Nature Immersion and Goals: Perspective of the Dual-Valuing Process Model

by

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BSc, University of Toronto, 2017

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Abstract

Being in nature has been associated with many positive outcomes, including well-being and, more recently, with sophisticated outcomes such as goal orientation. We proposed that the dialectic between the organismic valuing process (OVP) and sociocognitive valuing process (SVP) accounts for why immersion in natural environments may lead to a preference for pursuing intrinsic goals (e.g., affiliation, personal growth) over extrinsic goals (e.g., popularity, financial success). We randomly assigned participants (N = 75) to go on a series of up to five walks in four different kinds of environments, representing a continuum of natural environments. We hypothesized that participants who were immersed in more natural environments would report a higher relative intrinsic goal orientation than participants in less natural environments, and that this effect would be mediated by both activation of the OVP and non-activation of the SVP. We found no significant main effect of nature immersion on relative intrinsic goal valuing ($b = 0.10$, $p = 0.34$), but we did find a significant positive effect of nature immersion on activation of the OVP ($b = 0.37$, $p < 0.01$) and a significant negative effect of wild nature immersion on activation of SVP ($b = -0.28$, $p < 0.01$). However, post-hoc tests revealed that participants in the most natural environment (i.e., the Forest condition) were the most likely to experience effects of both OVP activation and SVP non-activation. Interpretations of these results are discussed, and limitations of the study are addressed.

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Acknowledgments

In this thesis, I report partial findings from a study that is part of a larger, multi-study project (PI: Frederick Grouzet; Co-I: Thomas Spence) on the effect of nature on goals and well-being, including a pilot study that has been conducted to test the materials (i.e., maps). This thesis focuses only on variables that were relevant to specific hypotheses; other variables not relevant to the thesis have not been analyzed.

The study would have not been possible without the assistance of Callista Tolentino, Tristen Lozinski, Juno Brill, Ciara Milne, Camille Brinas, Helenah Gustavsson, Jocelyn Towsend, and Hazel Rueger for testing the materials and helping to run the experiment. I also wanted to acknowledge the support of my family and friends, especially my fellow cohort members who I started this journey with. So much love to Chris, Cara, MacKenzie and Max for being my rocks, and also to my lab mates Elliott, Myles and Tom. Finally, merci pour tout, Fred. I could not have asked for a more autonomy-supportive supervisor. Cheers!

Nature Immersion and Goals: Perspective of the Dual-Valuing Process Model

In the modern industrialized world, individuals take on many different roles, are part of social groups, have careers and are expected to act in socially acceptable ways. Moreover, the rise of cities and increase in population has made it more difficult to connect to nature. This is a problem because there is evidence linking nature contact with physical and mental benefits (e.g., Capaldi, Dopko, & Zelenski, 2014; Richardson, Cormack, McRobert, & Underhill, 2016). These effects can be explained using the biophilia hypothesis (Wilson, 1984), according to which humans have an innate desire to connect with nature due to their dependence on nature in our evolutionary past. If humans are so fundamentally and intimately connected to nature yet urban life limits nature contact and nature connection, this could have lasting effects on our well-being.

Grouzet (2013) proposed that spending time in nature could get us in touch with our organismic nature as well as separate individuals from societal influence. He also proposed that two processes work together to account for an individual's value system and goal orientation: the organismic valuing process (OVP, Rogers, 1964) and a sociocognitive valuing process (SVP). The OVP refers to an innate tendency to select goals based on our inner "organismic" values (i.e., close relationships, self-growth, etc.) to attain self-actualization. However, the social context also plays a large role in determining what type of goals humans value. The SVP refers to the process of socialization by close others or society as a whole, which could either be in sync or at odds with our inner values (Grouzet, 2013). In nature, there is freedom from social expectation. Therefore, nature immersion may have an effect on well-being by connecting individuals to their organismic "essence" as well as by allowing them to self-reflect without social influence. We first briefly review the literature on positive outcomes associated with nature and outline some of the proposed mechanisms, then we describe how the dual-valuing

process model can be used to explain the relationship between nature immersion and intrinsic and extrinsic goal valuation.

