive affect. For instance, nature reduces stress which produces happiness because one is no longer stressed. However, positive and negative affect are independent (Diener & Emmons, 1985). Influencing negative affect does not necessarily influence positive affect and vice versa. On the other hand, attention restoration contains tenets that may help explain why nature influences eudaimonic well-being. Specifically, Kaplan (1995) explains that compatible environments (a key component of attention restoration theory) are those that enable a person to engage in their desires. This could be interpreted as an environment that allows the authentic self to emerge. However, this has not been tested. Importantly, though,

attention restoration theory provides an important framework for understanding how nature can reduce aspects of ill-being but does not fully explain why nature increases well-being.

More recently, Kaplan and Kaplan (2011; 2009) broadened attention restoration theory to capture the benefits of nature beyond restoration of attentional resources. They refer to their model as the reasonable person model. A reasonable person is proposed to be able to conduct three processes: build effective mental models that accurately predict an environment, produce meaningful action in an environment, and be effective. A core cause of unreasonableness is proposed to be an overload of information upon any of these processes. Nature can purportedly reduce the influx of overwhelming information, as it elicits soft fascination which does not require directed attention. The reasonable person model does not overcome the drawbacks of attention restoration theory that I have raised. In the reasonable person model, the well-being benefits of nature are encapsulated in the experience of reasonableness. That is, being reasonable is being well. However, no further explanation is offered of the processes at play.

Biological Processes

Psychological explanations of nature's benefits take into account evolutionary history but neglect biological explanations. Kuo (2015) attempts to integrate these by focusing on the experiences in nature (e.g., walking, viewing, locations) and the aspects of nature that are known to be beneficial (e.g., negative air ions, biodiversity, pollution) for physiological and psychological well-being. The proposed model suggests that spending time in nature with active ingredients for health benefits will influence factors about a person including their momentary physiological and psychological state as well as healthy behaviours. The physiological and psychological states, in conjunction with the healthy behaviours are believed to lead to health

outcomes. This model is a worthwhile attempt to integrate disparate lines of research but does not fully explain why nature increases well-being.

These theories of why nature is beneficial have provided important insight and inspired strong lines of research. However, they mainly focus on the reduction of ill-being (e.g., stress, depression, and anxiety), but do not adequately capture the increase of well-being (e.g., hedonic and eudaimonic well-being) caused by nature. A potential mechanism to make sense of this benefit for well-being is the ability of nature to inspire a connection to something beyond oneself.

Self-Transcendence

Self-transcendence has been approached from a variety of perspectives. For instance, self-transcendence has been thought of as an experience of spirituality (Piedmont, 1999), a component of personality (Cloninger, Przybeck, Svrakic, & Wetzel, 1994; Cloninger, Svrakic, & Przybeck, 1993), and a capstone need (Koltko-Rivera, 2006). The experience of self-transcendence is often discussed in conjunction with a spiritual experience or a connection to a higher being. In fact, a factor analysis of several self-transcendence scales showed that spiritual aspects including sacredness and higher consciousness were core constructs (Akyalcin, Greenway, & Milne, 2008). In addition, the same factor analysis found that interconnectedness and unity were also core constructs that reflect non-spiritual conceptualizations. This study was limited by the use of mostly spiritual-based scales, but the findings still reflect generally agreed upon conceptions of self-transcendence. Specifically, self-transcendence involves a self-diminutive experience often coupled with a sense of unity or interconnectedness (Yaden, Haidt, Hood, Vago, & Newberg, 2017). Approached from this perspective, self-transcendence is succinctly defined as the experience of feeling connected to something beyond oneself (Yaden et

al., 2017). Some people may experience self-transcendence as spiritual or religious connection and others may experience it as a connection to others or nature. The phenomenological experience of self-transcendence is idiosyncratic.

As mentioned previously, explanations of why nature is beneficial often refer to a connection to nature that is rooted in evolutionary history. Self-transcendence could be seen as an extension of this connection. Connecting to an evolutionary history—a human heritage—could be felt as a connection to something greater than oneself. This is especially evident in definitions of self-transcendence that consider it to be connecting to anything beyond oneself, whether across time or place (Akyalcin et al., 2008; Piedmont, 1999). Admittedly, self-transcendence is a nebulous concept that encompasses a variety of experiences including awe (Shiota, Keltner, & Mossman, 2007), flow (Nakamura & Csikszentmihalyi, 2002), and mindfulness (Brown, Ryan, & Creswell, 2007). However, the core experience concerns the reduction of a sense of self or a moving beyond current experience (Farber, 1951). This experience is proposed to be inspired by engaging with nature and proposed to influence well-being.

Nature is grand and encompasses the earth. Even when in a completely human-built environment, nature can emerge as a dandelion through the cracks in the sidewalk or a garden box of flowers. Nature is all around us. Thus, nature physically transcends humans and may also activate feelings of self-transcendence. In fact, nature settings are commonly used to inspire awe and a smaller sense of self, which are aspects of self-transcendence experiences (Piff, Dietze, Feinberg, Stancato, & Keltner, 2015; Shiota et al., 2007). Moreover, a sense of general connection to things other than oneself is related to nature connectedness (Zelenski & Nisbet, 2014). Important to the current discussion, this sense of general connection is also related with

well-being (Zelenski & Nisbet, 2014). Considering the relationships that self-transcendence has with nature and well-being, I propose that it could serve as an explanation of why nature benefits well-being.

Conditions that Affect Nature's Benefits

Self-transcendence may help explain why nature is beneficial, but further inquiry is needed to understand when nature is beneficial. Specifically, what conditions are necessary for nature to be beneficial? Two types of conditions are discussed: exogenous and endogenous. Exogenous conditions are those about the situation and endogenous conditions are those about the person. There are many endogenous factors such as level of connection to nature, fear of the outdoors, and motivation. The focus of the present dissertation is on the endogenous condition of motivation. Why do people engage with nature and how does this affect the receipt of the benefits?

Exogenous Factors

There are many exogenous conditions that can moderate nature's benefits. For example, manicured nature can result in different emotional experiences than wild nature (Davis & Gatersleben, 2013) and positive affect is higher in settings with rich biodiversity (Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007; Wolf, Zu Ermgassen, Balmford, White, & Weinstein, 2017).

Another important exogenous variable is the type of natural setting. Recent evidence has revealed how different natural settings have different influences upon well-being. In a large scale study on the restorative effects of different natural settings, White, Pahl, Ashbullby, Herbert, and Depledge (2013) drew from a national sample of English citizens who were asked to recall a time during the past week that they went outdoors and how it felt. Broad categories of urban,

rural, and coastal environments differed in their perceived restorative effects. Coastal settings were perceived as the most restorative and urban perceived to be the least. More specifically, woodlands, beaches, and hills or mountains were perceived to be more restorative than other settings including city parks, open countryside, rivers or lakes, and others. In an experimental study, tundras (which included open plains and mountains) were seen as more restorative than deserts, grasslands, coniferous forests, deciduous forests, and tropical forests (Han, 2007).

The distinction between exposure and engagement is not often made but could serve as an important exogenous condition. Specifically, I define exposure as primarily visual as this is the manner in which nature exposure is most commonly operationalized, in the form of people looking at pictures (Ulrich, 1979, 1983), watching videos (Piff et al., 2015; Zelenski, Dopko, & Capaldi, 2015), or viewing nature from a window (R. Kaplan, 2001). Nature can be engaged with using more senses than vision and each can be beneficial (Franco, Shanahan, & Fuller, 2017). Thus, I hold that nature engagement is the experience of nature with more than visual sense. The differential effects of this exogenous variable are not well studied, but some evidence can be derived from a comparison of meta-analyses. One meta-analysis of nature exposure upon hedonic well-being found an effect size of .26 for laboratory studies that involved visual sensing of nature and an effect size of .37 for studies where participants were physically present in nature (McMahan & Estes, 2015). The effects were larger when they were in the environment and sensing nature with more than visual sensation. Another meta-analysis of the effects of gardening upon mental well-being (broadly defined) found an effect size of .47 (Soga, Gaston, & Yamaura, 2017). Gardeners engage with nature using more senses than participants only exposed to pictures of nature in the experimental studies. Gardeners dig their hands in the dirt and physically interact with nature. This effect size is much larger than those in McMahon and Estes' meta-

analysis, which could be taken as evidence that engaging with nature using multiple senses is more beneficial for well-being. However, this interpretation is made cautiously because these meta-analyses are not directly comparable. There are many factors that were different between them such as the autonomous choice to be in the gardening studies compared to random assignment in most of the exposure studies. The autonomous choice to engage in an activity is an important endogenous factor that needs to be considered.

Endogenous Factors

Awareness and attention are required in different levels throughout the day. Recall that attention restoration theory posits that some activities do not require directed attention. Thus, whether or not people are paying attention to nature may be implicated in the nature-wellbeing relationship as well. In a study on the restorativeness of nature, Lin and colleagues (2014) exposed participants to pictures that varied in the salience of trees. Pictures with more trees were seen as more restorative. A more noteworthy finding, though, is that participants who had been made aware of the trees felt more restored and rated the settings as higher on perceived restorativeness. Another study in which participants were asked to notice nature around them in their daily life found that noticing nature aids in producing well-being benefits more than noticing the built environment (Passmore & Holder, 2017). Thus, attention may moderate the effect of nature upon restoration.

Personality may also be implicated as endogenous factor that influences whether nature benefits well-being. A large-scale survey from Australia assessed well-being, personality, and nearby greenspace (Ambrey & Cartlidge, 2017). Participants who were high on emotional stability (i.e., low neuroticism) report greater benefits of nearby greenspaces than those low on emotional stability. These findings are correlational and it needs to be determined whether those

with greater emotional stability report greater well-being when in nature or whether greater well-being in nature fosters greater emotional stability.

Type of motivation. Another potential endogenous factor that has not been investigated is type of motivation. Understanding why people engage with nature is difficult, especially considering the variety of activities that can be undertaken while in nature, ranging from hiking to dirt biking. If focusing on the variety of behaviours, the motivators are equally as vast. However, if we consider that at the core of these behaviours is the concept of nature, there may be a focal point for understanding motivation. The earliest research on motivations to engage with nature were conducted from the standpoint that nature must have some instrumental value that people expect to achieve when engaging with it (Manfredo, Driver, & Tarrant, 1996). Thus, a list was compiled of “consequences that are expected or desired” (Tinsley, 1986, p. 10). This list, known as the Recreation Experience Preference (REP) scale, is exhaustive with 234 items assessing 21 superordinate factors of 44 reasons. This shows that there are many reasons why people engage with nature, including the escape that it provides, its benefits, and as a manner of meeting or being with people. Unfortunately, a list of reasons that one engages with nature is atheoretical and lacks predictive power.

There are very few theory-based inquiries into why people engage with nature. Most research into why people engage with nature is conducted under the umbrella of recreation research, which has a broad scope that includes everything from kayaking to green space visitation to extreme sports. Most of these inquiries have focused on single activities and the reasons people engage in them. Only recently has a model been proposed to explain the choice of nature- versus culture-based recreation preferences (Marques, Reis, Menezes, & Salgueiro, 2017). The authors echo the concern about the focus of this literature on single activities. They

also suggest that, in the rare case that a theoretical approach is taken, the theory of planned behaviour is dominant (Ajzen, 1991). The theory of planned behaviour invokes attitudes, subjective norms, and perceived behavioural control in predicting behavioural intentions.

Despite their critique, Marques and colleagues (2017) employ the theory of planned behaviour with only the minor addition of environmental attitudes and motives as predictors of preferences for activities in nature. Unfortunately, their understanding of motives is a far less nuanced perspective of intrinsic and extrinsic motivation than is found in contemporary motivation research. They refer to internal and external forces but fail to break them down along the well-established relative autonomy continuum (Ryan & Connell, 1989).

Self-determination theory proposes a continuum of types of motivation, from controlled to autonomous (Deci & Ryan, 2012; Ryan & Deci, 2000b). Controlled motivations are when behaviour is conducted as a means to a separable end. Examples of controlled motivations are a child cleaning their room to receive a reward or an employee performing their work to avoid guilt. Controlled motives encompass external regulation (i.e., punishment and rewards) and introjection (i.e., guilt, shame, or self-esteem contingency; Ryan & Deci, 2000a). By contrast, autonomous motives are when behaviour is conducted because it represents who one is or because of the satisfaction or enjoyment of engaging in the activity. Autonomous motives include identified regulation (i.e., accept the value of the activity), integration (i.e., activity is part of oneself), and intrinsic motivation (i.e., performing an activity for the sake of the activity). These represent a continuum of motivation, known as the relative autonomy continuum (Ryan & Connell, 1989). This relative autonomy continuum is related to well-being. More autonomous motives positively relate with well-being and more controlled motives are negatively related or

unrelated with well-being (Roth, Assor, Kanat-Maymon, & Kaplan, 2006; Ryan & Deci, 2000b). This pattern has been found in a variety of domains including education and sports.

I propose that the pattern will also be found in relation to nature. Specifically, autonomous motivation to engage with nature is expected to positively relate with well-being and controlled motivation to engage with nature is expected to be unrelated with well-being. Controlled motivation is expected to be unrelated with well-being, not negatively related as found in previous research (Roth et al., 2006), because of the generally beneficial effects of nature. That is, I hypothesize that autonomous motivation is necessary to receive the benefits of nature, but controlled motivation would not lead to a decline in well-being—only a lack of receiving the benefits of nature.

In attempting to assess why someone engages with nature, it would be possible to classify the reasons people provide for engaging with nature as more or less autonomous. For example, a nationwide survey from Switzerland revealed that the dominant reason for engaging with nature is to “experience nature” (Zeidenitz, Mosler, & Hunziker, 2007). This could be interpreted as an autonomous motivation to engage with nature. Such an approach of classifying reasons as autonomous or controlled has been attempted. In a study of overnight campers at a US national park, Cini, Kruger, and Ellis (2013) asked people why they were visiting the park and classified the reasons as either “more autonomous” or “less autonomous.” Their findings showed that more autonomous reasons were positively correlated with well-being, whereas less autonomous (i.e., more controlled) were negatively correlated with well-being. These results align with predictions of SDT, but they should be interpreted with caution because the relative autonomy continuum has been artificially dichotomized. Artificially dichotomizing quantitative variables leads to a

loss of information especially concerning individual differences and can lead to spurious effects (MacCallum, Zhang, Preacher, & Rucker, 2002).

Altogether, self-determination theory and existing research suggest that the beneficial effects of nature may depend on the type of motivation that one has for engaging with nature. If forced to engage with nature, greater hedonic or eudaimonic well-being would be unlikely. By contrast, though, volitional engagement with nature would be more likely to lead to well-being benefits.

Program of Research

The current program of research focuses on two main questions about the benefits of engaging with nature: (1) does self-transcendence explain why nature is beneficial to well-being? (2) Does motivation to engage with nature affect whether nature is beneficial? These questions are explored in two manuscripts. The first manuscript, *Connecting to something greater and feeling greater: Self-transcendence as a potential explanation of the positive effect of nature exposure on well-being*, involves a series of four studies testing the mediating role of self-transcendence in the nature-wellbeing relationship. The second manuscript, *Understanding nature engagement motivation: A test of self-determination theory in a novel environment*, involves a series of studies examining nature engagement motivation from an SDT perspective including a test of whether nature's benefits are reliant on motivation.

Chapter 2: Connecting to Something Greater and Feeling Greater: Self-Transcendence as a
Potential Explanation of the Positive Effect of Nature Exposure on Well-Being

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Contributions

I would like to acknowledge my collaborator's role in this project as well as explain my role. For this project, I planned the series of studies in this manuscript in consultation with Dr. Grouzet. I conducted Study 1 myself and worked with Dr. Grouzet and our lab research assistants (RAs) to conduct Studies 2 and 3. I performed all analyses for all studies. I wrote the first draft of the manuscript and made several revisions after feedback. Some versions have been edited by Dr. Grouzet. More edits were also made after suggestions from peer reviewers.

Abstract

Engaging with nature is beneficial to humans (McMahan & Estes, 2015; Russell et al., 2013). The mechanisms that explain this positive relation are, however, less understood. Many different explanations have been proposed—most of which fail to explain why nature increases well-being. We proposed that self-transcendence is activated by exposure to nature and, in turn, enhances well-being. In a series of four studies, we tested the role of self-transcendence as a mediator between nature exposure and well-being. Study 1 is an experimental test of the impact of watching nature videos upon self-transcendence and well-being. Then, using experimental daily diary methods in Study 2, we tested the influence of self-transcendence upon well-being. Finally, in Study 3 we tested the mediation model in an externally valid setting (i.e., walking in nature). Results indicate that self-transcendence is influenced by actual nature, and findings are mixed about whether it is influenced by virtual nature. Moreover, self-transcendence is correlated with well-being, but only causally influenced eudaimonic well-being. These findings are discussed with a particular focus on the role of self-transcendence and implications for nature-well-being research.

Keywords: nature, well-being, happiness, self-transcendence

Connecting to Something Greater and Feeling Greater: Self-Transcendence as a Potential Explanation of the Positive Effect of Nature Exposure on Well-Being

Being in nature is good for people in many respects. Nature can aid in restoration from attentional fatigue (S. Kaplan, 1995, 2001), foster creativity (Tyrväinen et al., 2014), improve self-control (Beute & de Kort, 2014), and contribute to academic outcomes (Benfield, Rainbolt, Bell, & Donovan, 2013). Considerable attention has also been paid to the benefits of nature for well-being. To explain why nature is beneficial to humans, early theories referred to the evolutionary history of an unconscious preference for and connection to particular nature settings (e.g., Ulrich, 1979). Many other researchers have attempted to explain this positive relation between nature and well-being with particular psychological mechanisms, but with mixed findings (see Howell & Passmore, 2013 for a review). Of the many proposed mechanisms, including spirituality (Kamitsis & Francis, 2013) and meaning in life (Howell, Passmore, & Buro, 2013), several are succinctly subsumed within a holistic conception of self-transcendence. Thus, the current research aims to clarify the nature-wellbeing relation by proposing that self-transcendence can help explain why nature is beneficial.

Nature and Well-Being

Well-being is a broad concept with some conceptions that include physiological health, other conceptions focusing on stress, and others that focus directly on happiness. The hedonic view of well-being focuses on pleasure, which is derived from infrequent negative emotions and frequent positive emotions (Ryan & Deci, 2001). Alternatively, the eudaimonic view of well-being focuses on a life of virtue, which is constituted by engagement in activities that are concordant with one's true self or *daimon* (Ryan & Deci, 2001). These have both been examined as outcomes of nature exposure.

On the one hand, the influence of nature exposure upon hedonic well-being has received widespread attention. A meta-analysis by McMahan and Estes (2015) supports the positive relation between nature exposure and positive affect as well as a negative relation with negative affect. On the other hand, there is less clear evidence of the relation between nature exposure and eudaimonic well-being. One particular difficulty is due to the many ways eudaimonic well-being has been operationalized. In the nature-wellbeing literature, some assessments focus on state-like feelings such as items assessing interest, engagement, and enthusiasm (Løvoll, Vittersø, & Wold, 2016) or the Elevating Experience Scale (Huta & Ryan, 2010). These assessments are related with nature exposure. In a study of the affective experience of outdoor trips, physical education students who went on coastal and skiing trips recalled high levels of interest, more than feelings of pleasure (Løvoll et al., 2016). Unfortunately, results for the engagement and enthusiasm items were not reported in the study. In a study of the effect of season and type of contact with nature (actual or virtual), participants who walked in nature reported greater elevation than those who walked indoors, and participants who sat in actual nature also reported greater elevation than those who viewed pictures of nature (Brooks, Ottley, Arbuthnott, & Seigney, 2017). These findings were consistent across seasons—summer and snowy winter. They may also be consistent across time. A daily diary study in which participants were instructed to seek out and immerse themselves in nature as often as possible during a two-week period found that feelings of elevation were higher than in a control condition (Passmore & Howell, 2014). These findings were replicated in another daily diary study where participants were asked to pay attention to nature, the built environment, or continue business-as-usual over a two-week period (Passmore & Holder, 2017). In both of these latter studies, however, another assessment of eudaimonic well-being, meaning in life, was unaffected. Perhaps the elevating experience scale is more

susceptible to single-occurrence manipulations than meaning in life which represents trait aspects of eudaimonic well-being (Huta & Waterman, 2014).

Other assessments used in nature-wellbeing research are more broad and encompass multiple facets of eudaimonic well-being, such as Ryff's (1989; Ryff & Keyes, 1995) Psychological Well-Being scale or Waterman and colleagues' (2010) Questionnaire for Eudaimonic Well-Being. Ryff's Psychological Well-Being scale assesses six categories: self-acceptance, environmental mastery, positive relations, purpose in life, personal growth, and autonomy. Correlational research has shown that the personal growth subscale is positively related with self-reported nature exposure (Herzog & Strevey, 2008). However, in another study, the experience subscale of nature relatedness scale (which approximately reflects long-term or habitual nature exposure) has been found to be unrelated to all subscales of psychological well-being (Lawton, Brymer, Clough, & Denovan, 2017).

Finally, when using the Questionnaire for Eudaimonic Well-Being, a relationship between nature exposure and eudaimonic well-being has been observed (Webber et al., 2015). While Webber and colleagues' study lacks experimental control, the mixed methods (i.e., quantitative and qualitative assessments) both observed a positive relation between gardeners' time spent in the garden and eudaimonic well-being. Further experimental studies are needed to clarify the relationship between nature exposure and various aspects of eudaimonic well-being.

The short list of aforementioned studies shows a positive relation between nature exposure and eudaimonic well-being. Extending further from nature exposure to nature connectedness provides greater evidence for this relation. Although nature exposure and nature connectedness are not the same construct, they are related. In fact, nature exposure and connectedness have a bidirectional relation, whereby those who are exposed to nature report

greater connectedness to it (Mayer et al., 2009) and those with higher levels of nature relatedness engage with it more (Nisbet, 2011; Nisbet et al., 2009). Connectedness to nature is positively related with psychological well-being (Howell et al., 2011, 2013; Trigwell et al., 2014; Zelenski & Nisbet, 2014). It should be noted, however, that this relationship varies for different factors of psychological well-being. For instance, Nisbet and Zelenski (2013) found that personal growth and autonomy were consistently related with nature relatedness across four studies, but purpose in life was inconsistently related with nature relatedness across the studies. Self-acceptance and environmental mastery were assessed in two of the four studies. Nature relatedness was correlated with self-acceptance in one study while environmental mastery was unrelated in both. However, another study found that purpose in life and environmental mastery are related with nature relatedness when environmental attitudes are controlled for (Nisbet et al., 2011).

What Explains the Nature-Well-Being Relation?