Proposed Mechanisms for the Positive Effects of Nature

Being in nature has been found to be positively related to cognitive function (e.g., Hartig, Mang & Evans, 1991; Staats & Hartig, 2004) and physical health (e.g., Shanahan et al., 2016). Moreover, many studies show nature immersion and connection to be associated with hedonic and eudaimonic well-being (e.g., Capaldi et al., 2015, 2017; Richardson, Cormack, McRobert, & Underhill, 2016), as well as positive affect (e.g., Ballew & Omoto, 2018), vitality (Cervinka, Roderer, & Hefler, 2011), and meaning in life (e.g., Howell, Passmore, & Buro, 2013). There have been many different mechanisms advanced to explain these positive effects of nature.

To explain the cognitive benefits of nature, Kaplan (1995) proposed attention restoration theory which suggests that urban living drains our attention and leads to cognitive fatigue. The theory suggests that since natural environments are inherently fascinating, attending to them requires less cognitive effort which replenishes cognitive resources and leads to an increase in well-being as a result (Berto, 2014). Moreover, Ulrich (1983) proposed the stress-reduction theory to explain physiological benefits of nature. According to this theory, natural environments provide resources that would have been vital to our survival in the past. Therefore, knowing that these resources are nearby automatically leads to decreased physiological arousal. Both of these theories have been referred to as homeostatic models because they are "based on a concept of nature as a recovery system … where the focus is on a passive return to a 'normal' mental functioning" (Rainisio & Inghilleri, 2013, p. 108). However, Mayer and colleagues (2009) note that the benefits of nature "may extend beyond helping people to recover from stress and mental fatigue" (p. 609). Given the wide variety of positive benefits of nature, it is unlikely that these

two theories can explain all of the positive benefits of nature immersion, such as why it is positively related to outcomes such as meaning in life (Brooks, Ottley, Arbuthnott, & Sevigny, 2017; Howell, Passmore, & Buro, 2013) and subjective vitality (Ryan et al., 2010).

Another way to explain the psychological benefits of nature has been by invoking self-determination theory (Deci & Ryan, 2000). Weinstein and colleagues (2009, 2015) found that nature immersion leads to positive outcomes through satisfaction of fundamental needs, such as relatedness and autonomy. For example, Weinstein and colleagues (2015) discuss how engaging with nature can lead to a sense of community cohesion, which satisfies the need for relatedness. However, a series of studies by Ryan and colleagues (2010) found that nature engagement was related to an increase in subjective vitality, an effect that remained even after controlling for social factors. In a daily diary study (Study 4), they found that when controlling for physical and social activity, as well as just being outdoors (yet not in a very "natural" location), the presence of nature alone predicted vitalization. Therefore, there seems to be an independent effect of nature itself on well-being. But what is it about being in nature that makes us happy and fulfilled beyond satisfying our psychological needs?

One of the most frequently cited mechanisms used to explain nature benefits is the biophilia hypothesis (Kellert & Wilson, 1993; Wilson, 1984). According to this hypothesis, people have an innate desire to affiliate with nature due to their reliance on the natural environment in their evolutionary past, and that satisfaction of this desire leads to an increase in well-being. Preference for natural (vs. urban) scenes, zoo attendance, even the extent of owning pets has been used as supporting evidence for this idea (Gullone, 2000). Moreover, it has been proposed recently that nature relatedness is a psychological need of its own, separate from social relatedness as proposed by self-determination theory (Baxter & Pelletier, 2019). Nisbet and

colleagues (2011) found that those who were higher in trait nature relatedness showed greater purpose in life, self-acceptance, autonomy, personal growth and positive relationships than those lower in the trait.