The well-being benefits of engaging with nature have been explained to result from many different processes. For instance, the biophilia hypothesis posits that humans have an innate need to affiliate with nature and, thus, humans have affective responses to engaging with nature (Kellert & Wilson, 1993; Ulrich, 1983; Wilson, 1984). This innate affect-nature connection has been proposed to be a result of evolutionary forces and, thus, an evolutionary functional model of affect regulation can aid in explaining why people experience well-being gains from engaging with nature (Richardson, McEwan, Maratos, & Sheffield, 2016). These and other theories are helpful, but do not fully capture the experience of being in nature, which can be described as feeling connected to something greater than oneself and, thus, a sense of smallness of self. To date, only aspects of these experiences have been explored.

Connection to nature is a prime example of feeling connected to something greater than

oneself. Connection to nature has been conceived of as a state and a trait. As a state, it embodies feelings of community with nature, which characterizes a connection to something greater than oneself. As mentioned previously, it is influenced by nature exposure, but it also mediates the relationship between nature exposure and hedonic well-being (Mayer et al., 2009). Connection to nature has one focal point of connecting to something greater: nature.

Spirituality also involves feeling connected to something greater, but involves more foci or, at least, a more ambiguous focus. Spirituality has also been explored as an explanation of the well-being benefits of nature, especially eudaimonic well-being. The relationship between nature and spirituality has been pondered for centuries. In psychology, Jung proposed that basic archetypes are perceived in the natural world and they lead to spiritual experiences (Schroeder, 1992). Nature itself has also been regarded as inherently spiritual with a number of spiritually-loaded terms being used to describe experiences in nature, such as “transformative” (Davis, 2014; Ewert, Overholt, Voight, & Wang, 2011) or experiencing spiritual “inspiration” (Fredrickson & Anderson, 1999). Furthermore, measures of spirituality commonly contain items relating to nature (e.g., Gomez & Fisher's [2003] Spiritual Well-Being Questionnaire; Underwood & Teresi's [2002] Daily Spiritual Experience Scale). Empirical inquiry has found that spirituality can be inspired by nature stimuli (Saroglou, Buxant, & Tilquin, 2008) and that spirituality mediates the relation between nature exposure and connection to well-being (Kamitsis & Francis, 2013; Trigwell et al., 2014).

Finally, experiences of awe, absorption, and hypo-egoism are known to be influenced by natural settings and associated with well-being (Keltner & Haidt, 2003; Leary, Tipsord, & Tate, 2008; Williams & Harvey, 2001).

Self-Transcendence as the Unifying Explanatory Variable

A closer look at the mediating roles of connectedness to nature and spirituality between nature exposure and well-being can lead to the emergence of a common explanation. Indeed, connectedness to nature, spirituality, and hypo-egoism are nearly consensually recognized as components of self-transcendence (Cloninger, Svrakic, & Przybeck, 1993; Piedmont, 1999; cf. Seligman, Steen, Park, & Peterson, 2005). Furthermore, feelings of absorption, awe, and fascination are characteristic of self-transcendence. Self-transcendence involves reducing the boundaries of one's self by connecting to something greater (Akylcin et al., 2008; Grouzet et al., 2005). Connecting to something greater can occur through a connection to a time in the past or future, to a sense of spirituality, to a unified consciousness, or to anything outside of the self, such as humanity or the cosmos (Cloninger et al., 1993; Levenson, Jennings, Aldwin, & Shiraishi, 2005; Levin & Steele, 2005). Therefore, we propose that self-transcendence could unify these diverse explanations of the well-being benefits of nature.

Nature and self-transcendence relations. This is not the first time that self-transcendence has been implicated within a nature framework or that nature is regarded as transcendent (e.g., Laski, 1961). For example, Williams and Harvey (2001) asked people who regularly engage with nature to recall a time that they had a transcendent experience in a forest and found that being in nature has various effects for people, including transcendent experiences. Transcendent experiences were described as either diminutive feelings or deep flow. The diminutive feeling was characterized by a sense of feeling small in comparison to the natural world and feelings of fascination and novelty. The deep flow experience was characterized by absorption in the natural world. Diminutive feelings and deep flow are aspects of self-

transcendence (Yaden et al., 2017) which have been found to result from nature experiences in experimental inquiries.

Diminutive feelings are similar to the small self, quiet ego, or hypo-egoic processes. The small self or quiet ego characterizes a sense of humility in the world—a person’s ego or sense of self is small in comparison to larger or more important things such as nature or society. The small self is believed to be affected by perceiving something to be “more vast and powerful than oneself” (Piff et al., 2015, p. 884). Note the similarity between this mechanism and the aforementioned conception of transcendence. Another related concept is allo-inclusivity, which is the notion of including other entities (such as nature) in one’s identity. When people include the natural world in their identity, they are likely to feel connected to many other aspects of the world including other people and they are likely to have spiritual experiences (Leary et al., 2008).

The idea that these feelings of connectedness are all intimately tied together has been explored as a sense of general connectedness. Zelenski and Nisbet (2014) assessed feelings of connectedness to one’s country, culture, family, music, home, and friends. These were all combined into a single factor of general connectedness. They found that connectedness was related to inclusion of nature in the self and nature relatedness, however the relation with nature relatedness was less strong. This relationship between nature and connectedness has also been explored experimentally. In a daily diary study, participants who were asked to take notice of nature settings reported that they felt a sense of general connectedness more than those who were asked to take notice of human-built settings and those who were not asked to take notice of anything (Passmore & Holder, 2017).

Taking notice of certain natural setting can not only inspire a sense of connectedness but

can also inspire awe. Awe itself is proposed to be elicited through vastness and accommodation (Keltner & Haidt, 2003), which are features of many natural settings including mountains, large trees, vistas, canyons, and cliffs (Shiota et al., 2007; Zhang & Keltner, 2016). For example, one study found that standing in a grove of towering trees leads to a sense of awe (Piff et al., 2015). This research is important to mention because awe has been characterized as an emotional experience of self-transcendence (Yaden et al., 2017).

Combining several of the above approaches, Davis and Gatersleben (2013) exposed participants to different natural settings to determine the role of connectedness to nature in experiences of self-transcendence and awe. They found that trait connectedness to nature predicted experiences of transcendence and awe when engaging with a wild, as opposed to manicured, natural setting. The current research builds upon the different lines of research on nature's relation with spirituality, connection to nature, and transcendent emotions by integrating them into a holistic conceptualization of self-transcendence and exploring its role in predicting well-being.

Self-transcendence and well-being relations. Self-transcendence may be related to well-being because it has been proposed to include certain positive emotions (i.e., hedonic well-being) and phenomena such as flow and peak experiences (i.e., eudaimonic well-being)(Yaden et al., 2017). Empirically, a positive correlation between feelings of self-transcendence and well-being has been noted among homeless adults (Runquist & Reed, 2007). Some experimental evidence comes from research among elderly populations, with an intervention designed to increase self-transcendence leading to greater life satisfaction and other indicators of well-being (McCarthy, Ling, Bowland, Hall, & Connelly, 2015). In another experimental study (Saroglou et al., 2008), participants watched video clips of childbirth, nature, humour, or beer production. The

nature and childbirth videos (self-transcendence-activation videos) were more effective than the other videos at increasing a sense of spirituality and positive emotions. Thus, there is precedence for this relation, but a lack of well-controlled experimental evidence. The current research addresses this lack.

Current Studies

As the above review outlines, nature seems to influence both hedonic and eudaimonic well-being, but several mediators have been examined in the literature including spirituality, connectedness to nature, and a sense of smaller self. These are succinctly captured in the concept of self-transcendence. To test the role of self-transcendence in the nature-well-being relation, we conducted four experimental studies addressing the causal relation. Specifically, we utilize a double randomization experimental approach to mediation (MacKinnon, Fairchild, & Fritz, 2007, aka experimental-causal-chain design, Spencer, Zanna, & Fong, 2005), wherein nature exposure is manipulated and self-transcendence and well-being are assessed (Study 1) then self-transcendence is manipulated and well-being is assessed (Study 2). Additionally, in Study 3 we tested the full mediation model in an externally valid setting.

Study 1

The purpose of Study 1 was to test the proposed mediation model by using a common paradigm of exposing participants to nature through videos (Mayer et al., 2009; Ryan et al., 2010). Two independent samples were collected, using mostly the same recruitment and methodology. The second sample served as a direct replication.

Methods

Participants and procedure. Two independent samples were collected (N = 406 and 369) were recruited from the online recruitment tool *CrowdFlower* to take part in a study about

videos and happiness in exchange of CAD\$0.35. Participation for sample 1 was restricted to IP addresses from the United Kingdom, Canada, and the United States. For sample 2, this was expanded to include Australia, Ireland, and New Zealand.

Participants started by providing demographic information and completing a measure of trait connectedness to nature. Then, participants were assigned to one of three conditions.¹ In the Nature Condition, participants watched a video that included several sweeping landscapes and many different animals including ducks and bears.² Participants in the Urban Condition watched a video of a helicopter ride over Las Vegas at night. In order to ensure that the hypothesized effect of nature upon self-transcendence is not only due to an increase of positive affect, we included a Positive Condition that involved a video of puppies and kittens meeting for the first time.³ The videos were edited to have the same length and the same audio track (i.e., a live performance of Beethoven's 9th Symphony - Movement IV - "Ode to Joy"). After watching the video, participants completed a battery of questionnaires to measure state connectedness to nature, self-transcendence, hedonic well-being, and eudaimonic well-being.

¹ For Sample 1, the online survey system we used did not allow random assignment. Thus, participants were assigned to each condition based upon birth month. Participants whose birthdays were in January, April, July, and October were assigned to the nature condition; February, May, August, and November were assigned to the urban condition; March, June, September, and December were assigned to the positive condition. Month of birth is not associated with self-transcendence or well-being in existing literature. Participants in Sample 2 were randomly assigned.

² Videos can be viewed at <https://www.youtube.com/watch?v=0ZqmpFQRxpY>, <https://www.youtube.com/watch?v=cRYOAGAUAMk>, <https://www.youtube.com/watch?v=8zFnd1AYzEQ>

³ The three videos were chosen from a pilot study in which 75 participants rated nine videos on their ability to inspire self-transcendence, connection to nature, and positive affect.

Participants with more than 30% missing data were removed from analyses ($n = 41$ for Sample 1, $n = 34$ for Sample 2). Participants who completed the study in less than 5 minutes ($n = 36$ and 27) or took longer than 40 minutes ($n = 5$ and 50) were screened because they were most likely not paying attention. Participants in Sample 1 who spent less than 90 seconds ($n = 27$) or more than 4 minutes ($n = 17$) on the video page were also excluded from the analyses. Sample 2 participants were forced to remain on the video page for 90 seconds and describe the video and the most intriguing or interesting aspects. Those who did not respond to this were excluded from the analyses ($n = 2$). Participants whose responses were outliers on most or all variables were excluded from the analyses ($n = 1$ and 3). The resulting size of Sample 1 was 321 participants, age range = 18 to 77, $M = 40$; $SD = 13.2$; 62% female and 2 participants who did not indicate their gender. The resulting size of Sample 2 was 254, age range = 16 to 76, $M = 35.4$; $SD = 11.6$; 59.7% female and 4 participants who did not indicate their gender.

Measures

General and state connectedness to nature. Mayer and Frantz's (2004) Connectedness to Nature Scale was used to assess general emotional connection to the natural world. Participants were asked to rate statements on a 5-point Likert scale (1) "false" to (5) "true" while thinking about how they feel in general. A sample item is, "I often feel a sense of oneness with the natural world around me." The scale had adequate reliability (Cronbach's $\alpha_{\text{Sample 1}} = .87$ and $\alpha_{\text{Sample 2}} = .86$). To assess state connectedness to nature the instruction was modified so participants focused on how they were currently feeling. For example, "I often feel" was read as "I feel ..." or "In this moment I feel ..." The state version of the scale showed high reliability ($\alpha = .93$ and $.90$).

State self-transcendence. Self-transcendence was measured using an altered version of Piedmont's (1999) Spiritual Transcendence Scale. We altered some items and removed others to ensure that the scale was assessing a state (rather than general) sense of self-transcendence.⁴ Moreover, items that overlapped with the eudaimonic well-being measure were removed to avoid inflated correlations. The resulting scale included 15 items that assess feelings of transcending time and place and feelings of experiencing a larger perspective or connection to things outside of oneself. Participants responded along a 7-point Likert scale from (1) “very untrue of me” to (7) “very true of me.” A sample item included, “I feel that on a higher level all of us share a common bond.” The scale showed high reliability ($\alpha = .94$ and $.93$).

Hedonic well-being. Hedonic well-being was measured by the Scale of Positive and Negative Experience (Diener et al., 2010) that consists of 6 positive (e.g., positive, joyful) and 6 negative (e.g., negative, angry) items. Participants were instructed to report how much they were currently experiencing each on a 5-point Likert scale from (1) “very slightly or not at all” to (5) “very much.” This scale showed high reliability for both the positive ($\alpha = .95$ and $.93$) and negative subscales ($\alpha = .91$ and $.92$). Whereas positive and negative are independent constructs, it can be beneficial to examine them in conjunction (Diener et al., 2010). Consequently, a

⁴ Eight items were removed from the original scale to ensure comparability with state assessment of self-transcendence. These items could not be altered to reflect state experiences. They are: “Although dead, images of some of my relatives continue to influence my current life”, “I am a link in the chain of my family’s heritage, a bridge between past and future”, and “I am concerned about those who will come after me in life”, “I still have strong emotional ties with someone who has died”, “I find inner strength and/or peace from my prayers or meditations”, “I believe that death is a doorway to another plane of existence”, “When in prayer or meditation, I have become oblivious to the events of this world”, “The desires of my body do not keep me from my prayers or meditations.”

measure of balanced affect was calculated by subtracting the negative affect scores from the positive ($\alpha = .91$ and $.88$).

Eudaimonic well-being. The 21-item Questionnaire for Eudaimonic Well-Being (Waterman et al., 2010) was used to assess eudaimonia. Participants were instructed to respond in a manner that was reflective of how things were actually going in their life, not how they wished them to be. Participants responded on a 7-point Likert scale ranging from (1) “very untrue of me” to (7) “very true of me.” A sample item was, “I believe I have discovered who I really am.” The scale showed high reliability ($\alpha = .88$).

Sample 1 Results

In order to determine the effectiveness of watching videos upon feeling connected to nature, we regressed nature connectedness on the conditions. We first created two orthogonal contrast variables: (1) Nature condition (+0.5) vs. Urban condition (-0.5) vs. Positive Condition (0), and (2) Nature condition (+0.333) and Urban condition (+0.333) vs. Positive Condition (-0.667) (see Davis, 2010 for an explanation of the necessity of orthogonal contrasts in planned comparisons). The first contrast tests a difference between the Nature and Urban condition and the second contrast tests a difference between the Positive condition and the other conditions. Both contrast variables were entered into the model at the same time.

We first regressed State Nature Connectedness on General Nature Connectedness and extracted the residuals to obtain a measure of state with the trait removed (referred to as pure nature connectedness). Results indicate that participants’ pure nature connectedness was significantly higher in the Nature condition ($M = 0.13$, $SD = 0.38$) than in Urban condition ($M = -0.19$, $SD = 0.54$), $b = 0.71$, $t_{318} = 5.21$, $p < .001$, $\eta^2 = .08$, but there was no significant difference between the Positive condition ($M = 0.04$, $SD = 0.39$) and other conditions, $b = -0.15$,

$t_{318} = -1.35, p = .179, \eta^2 = .01$.

In order to test the Nature-Self-Transcendence-Well-Being mediation model we first examined the effect of nature exposure on well-being by regressing each well-being outcome on the contrast variables. No significant difference was found between the Nature and Urban conditions on positive affect ($M_{Nature} = 3.07, SD_{Nature} = 1.13; M_{Urban} = 2.93, SD_{Urban} = 1.09$), $b = 0.15, t_{317} = 0.971, p = .333, 95\% \text{ CI } [-0.15, 0.44], \eta^2 = .00$, balanced affect ($M_{Nature} = 1.62, SD_{Nature} = 1.58; M_{Urban} = 1.49, SD_{Urban} = 1.54$), $b = 0.12, t_{317} = 0.609, p = .543, 95\% \text{ CI } [-0.28, 0.53], \eta^2 = .00$, or eudaimonic well-being ($M_{Nature} = 98.58, SD_{Nature} = 15.49; M_{Urban} = 98.79, SD_{Urban} = 15.45$) conditions, $b = -0.21, t_{318} = -0.092, p = .927, 95\% \text{ CI } [-4.70, 4.28], \eta^2 = .00$. However, participants who watched a Positive video, compared to those who watched the other videos, reported higher positive affect, ($M_{Positive} = 3.41, SD_{Positive} = 1.00$), $b = -0.41, t_{317} = -3.324, p < .001, 95\% \text{ CI } [-0.66, -0.17], \eta^2 = .03$, balanced affect ($M_{Positive} = 2.23, SD_{Positive} = 1.23$), $b = -0.67, t_{317} = -3.994, p < .001, 95\% \text{ CI } [-1.00, -0.34], \eta^2 = .05$, and eudaimonic well-being ($M_{Positive} = 102.72, SD_{Positive} = 17.43$) and other conditions, $b = -4.04, t_{318} = -2.148, p = .033, 95\% \text{ CI } [-7.74, -0.34], \eta^2 = .01$.

The relationship between nature and self-transcendence was examined next. Participants in the Nature condition reported greater self-transcendence ($M = 4.62, SD = 1.21$) than those in the Urban condition ($M = 4.24, SD = 1.12$), $b = 0.38, t_{318} = 2.29, 95\% \text{ CI } [0.05, 0.71], p = .023$. However there was no significant difference between the Positive condition ($M = 4.56, SD = 1.20$) and other conditions, $b = -0.13, t_{318} = -0.95, 95\% \text{ CI } [-0.40, 0.14], p = .341$. Self-transcendence was significantly related with positive affect, $b = 0.48, t_{316} = 10.99, 95\% \text{ CI } [0.39, 0.56], p < .001$, balanced affect, $b = 0.57, t_{316} = 9.24, 95\% \text{ CI } [0.45, 0.69], p < .001$, and eudaimonic well-being, $b = 6.00, t_{317} = 8.67, 95\% \text{ CI } [4.64, 7.37], p < .001$.

The mediation model of nature influencing well-being through self-transcendence was tested using Hayes' (2013) PROCESS macro for SPSS. The bootstrap 95% confidence interval for the indirect effect based on 10,000 resamples showed that when comparing the Nature and Urban conditions, self-transcendence significantly mediated the effect upon positive affect, $ab = 0.17$, Boot SE = 0.08, 95% CI [0.02, 0.33], balanced affect, $ab = 0.21$, Boot SE = 0.09, 95% CI [0.03, 0.40], and eudaimonic well-being, $ab = 2.29$, Boot SE = 1.01, 95% CI [0.46, 4.42]. Comparing the positive and other conditions, there was no significant indirect effect for positive affect, $ab = -0.07$, Boot SE = 0.07, 95% CI [-0.19, 0.06], balanced affect, $ab = -0.08$, Boot SE = 0.08, 95% CI [-0.23, 0.07], and eudaimonic well-being, $ab = -0.78$, Boot SE = 0.83, 95% CI [-2.44, 0.82]. The results are presented in Figure 1.⁵

Sample 2 Results

As in Sample 1, results indicate that pure nature connectedness was significantly higher in the Nature condition ($M = 0.07$, $SD = 0.41$) than in the Urban condition ($M = -0.13$, $SD = 0.52$), $b = 0.43$, $t_{250} = 2.76$, $p = .006$, $\eta^2 = .03$ and no significant difference between the Positive ($M = 0.08$, $SD = -0.13$) and other conditions, $b = -0.22$, $t_{250} = -1.75$, $p = .082$, $\eta^2 = .01$.

No significant difference was found between the Nature and Urban conditions of positive affect ($M_{Nature} = 3.26$ $SD_{Nature} = 1.04$; $M_{Urban} = 3.16$, $SD_{Urban} = 1.10$), $b = 0.09$, $t_{250} = 0.546$, $p = .585$, 95% CI [-0.24, 0.43], $\eta^2 = .00$, balanced affect ($M_{Nature} = 1.54$ $SD_{Nature} = 1.62$; $M_{Urban} = 1.57$, $SD_{Urban} = 1.67$), $b = -0.03$, $t_{250} = -0.106$, $p = .916$, 95% CI [-0.54, 0.49], $\eta^2 = .00$, or eudaimonic well-being ($M_{Nature} = 95.17$ $SD_{Nature} = 15.09$; $M_{Urban} = 96.72$, $SD_{Urban} = 14.29$)

⁵ Analyses were also run including participants who were originally screened from analyses for taking too long to complete the study ($n = 343$ for positive and balanced affect, $n = 344$ for eudaimonic well-being). Results follow the same patterns as when data were fully screened.

conditions, $b = -1.55$, $t_{250} = -0.660$, $p = .510$, 95% CI [-6.17, 3.07], $\eta^2 = .00$. Nor was an effect found after watching a Positive video than after watching other videos on positive affect ($M_{Positive} = 3.26$, $SD_{Positive} = 1.11$), $b = -0.05$, $t_{250} = -0.362$, $p = .718$, 95% CI [-0.33, 0.23], $\eta^2 = .00$, balanced affect ($M_{Positive} = 1.83$, $SD_{Positive} = 1.31$), $b = -0.28$, $t_{250} = -1.502$, $p = 0.134$, 95% CI [-0.65, 0.08], $\eta^2 = .01$, or eudaimonic well-being ($M_{Positive} = 98.01$, $SD_{Positive} = 15.82$), $b = -2.01$, $t_{250} = -0.990$, $p = .323$, 95% CI [-5.99, 1.98], $\eta^2 = .00$.

There were no significant differences in self-transcendence between the Nature condition ($M = 4.66$, $SD = 1.13$) and the Urban condition ($M = 4.55$, $SD = 1.06$), $b = 0.11$, $t_{250} = 0.62$, 95% CI [-0.24, 0.46], $p = .533$, nor between the Positive condition ($M = 4.60$, $SD = 1.16$) and other conditions, $b = 0.01$, $t_{250} = 0.04$, 95% CI [-0.28, 0.29], $p = .969$. Self-transcendence was significantly related with positive affect, $b = 0.51$, $t_{249} = 9.86$, 95% CI [0.41, 0.62], $p < .001$, balanced affect, $b = 0.56$, $t_{249} = 7.03$, 95% CI [0.40, 0.71], $p < .001$, and eudaimonic well-being, $b = 5.56$, $t_{249} = 7.13$, 95% CI [4.02, 7.09], $p < .001$.

Self-transcendence did not mediate the effect of setting (urban vs. nature) on positive affect $ab = 0.06$, Boot SE = 0.09, 95% CI [-0.12, 0.24], balanced affect, $ab = 0.06$, Boot SE = 0.10, 95% CI [-0.12, 0.26], and eudaimonic well-being, $ab = 0.62$, Boot SE = 0.99, 95% CI [-1.24, 2.67]. Comparing the positive and other conditions, there was also no significant indirect effect for positive affect, $ab = 0.00$, Boot SE = 0.08, 95% CI [-0.15, 0.15], balanced affect, $ab = 0.00$, Boot SE = 0.08, 95% CI [-0.16, 0.17], and eudaimonic well-being, $ab = 0.02$, Boot SE = 0.83, 95% CI [-1.55, 1.74]. The results are presented in Figure 2.⁶

⁶ Analyses were also run including participants who were originally screened from analyses ($n = 309$).

Results follow the same patterns as when data were fully screened.

Discussion

The results from Sample 1 provide preliminary support for the mediating role of self-transcendence but were not replicated among Sample 2. Watching the positive video had a stronger impact on both hedonic and eudaimonic well-being than the other conditions, but this effect was not mediated by self-transcendence.

The consistent result of Study 1, in samples 1 and 2, is that self-transcendence is positively related with both hedonic and eudaimonic well-being. Contrary to what was hypothesized, the direct impact of the nature manipulation upon well-being was not supported, despite being well-documented (Mayer et al., 2009; Ryan, Weinstein, et al., 2010) and even having been achieved with ostensibly less powerful manipulations (i.e., pictures; Ulrich, 1979, 1983).

Furthermore, it should be noted that because the Positive video included puppies and kittens playing outdoors in grass, one may consider that the video presented another aspect of nature (i.e., including both animal and natural references) rather than simply inducing positive affect. This reference to nature may explain the absence of a significant difference between Nature and Positive condition on state nature connectedness. However, this reference to Nature seems to not induce self-transcendence. Thus, there is an inspirational quality of broader aspects of nature that inspire self-transcendence, as indicated by the ability of the nature manipulation to lead to greater self-transcendence in Sample 1. The effect of nature upon self-transcendence and the indirect mediating effect were not replicated in Sample 2.

There are several potential explanations for the replication failure between samples. First, recruitment for Sample 2 had less restrictions on geographic region and included participants who were rated as “less trustworthy” by *Crowdflower* (as determined through an undisclosed

algorithm). Another potential reason could be that Sample 2 participants were forced to stay on the video page whereas Sample 1 participants could continue to the next page at any time during the video. Whereas Sample 1 participants who skipped the video (i.e., spent too little time on the page) were removed from analyses, Sample 2 participants were forced to remain on the video page and therefore remain in the analyses. Overall, although the findings suggest that the proposed mediation model is not well-supported, several important relations were observed, which warrant further inquiry.

Study 2

In Study 1, correlational support was found for the relation between self-transcendence and well-being. The aim of Study 2 was to focus on this specific relation, using an experimental manipulation of self-transcendence to test its influence upon well-being. Eudaimonic well-being is a relatively stable concept, which can make detection of changes difficult during brief periods. Consequently, we used a daily diary to increase the impact of the self-transcendence manipulation and its impact on eudaimonic well-being.

Methods

Participants and procedure. A total of 102 participants were recruited from the undergraduate participant pool at the University of Victoria. They were invited to take part in a two-week daily diary study entitled “Well-Being and the Self” in exchange for course credit. For two weeks of daily diaries, participants completed daily measures of well-being. During the second week, participants were randomly assigned to either a Self-Transcendent or Self-Enhancement Condition (randomisation with gender balancing) where they read a daily statement on self-transcendence (e.g., “I often feel a connection to something greater than myself”) or self-enhancement (e.g., “I want to be influential and have an impact on other

people”) and described a recent experience that supports the statement. A different self-transcendent or self-enhancement statement was presented each day for the respective conditions. The manipulation was inspired by a similar manipulation used by Roccas (2003). We expanded the number of self-transcendent and self-enhancement statements by drawing respective life goal statements from Grouzet and colleagues' (2005) circumplex model of goals.

A total of 1064 entries were collected, with participants completing an average of 10 daily questionnaires. Participants who indicated that they would not like their data included in the analyses were removed ($n = 5$). Participants who did not complete any daily diaries during the second week (manipulation week) were also removed from analyses ($n = 3$). Furthermore, any daily observations that took less than 1.2 minutes to complete were removed from the analyses ($j = 57$). Daily observations were also removed when no written response was given for the manipulation ($j = 63$).⁷ This resulted in 909 daily observations for 94 participants, age range = 18 to 35; $M_{age} = 21.3$; $SD_{age} = 2.82$; 80% female.

Measures. Measures of hedonic well-being (average within-participant $\alpha = .88$; overall $\alpha = .94$; Intraclass Correlation Coefficient = .45) and eudaimonic well-being (average within-participant $\alpha = .92$; overall $\alpha = .85$; ICC = .83) were the same as in Study 1. Outcome variables were centered at the person-level of Week 1. Week 2 involved a manipulation and, therefore, including those values in the centering process would skew the baseline values. Person-level centering was done to distinguish within-participant effects from between-participant effects (Paccagnella, 2006) and aid in testing cross-level interactions (Bliese, 2012).

⁷ Four outlying observations for balanced affect and 4 observations for eudaimonic well-being were removed from the analyses. Results follow the same patterns when these responses are included.

Results and Discussion

Data were analyzed using multilevel modeling. Previous research has found an effect of weekend on hedonic well-being (Ryan, Bernstein, & Brown, 2010). Thus, we tested the effect of a Weekend variable (1 = Friday-Sunday vs. 0 = Monday-Thursday) and control for it. Results revealed a significant effect of Weekend upon positive affect, $b = 0.10$, $SE = 0.05$, $df = 813$, $p = .024$, and a marginally significant effect upon balanced affect, $b = 0.14$, $SE = 0.08$, $df = 809$, $p = .073$. However, Weekend was not significantly related to eudaimonic well-being, $b = -0.08$, $SE = 0.40$, $df = 807$, $p = .844$. Consequently, Weekend was controlled for in the positive and balanced affect models.

The results are summarized in Table 1. The main effects of Week and Condition were non-significant in all models. The interaction between week and condition was the focus of the present analysis. It was predicted that during Week 2 participants in the self-transcendent condition would report the highest well-being. The interaction between week and condition was significant for eudaimonic well-being.

An examination of simple effects showed that there was a significant effect of Week upon eudaimonic well-being in the Self-Transcendent Condition, $b = 1.25$, $SE = 0.54$, $df = 418$, $p = .021$, $\text{pseudo } R^2 = .01$. In addition, during Week 2, participants in the Self-Transcendent Condition reported marginally significantly greater eudaimonic well-being than those in the Self-Enhancement Condition, $b = 2.03$, $SE = 1.09$, $df = 85$, $p = .066$, $\text{pseudo } R^2 = 0.02$. Thus, both within- and between-participant effects were evidenced.

In sum, daily focus on self-transcendence influenced eudaimonic, but not hedonic well-being. These findings support the causal relationship between self-transcendence and eudaimonic well-being—the second part of the proposed mediation model explaining the relation between

nature and well-being.

Study 3

Studies 1 and 2 provided some mixed support for a causal relation between nature and self-transcendence and between self-transcendence and well-being. Issues of replication that arose in Study 1 may have been due to the use of virtual nature, which has a lesser effect than actual nature upon well-being and connectedness to nature (Mayer et al., 2009; McMahon & Estes, 2015). Thus, the aim of Study 3 was to test the proposed mediation model in an externally valid setting. More specifically, we proposed that participants who walked in nature (vs. inside a building or not walking at all) would experience higher levels of self-transcendence and well-being.

Methods

Participants and procedure. A total of 218 participants were recruited from the University of Victoria undergraduate participant pool to take part in a study called “How good is your memory?” Presenting the study as a memory task served to focus participants’ attention on the environment at hand. Participants signed up to come to the laboratory where they completed the study in groups of up to three people. After consenting to participate, each participant was randomly assigned to one of three conditions: Nature Walk, Indoor Walk, and No Walk (i.e., remain in the lab). Blind research assistants (except for the lead author who was involved in most sessions) were randomly assigned to guide participants on each of the activities. Both walking activities were 20 minutes in length. Participants in all conditions were instructed to “take time to observe [the] surroundings and take in as much of the environment as possible.” In the Outdoor Walk condition, a participant and research assistant left from the nearest exit of the building and took the most direct route to a nature trail on campus that ventures through thickets, a forest

consisting primarily of cedar trees, and over a small creek. In the Indoor Walk condition, they went throughout the three floors and basement of the main building, out to an adjacent building, then onto another adjacent building. These walks involved mostly non-repeating routes (save for one hallway indoors and the returning stairwell for both Indoor Walk and Nature Walk conditions). Participants in the No Walk condition remained in a waiting room for 5 minutes. The No Walk condition was chosen to discern that effects were not due to the exercise of walking. Following the respective activity, participants were directed to a computer lab to complete the ostensible memory task⁸ and a battery of questionnaires. One participant's responses were removed from analyses because he responded by selecting the first response for every item. Participant age ranged from 17 to 64 ($M = 20.8$, $SD = 5.4$), with 81% identifying as female, one participant who identified as genderfluid, and four participants who did not indicate their gender.

Measures. Participants completed the same measures as in Studies 1 and 2: state connectedness to nature ($\alpha = .86$), self-transcendence ($\alpha = .89$), hedonic well-being ($\alpha = .92$), and eudaimonic well-being ($\alpha = .83$). In addition, research assistants were asked to report the weather at the time of the walk, indicating whether it was sunny, cloudy, partially cloudy, or rainy as well as the perceived temperature (e.g., cold, warm, etc.).

⁸ The memory tasks included 7-8 questions (both open-ended and multiple choice) that pertained to each condition. Sample questions in the Nature Walk condition were "What types of trees did you see?" and "What were the different pathways composed of? (e.g., gravel, cement, wood)." For the Indoor Walk condition, sample questions were "How many elevators are in the Cornett building?" and "What colour is the floor in the A-wing?" Finally, the No Walk memory task included questions such as "Was the window open in the room? Y/N" and "Describe what the chairs looked like."

Results and Discussion

The effectiveness of the manipulation was tested by regressing nature connectedness on similar contrast coded variables as in Study 1: (1) Nature Walk condition (+0.5) vs. Indoor Walk condition (-0.5), and No Walk condition (0), and (2) Nature Walk condition (+0.333) and Indoor Walk condition (+0.333) vs. No Walk condition (-0.667). The nature walk led to significantly greater nature connectedness ($M = 3.84$) than the indoor walk ($M = 3.34$), $b = 0.49$, $t_{212} = 4.24$, $p < .001$, $\eta^2 = .07$, and participants in the No-Walk condition ($M = 3.24$) reported significantly lower nature connectedness than those in the other two conditions, $b = 0.35$, $t_{212} = 3.58$, $p < .001$, $\eta^2 = .05$.

Because weather is known to predict affect (Connolly, 2013), we tested its effect on hedonic well-being. Positive and balanced affect were regressed on research assistants' ratings of temperature and weather. However, no significant effects were found on positive affect, $R^2 = .01$; $b_{\text{sunny}} = -0.11$, $t_{65} = -0.45$, $p = .658$; $b_{\text{temp}} = 0.09$, $t_{65} = 0.78$, $p = .438$, or balanced affect, $R^2 = .01$; $b_{\text{sunny}} = -0.18$, $t_{65} = -0.52$, $p = .608$; $b_{\text{temp}} = 0.11$, $t_{65} = 0.69$, $p = .492$. Therefore, temperature and weather variables were not included in the following analyses.

To examine the effect of nature exposure on well-being, each well-being outcome was regressed on the contrast variables as defined above. After taking a nature walk, participants reported greater positive affect ($M = 3.67$, $SD = 0.67$) than those who took an indoor walk ($M = 3.03$, $SD = 0.90$), $b = 0.64$, $t_{214} = 4.40$, $p < .001$, 95% CI [0.35, 0.93], $\eta^2 = .08$, but no significant difference was found between the No Walk condition ($M = 3.15$, $SD = 1.00$) and other conditions, $b = 0.20$, $t_{214} = 1.518$, $p = .131$, 95% CI [-0.04, 0.44], $\eta^2 = .01$. Participants who went for a nature walk also reported significantly greater balanced affect ($M = 2.40$, $SD = 0.89$) than those who went for an indoor walk ($M = 1.50$, $SD = 1.31$), $b = 0.90$, $t_{214} = 4.62$, $p < .001$, 95% CI

[0.52, 1.28], $\eta^2 = .09$, and participants in the No Walk condition reported significantly lower balanced affect than those in the other conditions ($M = 1.62$, $SD = 1.23$), $b = 0.33$, $t_{214} = 2.02$, $p = .05$, 95% CI [0.01, 0.66], $\eta^2 = .02$. No significant difference in eudaimonic well-being was found between the Nature Walk ($M = 102.83$, $SD = 13.64$) and Indoor Walk ($M = 99.34$, $SD = 13.90$) conditions, $b = 3.49$, $t_{214} = 1.54$, $p = .125$, 95% CI [-0.98, 7.96], $\eta^2 = .01$, nor between the No Walk condition ($M = 99.67$, $SD = 12.96$) and other conditions, $b = 1.42$, $t_{214} = 0.74$, $p = .461$, 95% CI [-2.38, 5.22], $\eta^2 = .00$.

Self-transcendence was significantly higher in the Nature Walk condition ($M = 4.45$, $SD = 0.99$) than the Indoor Walk condition ($M = 4.04$, $SD = 0.79$), $b = 0.41$, $t_{214} = 2.68$, 95% CI [0.11, 0.71], $p = .008$ and significantly lower in the No Walk condition ($M = 3.89$, $SD = 0.93$) than the other conditions, $b = 0.36$, $t_{214} = 2.75$, 95% CI [0.10, 0.61], $p = .006$. Self-transcendence was significantly related with positive affect, $b = 0.26$, $t_{213} = 4.11$, 95% CI [0.13, 0.38], $p < .001$, balanced affect, $b = 0.22$, $t_{213} = 2.58$, 95% CI [0.05, 0.39], $p = .01$, and eudaimonic well-being, $b = 6.26$, $t_{213} = 6.79$, 95% CI [4.44, 8.08], $p < .001$.

When comparing the Nature and Urban conditions, self-transcendence significantly mediated the effect upon positive affect, $ab = 0.10$, Boot SE = 0.05, 95% CI [0.02, 0.22], balanced affect, $ab = 0.09$, Boot SE = 0.05, 95% CI [0.01, 0.22], and eudaimonic well-being, $ab = 2.45$, Boot SE = 1.05, 95% CI [0.62, 4.82]. When comparing the No Walk to the walk conditions, self-transcendence also significantly mediated the effect upon positive affect, $ab = 0.09$, Boot SE = 0.04, 95% CI [0.03, 0.19], balanced affect, $ab = 0.08$, Boot SE = 0.04, 95% CI [0.02, 0.20], and eudaimonic well-being, $ab = 2.22$, Boot SE = 0.90, 95% CI [0.66, 4.25]. The results are presented in Figure 3.

Taken together, these findings provide important support for the external validity of self-

transcendence as a partial mediator of the relation between nature exposure and well-being. Walking in nature appears to be an important predictor of self-transcendence and well-being. Moreover, similar effects observed in the No Walk and Indoor conditions suggest that the positive effects of Nature are not due to walking.

General Discussion

The objective of this research was to explore the role of self-transcendence in the relation between nature exposure and well-being. Using an experimental approach, Studies 1 (Sample 1), 2, and 3 provided preliminary empirical support for the causal effect of nature upon well-being as mediated by self-transcendence. Importantly, self-transcendence appears to be consistently related with hedonic and eudaimonic well-being. However, when experimentally manipulated, it only exerted an influence upon eudaimonic well-being. Finally, Study 3 provided an externally valid support to the mediation model. Walking in nature appears to influence well-being via self-transcendence.

Mixed Support for the Nature-Well-Being Relation: Virtual versus Actual Nature

The impact of nature exposure upon hedonic well-being is well-known (McMahan & Estes, 2015). However, the current study failed to replicate this finding, except in Study 3. This inconsistency could be due to the difference between exposure to virtual and actual nature. Indeed, Study 1 involved exposure to virtual nature, whereas Study 3 involved exposure to actual nature. The use of nature videos to influence well-being has been well-established (Mayer et al., 2009; Parsons, Tassinary, Ulrich, Hebl, & Grossman-Alexander, 1998; Ulrich et al., 1991), but the difference in effectiveness of such manipulations has also been noted by Mayer and colleagues (2009). They found that being in actual nature can have a greater impact upon well-being than viewing virtual nature. Indeed, Mayer and colleagues (2009) found that connection to

nature only mediated the relation between actual nature and well-being, not the relation between virtual nature and well-being. Our studies show similar findings. As discussed below, the differential impact of virtual and actual nature exposure on well-being might actually be explained by the mediating role of self-transcendence.

Nature and Eudaimonic Well-Being

Contrary to what was hypothesized, eudaimonic well-being was not affected by nature in any of the studies. It appears that eudaimonic well-being has a tenuous relationship with nature exposure. In fact, a recent paper that proposes an explanation of why exposure to nature benefits eudaimonic well-being fails to cite any experimental evidence (Cleary, Fielding, Bell, Murray, & Roiko, 2017). Rather, the authors rely on evidence from connection to nature which has a well-established relationship with eudaimonic well-being (Cervinka et al., 2012; Howell et al., 2011; Nisbet et al., 2011; Trigwell et al., 2014; Zelenski & Nisbet, 2014). Connection to nature and exposure to nature are qualitatively different and, therefore, research in these areas cannot be equated. For instance, findings about connectedness to nature cannot be used to state that exposure to nature has the same effects. In contrast to these examples, a study of self-reported contact with nature and well-being found that greater contact with nature was associated with greater personal growth, but not other indicators of eudaimonic well-being (Herzog & Strevey, 2008).

A main issue that plagues the study of the relationship between nature engagement and eudaimonic well-being is stability. Eudaimonic well-being is stable. It is not an easily altered affective state like hedonic well-being. Instead, eudaimonic well-being it is a cognitive and experiential phenomenon that involves establishing an authentic self and living according to it (Ryff, 1989; Waterman, 1993). Determining what one's authentic self is takes time, as does

altering behaviour to align with an authentic self. Thus, altering levels of eudaimonic well-being is difficult and may not be achievable in short-term laboratory studies. Rather, determining the influence of nature engagement upon eudaimonic well-being may require longitudinal studies. For instance, daily diary methods in Study 2 were helpful in revealing a change in eudaimonic well-being from one week to the next.

The Role of Self-Transcendence

Self-transcendence was hypothesized as the mediator between nature and well-being because of previous empirical evidence with similar constructs (e.g., spirituality) and because of theoretical arguments related to the inherently transcendent qualities of nature (Snell & Simmonds, 2015). This hypothesis could appear counter intuitive in the context of Western culture where a focus on self-enhancement (e.g., physical image, attractiveness, hedonism) is often presented as the key to happiness. Results of the studies herein suggest differently. For example, Study 3 revealed that self-transcendence is better than self-enhancement for increasing eudaimonic well-being. However, no effect was determined for hedonic well-being, perhaps because focusing on self-enhancement is also effective at altering hedonic well-being which is inherently pleasure based.

The mediating role of self-transcendence can help explain the inconsistent findings when exposing participants to virtual nature (Study 1) or actual nature (Study 3). Indeed, watching videos of nature does not have the same effect upon self-transcendence because of the setting people are in. Sitting at a computer or watching on a mobile device has very little capacity to transport people to a place where they can feel connected to what they are watching or other transcendent aspects. While it is possible to feel “immersed” in a movie, it is unlikely that participants felt this way while watching the brief videos. Thus, the video may not have been an

effective manipulation of nature exposure. Conversely, being in an actual nature setting is potentially inherently transcending. The nature walk in Study 3 involved some areas of total immersion in nature, with canopies overhead and woods all around. These situations would have more power to influence self-transcendence than videos. Heintzman (2011) echoed similar concerns in a review of the influence of nature upon spirituality. He noted that the influence of nature immersion can be strong, but it is affected by the conditions under which people go into nature (i.e., their personal history and current circumstances, motivation and attitude, sociodemographic characteristics, or spiritual tradition), the setting they are in (i.e., how natural it is, how much of an opportunity it provides for escape or being away, or the meaning of the place that is being visited), and the recreation undertaken in nature (i.e., solo and intense activities, solitude or with a group).

Limitations and Future Directions

The current research focuses on self-transcendence as a potential mediator between nature and well-being, but there are other factors that we did not control for that may have also affected well-being in the Nature conditions. For example, in Study 3, air quality could explain the relation between nature walk and well-being (Kuo, 2015). We recognize that other factors may mediate the relationship between nature engagement and well-being. We do not believe that self-transcendence is the only mediator of this relation.

Online recruitment in Study 1 may present another limitation. Although this technique could lead to a sample with more diverse demographics, the use of online surveys and online videos does not offer the most controlled environment. Studies 2 and 3 addressed all these issues by testing the hypotheses in an everyday setting and actual nature. Pertaining to the videos in Study 1, it should be restated here that the Positive Affect condition could be problematic. The

Positive Affect video contained images of nature, which may have affected the interpretation of difference between it and other conditions. Findings from sample 1 showed, however, that when compared to a video of urban settings, the video of nature settings was effective at influencing self-transcendence.

Conclusion

The current research provides preliminary evidence of the potential mediating role of self-transcendence in the effect of exposure to nature on well-being. Of particular import is that an outward, transcendent focus is better for people's well-being and that this can be fostered through going outside into nature rather than simply watching a nature video. Nature is incredibly powerful and has the potential to shape what people think about and how they feel.

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Table

Table 1

Multilevel model results from Study 2

Variable	Positive Affect				Balanced Affect				Eudaimonic Well-Being			
	Estimate	SE	<i>df</i>	<i>p</i>	Estimate	SE	<i>df</i>	<i>p</i>	Estimate	SE	<i>df</i>	<i>p</i>
Intercept	-0.04	0.050	811	.418	-0.05	0.082	807	.525	-0.16	0.464	806	.731
Weekend (Weekend = 1; Week days = 0)	0.10	0.047	811	.027	0.13	0.077	807	.081	--	--	--	--
Week (Week 1 = 0; Week 2 = 1)	0.05	0.070	811	.467	0.18	0.109	807	.097	-0.68	0.565	806	.228
Condition (Self-Enhancement = 0; Self-Transcendence = 1)	0.00	0.063	91	.999	0.00	0.105	91	.999	0.14	0.637	91	.831
Week × Condition	0.13	0.092	811	.154	0.14	0.152	807	.345	1.91	0.789	806	.016
Effect Size (Pseudo- R^2)		.02				.02				.01		

Figures

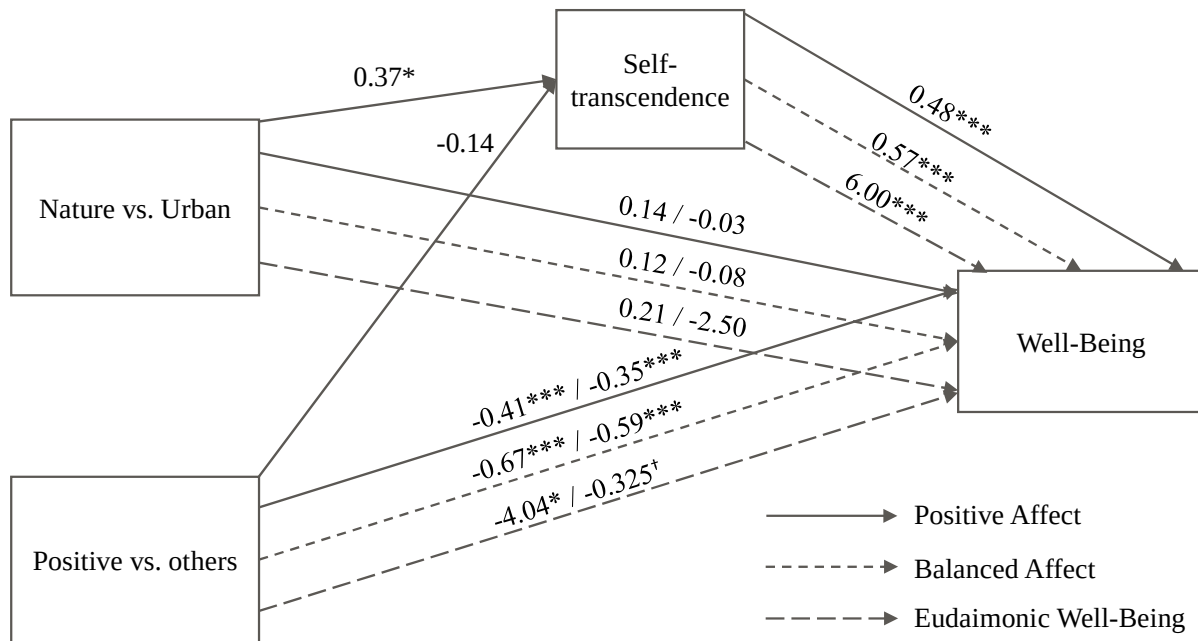


Figure 1. Study 1, Sample 1 mediation model of influence of condition upon self-transcendence and well-being. Both the total and direct effect of condition upon well-being are presented, respectively.

† $p = .06$. * $p < .05$. *** $p < .001$.

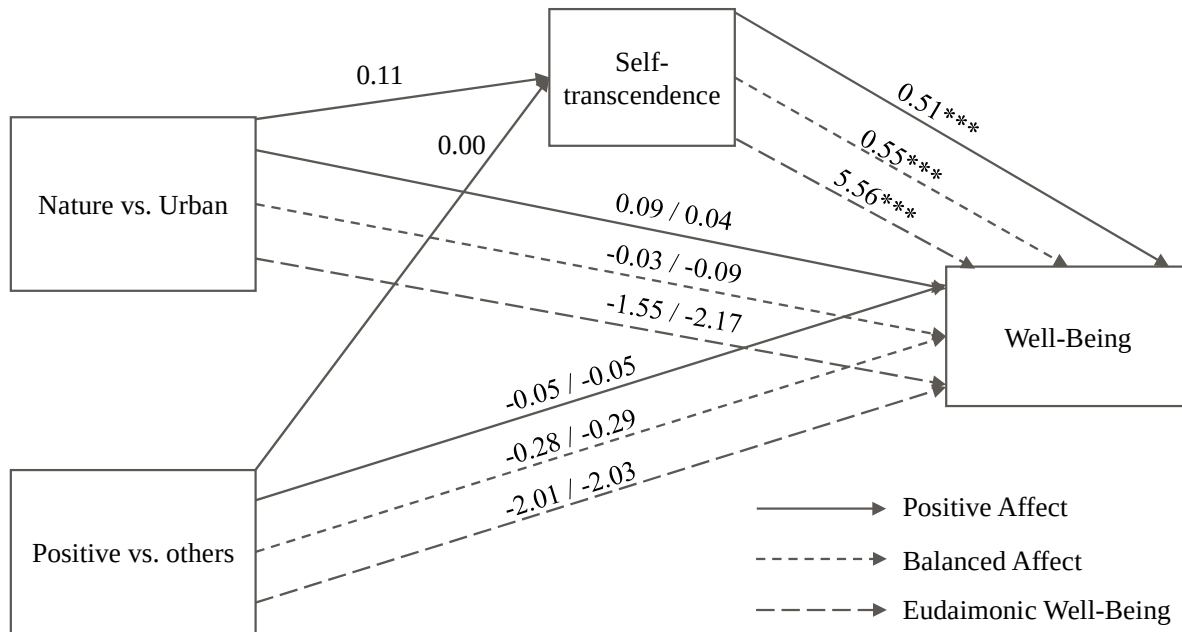


Figure 2. Study 1, Sample 2 mediation model of influence of condition upon self-transcendence and well-being. Both the total and direct effect of condition upon well-being are presented, respectively.

*** $p < .001$.

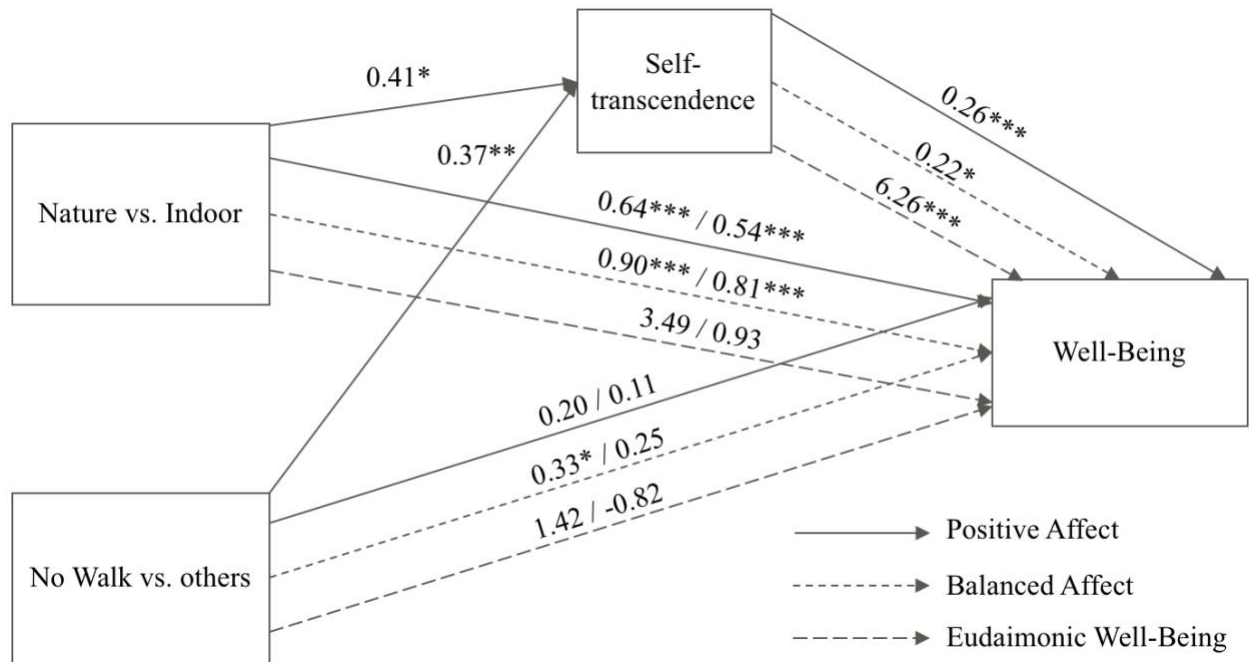


Figure 3. Study 3 mediation model of influence of condition upon self-transcendence and well-being. Both the total and direct effect of condition upon well-being are presented above, respectively.

* $p < .05$. ** $p \leq .01$ *** $p < .001$.

Chapter 3: Understanding Nature Engagement Motivation: A Test of Self-Determination Theory
in a Novel Environment

by

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Contributions

Inspired by the great benefits of nature and the findings of Manuscript 1, I wanted to explore how to increase nature engagement so that people can receive the benefits of nature. In a conversation with Dr. Grouzet, we deemed that a necessary first step was to understand nature engagement motivation. Dr. Grouzet and I planned the series of studies in Manuscript 2. Item generation for the scale was conducted by myself, Dr. Grouzet, Myles Maillet, and Tyler Carey. All studies were conducted by myself and RAs in our lab (see acknowledgements). Study 1 analyses were conducted by Myles Maillet. Study 2 analyses were conducted by both Myles Maillet and myself. I conducted the measurement invariance and mediation analyses, Myles Maillet conducted the ESEM, and all others were conducted by Myles then independently verified by me. Analyses were reviewed by all authors at regular meetings. I wrote the introduction and discussion with some feedback from Myles Maillet. He and I collaborated to write the methods and results.

Abstract

People regularly engage with the natural world. There is little understanding of why people engage with nature. Existing research is largely atheoretical. Self-determination theory is, thus, applied to develop an understanding of why people engage with nature. A series of studies confirm that self-determination theory's proposed relative autonomy continuum is supported in this area. Furthermore, postulates of basic need satisfaction, motivation, and well-being were tested to reveal that, as predicted by the theory, basic need satisfaction while outside is associated with motivation to engage with nature; however, contrary to what was expected, well-being is more related with basic need satisfaction than motivation. This is an initial step in a line of theory-based research on nature engagement motivation. Future research can explore these postulates experimentally. Furthermore, this research serves as a jumping off point to apply self-determination theory's understanding of nature engagement motivation to increasing nature engagement.

Keywords: nature, motivation, self-determination theory

Understanding Nature Engagement Motivation: A Test of Self-Determination Theory in a Novel Environment

Nature is inescapable, whether it is a dandelion that emerges through a crack in pavement or the vast boreal forest of Canada that makes up 55% of the country's natural vegetation (La Roi, 2013) and, yet, people are spending less time in nature (Rideout, Foehr, & Roberts, 2010). Although nature is everywhere, people may not notice it or want to engage with it. There are many reasons to go out into nature, including the psychological and physiological benefits (see Martens & Bauer, 2013 for a review). While these reasons can serve as motivators, they are not representative of any specific type of motivation. Research on nature engagement motivation would be better served by integrating a theoretical perspective. Self-determination theory's relative autonomy continuum of motivation has been well-established in many areas (Sheldon, Osin, Gordeeva, Suchkov, & Sychev, 2017). Consequently, self-determination theory serves as a useful tool for understanding nature motivations. However, it has not been examined in this area and has not been well-tested to explain motivation for generally interesting activities (cf. Pelletier, Vallerand, Brière, & Blais, 1989). Thus, in this paper, we seek to understand why people engage with nature from a theoretically grounded perspective, testing the validity of self-determination theory for explaining motivations to engage with nature.

Examining Nature Engagement

The study of motivation for engaging with nature is particularly important because of benefits that nature engagement can have. First, and foremost, simply feeling connected to nature can benefit one's psychological well-being (Capaldi et al., 2014). Actually engaging with nature or being exposed to it can benefit psychological well-being even more (Mayer et al., 2009; McMahan & Estes, 2015). Furthermore, physical health can benefit from being in nature (Bowler

et al., 2010; Kuo, 2015). Despite the fact that people generally prefer natural over non-natural settings (Frumkin, 2001), there is decreased engagement with nature and increased engagement with electronics (Rideout et al., 2010). Nature is becoming an untapped natural resource of well-being benefits, but there is a dearth of research on peoples' motivation for engaging with it.

Determining the type of motivation that people have for engaging with nature can be difficult, especially when considering the variety of activities that people do in nature ranging from extreme sports to leisurely strolls. Existing efforts have largely focused on recreation experiences (Tinsley, 1986). Within recreational literature, there is a focus on the reasons people engage in outdoor or nature-based activities, but the research often has a narrow focus. For instance, research has been conducted on the motivation for sea kayaking (O'Connell, 2010), which may not be generalizable to other activities. There are innumerable activities that can be undertaken in nature. We consider that nature is at the core of these activities. Many people engage in these nature-based activities for a variety of reasons. Instead of focusing on a particular activity or a particular reason, we are more concerned with exploring the general motivation that people have for engaging with nature, regardless of the activity undertaken.

Some of the earliest research on why people engage with nature found that people primarily seek time in a forest because it is a place for sport and play, it is fascinating, it is a sanctuary, it is part of the national heritage, and it is a place where they can exercise their full capabilities (Bultena & Taves, 1961). This research received limited follow-up, despite a report commissioned from the presidential office of Ronald Reagan on Americans' outdoor activity (Tinsley, 1986). The report presented a variety of outdoor activities that Americans engaged in and, important to the current discussion, determined that the motivations for engaging with nature are primarily found within the psychological and physiological benefits of leisure

(Tinsley, 1986). Major motivations for outdoor recreation were the shared enjoyment with others; feeling of escape; searching for a sense of competence, self-esteem, or self-worth; and a desire to be in pleasant surroundings (Schreyer, 1986). While the research that was compiled to inform this list had considerable methodological flaws and is largely not cited, the list formed an important basis for research that continues today.

Recent research has not significantly altered this list of reasons and they appear to be applicable to a variety of activities. Such motivations have been found for many activities including general outdoor recreation (Walker, Deng, & Dieser, 2001; D. White, 2008), outdoor guiding activities (Eliason, 2011), student participation in guided outdoor activities (Festeu, 2002), visiting or vacationing in forested recreation areas (Bultena & Taves, 1961), camping (Kyle, Absher, Hammitt, & Cavin, 2006), wetlands tourism (T. H. Lee, 2009), birding (Glowinski & Moore, 2014), nature-based or outdoor adventure tourism (Luo & Deng, 2008; Pomfret & Bramwell, 2014), sea kayaking (O'Connell, 2010), mountain biking (Skår, Odden, & Inge Vistad, 2008), outdoor adventure among older adults (Sugerman, 2003), and picnicking and skiing/snowboarding (Zeidenitz et al., 2007).

Reasons for Recreation

The motivations that have been discussed above are simply lists of reasons that people engage with nature but are not informed by motivation theories. The most common questionnaire that has compiled a list of reasons for engagement with nature is the Recreation Experience Preference (REP) scale (Driver, 1983; Driver, Tinsley, & Manfredi, 1991; Manfredi et al., 1996). The REP has 234 items that assess 21 subscales including achievement, autonomy, risk taking, being with similar people, meeting new people, learning, enjoy nature, introspection, creativity, nostalgia, fitness, social escape, physical escape, teaching, and risk reduction.

Unfortunately, the list suffers from low predictive power because of the lack of theoretical basis. Another drawback is the size of the scale which limits applicability.

Another issue with the REP is generalizability. For example, Shin, Kwon, Hammitt, and Kim (2005) note that the REP is insufficient to examine motivations for engaging with greenspace within urban settings. Thus, they developed a scale of psychosocial outcomes that could serve as motivators for greenspace contact. The scale developed by Shin and colleagues, like the REP, contains a list of reasons that people cite for engaging with nature.

By listing the multitude of reasons that are possible for engaging with nature, the REP and Shin and colleagues' (2005) scale focus on goal states rather than motivation types. The factors that compose these scales represent independent constructs that are the desired end states of engaging with nature. Thus, nature is regarded as instrumental to achieving these separable end states. This can be characterized as extrinsic motivation because the activity is seen as means to a separable end (Vansteenkiste, Niemiec, & Soenens, 2010). On the other hand, going out into nature simply for the enjoyment of going out into nature (which is a subscale of the REP) is more representative of intrinsic motivation.

The existing research concerned with motivation to engage with nature suffers from a lack of theoretical framework. Existing scales are simply exhaustive list of potential reasons for engaging with nature. Instead of this atheoretical approach, a theoretically grounded approach to studying motivation for nature engagement is needed. There may be many reasons to engage with nature, which contributes to the lengthiness of the REP. However, these reasons could be surmised as ranging from autonomous to controlled, which has been proposed within self-determination theory to explain all human behaviour.

Self-Determination Theory

Self-determination theory (SDT) postulates that all of human motivation can be described along a continuum from extrinsic to intrinsic motivation (Deci & Ryan, 2000). External regulation is the quintessential example of extrinsic motivation where the behaviour is engaged in to satisfy an external demand or receive a reward. Introjected regulation involves engaging in an activity because of internally felt pressures that originate from external sources. Introjection is the result of a type of internalization of external values often associated with fear, guilt, or anxiety. Identified regulation is when an activity is engaged in because the value of the activity is understood. Integrated regulation, the most autonomous form of extrinsic motivation, occurs when a behaviour comes to be recognized as part of the self and is fully congruent with other aspects of the self. Intrinsic motivation involves engaging in an activity for the pleasure, enjoyment, or interest of doing that activity. Intrinsic motivation, while often thought of as a single global concept, has also been separated into separate forms of intrinsic motivation to know and intrinsic motivation to experience stimulation (Vallerand et al., 1992). Intrinsic motivation to know is still related to the inherent pleasure of the activity, but it is more specifically concerned with the knowledge that one gains while learning, exploring, or seeking understanding in the activity. Intrinsic motivation to experience stimulation concerns sensory stimulation—when a person engages in an activity for the pleasurable sensations or stimulation that arise from that activity.

Apart from intrinsic and extrinsic motivation, amotivation is also an important motivational construct (Ryan & Deci, 2000a). Amotivation represents a state of non-intentional behaviour that has a completely impersonal perceived locus of causality. A person who is amotivated has no desire or willingness to engage in a behaviour or does not understand why he,

she, or they are engaging in it but still engages in it.

The types of regulation (intrinsic, integrated, identified, introjected, external) range from autonomous to controlled. These different types of regulation have been found to independently contribute to different outcomes and show functional independence in numerous factor analyses. Despite this, many choose to investigate the continuum along which the types of regulation fall: autonomous to controlled (Ryan & Connell, 1989). This is referred to as the relative autonomy index (RAI). Critics suggest that too much information is lost when reducing information about the individual types of regulation to a single factor and that the ordered continuum is not supported (Chemolli & Gagné, 2014). However, the RAI is proposed not to be a common factor of the types of regulation, but instead a reflection of the differences in relative autonomy which is a superordinate factor of autonomy (Sheldon et al., 2017).

Self-determination theory also contains a proposition that three basic psychological needs—autonomy, competence, and relatedness—are necessary for growth and optimal functioning (Deci & Ryan, 2000). Furthermore, these psychological needs are proposed to be predictors of autonomous, especially intrinsic, motivation (Ryan, 1995).

Behavioral outcomes. The different forms of motivation have different behavioural outcomes. In particular, autonomous forms, which are fostered through autonomy support, can be maintained longer than external regulation in the absence of rewards or punishment (Ryan & Deci, 2000a). For externally regulated behaviours, behaviour diminishes without the sustained use of rewards or punishment. Contrastingly, removing autonomy support does not necessarily diminish autonomous forms of regulation or the behaviour. For example, children who clean their room because they are receiving candy (i.e., externally regulated) will most likely only continue as long as the candy is offered. Rather, if someone learned piano from an autonomy-

supportive instructor who offered explanatory rationale, acknowledged feelings, and displayed patience (among other autonomy-supportive methods; Deci & Ryan, 2012), the person will likely engage freely in it without the use of rewards or punishment and after leaving the autonomy supportive environment. It is important to note that people can change the type of motivation that they have for a behaviour. Behaviours that begin as externally regulated can become internalized and, therefore, more autonomously regulated, and vice versa—autonomously regulated behaviours can become more controlled (Deci, Koestner, & Ryan, 1999; Ryan, 1995). A person is not stuck with a particular type of motivation.

Well-being outcomes. The type of motivation is important for the well-being that one experiences surrounding a behaviour. Engaging in a behaviour for autonomous reasons is likely to be associated with higher well-being than for controlled reasons (Ryan et al., 2008). As mentioned previously, the satisfaction of the basic psychological needs is proposed to be a precipitant of the type of motivation. Therefore, need satisfaction is both directly and indirectly related to well-being (Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon, Ryan, & Reis, 1996).

Self-determination theory to explain nature engagement. The continuum of motivation as outlined within SDT has been applied in many domains ranging from education (Vallerand et al., 1992) to pro-environmental behaviours (Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998). We propose that it is equally applicable to understanding motivation for engaging with nature.

Due to the dearth of research on motivations to engage with nature and the limitations of existing scales, we sought to approach the topic from an established theoretical framework. Moreover, there is a need to test the validity of self-determination theory's propositions in this novel area.

The difficulty of applying self-determination theory to nature engagement is that nature is inherently interesting, as evidenced by a general preference of natural over non-natural settings (Shepard, 1982; Ulrich, 1983; Wilson, 1984). Self-determination theory has been applied in many contexts that are not inherently interesting such as health behaviours. Thus, there is a need to test its relevance in an area that is inherently interesting. To date, this has only been undertaken in the study of leisure motivation (Pelletier et al., 1989).

Current Research

The goal of the current research is to apply the self-determination continuum to a novel area which most people find inherently interesting – nature engagement. There is also a need for a scale of motivation to engage with nature that is informed by motivation research and not restricted to a specific activity. An initial study with three independent samples was conducted to validate self-determination theory's relative autonomy continuum in the area of nature engagement. Another study with two independent samples was conducted to test the propositions of self-determination theory and nature engagement as they relate to affective, behaviour, and cognitive outcomes.

Study 1

The goal of Study 1 was to examine the different types of motivation from SDT in the area of nature engagement. To this end, a scale was developed after consulting with existing motivation scales (Pelletier, Rocchi, Vallerand, Deci, & Ryan, 2013; Pelletier et al., 1998; Ryan & Connell, 1989; Vallerand et al., 1992). This scale was employed in three independent samples, examining the presence, structure, and independence of the proposed motivation types. Sample 1 completed a preliminary version of the nature engagement motivation scale (NEMS), Sample 2 completed a shortened version of the NEMS, and Sample 3 completed a final version of the

NEMS.

Methods

Participants and procedure. Participants ($n = 497$, $n = 360$, $n = 300$) were recruited from the University of Victoria. Trained research assistants recruited participants from public spaces on the university campus. Participants were asked if they would like to participate in a study about “why do you go outside to nature?” Participants were offered a small chocolate bar in exchange for their participation. Participants who indicated they had participated in previous samples were removed from Samples 2 and 3 ($n = 23$, $n = 5$). Data screening for Samples 1 and 2 was completed by removing participants with more than 10% missing data ($n = 22$, $n = 1$). Following this, we conducted multiple imputation for missing observations (mean of 1.8 and 1.2 per item in each sample, respectively; conducted with the Amelia II package in R; Honaker, King, & Blackwell, 2011) and participants were removed based on visual inspection of Mahalanobis’ distance scores ($n = 19$ and $n = 6$).⁹ Sample 1 ($n = 456$) was 59.5% female and ranged from 17 to 66 years of age ($M = 22$, 85.2% of participants under the age of 25). Sample 2 ($n = 330$) was 60.1% female and ranged from 18 to 88 years of age ($M = 21$, 91.6% of participants under the age of 25). Sample 3 (final $n = 295$) was 62.4% female and ranged from 13 to 69 years of age ($M = 22.64$, 74.6% of participants under the age of 25).

Measures. The initial version of the NEMS contained 49 items spanning 7 theoretical subscales: *intrinsic motivation – for knowledge* (4 items), *intrinsic motivation – for stimulation* (8 items), *integrated* (7 items), *identified* (7 items), *introjected* (8 items), and *external regulation* (10 items), as well as *amotivation* (5 items). Items were possible responses to the question, “Why do you go outside to nature?” Participants responded along a 7-point scale from (1) “Does not

⁹ Results do not noticeably change if outliers are removed at the $p < .001$ chi-square cutoff, or if all outliers are included in analyses.

correspond at all” to (7) “Corresponds exactly.” Participants were informed that going outside to nature can include anything from a brief walk to more immersive experiences such as camping, but not outdoor activities that are engaged in for commuting or working. Samples 2 and 3 completed increasingly refined versions of this scale.

Results

To examine the structure of the scale and the independence of subscales among Sample 1, exploratory factor analyses (EFA) were conducted, each using maximum likelihood estimation and oblique rotation (“psych” package in R; Revelle, 2018). First, the items were grouped into four categories based on conceptual similarity: (1) items for *intrinsic motivation – for knowledge* and *intrinsic motivation – for stimulation*, (2) items for *integrated* and *identified regulation*, (3) items for *introjected* and *external regulation*, and (4) items for *amotivation*. A separate EFA was conducted on each category. A combination of parallel analysis and theoretical reasoning was used to determine the number of recommended factors for each category (package “paran” in R; Dinno, 2015). No item correlations exceeded .80, indicating the absence of multicollinearity (Tabachnick & Fidell, 2007). For each of the separate EFAs, items demonstrating a 0.30 loading (pattern matrix) for the appropriate factor were retained¹⁰. As expected, within each EFA, the expected subscales were distinguishable. In this phase 15 items were removed: 11 because they cross-loaded too high on other factors, 3 because the items were too similar to other items, and 1 because it did not load well onto any factor. An overall EFA and parallel analysis of the remaining 34 items indicated an 8-factor solution, but the last eigenvalue barely exceeded the randomness threshold, and accounted for less than 1% of the sample variance. Therefore, a 7-factor solution representing the proposed factors was examined, which

¹⁰ See Supplemental Material following this manuscript for tables of the factor loadings from all studies.

accounted for 62% of the sample variance.

Sample 2 completed a 33-item version of the scale¹¹. The same separate EFAs and an overall EFA were examined as in Sample 1. Based on low factor loadings and moderately large cross-loadings 4 items were removed, resulting in a 29-item version of the scale. Parallel analysis of the resulting 29 items indicated a 7-factor solution, which accounted for 62% of the sample variance. The subscales were classified as *intrinsic motivation – for knowledge* (3 items), *intrinsic motivation – for stimulation* (4 items), *integrated* (4 items), *identified* (4 items), *introjected* (4 items), and *external regulation* (6 items), as well as *amotivation* (3 items).

Confirmatory factor analyses (CFA)¹² were conducted on the 29-item version of the scale, which was completed by participants in Sample 3. Item correlations did not exceed .71, indicating an absence of multicollinearity. The CFA results for the 7-factor solution indicated acceptable fit, $\chi^2(356) = 857.943$, $p < .001$, CFI = .873, SRMR = .091, RMSEA = .069. Item loadings ranged between .56 and .86.

The correlation between *intrinsic motivation – for stimulation* and *identified regulation* was high in the CFA (.95) and most items loaded onto the same factor in previous EFAs. Thus, we investigated the face validity of the items involved. We noticed that three of the *identified regulation* items were focused on outcomes. Stimulation is a primary outcome when engaging with nature, which may explain the high correlation. Therefore, we decided to remove these three items and combine the remaining *identified regulation* item with the *integrated regulation* factor – renaming this factor *integrated-identified regulation* (see Table 1 for list of items with

¹¹ Due to a clerical error, one intrinsic motivation – for knowledge item was not included in the survey for Sample 2. It was included in all other versions. Results for Sample 2 involve a 33-item version which does not include this item.

¹² CFAs were conducted using robust maximum likelihood estimation (using the “lavaan” package in R; Rosseel, 2012). The first item loading for each factor was fixed to 1.0 for identification purposes.

notation of items that were removed; we advise caution regarding the risk of multicollinearity if using all 29-items). Integrated and identified regulation are both autonomous forms of extrinsic motivation (Ryan & Connell, 1989; Ryan & Deci, 2000a) and are not always distinguished in self-determination theory scales (Koestner, Losier, Vallerand, & Carducci, 1996; Losier & Koestner, 1999; Losier, Perreault, Koestner, & Vallerand, 2001; Pelletier et al., 1989; Vallerand et al., 1992). Gagné and colleagues (2015) similarly could not identify integrated regulation as a separate factor and note that there is no evidence that it accounts for additional variance in different outcomes above the effect of identified regulation and intrinsic motivation. The difficulty of distinguishing integrated regulation from others may be due to how it is assessed. Integrated regulation is concerned with the activity being fully integrated into one's self and not in conflict with any other aspects of the self. This may not be possible to assess with self-report measures (Roth et al., 2006; Sheldon et al., 2017). Thus, further analyses are conducted using a revised, 6-factor (26-item) version of the NEMS.

A CFA of the 6-factor solution in Sample 3 showed adequate fit, $\chi^2(284) = 736.899$, $p < .001$, CFI = .866, SRMR = .096, RMSEA = .074. Item loadings ranged between .49 and .85. The factor correlations reflected the proposed simplex structure of the self-determination continuum and the NEMS subscales demonstrated high internal consistency (see Table 2).

Exploratory structural equation modeling. To overcome some limitations of CFA (i.e., to avoid inflated factor correlations and to examine potential cross-loadings) exploratory structural equation modelling (ESEM) was conducted in MPlus with target rotation on each sample (see Marsh, Morin, Parker, & Kaur, 2014). Results of the ESEM indicated good fit, $\chi^2(184) = 380.314$, $p < .001$, CFI = .942, SRMR = .024, RMSEA = .060. Most item loadings ranged from .46 to .90, with the exception of two *integrated-identified regulation* items (.40 and

.25) and one *external regulation* item (.27). Most cross-loadings were less than .34, with the exception of one item (.39) cross-loading onto an adjacent factor.

Discussion

Self-determination theory's continuum of regulation types was evaluated in the area of nature engagement. Across three samples, the proposed regulation types were found to be independent and follow the proposed simplex-structure that has been found in numerous other areas (Guay, Vallerand, & Blanchard, 2000; Ryan & Connell, 1989; Sheldon et al., 2017). This provides preliminary evidence for self-determination theory's applicability in the area of nature engagement. Further tests of the theory are necessary to establish its applicability in this area.

Study 2

The aim of Study 2 is to evaluate whether propositions of SDT concerning antecedents, consequences, and correlations of motivation are upheld in the area of nature engagement. Specifically, we examine 3 research questions. The satisfaction of basic psychological needs is a known predictor of autonomous regulation (Deci & Ryan, 2000), which is a predictor of more consistent behaviour when compared to controlled regulation (Deci & Ryan, 2012). Thus, our first research question is, does need satisfaction predict motivation and, subsequently, behaviour? Secondly, motivation is proposed to exist in a hierarchical model consisting of one's global motivation (also known as orientations), contextual motivation, and situational motivation (Vallerand, 1997). Motivation at each level can influence other levels. At the contextual and situational levels, distinct contexts and situations may be more or less related (e.g., academic motivation maybe more related to work motivation than to sport motivation). Thus, our second research question is, to what extent are the types of nature engagement motivation related to other contextual motivations? Thirdly, there are a number of phenomena that are expected to be

related with nature engagement motivation such as connectedness to nature and well-being. Thus, our third research question is, does type of motivation relate with conceptually similar phenomena? We expected autonomous motivation to be related to greater involvement in similar domain attitudes, cognitions, and behaviours (i.e., nature relatedness, nature connectedness, environmental concern, reasons for recreational engagement, and reduced fear of outdoors). By contrast, more controlled forms of motivation were expected to be unrelated or negatively related. Furthermore, a postulate of the hierarchical model of intrinsic and extrinsic motivation is that autonomous motivation is related with well-being (Vallerand, 1997). Moreover, nature exposure is a known predictors of well-being (McMahan & Estes, 2015). Building off of the aforementioned mediation model of need satisfaction, motivation, and nature behaviour, we also expect that well-being is predicted by each of these. Thus, relations between well-being and these predictors are examined.

Methods

Participants and procedure. Two independent samples of participants ($n = 358$ and $n = 316$, respectively) were recruited from the University of Victoria undergraduate participant pool. Participants were invited to complete a battery of questionnaires in a computer lab. Several measures were completed by both samples, but others were split up by sample to reduce participant fatigue. The samples were mostly female (76.5% and 83.2% female). The mean ages were 23 and 21 years of age (with 90% and 88.6% of participants under the age of 25).

Measures. To reduce participant fatigue, measures were split equally between samples. Both samples completed measures that were deemed central to the purpose of the study. For each measure, the sample that completed it is noted.

Nature engagement motivation. Both samples completed the 29-item version of the scale

developed in Study 1. The scale showed high reliability (Cronbach's $\alpha_{\text{sample 1}} = .87$, $\alpha_{\text{sample 2}} = .84$).

Perceived satisfaction of psychological needs while outside. Both samples completed an adapted version of the Basic Psychological Needs Scale (Gagné, 2003) to assess perceived satisfaction of three psychological needs while outside: *autonomy*, *competence*, and *relatedness*. The scale contains 21 items, for each of which participants respond how much it is true of them on a 7-point Likert scale from “Not at all true” to “Very true.” A sample item for *autonomy* is, “I feel like I am free to decide for myself how to live my life.” A sample item for *competence* is, “I have been able to learn interesting new skills recently.” Finally, a sample item for *relatedness* is, “I really like the people I interact with.” The scale showed high reliability ($\alpha_{\text{sample 1}} = .90$, $\alpha_{\text{sample 2}} = .89$).

Nature exposure. Both samples completed a brief 4-item measure of nature exposure created by Kamitsis and Francis (2013). Participants were asked to rate their level of exposure to natural environments in everyday and non-everyday life on a 5-point scale ranging from (1) “Low” to (5) “High”, and to indicate how much they take notice of these natural environments in everyday and non-everyday life on a 5-point scale ranging from (1) “Not much” to (5) “A great deal”. Everyday and non-everyday nature exposure were calculated as products of each of the relevant items from the nature exposure scale. For instance, how much participants noticed nature in everyday settings was multiplied by how much exposure they had in everyday settings to create a single indicator of everyday nature exposure. The scale showed adequate reliability ($\alpha_{\text{sample 1}} = .64$, $\alpha_{\text{sample 2}} = .53$).

Frequency and duration in nature. In addition, participants in both samples were asked to recall their amount of time spent in nature. They were asked “On average, in the past 6 months, how many times a week have you gone out into/sought time in nature?” with responses

ranging from (0) “Less than once per week” to (8) “More than seven times per week.”

Participants were also asked “In minutes, how long do you spend in nature per week?” with responses ranging from (0) “Less than 5 minutes per week” to (8) “Five or more hours per week.” The scale showed moderate reliability ($\alpha_{\text{sample 1}} = .75$, $\alpha_{\text{sample 2}} = .73$).

Motivation scales. Sample 1 completed several motivation scales. The General Motivation Scale (GMS) to assess motivation toward behaviour in general (Guay, Mageau, & Vallerand, 2003). It consists of 24 items spanning 8 factors: *intrinsic motivation – for stimulation*, *intrinsic motivation – for accomplishment*, *intrinsic motivation – for knowledge*, *integrated regulation*, *identified regulation*, *introjected regulation*, *external regulation*, and *amotivation*. In response to the statement, “In general, I do things...” participants were asked to respond on a 7-point Likert scale ranging from (1) “Does not correspond at all” to (7) “Corresponds exactly.” All motivation scales used this same response scale. Sample items include, “because I like making interesting discoveries” (*intrinsic motivation – for knowledge*) and “because I force myself to do them” (*introjected regulation*). The scale showed high reliability ($\alpha_{\text{sample 1}} = .87$).

The Leisure Motivation Scale (LMS; Pelletier, Vallerand, Brière, & Blais, 1989) was used to assess the motivation that people have for specific leisure activities. Participants were instructed to think of a leisure activity they do most often and then respond to items answering the question, “Why do you generally do leisure activities?” It consists of 24 items spanning the same factors as the GMS, with the exception of an *integrated regulation* factor. Sample items include, “because I absolutely must have my leisure time to be in a good mood” (*introjected regulation*) and “for the pleasure I feel when I outdo myself in interesting activities” (*intrinsic motivation – for accomplishment*). The scale showed high reliability ($\alpha_{\text{sample 1}} = .89$).

The 28-item Academic Motivation Scale (AMS; Vallerand et al., 1992) was used to assess reasons for pursuing post-secondary education. The AMS assesses the same 7 subtypes of behaviour regulation as the LMS. Sample items include “For the intense feelings I experience when I am communicating my own ideas to others” (*intrinsic motivation – for stimulation*) and “I can't see why I go to college and frankly, I couldn't care less” (*amotivation*). The scale showed high reliability ($\alpha_{\text{sample 1}} = .90$).

The Sport Motivation Scale II (SMS-II) was employed to measure motivation to participate in recreational sports (Pelletier et al., 2013). The scale assesses 6 factors: *intrinsic motivation*, *integrated regulation*, *identified regulation*, *introjected regulation*, *external regulation*, and *amotivation*. Sample items include, “Because it gives me pleasure to learn more about my sport” (*intrinsic motivation*), and “Because I feel better about myself when I do” (*introjected regulation*). The scale showed high reliability ($\alpha_{\text{sample 1}} = .90$).

The 24-item Motivation Toward Environment Scale (MTES; Pelletier et al., 1998) was employed to assess reasons for engaging in pro-environmental behaviours. The MTES measures SDT's types of regulation, but with a general intrinsic motivation factor. Each item is a potential answer to the question, “Why are you doing things for the environment?” Items include, “It is a sensible thing to do” (*identified regulation*) and “To avoid being criticized” (*external regulation*). The scale showed high reliability ($\alpha_{\text{sample 1}} = .91$).

Nature relations. To explore participants' feelings of connection to the natural world, Sample 1 completed the Nature Relatedness scale (NR; Nisbet et al., 2009) and Sample 2 completed the Connectedness with Nature Scale (CNS; Mayer & Frantz, 2004). The NR scale is a 21-item comprehensive measure of personal feelings of relations to nature, perspectives one has of nature, and one's experiential connection to the natural world. Participants responded on a

5-point Likert scale from “Strongly disagree” to “Strongly agree” to item such as, “My relationship to nature is an important part of who I am.” The nature relatedness scale showed high reliability ($\alpha_{\text{sample 1}} = .87$). The CNS is a 14-item scale designed to assess subjective feelings of emotional connection to the natural world. Participants were asked to indicate how much they agree that each statement describes them along the same 5-point scale as in the NR. A sample item is, “I feel as though I belong to the Earth as equally as it belongs to me.” The connectedness to nature scale showed good reliability ($\alpha_{\text{sample 2}} = .83$).

Environmental concern. Sample 1 completed the New Ecological Paradigm (NEP; Dunlap, Van Liere, Mertig, & Jones, 2000) to assess environmental concern. The NEP is a 15-item scale that assesses participants’ concerns about the protection and sustainability of the earth with questions such as, “The balance of nature is very delicate and easily upset.” Participants responded on a 5-point Likert scale from “Strongly agree” to “Strongly disagree.” The scale showed high reliability ($\alpha_{\text{sample 1}} = .87$).

Outdoor fears. Sample 1 completed the Outdoor Situational Fear Inventory (OSFI; Young, Ewert, Todd, Steele, & Quinn, 1995) to measure fears of outdoor settings in recreation experiences. The OSFI is a 33-item scale that asks participants to indicate their level of concern about 33 different outdoor-related anxiety-inducing situations or phenomena such as “getting dirty,” “not having enough physical strength,” or “unable to control physical environment.” Participants responded on a 10-point sliding scale from “Not at all anxious” to “Very anxious.” The scale showed high reliability ($\alpha_{\text{sample 1}} = .93$).

Social desirability. Sample 1 completed the 40-item Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1991) to assess two aspects of social desirability – *self-deception* and *impression management*. A sample item for *self-deception* is, “I am in control of my own

fate.” A sample item for *impression management* is, “I never take things that don’t belong to me.” Participants responded on a 7-point Likert scale from “Not True” (1) to “Very True” (7). The scale showed good reliability ($\alpha_{\text{sample 1}} = .82$).

Reasons for nature engagement. To measure participants’ reasons for going outside, Sample 2 completed the reduced version of the Recreation Experience Preference scale (REP; Driver, 1983; Driver et al., 1991; Manfredi et al., 1996) was administered using only the 113 core items. The REP assesses many different reasons that people have for engaging in recreational activity, including the following subscales: *Achievement, Autonomy, Risk Taking, Equipment, Family Togetherness, Similar People, New People, Learning, Enjoy Nature, Introspection, Creativity, Nostalgia, Fitness, Rest, Social Escape, Physical Escape, Social Security, Escape Family, Teaching, and Risk Reduction*. Participants indicated how much each item was representative of a reason that they engage with nature on a 7-point scale from “Not at all true” to “Very true.” Items included such statements as, “To gain a sense of self-confidence” (*Achievement*) and “To do something with your family” (*Family Togetherness*). The scale showed high reliability ($\alpha_{\text{sample 2}} = .98$).

Well-being. Sample 2 completed several scales to assess various aspects of well-being. The 21-item Questionnaire for Eudaimonic Well-Being (QEWB; Waterman et al., 2010) was used to assess eudaimonia. It focuses on “self-discovery, perceived development of one’s best potentials, a sense of purpose and meaning in life, intense involvement in activities, investment of significant effort, and enjoyment of activities as personally expressive” (p. 41). Participants were instructed to respond in a manner that was reflective of how things were actually going in their life, not how they wished them to be. Participants responded on a 7-point Likert scale ranging from (1) “Very untrue of me” to (7) “Very true of me.” Sample items include “I believe I

have discovered who I really am” and “When I engage in activities that involve my best potentials, I have this sense of really being alive.” The scale showed good reliability ($\alpha_{\text{sample}} = .85$).

Affect was measured using the Scale of Positive and Negative Experience (SPANE; Diener et al., 2010). The scale consists of 12 items, including half positive emotions (e.g., “positive” or “joyful”) and half negative emotions (e.g., “negative” or “angry”). Participants were instructed to report how much they were currently feeling each emotion on a 5-point Likert scale from “Very slightly or not at all” to “Very much.” The scale showed good reliability ($\alpha_{\text{sample}} = .89$).

The 8-item Flourishing Scale (Diener et al., 2010) was used to assess optimal functioning including positive relationships, competence, and meaning and purpose in life. Items are responded to on a 7-point Likert scale ranging from (1) “Strongly Disagree” to (7) “Strongly Agree.” Sample items include, “I lead a purposeful and meaningful life” and “I actively contribute to the happiness and well-being of others.” The scale showed good reliability ($\alpha_{\text{sample}} = .86$).

Life satisfaction was assessed with Diener, Emmons, Larsen, and Griffin’s (1985) Life Satisfaction Scale. It consists of 5 items to which participants respond on a 7-point Likert scale from (1) “Strongly Disagree” to (7) “Strongly Agree”. Sample items include, “I am satisfied with my life” and “In most ways my life is close to ideal.” The scale showed good reliability ($\alpha_{\text{sample}} = .85$).

Finally, the Subjective Vitality scale (Ryan & Frederick, 1997) was used to assess feelings of aliveness and energy. It consists of 6-items to which participants respond on a 7-point scale from (1) “Not at all true” to (7) “Very true.” Sample items include, “I feel alive and vital”

and “I look forward to each new day.” The scale showed high reliability ($\alpha_{\text{sample 2}} = .92$).

Results

The presence and structure of the different regulation types was again tested in Study 2 with a confirmatory factor analysis and exploratory structural equation modeling.

Factorial structure of the measure. Only three item correlations reached .9, all other correlations were .8 or lower, indicating the absence of multicollinearity. The CFA results for the 6-factor solution indicated acceptable fit, $\chi^2(284)_{\text{Sample 1}} = 722.654$, $p < .001$, CFI = .916, SRMR = .085, RMSEA = .066; $\chi^2(284)_{\text{Sample 2}} = 672.388$, $p < .001$, CFI = .914, SRMR = .077, RMSEA = .066. See Table 2 for factor correlations and subscale reliabilities.

Results of the ESEM for each sample indicated good fit, $\chi^2(184)_{\text{Sample 1}} = 267.891$, $p < .001$, CFI = .984, SRMR = .016, RMSEA = .036; $\chi^2(184)_{\text{Sample 2}} = 322.034$, $p < .001$, CFI = .969, SRMR = .021, RMSEA = .049. For Sample 1, most item cross-loadings were below .31, with the exception of one item (.51) cross-loading onto an adjacent factor. For Sample 2, most item loadings ranged from .50 to .98, with the exception of one *identified regulation* item (.27). Most of the cross-loadings were below .28, with the exception of one item (.44) cross-loadings onto an adjacent factor. The cross-loading items were different for each sample. See Table 2 for factor correlations.

Invariance. Measurement and factor invariance of the NEMS was tested across gender. The two samples were combined with Sample 3 of Study 1 to ensure sufficient sample size for both genders. All gender binary participants were retained ($n_{\text{males}} = 215$; $n_{\text{females}} = 744$). The configural model, in which no parameters were constrained to be equal across gender, showed good fit (see Table 3). The metric model, in which pattern factor loadings were constrained across groups, did not differ significantly from the configural model, indicating invariance. The

scalar model, in which observed variable intercepts and loadings were constrained across groups, differed significantly from the metric model. The uniqueness model, in which residual variances of the observed variables, intercepts, and loadings were constrained across groups, differed significantly from the scalar model. The scale proves to be somewhat variant across gender, beyond factor loading invariance. It should be noted that the latter two levels of invariance are rarely met, with residual invariance being extremely unlikely and of little substantive value (Byrne & Stewart, 2006; Meredith, 1993).

Need satisfaction, motivation, and behavior. The mediational hypothesis that need satisfaction predicts motivation and, subsequently, behavior was investigated using structural equation modeling. Need satisfaction was treated as a latent variable of three parcels; each containing two autonomy items, two competence items, and three relatedness items (Kline, 2015). An RAI score was calculated by subtracting external and introjected regulation scores from intrinsic and integrated-identified regulation scores (Ryan & Connell, 1989). Four parcels which contained one or two items from each regulation type were created. Each of these parcels was then used as an indicator for the RAI. Nature exposure was computed as 3 separate non-latent variables: time spent in nature, everyday nature exposure, and non-everyday exposure. Time spent in nature was an average of the frequency and duration items. Each outcome was run in separate models to enable independent testing of full or partial mediation. Standardized effects are reported.

The full mediation model for time spent in nature showed good fit $\chi^2(19) = 95.23, p < .001$, CFI = .98, SRMR = .051, RMSEA = .073. The partial mediation model showed better fit $\chi^2(18) = 75.06, p < .001$, CFI = .98, SRMR = .035, RMSEA = .065;

$\Delta\chi^2_{Satorra-Bentler}(1) = 16.94, p < .001$. The indirect effect was significant, $ab_{\text{time}} = .083, p < .001$

(see Figure 1).

The full mediation model for everyday nature exposure showed good fit $\chi^2(19) = 66.15, p < .001$, CFI = .99, SRMR = .037, RMSEA = .057. The partial mediation model showed better fit $\chi^2(18) = 61.07, p < .001$, CFI = .99, SRMR = .032, RMSEA = .056; $\Delta\chi^2_{SB}(1) = 5.37, p = .02$. The indirect effect was significant, $ab_{\text{everyday}} = .096, p < .001$ (see Figure 1).

The full mediation model for non-everyday nature exposure showed good fit $\chi^2(19) = 106.28, p < .001$, CFI = .97, SRMR = .053, RMSEA = .078. The partial mediation model showed better fit $\chi^2(18) = 80.74, p < .001$, CFI = .98, SRMR = .035, RMSEA = .068; $\Delta\chi^2_{SB}(1) = 21.66, p < .001$. The indirect effect was significant, $ab_{\text{non-everyday}} = .127, p < .001$ (see Figure 1).

Relations with well-being. Well-being is known to relate to need satisfaction, motivation, and nature exposure. Consequently, these relations were tested in an integrated model of the above mediation findings. Well-being was regressed on need satisfaction, motivation, and nature behaviours. A single latent variable of well-being was indicated by the means of each type of well-being (i.e., flourishing, balanced affect, and eudaimonic well-being). We chose to treat well-being as a unitary latent variable because well-being can be thought of as a unitary concept comprised of a number of indicators (DeHaan & Ryan, 2014; Kashdan, Biswas-Diener, & King, 2008; McMahan & Estes, 2011). Furthermore, each of the predictor variables has been related with different types of well-being, thus, for reasons of parsimony, well-being was treated as a unitary latent variable. The model fit well, $\chi^2(78)_{\text{Sample 2}} = 178.62, p < .001$, CFI = .95, SRMR = .047, RMSEA = .066. Well-being was significantly related with need satisfaction, $\beta = .894, p < .001$, but not the RAI, $\beta = -.057, p = .403$, time spent in nature, $\beta = -$

.082, $p = .141$, everyday nature exposure, $\beta = -.047$, $p = .346$, or non-everyday nature exposure, $\beta = -.081$, $p = .181$. See Figure 2 for a representation of the model with all findings.

Nature engagement motivation and other motivations. To address our second research question, relations between similar regulation types on the NEMS and other motivations scales were examined. Overall, the NEMS factors were mostly correlated with the same factors on other SDT scales (see Table 4). More specifically, nature engagement motivation was closely related to motivation for pro-environmental behaviours and sport motivation across all factors. Autonomous forms of motivation were correlated among nature engagement motivation and leisure motivation as well as general motivation. Relations between nature engagement motivation and academic motivation were the lowest, but still positive.

Nature engagement motivation and other phenomena. To address our third research question, we examined the relations between nature engagement motivation and other scales. CFAs were used to test the structure of all scales involved. All measures demonstrated acceptable model fit.¹³ Results are reported in Table 5.

Nature relations, environmental concern, and outdoor fears. Nature relatedness, connectedness to nature, and the new ecological paradigm¹⁴ were mostly positively related with autonomous nature engagement motivation, as expected. Notably, autonomous motivation types (and introjected regulation) were more closely related to the self and environment subscales of nature relatedness than the perspective subscale.

The Outdoor Situational Fear Index was negatively related with autonomous forms of

¹³ In addition to reverse coding negatively worded items in all scales, a “negative” factor was also included for the NR and NEP scales. For scales with a large number of items loading on a given factor (i.e., BIDR, CNS, and OSFI) random parcels of items were created, loading onto the appropriate factors.

¹⁴ For the New Ecological Paradigm scale, reported results involve a 5-factor structure with a superordinate *environmental concern* factor.

regulation as expected. Furthermore, fears were positively related with extrinsic regulation and amotivation.

Social desirability. The CFA of the BIDR indicated poor fit, which has occurred in previous research (Kroner & Weekes, 1996; Li & Li, 2008). The structure of the BIDR was tested using several suggestions found in the literature such as one general factor encompassing two latent factors (Gignac, 2013) and was still undesirable. Nonetheless, we decided to examine the relation between the two-factor BIDR model and the NEMS, but these findings need to be interpreted with caution. Findings indicate significant positive relations with the RAI, but not individual regulation types.

Reasons for nature engagement. To examine relations between the recreation experience preference scale (REP)¹⁵ and the NEMS, each motivation type was regressed on all subscales of the REP to partial out potential overlapping effects of each reason to engage. Results thus show the unique relation between each reason and motivation type. Results reveal relations between the relative autonomy continuum and going outside because of the enjoyment of nature (Table 6). External regulation and going outside for achievement were related. The desire to learn and the desire to teach were also related with the relative autonomy continuum, with intrinsic motivation – for knowledge significantly related with the desire to learn. These results align with the theoretical bases of the continuum of types of motivation.

General Discussion

The objective of the current research was to evaluate the viability of self-determination theory to explain motivations to go outside to nature. In particular, we were interested in determining whether the different types of motivation proposed by self-determination theory

¹⁵ A CFA was not conducted on the REP as it contains several single-item factors and we did not have sufficient degrees of freedom.

existed in the area of nature engagement. In addition, several propositions of antecedents and outcomes of motivation were tested. In two studies, several propositions of self-determination theory are confirmed—for the first time—in the area of nature engagement. In particular, the relative autonomy continuum exists in nature engagement motivation. Although integrated and identified regulation were not distinguished in the current analysis, all other types of regulation were identified through exploratory and confirmatory factor analysis. Moreover, nature engagement motivations were determined to be distinct from motivations for other activities including motivations for academics, pro-environmental behaviours, and sports. In addition, we found that need satisfaction predicted motivation, which predicted nature behaviours. The findings are discussed in relation to existing self-determination theory research. Implications for encouraging nature engagement are also discussed.

Testing Self-Determination Theory

The current research is the first instance that the self-determination theory continuum has been explored in the setting of recreational nature engagement. Some similar phenomena have been examined using the framework of self-determination theory, including motivation toward the environment which addresses environmental protection (Pelletier et al., 1998). Although motivation types in these domains are correlated, they are distinct and show different structures. For instance, in the current study, introjection is much less of a prevalent regulatory style. Moreover, the hierarchical model of motivation outlines that motivation in contexts that are similar should be more strongly related and, conversely, dissimilar contexts should be less related (Vallerand, 1997). In line with these propositions, nature engagement motivation is more similar to sport, leisure, and pro-environmental motivation than academic motivation. This is most likely due to some sports and leisure activities being conducted in nature and an obvious

connection between pro-environmental behaviours and nature. Importantly, though, these correlations were low enough to indicate that motivation for nature engagement is a conceptually distinct phenomenon.

On the other hand, motivation for academics and nature engagement are largely unrelated with only a few moderate relations. This is potentially because they are largely unrelated domains. There are instances of nature-based schools, but these are rare. The existing relations between the nature engagement and academic motivation are likely a result of global motivation exerting a top-down influence on both contexts (Guay et al., 2003).

Not only is this a novel application of self-determination theory, but the present area of research (nature engagement) is regarded as inherently interesting to many people and, therefore, has interesting applications for self-determination theory. In particular, many self-determination theory assessments of motivation are in fields that are not inherently interesting or have elements of control built into them. For example, education settings may be interesting to some, but the education system is, by and large, quite a controlling setting. Leisure motivation is one domain of interesting activities that has validated self-determination theory's relative autonomy continuum (Pelletier et al., 1989; Vallerand, Blais, Brière, & Pelletier, 1989). Despite the possibility that people engage with nature as a leisure activity, nature engagement motivation is distinct from leisure motivation with only moderate correlations between factors.

As mentioned previously, integrated regulation was not distinguishable from identified regulation using the current scale. The theoretical framework of self-determination theory suggests that integrated regulation is distinct from identified regulation. However, assessing integrated regulation as a form of nature engagement motivation proved difficult. This has also been noted in other behavioural domains. In fact, Gagné and colleagues (2015) dropped

integrated regulation items from their multidimension work motivation scale because the items could not be distinguished from intrinsic motivation or identified regulation. Furthermore, several other self-determination theory scales do not even include an integrated factor (Losier et al., 2001; Pelletier et al., 1989; Vallerand et al., 1992). This is most likely because detecting integrated motivation using self-report measures is difficult (Gagné et al., 2015; Roth et al., 2006; Sheldon et al., 2017). Future research should explore means of assessing integrated regulation.

Self-determination theory proved to be a useful framework for understanding nature engagement motivation. The only existing scale of motivations to engage with nature, the Recreation Experience Preference scale, is cumbersome and difficult to interpret. This is evident in the relations that it had with the NEMS. The variety of reasons to engage with nature are succinctly captured in the different types of motivation. Moreover, the types of motivation are theoretically grounded and relate in predictable ways to other phenomena.

Need Satisfaction, Motivation, and Behaviour

Self-determination theory's propositions concerning antecedents and outcomes of motivation are also supported in this novel area. Specifically, as proposed by Deci and Ryan (2000), need satisfaction outside is positively related with motivation, and both are related with behavioural engagement. Importantly, though, our findings suggest that motivation does not fully mediate the relation between need satisfaction and behaviour as it has in previous research (Hagger, Chatzisarantis, & Harris, 2006). Although need satisfaction and motivation vary in the strength of their relationship with the different behavioural measures, relations with non-everyday nature exposure are the strongest. This finding further supports self-determination theory's relative autonomy continuum because non-everyday nature exposure and time spent in

nature require volition and intentional action, more than everyday nature exposure. Everyday nature exposure assessed how much people noticed nature in their everyday lives, not how much they sought nature, which was predictably unrelated with motivation.

Nature Engagement Motivation and Well-Being

Building upon previous lines of research showing that well-being is affected by need satisfaction (Deci & Ryan, 2000), motivation type (Ryan & Deci, 2000b; Vallerand, 1997), and nature behaviours (McMahan & Estes, 2015), we simultaneously explored these effects. When well-being was simultaneously regressed on these, need satisfaction emerged as the only significant predictor. This does not support our hypothesis that motivation would be essential to the benefits of nature. Similar to our findings, Milyavskaya and Koestner (2011) determined that autonomous motivation only partially mediates the relationship between need satisfaction and well-being. These findings were across several domains (e.g., family, school, work). Taken together, these findings suggest that the well-being benefits of engaging with nature are connected to the satisfaction of basic psychological needs of autonomy, competence, and relatedness while engaging in the task. Moreover, the relation between need satisfaction and well-being could indicate that need satisfaction moderates the effect of nature on well-being whereby well-being is only received when one's psychological needs are satisfied in nature. Future research is needed to refine this relation.

Importantly, though, these findings do not rule out the possibility that motivation is related with well-being. The reason that the relationship may not have emerged in the current study is most likely due to the intimate relationship between motivation and need satisfaction. The relationship, as proposed by SDT, is that relative autonomy continuum is a product of basic need satisfaction. Specifically, the experience of intrinsic motivation is theoretically due to the

satisfaction of the psychological needs of autonomy, competence, and, in some cases, relatedness (Deci & Ryan, 2012). Need satisfaction is not only related with motivation, but it is also conceptually similar. Consider how self-determination theory posits that motivation varies as a function of autonomy and satisfaction of the psychological need for autonomy is a predictor of this. This relationship is evidently tangled. The overlap in concepts may explain why need satisfaction is the only significant predictor of well-being when entered simultaneously with motivation. Need satisfaction may have accounted for the same variance as motivation.

Nature Engagement Motivation and Other Nature-Related Phenomena

It is conceivable that motivation to engage with nature is associated with favourable attitudes towards nature and feelings of connectedness to nature. Thus, it was expected that nature-related phenomena would be related, but distinct from nature engagement motivation. Our findings align with this hypothesis, especially concerning a subjective sense of connection to nature. Specifically, autonomous forms of nature engagement motivation are positively related with connectedness to nature. On the other hand, nature engagement motivation was inconsistently related with nature relatedness. The self subscale, which indicates a sense of subjective connection with nature, and the experience subscale, which indicates comfort and familiarity with nature, were both positively related with autonomous forms of nature engagement motivation. However, the perspective subscale, which is more concerned with environmental concern, was unrelated with most forms of autonomous motivation except intrinsic motivation – for stimulation. Both our analyses and previous research show that this subscale is generally less related to the other two subscales (Nisbet et al., 2009). This makes sense because the self and experience subscale of nature relatedness reflect more psychological and experiential connectedness to nature whereas the perspective subscale reflects attitudes

towards protecting nature. In fact, the perspective subscale showed similar relations with nature engagement motivation as the new ecological paradigm—a broad indicator of environmental concern.

These three relations among nature engagement, connection to nature, and environmental concern require further examination. Ostensibly, engaging with nature should influence or have a bidirectional relationship with both connection to nature and environmental concern. Our findings suggest that motivation to engage with nature is more strongly related to connection with nature than environmental concern.

The relationship between nature engagement and concern has been widely examined. Early childhood experiences in nature are claimed to be one of the strongest influences upon later life environmental concern (Chawla, 1998). Furthermore, experimental laboratory research has found that exposure to nature videos influences environmental concern (Zelenski et al., 2015). However, research conducted with the nature relatedness scale found that environmental concern does not vary between those who do and do not participate in nature activities (Nisbet et al., 2009). Nature engagement is a broad construct that can include many outdoor recreational activities, some of which are more consumptive than appreciative (Dunlap & Heffernan, 1958). Consumptive activities—which involve taking something from the environment—may not be as effective for fostering environmental concern as appreciative activities—which involve enjoyment of the natural environment without altering it. Thus, the relationship between nature engagement and concern may be moderated by some other factors. Indeed, a systematic review of the topic found that although the relationship between participation in outdoor activities and environmental concern may be intuitive, it may not be as strong as suspected and is not due solely to participation (Berns & Simpson, 2009). Our findings reflect this weaker relationship.

Disentangling the relationship between nature engagement and connection to nature is similarly difficult. Our findings suggest that being autonomously motivated to engage with nature is associated with feeling subjectively connected to it. Moreover, the relationship is stronger than the previously discussed relation between nature engagement motivation and environmental concern. However, previous research has found the opposite pattern. Nisbet and Zelenski (2013) found that nature relatedness is more strongly related with concern than engagement. It should be noted that they did not distinguish between the different subscales of nature relatedness and the findings are from two separate studies. Perhaps the inconsistency in findings is because it is easier to espouse an attitude or have a cognition than it is to engage in a behaviour. Raudsepp (2005) conducted a large survey of a variety of environmental measures and found that connection to nature is related with both engagement with nature and environmental concern. However, for both of these measures, the psychological component showed a stronger relation than the behavioural. In particular, interest in nature was more strongly related with connection than actual engagement with nature. Also, pro-environmental behaviour intentions were more strongly related with connection than actual engagement in pro-environmental behaviours. Overall, more autonomous forms of motivation are positively related with connection to nature and environmental concern. Moreover, those who are autonomously motivated report less fear of nature.

Limitations

All recruitment was conducted in a city that is known for outdoor recreation and easy access to nature. Thus, the samples may be biased. These individuals may have displayed more autonomous motivation to engage with nature, thereby confirming those aspects of the theory. Despite this possible bias, the scale still reflected the proposed continuum of motivation. Another

limitation of the samples was the inclusion of mostly undergraduate students. For Study 1, research assistants did not restrict recruitment to undergraduates, but the samples were primarily undergraduate students. Similarly, Study 2 was limited to undergraduate students from the psychology participant pool. Thus, future research is required to determine the generalizability of these findings.

The NEMS items were inspired primarily from a select few self-determination theory regulation scales. While we do not believe this caused any issues with the performance of the scale, it may have narrowed the potential focus of items.

This study provides important insight into the role of motivation in nature engagement but is only correlational. The causal conclusions that were drawn are based upon theoretical bases from several lines of research in SDT, but the veracity of these causal claims in the area of nature engagement still needs to be evaluated. For instance, the role of need satisfaction in motivation and well-being that emerged in our study should be examined experimentally or longitudinally before concluding that need satisfaction is the determinant.

Conclusion

Self-determination theory provides a useful framework for understanding people's motivation for engaging with nature. The different types of regulation proposed by SDT were confirmed in this area of nature engagement. Furthermore, several postulates of SDT were supported, namely, that need satisfaction was related with well-being. This research serves to further the field of motivation by extending SDT to a new area and confirming important aspects of the theory. This research also serves to further the field of nature engagement as the understanding of motivation is necessary for increasing nature engagement so that people can receive nature's many benefits.

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Tables

Table 1

Items on the 26-Item and 29-Item Versions of Nature Engagement Motivation Scale.

<i>Why do you go outside to nature?</i>	
<i>Intrinsic Motivation – For Knowledge</i>	
1	For the pleasure that I experience in broadening my knowledge about nature.
2	For the pleasure I experience when I discover new things never seen before.
3	Because when I go outside to nature I experience pleasure and satisfaction while learning new things.
4	Because going outside to nature allows me to continue to learn about many things that interest me.
<i>Intrinsic Motivation – For Stimulation</i>	
5	For the pleasure that I experience when I go outside to nature.
6	For the pleasure that I experience when I feel completely absorbed in nature.
7	Because I like the feeling I get when I go outside to nature.
8	Because I find pleasure in going outside to nature and being surrounded by nature.
<i>Integrated Regulation</i>	
9	Because going outside to nature is part of my identity.
10	Because going outside to nature is a fundamental part of who I am.
11	Because I identify with nature.
12	Because going outside to nature is part of the way I have chosen to live my life.
<i>Identified Regulation</i>	
13	^a Because I personally value going outside to nature.
14	^b Because I see many personal advantages of going outside to nature.
15	^b Because I understand the worth of going outside to nature.
16	^b Because I know that going outside to nature is good for me.
<i>Introjected Regulation</i>	
17	Because I would feel guilty if I didn't go outside to nature.
18	Because I would feel bad if I didn't go outside to nature.
19	Because I feel that I must go outside to nature regularly.
20	Because I would feel bad if I was not taking time to go outside to nature.
<i>External Regulation</i>	
21	Because I feel pressured by others or by circumstances to go outside to nature.
22	Because my friends or family insist that I go outside to nature.
23	Because going outside to nature allows me to be well regarded by people that I know.
24	For the recognition I get from others when I go outside to nature.
25	Because other people will be upset if I don't go outside to nature.
26	Because people around me think it is important to engage with nature.
<i>Amotivation</i>	
27	I don't know why I go outside to nature, I can't see what I'm getting out of it.
28	It's not clear to me why I go outside to nature; I don't think my place is in nature.
29	I cannot see why I go outside to nature and frankly, I could not care less.

Note. ^a In the 26-item version, this item is combined with the Integrated Regulation items to create an Integrated-Identified Regulation Factor; ^b These items are removed in the 26-item version of the scale.

Table 2

Factor Correlations and Internal Subscale Reliabilities of the NEMS for Study 1 - Sample 3 and Study 2 Both Samples.

	IN-K			IN-S			IG/ID			IJ			EX			AM		
<i>Study - Sample</i>	<i>1-3</i>	<i>2-1</i>	<i>2-2</i>	<i>1-3</i>	<i>2-1</i>	<i>2-2</i>	<i>1-3</i>	<i>2-1</i>	<i>2-2</i>	<i>1-3</i>	<i>2-1</i>	<i>2-2</i>	<i>1-3</i>	<i>2-1</i>	<i>2-2</i>	<i>1-3</i>	<i>2-1</i>	<i>2-2</i>
IN-K				.54	.58	.59	.57	.73	.67	.40	.32	.22	.08	.10	-.06	-.29	-.34	-.42
IN-S	.71	.71	.71				.51	.67	.62	.30	.24	.29	-.18	-.19	-.29	-.47	-.59	-.58
IG/ID	.83	.80	.75	.83	.81	.79				.44	.40	.34	.03	.02	-.13	-.27	-.42	-.44
IJ	.54	.39	.22	.43	.34	.30	.65	.47	.36				.31	.42	.40	-.03	-.15	-.12
EX	.02	.11	-.09	-.26	-.20	-.33	-.03	.00	-.19	.28	.46	.42				.36	.31	.40
AM	-.28	-.36	-.47	-.62	-.67	-.66	-.46	-.48	-.53	-.11	-.18	-.10	.63	.35	.44			
α	.82	.90	.87	.86	.92	.90	.89	.92	.91	.80	.86	.84	.82	.83	.85	.81	.87	.85

Note. IN-K = Intrinsic Motivation – for Knowledge; IN-S = Intrinsic Motivation – for Stimulation; IG/ID = Integrated/Identified Regulation; IJ = Introjected Regulation; EX = External Regulation; AM = Amotivation. Factor correlations from the exploratory structural equation modeling (ESEM) are above the diagonal, and those from the confirmatory factor analysis (CFA) are below the diagonal. Internal subscale reliabilities (Cronbach's α) for each sample are along the bottom.

Table 3

Fit Indices and Model Comparisons for Tests of Measurement Invariance

Model	χ^2	df	Scaled CFI	Scaled RMSEA	$\Delta\chi^2$	Δdf	p	Δ Scaled CFI	Δ Scaled RMSEA
Configural	1887.8	568	0.913	0.062	--	--	--	--	--
Metric	1919.1	588	0.913	0.061	26.132	20	0.162	0	0.001
Scalar	1969.7	608	0.91	0.061	50.918	20	<.001	0.003	0
Uniqueness	2241.7	634	0.897	0.064	148.264	26	<.001	0.014	0.003

Table 4

Factor Correlations of the NEMS Subscales with Self-Determination Theory Based Scales.

	GMS	LMS	AMS	MTES	SMS-II
Intrinsic - Knowledge	.46	.62	.42	.71^b	.53^b
Intrinsic - Stimulation	.33	.49	.30	.51^b	.30^b
Integrated ^a	.39	-	-	.69	.40
Identified ^a	.22	.42	.00	.40	.37
Introjected	.21	.32	.24	.49	.36
External	.50	.49	.21	.60	.60
Amotivation	.33	.57	.36	.55	.45

Note. GMS = General Motivation Scale; LMS = Leisure Motivation Scale; AMS = Academic

Motivation Scale; MTES = Motivation Toward the Environment Scale; SMS-II = Sport

Motivation Scale; The LMS and AMS scales do not include an Integrated Regulation Factor;

^a NEMS Integrated-Identified factor correlation with separate Integrated and Identified factors of other SDT scales; ^b NEMS Intrinsic-Knowledge and Intrinsic-Stimulation correlations with a general Intrinsic factor.

Table 5

Factor Correlations Between Motivation Types and Nature Measures as well as Social Desirability

Measures & Subscales	Sample	IN-K	IN-S	IG-ID	IJ	EX	AM	RAI
<i>Nature Relatedness</i>	1							
Self		.68	.70	.81	.33	-.07	-.48	.62
Perspective		.21	.30	.23	.13	-.18	-.34	.35
Experience		.68	.75	.83	.31	-.14	-.54	.69
<i>Connectedness to Nature</i>	2	.62	.59	.69	.14	-.16	-.41	.57
<i>New Ecological Paradigm</i>	1	.22	.36	.28	.19	-.15	-.32	.26
<i>Outdoor Fears</i>	1	-.15	-.26	-.34	.02	.28	.26	-.40
<i>Social Desirability</i>	1							
Self-Deception		.11	.08	.21	-.12	-.22	-.14	.28
Imp. Management		.21	.09	.18	-.09	-.10	-.13	.26

Note. IN-K = Intrinsic Motivation – For Knowledge; IN-S = Intrinsic Motivation – For Stimulation; IG/ID = Integrated/Identified Regulation; IJ = Introjected Regulation; EX = External Regulation; AM = Amotivation; RAI = Relative Autonomy Index. Bolded values are significant at $p < .001$.

Table 6

Each Motivation Type Regressed on All Reasons for Outdoor Recreation

	IN-K	IN-S	IG-ID	IJ	EX	AM	RAI
Achievement	.01	-.01	.08	.25	.42	.03	-.59
Autonomy	.00	.07	.02	-.08	-.01	.06	.14
Risk Taking	.05	-.01	-.03	-.03	-.08	-.03	.09
Equipment	-.07	-.04	.02	-.04	-.02	.03	.02
Family Togetherness	-.01	-.01	.01	.03	.09	.01	-.12
Similar People	.00	.01	.00	-.09	-.05	-.05	.14
New People	-.10	-.09	-.14	.10	.10	.08	-.43
Learning	.49	.08	.15	-.02	-.02	-.04	.48
Enjoy Nature	.16	.42	.40	.10	-.12	-.16	.71
Introspection	.07	.09	.13	.05	-.07	-.03	.22
Creativity	-.02	.01	.07	-.07	-.01	-.05	.14
Nostalgia	.05	.04	.02	-.06	-.03	-.01	.15
Physical Fitness	-.02	.11	.03	.11	-.10	-.09	.06
Physical Rest	.01	-.02	-.04	-.05	-.03	.00	.04
Escape Personal-Social Pressures	.00	.03	.00	.13	.01	-.08	-.13
Escape Physical Pressures	-.12	-.05	-.09	.02	-.01	.05	-.18
Social Security	.01	-.02	.03	.10	.02	-.02	-.10
Escape Family Pressures	.00	-.05	.02	.05	.06	.04	-.11
Teaching	.03	.05	.11	-.14	-.19	-.02	.48
Risk Reduction	-.03	-.11	-.19	.01	.09	.04	-.35

Note. IN-K = Intrinsic Motivation – For Knowledge; IN-S = Intrinsic Motivation – For

Stimulation; IG-ID = Integrated-Identified Regulation; IJ = Introjected Regulation;

EX = External Regulation; AM = Amotivation; RAI = Relative Autonomy Index. Bolded values

are significant at $p < .001$.

Figures

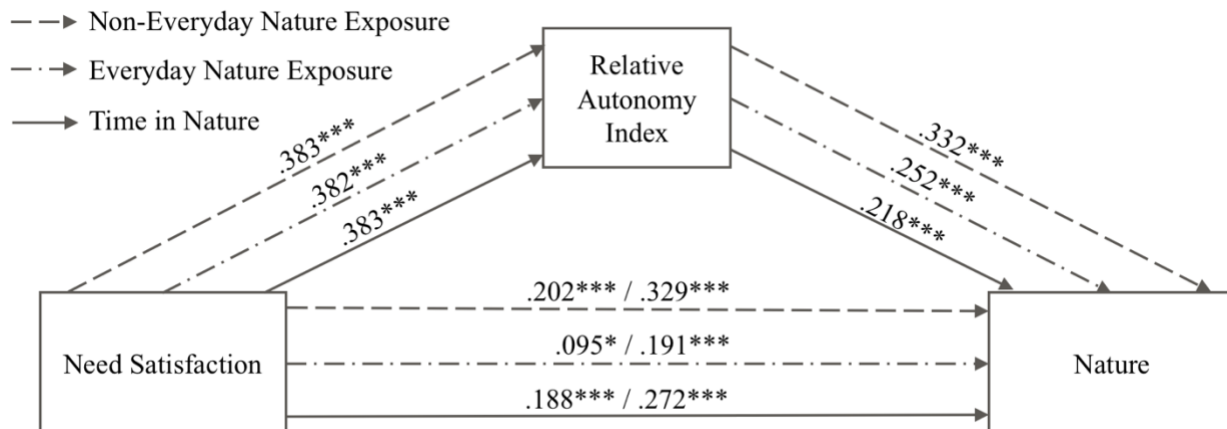


Figure 1. Partial mediation results from basic psychological need satisfaction through motivation to three nature behaviour outcomes. Each model was tested separately. Both the direct and total effects are presented, respectively.

[†] $p < .06$, *** $p < .001$.

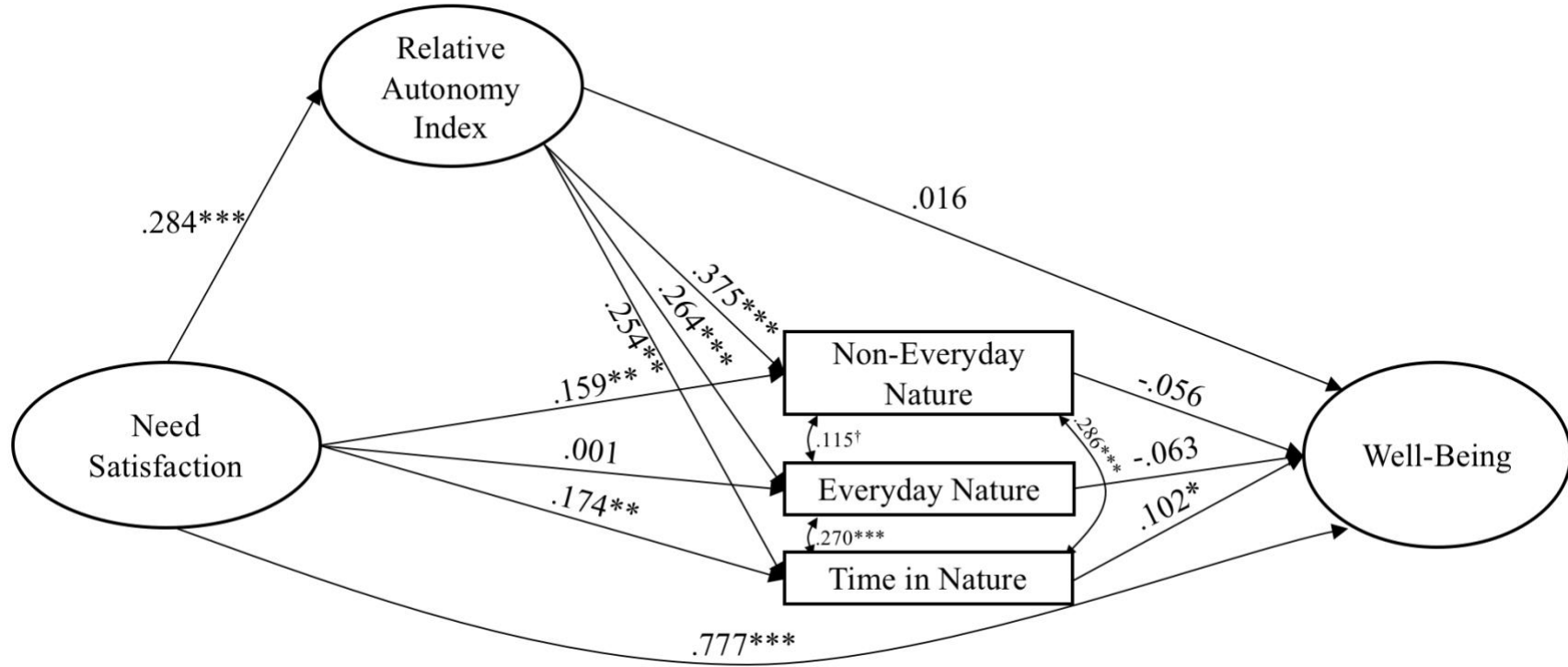


Figure 2. Basic psychological need satisfaction while outside, nature engagement motivation, and nature behaviours as predictors of well-being.

$^{\dagger} p = .06$, $^{*} p < .05$, $^{***} p < .001$

Supplemental Material

Table 1

Loadings from Exploratory Factor Analysis of Intrinsic Motivation NEMS Items in Study 1 –

Sample 1

Item #	Item	Factor 1	Factor 2
1	pleasure...broadening my knowledge		.75
2	pleasure...discover new things never seen before		.60
3	pleasure and satisfaction...learning new things		.80
4	learn about many things that interest me		.89
5	satisfaction of going outside to nature	.92	
6	pleasure when I go outside to nature	.87	
7	pleasure when I feel completely absorbed	.82	
8	pleasure...living exciting experiences	.52	.30
9	intense feelings...when I go outside to nature	.53	
10	"high" feeling...while going outside to nature	.43	.36
11	I like the feeling when I go outside to nature	.83	
12	pleasure...being surrounded by nature	.79	

Table 2

Loadings from Exploratory Factor Analysis of Integrated and Identified Regulation NEMS Items

in Study 1 – Sample 1

Item #	Item	Factor 1	Factor 2
13	aligned with my personal values	.25	.60
14	an integral part of my life	.53	.36
15	part of my identity	.90	
16	expresses who I am	.88	
17	fundamental part of who I am	.93	
18	I identify with nature	.65	
19	part of the way I have chosen to live my life	.70	
20	many personal advantages		.86
21	one of the best ways I...develop...aspects of myself	.33	.49
22	going outside to nature is interesting		.65
23	I personally value going outside to nature		.81
24	it is important to me	.38	.45
25	I understand the worth		.68
26	I know it is good for me		.58

Table 3

Loadings from Exploratory Factor Analysis of Introjected and External Regulation NEMS Items in Study 1 – Sample 1

Item #	Item	Factor 1	Factor 2
27	I would feel guilty if I didn't	.33	.38
28	I want to show myself that I am capable	.41	.27
29	I would feel bad if I didn't		.54
30	I must...to feel good about myself	.28	.47
31	I force myself to go outside to nature	.39	.27
32	I feel that I must go outside to nature regularly		.60
33	I would regret not going outside to nature		.82
34	I would feel bad if I was not taking time to		.84
35	I am forced to in order to accomplish other tasks	.55	
36	I feel pressured by others or by circumstances	.58	
37	I receive a tangible reward		.43
38	negative consequences will arise if I don't		.39
39	my friends or family insist	.75	
40	activities (other than commuting and working) that I do		.25
41	allows me to be well regarded by people that I know	.62	
42	recognition I get from others	.73	
43	other people will be upset	.65	
44	people around me think it is important	.70	

Table 4

Loadings from Exploratory Factor Analysis of Amotivation NEMS Items in Study 1 – Sample 1

Item #	Item	Factor 1
45	I don't know...I can't see what I'm getting out of it	.81
46	I don't know...I'm wasting my time.	.81
47	not clear to me...I don't think my place is in nature	.77
48	I used to have good reasons...but now I wonder why	.61
49	I cannot see why...and frankly I could not care less	.82

Table 5

Loadings from Exploratory Factor Analysis of 34-item Version of NEMS in Study 1 – Sample 1

Item #	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1	pleasure...broadening my knowledge	.71						
2	pleasure...discover new things never seen before	.51						
3	pleasure and satisfaction...learning new things	.72						
4	learn about many things that interest me	.79						
5	satisfaction of going outside to nature		.83					
6	pleasure when I go outside to nature		.79					
7	pleasure when I feel completely absorbed		.75					
11	I like the feeling when I go outside to nature		.71					
12	pleasure...being surrounded by nature		.75					
15	part of my identity			.79				
17	fundamental part of who I am			.84				
18	I identify with nature			.56				
19	part of the way I have chosen to live my life			.68				
20	many personal advantages		.36					
22	going outside to nature is interesting	.35	.50					
23	I personally value going outside to nature		.60					
25	I understand the worth		.32					
26	I know it is good for me							
27	I would feel guilty if I didn't				.41			
29	I would feel bad if I didn't				.59	.32		
30	I must...to feel good about myself				.46			
32	I feel that I must go outside to nature regularly			.33		.30		
33	I would regret not going outside to nature					.73		
34	I would feel bad if I was not taking time to					.91		

36	I feel pressured by others or by circumstances		.38
39	my friends or family insist	.61	
41	allows me to be well regarded by people that I know	.67	
42	recognition I get from others	.79	
43	other people will be upset	.45	
44	people around me think it is important	.79	
45	I don't know...I can't see what I'm getting out of it		.83
46	I don't know...I'm wasting my time.		.84
47	not clear to me...I don't think my place is in nature		.63
49	I cannot see why...and frankly I could not care less		.79

Table 6

Loadings from Exploratory Factor Analysis of Intrinsic Motivation Items from the 33-Item

Version of the NEMS in Study 1 – Sample 2

Item #	Item	Factor 1	Factor 2
1	pleasure...broadening my knowledge	.39	.42
2	pleasure...discover new things never seen before	.50	.37
3	pleasure and satisfaction...learning new things	1.00	
5	satisfaction of going outside to nature		.70
6	pleasure when I go outside to nature		.82
7	pleasure when I feel completely absorbed		.88
11	I like the feeling when I go outside to nature		.71
12	pleasure...being surrounded by nature		.80

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 7

Loadings from Exploratory Factor Analysis of Integrated and Identified Regulation Items from

the 33-Item Version of the NEMS in Study 1 – Sample 2

Item #	Item	Factor 1	Factor 2
15	part of my identity	.90	
17	fundamental part of who I am	.92	
18	I identify with nature	.58	
19	part of the way I have chosen to live my life	.49	.36
20	many personal advantages		.75
22	going outside to nature is interesting		.69
23	I personally value going outside to nature		.80
25	I understand the worth		.69
26	I know it is good for me		.76

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 8

Loadings from Exploratory Factor Analysis of Introjected and External Regulation Items from the 33-Item Version of the NEMS in Study 1 – Sample 2

Item #	Item	Factor 1	Factor 2
27	I would feel guilty if I didn't	.64	
29	I would feel bad if I didn't	.74	
30	I must...to feel good about myself	.58	
32	I feel that I must go outside to nature regularly	.73	
33	I would regret not going outside to nature	.63	
34	I would feel bad if I was not taking time to	.50	
36	I feel pressured by others or by circumstances		.81
39	my friends or family insist		.55
41	allows me to be well regarded by people that I know		.60
42	recognition I get from others		.60
43	other people will be upset		.71
44	people around me think it is important	.31	.58

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 9

Loadings from Exploratory Factor Analysis of Amotivation Items from the 33-Item Version of the NEMS in Study 1 – Sample 2

Item #	Items	Factor 1
45	I don't know...I can't see what I'm getting out of it	.81
46	I don't know...I'm wasting my time.	.66
47	not clear to me...I don't think my place is in nature	.72
49	I cannot see why...and frankly I could not care less	.85

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 10

Loadings from Exploratory Factor Analysis of 28-item Version of NEMS in Study 1 – Sample 2

Item #	Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1	pleasure...broadening my knowledge		.39				.43	
2	pleasure...discover new things never seen before		.91					
3	pleasure and satisfaction...learning new things		.84					
6	pleasure when I go outside to nature		.57					
7	pleasure when I feel completely absorbed						.33	.26
11	I like the feeling when I go outside to nature		.39					
12	pleasure...being surrounded by nature		.30	-.31				.29
15	part of my identity				.76			
17	fundamental part of who I am				.84			
18	I identify with nature				.53		.38	
19	part of the way I have chosen to live my life				.52			
20	many personal advantages						.44	
23	I personally value going outside to nature			-.32			.34	
25	I understand the worth						.48	
26	I know it is good for me						.64	
27	I would feel guilty if I didn't					.67		
29	I would feel bad if I didn't					.65		
32	I feel that I must go outside to nature regularly				.31	.58		
34	I would feel bad if I was not taking time to					.53		
36	I feel pressured by others or by circumstances	.79						
39	my friends or family insist	.45						
41	allows me to be well regarded by people that I know	.65						
42	recognition I get from others	.67						
43	other people will be upset	.52						

44	people around me think it is important	.67	
45	I don't know...I can't see what I'm getting out of it		.85
47	not clear to me...I don't think my place is in nature		.78
49	I cannot see why...and frankly I could not care less		.73

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 11

Loadings from 7-Factor Confirmatory Factor Analysis of 29-Item Version of the NEMS in

Study 1 – Sample 3

Factor	Item #	Items	Estimate
Intrinsic - for knowledge			
	1	pleasure...broadening my knowledge	.82
	2	pleasure...discover new things never seen before	.64
	3	pleasure and satisfaction...learning new things	.77
	4	learn about many things that interest me	.68
Intrinsic - for stimulation			
	6	pleasure when I go outside to nature	.85
	7	pleasure when I feel completely absorbed	.75
	11	I like the feeling when I go outside to nature	.78
	12	pleasure...being surrounded by nature	.81
Integrated			
	15	part of my identity	.84
	17	fundamental part of who I am	.86
	18	I identify with nature	.74
	19	part of the way I have chosen to live my life	.82
Identified			
	20	many personal advantages	.74
	23	I personally value going outside to nature	.77
	25	I understand the worth	.79
	26	I know it is good for me	.70
Introjected			
	27	I would feel guilty if I didn't	.67
	29	I would feel bad if I didn't	.80
	32	I feel that I must go outside to nature regularly	.64
	34	I would feel bad if I was not taking time to	.75
External			
	36	I feel pressured by others or by circumstances	.80
	39	my friends or family insist	.70
	41	allows me to be well regarded by people that I know	.59
	42	recognition I get from others	.65
	43	other people will be upset	.57
	44	people around me think it is important	.56

Amotivation

45	I don't know...I can't see what I'm getting out of it	.78
47	not clear to me...I don't think my place is in nature	.79
49	I cannot see why...and frankly I could not care less	.74

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 12

Loadings from 6-Factor Confirmatory Factor Analysis of 26-Item Version of the NEMS in

Study 1 – Sample 3

Factor	Item #	Items	Estimate
Intrinsic - for knowledge			
	1	pleasure...broadening my knowledge	.83
	2	pleasure...discover new things never seen before	.64
	3	pleasure and satisfaction...learning new things	.77
	4	learn about many things that interest me	.69
Intrinsic - for stimulation			
	6	pleasure when I go outside to nature	.84
	7	pleasure when I feel completely absorbed	.76
	11	I like the feeling when I go outside to nature	.77
	12	pleasure...being surrounded by nature	.82
Integrated-Identified			
	15	part of my identity	.83
	17	fundamental part of who I am	.85
	18	I identify with nature	.74
	19	part of the way I have chosen to live my life	.82
	23	I personally value going outside to nature	.71
Introjected			
	27	I would feel guilty if I didn't	.67
	29	I would feel bad if I didn't	.80
	32	I feel that I must go outside to nature regularly	.62
	34	I would feel bad if I was not taking time to	.76
External			
	36	I feel pressured by others or by circumstances	.80
	39	my friends or family insist	.70
	41	allows me to be well regarded by people that I know	.59
	42	recognition I get from others	.65
	43	other people will be upset	.57
	44	people around me think it is important	.56
Amotivation			
	45	I don't know...I can't see what I'm getting out of it	.78
	47	not clear to me...I don't think my place is in nature	.79
	49	I cannot see why...and frankly I could not care less	.74

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 13

Loadings from 6-Factor Exploratory Structural Equation Modeling of the 26-Item Version of the NEMS in Study 1 – Sample 3

Item #	Item	IN K	IN S	IGID	IJ	EX	AM
1	pleasure...broadening my knowledge	.58					
2	pleasure...discover new things never seen before	.57	.34				
3	pleasure and satisfaction...learning new things	.78					
4	learn about many things that interest me	.58		.40			
6	pleasure when I go outside to nature		.57				
7	pleasure when I feel completely absorbed		.71				
11	I like the feeling when I go outside to nature		.46				
12	pleasure...being surrounded by nature		.79				
15	part of my identity			.53			
17	fundamental part of who I am			.50			
18	I identify with nature			.76			
19	part of the way I have chosen to live my life	.29		.40			
23	I personally value going outside to nature		.34				
27	I would feel guilty if I didn't				.68		
29	I would feel bad if I didn't				.90		
32	I feel that I must go outside to nature regularly				.39		
34	I would feel bad if I was not taking time to				.69		
36	I feel pressured by others or by circumstances					.69	
39	my friends or family insist					.59	
41	allows me to be well regarded by people that I know					.75	
42	recognition I get from others					.60	
43	other people will be upset				.40		.32
44	people around me think it is important					.74	
45	I don't know...I can't see what I'm getting out of it						.63
47	not clear to me...I don't think my place is in nature						.54
49	I cannot see why...and frankly I could not care less						.57

Note. Item numbers are original item numbers from 49-item version of the scale. IN-K = Intrinsic Motivation – for Knowledge; IN-S = Intrinsic Motivation – for Stimulation; IG/ID = Integrated/Identified Regulation; IJ = Introjected Regulation; EX = External Regulation; AM = Amotivation.

Table 14

Loadings from 6-Factor Confirmatory Factor Analysis of the 26-Item Version of the NEMS in

Study 2 – Sample 1

Factor	Item #	Item	Estimate
Intrinsic - for knowledge			
	1	pleasure...broadening my knowledge	.78
	2	pleasure...discover new things never seen before	.70
	3	pleasure and satisfaction...learning new things	.85
	4	learn about many things that interest me	.83
Intrinsic - for stimulation			
	6	pleasure when I go outside to nature	.84
	7	pleasure when I feel completely absorbed	.78
	11	I like the feeling when I go outside to nature	.83
	12	pleasure...being surrounded by nature	.88
Integrated-Identified			
	15	part of my identity	.86
	17	fundamental part of who I am	.89
	18	I identify with nature	.80
	19	part of the way I have chosen to live my life	.81
	23	I personally value going outside to nature	.76
Introjected			
	27	I would feel guilty if I didn't	.78
	29	I would feel bad if I didn't	.81
	32	I feel that I must go outside to nature regularly	.63
	34	I would feel bad if I was not taking time to	.82
External			
	36	I feel pressured by others or by circumstances	.79
	39	my friends or family insist	.74
	41	allows me to be well regarded by people that I know	.66
	42	recognition I get from others	.64
	43	other people will be upset	.75
	44	people around me think it is important	.61
Amotivation			
	45	I don't know...I can't see what I'm getting out of it	.85
	47	not clear to me...I don't think my place is in nature	.76
	49	I cannot see why...and frankly I could not care less	.84

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 14

Loadings from 6-Factor Exploratory Structural Equation Modeling of the 26-Item Version of the NEMS in Study 2 – Sample 1

Item #	Item	IN K	IN S	IGID	IJ	EX	AM
1	pleasure...broadening my knowledge	.88					
2	pleasure...discover new things never seen before	.48					
3	pleasure and satisfaction...learning new things	.81					
4	learn about many things that interest me	.86					
6	pleasure when I go outside to nature		.78				
7	pleasure when I feel completely absorbed		.60				
11	I like the feeling when I go outside to nature		.73				
12	pleasure...being surrounded by nature		.61				
15	part of my identity			.93			
17	fundamental part of who I am			.99			
18	I identify with nature			.54			
19	part of the way I have chosen to live my life			.72			
23	I personally value going outside to nature		.51				
27	I would feel guilty if I didn't				.81		
29	I would feel bad if I didn't				.85		
32	I feel that I must go outside to nature regularly			.31	.43		
34	I would feel bad if I was not taking time to				.83		
36	I feel pressured by others or by circumstances					.59	
39	my friends or family insist					.59	
41	allows me to be well regarded by people that I know					.78	
42	recognition I get from others					.81	
43	other people will be upset					.65	
44	people around me think it is important					.59	
45	I don't know...I can't see what I'm getting out of it						.87
47	not clear to me...I don't think my place is in nature						.65
49	I cannot see why...and frankly I could not care less						.91

Note. Item numbers are original item numbers from 49-item version of the scale. IN-K = Intrinsic Motivation – for Knowledge; IN-S = Intrinsic Motivation – for Stimulation; IG/ID = Integrated/Identified Regulation; IJ = Introjected Regulation; EX = External Regulation; AM = Amotivation.

Table 15

Loadings from 6-Factor Confirmatory Factor Analysis of the 26-Item Version of the NEMS in

Study 2 – Sample 2

Factor	Item #	Item	Estimate
Intrinsic - for knowledge			
	1	pleasure...broadening my knowledge	.78
	2	pleasure...discover new things never seen before	.70
	3	pleasure and satisfaction...learning new things	.85
	4	learn about many things that interest me	.83
Intrinsic - for stimulation			
	6	pleasure when I go outside to nature	.84
	7	pleasure when I feel completely absorbed	.78
	11	I like the feeling when I go outside to nature	.83
	12	pleasure...being surrounded by nature	.88
Integrated-Identified			
	15	part of my identity	.86
	17	fundamental part of who I am	.89
	18	I identify with nature	.80
	19	part of the way I have chosen to live my life	.81
	23	I personally value going outside to nature	.76
Introjected			
	27	I would feel guilty if I didn't	.78
	29	I would feel bad if I didn't	.81
	32	I feel that I must go outside to nature regularly	.63
	34	I would feel bad if I was not taking time to	.82
External			
	36	I feel pressured by others or by circumstances	.79
	39	my friends or family insist	.74
	41	allows me to be well regarded by people that I know	.66
	42	recognition I get from others	.64
	43	other people will be upset	.75
	44	people around me think it is important	.61
Amotivation			
	45	I don't know...I can't see what I'm getting out of it	.85
	47	not clear to me...I don't think my place is in nature	.76
	49	I cannot see why...and frankly I could not care less	.84

Note. Item numbers are original item numbers from 49-item version of the scale.

Table 16

Loadings from 6-Factor Exploratory Structural Equation Modeling of the 26-Item Version of the NEMS in Study 2 – Sample 2

Item #	Item	IN K	IN S	IGID	IJ	EX	AM
1	pleasure...broadening my knowledge	.82					
2	pleasure...discover new things never seen before	.59					
3	pleasure and satisfaction...learning new things	.71					
4	learn about many things that interest me	.85					
6	pleasure when I go outside to nature		.67				
7	pleasure when I feel completely absorbed		.60				
11	I like the feeling when I go outside to nature		.74				
12	pleasure...being surrounded by nature		.71				
15	part of my identity			.98			
17	fundamental part of who I am			.84			
18	I identify with nature			.73			
19	part of the way I have chosen to live my life			.59			
23	I personally value going outside to nature		.44				
27	I would feel guilty if I didn't				.78		
29	I would feel bad if I didn't				.84		
32	I feel that I must go outside to nature regularly				.50		
34	I would feel bad if I was not taking time to				.87		
36	I feel pressured by others or by circumstances					.69	
39	my friends or family insist					.66	
41	allows me to be well regarded by people that I know					.71	
42	recognition I get from others					.74	
43	other people will be upset					.73	
44	people around me think it is important					.69	
45	I don't know...I can't see what I'm getting out of it						.90
47	not clear to me...I don't think my place is in nature						.64
49	I cannot see why...and frankly I could not care less						.83

Note. Item numbers are original item numbers from 49-item version of the scale. IN-K = Intrinsic Motivation – for Knowledge; IN-S = Intrinsic Motivation – for Stimulation; IG/ID = Integrated/Identified Regulation; IJ = Introjected Regulation; EX = External Regulation; AM = Amotivation.

Chapter 4: General Discussion

The objective of the current program of research was to evaluate potential explanations for why and when nature affects well-being. These were addressed in two manuscripts. The first manuscript, *Connecting to something greater and feeling greater: Self-transcendence as a potential explanation of the positive effect of nature exposure on well-being*, showed that engaging with actual nature is beneficial for hedonic well-being and partially mediated by the experience of self-transcendence. However, watching videos of nature exhibited no influence upon well-being, but did inspire self-transcendence in one sample. Exposure to nature—virtual or actual—had no effect on eudaimonic well-being. Throughout all studies, self-transcendence was correlated with well-being (both hedonic and eudaimonic) but experimental manipulations of self-transcendence were only effective at impacting eudaimonic well-being.

Nature, Self-Transcendence, and Well-Being

The findings of Manuscript 1 add to a line of research on nature and well-being. The impact of actual nature on hedonic well-being closely aligns with McMahon and Estes' (2015) meta-analytic findings. However, our findings of the impact of virtual nature were significantly less than McMahon and Estes'. This may have been a result of the quality of videos used, how engaged participants were, or the medium on which participants viewed the videos. In a pilot study, participants rated the nature video as sufficient to inspire self-transcendence and well-being. However, the nature video did not lead to a greater well-being when compared with an urban video in Study 1. On the other hand, the puppies and kittens video significantly affected hedonic well-being in one of the samples, which may suggest that watching cute cat videos at work is better for your short-term well-being than watching nature videos. Future research is required in this area.

Contrary to what was hypothesized, the nature manipulations did not increase eudaimonic well-being. As discussed previously, eudaimonic well-being is a rather stable construct and may require more time to be altered. The long-term impact of nature upon well-being is an important area of inquiry. The current research only examined immediate impacts of nature manipulations and a longitudinal impact of self-transcendence. Future research could investigate how long-term or repeated nature engagement affects well-being.

Influencing Self-Transcendence

In testing the causal influence of self-transcendence upon well-being, only a small effect was found upon eudaimonic well-being, despite the constructs being moderately to strongly correlated in Study 1 and 3. Perhaps these weak and null findings of the self-transcendence manipulation occurred because the self-transcendence manipulations were not effective. A manipulation check was not conducted and, therefore, the effect of the manipulations upon self-transcendence cannot be known. However, a cursory look at the qualitative responses from participants' statements about self-transcendent and self-enhancement experiences revealed that some of the self-transcendent responses were limited to statements such as, "I have never felt this way" or "I am not spiritual." This may indicate that the manipulations would need to be refined in further investigations of this relationship.

In addition to the mixed findings of self-transcendence on well-being, the influence of nature upon self-transcendence also received mixed support. Perhaps the proposition that all nature inspires self-transcendence is too ambitious and, instead, there are more specific natural settings that inspire self-transcendence. Self-transcendence is often discussed in connection with the feeling of awe (Yaden et al., 2017). Research on awe has focused on specific natural settings. Awe is proposed to be elicited by information rich areas such as panoramic views of nature

(Shiota et al., 2007) or groves of towering trees (Zhang & Keltner, 2016). Caution needs to be taken not to conflate awe and self-transcendence. They are related, but only insofar that awe is a feeling that is often accompanied by self-transcendence. In fact, Shiota, Keltner, and Mossman (2007) found that recalling a time in nature inspired awe and many aspects of self-transcendence, but some aspects of self-transcendence including a feeling of connection to personal values and a connection to culture were more inspired by recalling a time of academic accomplishment. Perhaps nature experiences that involve landscapes or elements that are much larger than oneself are ones that inspire self-transcendence.

It is important to acknowledge the distinction between state and trait conceptualizations of self-transcendence. Yaden and colleagues (2017) examine self-transcendence from a state perspective—experiences, feelings, and emotions that are associated with self-diminishment and connection to something greater. Trait assessments of self-transcendence include ideas of general levels of connection to something greater than oneself such as a deity and general levels of self-diminishment. Whereas the literature that has been discussed thus far shows that a variety of natural experiences are sufficient to inspire state experiences of self-transcendence, trait-level self-transcendence may moderate this experience. Not all experiences in a forest lead to self-transcendence (Williams & Harvey, 2001). However, it cannot be determined from these findings whether the effect is moderated by the environment or the person—does the type of forest or the level of trait self-transcendence alter how transcendent one feels while nature?

Trait self-transcendence may not be necessary for individuals to have state self-transcendent experiences in nature, but trait self-transcendence may amplify state experiences. In Manuscript 1, exposure to actual nature inspired feelings of self-transcendence and exposure to virtual nature inspired self-transcendence in one of the two samples. Whereas these findings

suggest that nature can lead to greater feelings of self-transcendence, the effect may be amplified among those who hold higher levels of trait self-transcendence. Trait self-transcendence could manifest itself in general feelings of spirituality or openness to spiritual experiences. Perhaps individuals who are open to spiritual experiences or other self-transcendent experiences would experience greater state self-transcendent experiences.

Nature Engagement Motivation

In the second manuscript, *Understanding nature engagement motivation: A test of self-determination theory in a novel environment*, motivation was examined as an endogenous condition of whether nature is beneficial. A series of studies showed that SDT's relative autonomy continuum may be helpful in predicting engagement with nature, but it is unrelated with well-being. Instead, satisfaction of basic psychological needs while outside is more predictive of well-being than nature engagement motivation and nature exposure. This is preliminary evidence that the benefits of nature may depend on whether psychological needs are satisfied while engaging with nature. Well-being was treated as a single latent factor. It may be beneficial to examine relations with different types of well-being. This was not done in the current research because of an insufficient sample size.

The goal of Manuscript 2 was to examine motivation for engaging in recreational nature activities. This was an ambitious endeavour. There are many behaviours that can be undertaken in nature. Capturing all of the reasons for all of the behaviours in one continuum may seem dubious. However, the findings suggest that the continuum of motivation reflects a variety of reasons for engaging with nature. Moreover, we were primarily concerned with the motivation to go outside to nature and treated nature as the central focus—not the activity as has been done in previous research. This is analogous to studying academic motivation across all subjects.

Students are enrolled in a variety of subjects and there is presumed to be a central or general motivation for academics that can apply to most of the subjects a person is studying. With regards to nature engagement, we believe there is a central or general motivation that explains why people engage with nature across most of the activities they engage in.

One reason of why people engage with nature that was not captured in the current scale is that it was a value instilled from childhood. Wells and Lekies (2006) found that childhood experiences in nature, especially experiences in wild nature are believed to influence nature-friendly attitudes. Conceivably, experiences in nature as a child could also influence the type of motivation for engaging with nature and valuation of nature (Strife & Downey, 2009). Future research could examine the influence of childhood experiences in nature upon nature engagement motivation.

In addition, despite external regulation being an easy concept to understand, external regulation is hard to assess with self-report. The theoretical basis of external regulation is simple: rewards increase the future likelihood of a behaviour and punishment decreases the future likelihood of a behaviour. Unfortunately, there are many rewards and punishments that it quickly becomes unfeasible to assess them all. Our approach of focusing on pressures from friends and family was inspired by previous self-determination theory research (Vallerand et al., 1989; 1992). Focusing on these pressures may be limiting. Future research could examine the outcomes of the variety of external regulations. Do threats of punishment lead to different experiences in nature than promise of reward?

Implications and Future Directions

Nature and Eudaimonic Well-Being

Experiencing nature is important for both human health and well-being (Franco et al., 2017) as well as the earth's health and well-being (Grouzet & Lee, 2014; Hartig, 1993). The current research expanded upon a long line of research by adding an investigation of nature's impact upon hedonic and eudaimonic well-being. It is important to note that eudaimonic well-being may not be as related with nature exposure and engagement as previously thought. Manuscript 1 provided no support for the relationship. Manuscript 2 treated well-being as a unitary construct (see Kashdan, Biswas-Diener, & King, 2008) and found a relationship between psychological need satisfaction while outdoors and well-being and only between time in nature and well-being, not other nature exposure measures. These findings from Manuscript 2 do not necessarily indicate a relationship between nature and eudaimonic well-being. In fact, eudaimonic well-being had the lowest loading on the latent well-being factor. This lack of relationship is relatively consistent with previous research. Only a few indicators of trait eudaimonic well-being are related with nature exposure, contact, or engagement (e.g., Herzog & Strevey, 2008), while many others are unrelated (e.g., Herzog & Strevey, 2008; Passmore & Howell, 2014). Some state measurements of eudaimonic well-being are related with state experiences in nature (Passmore & Holder, 2017). There have been some attempts to explain how nature engagement could influence eudaimonic well-being (see Capaldi, Passmore, Nisbet, Zelenski, & Dopko, 2015; Cleary et al., 2017). I propose that a distinction needs to be made between state and trait experiences in nature and eudaimonic well-being. State experiences in nature may be insufficient to increase trait eudaimonic well-being but could increase state assessments. Moreover, perhaps trait level of nature engagement (e.g., habits) and trait

eudaimonic well-being are related. Further research is required to fully explore the relationship between nature and eudaimonic well-being—especially the causal influence of nature engagement. In addition, a systematic review of research in this area is needed.

The effect of engaging with nature may also be beneficial to nature itself because when people go to the natural world, they may endorse greater environmental concern (Berns & Simpson, 2009; Luo & Deng, 2008). The influence of contact with the natural world on environmental concern may not be direct, but instead it could be a function of the activity engaged in and time spent in contact with nature. Perhaps the relationship between nature engagement and environmental concern operates similar to the mere exposure effect (Bornstein, 1989), whereby increased contact with an individual can lead to greater liking of that individual. Often when things or people are admired, they are also cared for. In a similar manner, increased contact with nature could lead to a greater valuing of it and, therefore, greater concern for and protection of it.

Nature Engagement Interventions

There is a wealth of evidence that nature is beneficial for humans (see Bowler, Buyung-Ali, Knight, & Pullin, 2010; Coon et al., 2011; Franco et al., 2017; Martens & Bauer, 2013). With these benefits in mind, it is surprising that there has been a recent decline in the amount that people engage with nature. This is most likely due to strong competition for people's time between nature engagement and other leisure activities. The advent of mobile phones and social media has led to great connectivity between people. It is easy to open an app and see what friends are doing, regardless of how far away they live. However, the benefit of this technology comes at the cost of other beneficial activities. While it was once uncommon for elementary students to interact with technology and students had prescribed computer times, it is now that

personal computers are being considered as integral to education. Unfortunately, many of these devices draw attention, energy, and time away from the natural world. The decline in engagement with nature has been referred to as Nature Deficit Disorder (Louv, 2008). Although it is not a clinically recognized disorder, it does have marked issues—including reduced well-being.

The issue of decreasing nature engagement has been acknowledged by many government and volunteer organizations. In fact, a cursory search for reports on increasing nature engagement returns a variety of pamphlets and policy reports. A prominent report from the Canadian Parks Council (2014) covers the topics of why nature is necessary and how to increase engagement. Unfortunately, no research on how to increase nature engagement is presented. This helps to show that understanding nature engagement motivation is also important for informing public policy and park workers (Manning, 2010).

A proposition that suggests an easy way to address this deficit is to increase research into the benefits of nature and increase awareness of these benefits. This is the approach taken in the report by the Canadian Parks Council (2014) that was previously mentioned. However, awareness of the benefits of nature does not mean that people capitalize on opportunities to engage with nature (Maller, Townsend, Pryor, Brown, & St. Leger, 2006). In fact, even when told about the benefits of nature and being prescribed park visits by a primary care provider, only 13% of children who were prescribed park visits actually visited the park (Coffey & Gauderer, 2016). Another large scale attempt to increase nature engagement—specifically for the purpose of increasing well-being—utilized a wide reaching, clear campaign (Richardson, Cormack, McRobert, & Underhill, 2016). The campaign directed people to engage in “random acts of wildness” and suggested nearly 180 activities that people can do. Although the amount of

engagement was not reported, the authors estimate that people went outside to nature an average of 25 times during the 30-day campaign. Furthermore, connection to nature was higher at both follow-up time points, which could indirectly indicate that people actually engaged more with nature. The evidence suggests that a nature engagement campaign can lead to greater well-being but lacks indication of whether the campaign actually increases nature engagement. Thus, a better understanding of how and why people engage with nature is needed.

The Importance of Theory

Nature engagement motivation is an important consideration in this area that has not been well-studied. Thus, the current research addresses a gap in the literature. The current research on nature engagement motivation will hopefully stimulate a line of theory-based research on the topic. Without a theory informing research, follow up studies amount to little more than guessing future directions. Instead, a theory—including all its postulates, corollaries, and existing research—can inform future directions. In an aptly titled paper, *You can't play 20 questions with nature and win*, Newell (1973) points out that asking too many unfocused questions leads to more confusion than clarity. A general framework or theory could help tie together seemingly disparate lines of research and inform future directions. In the area of nature engagement motivation, the atheoretical research that exists has, thus far, led to intervention studies that blindly aim to affect engagement. The use of SDT can help direct future research aimed at increasing nature engagement. Within SDT, the most effective means of increasing motivation and sustained engagement in a behaviour is through the provision of autonomy support (Baumann & Kuhl, 2005; Deci & Ryan, 1987; Su & Reeve, 2011).

Providing Autonomy Support to Increase Nature Engagement

Autonomy support involves providing meaningful rationale, acknowledging and accepting negative feelings, using non-controlling language, providing meaningful choices, listening empathically and relying on informational language, and nurturing inner motivational resources (Su & Reeve, 2011). Importantly, Deci and colleagues (1994) noted that autonomy support is most effective when several modalities are employed (cf. Patall, Cooper, & Robinson, 2008; Steingut, Patall, & Trimble, 2017). Autonomy support has been studied in a variety of settings including therapy (Bell, 2010), education (Reeve, Jang, Carrell, Jeon, & Barch, 2004), self-control (Muraven, Gagné, & Rosman, 2008), health contexts (Ng et al., 2012), and athletics (Fenton, Duda, Quested, & Barrett, 2014). Applying it to nature engagement is a necessary next step.

Furthermore, research on nature engagement should not be limited to a single or limited number of theories. Other theories of behavioural engagement need to be applied to nature engagement to determine which is most valid and can produce the greatest engagement. Theory of planned behaviour and self-determination theory are applicable in this field but need not be the only ones. Self-efficacy could be examined for its role in whether and how people engage with nature. Does nature engagement depend on whether people feel like they can engage with nature? If so, how can intervention programs and public policies communicate that nature activities are so varied that there are activities for all persons?

The Broad Applicability of Nature Research

Nature engagement has long been considered a leisure activity and is, therefore, studied within the research areas of recreation and leisure studies. However, it should not be exclusively approached from this perspective. Nature engagement can operate differently from other

recreation and leisure activities because it sometimes requires more effort. For example, even a leisurely stroll through nature requires more effort than watching television or reading a book. As another example, nature could be engaged with while at work for some people (e.g., landscaping) and most people could alter their commute to work to increase contact with nature. Thus, inquiry into increasing nature engagement need not be restricted to recreation or leisure studies as it has often been.

Conclusion

Well-being has been heralded as an important outcome of nature engagement. The current program of research supports this proposition with some qualifications. Experiences in actual nature are more beneficial than experiences in virtual nature; nature engagement is beneficial for hedonic well-being but may not be for eudaimonic well-being; self-transcendence may play a minor role in explaining this relationship; the relative autonomy continuum exists in nature engagement motivation; and the benefits of engaging with nature may be dependent on need satisfaction while outside.

This program of research provides unique insight into the role of self-transcendence in the relationship between nature and well-being as well as the first instantiation of SDT's relative autonomy continuum in the area of nature engagement. The use of self-determination theory in the area of nature engagement motivation suggests a number of future directions for understanding when nature is beneficial and how to increase engagement. It is time to get out of our chairs and get outside. Perhaps while out there, we can think of future research and how to get others out there with us.

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