Nature and Valuing Intrinsic and Extrinsic Goals

There seems to be something about connecting to nature that gives individuals the opportunity to be "fully flourishing human beings" (Passmore & Howell, 2014, p.383). It has recently been found that connecting to nature leads to other positive benefits such as an individual's goal orientation, specifically, their preference for intrinsic vs. extrinsic goals (Weinstein et al., 2009). Intrinsic goals are considered to be congruent with the satisfaction of psychological needs, such as goals related to personal growth, emotional intimacy/ meaningful relationships, and community involvement, whereas extrinsic goals are typically associated with some type of reward or praise, such as financial success, fame/status, and image (Kasser & Ryan, 1996). Weinstein and colleagues (2009) found that feeling immersed in a "nature" setting (i.e., a lab room with many plants) compared to a non-nature setting (lab room with no plants) was positively related to valuing intrinsic goals and negatively related to valuing extrinsic goals. Grouzet (2013) proposed that immersion in nature leads individuals to prefer pursuing intrinsic goals rather than extrinsic goals because they are reminded of a fundamental connection to other living beings and because it allows for self-reflection. It can be argued that these opportunities have become harder to find in modern, urbanized cities.

Grouzet (2013) proposes that "any condition or environmental cue that reminds us of our organismic background and organismic life span can activate the organismic valuing process (OVP)" (p. 54). The OVP refers to a natural tendency to select goals based on values that are "right" for our development (i.e., close relationships, self-growth, etc.) in order to attain self-

actualization (Rogers, 1964). Activation of the OVP could take the form of 'wake up calls' or traumatic experiences, which reorient our perspectives on life values and goals. This activation, often unconscious, naturally causes a shift in values toward the pursuit of goals and behaviours that are in line with intrinsic values and desires and steers us away from extrinsic goals or concerns ultimately leading to positive effects on well-being. Grouzet (2013) also proposes the existence of other organismic calls that could have the same shifting function. One example is connecting to nature. Being immersed in nature allows us to become aware of a fundamental organismic connection to other living beings and interconnection with the earth.

Moreover, the natural world gives individuals an opportunity to separate themselves from other people and the distractions of the urbanized social world, leading to recognition of their fundamental organismic essence (Grouzet, 2013). Often, individuals internalize the values of their social environments, whether this be through their families, friends, or from the broader social context (e.g., media, political culture). In many Western societies, there could exist a conflict between one's intrinsic values and external pressure, such as to make lots of money or own many possessions (Grouzet, 2013). In many ways, the modern, urbanized world may act as a distraction from the awareness of one's organismic nature. In natural environments, it is possible that one is separated from the social world that maintains these beliefs. This allows the individual to engage in deep self-reflection without any social pressure or expectations.

Moreover, self-reflection may be heightened if an individual is in nature alone and not influenced by the presence other people. In support of this idea, Staats and Hartig (2004) found that going into nature alone was more beneficial to restoration than being with another person in nature. However, Cole and Hall (2010) found no significant effect of congestion on high-use wilderness trails on reported restoration. However, they did find partial support for agreement on

two descriptors that are relevant to our hypotheses: “I felt removed from my daily routines” and “I felt away from other people’s demands and expectations”, though the effect sizes were quite small. Compared to the other items (e.g., “There was much to attract and hold my attention”), these two items seem particularly relevant for affecting the extent to which the SVP is activated. Therefore, it may not only be that the OVP is being activated while in nature, but also that the SVP is not being activated, suggesting that the dual-valuing process model could explain the effect of nature immersion on intrinsic goal orientation, which would then indirectly have a positive effect on well-being (see Grouzet, 2013).

Natural Environment Continuum

Plenty of research suggests that nature has positive effects, but not all natural environments are equally “natural.” Many studies on the effects of nature have been done in lab settings, which have participants view nature photos and videos, but this method is not as effective or beneficial as sending participants out into “real” nature (e.g., Mayer et al., 2009; McMahan & Estes, 2015). Moreover, environments such as parks or cultivated gardens have more human influence compared to wilder environments such as forests or wilderness trails. Thus, it can be expected that different kinds of natural environments have different effects. For example, Davis and Gatersleben (2013) found that when participants were exposed to “wilder” nature, they were more likely to state the experience was “awe-inspiring,” whereas they felt more “calm” in cultivated nature. These effects also depended on one’s own connectedness to nature. That is, having high levels of the trait “connectedness to nature” led to more transcendent and awe-inspiring experiences in wild nature, whereas having low levels of this trait led to more “disturbing” experiences in wild nature. Moreover, Ivarson and Hagerhall (2008) found that viewing garden scenes (i.e., from photographs) that had more wild or natural elements was more

restorative than viewing a smaller garden "with no natural areas and no views" and also included some buildings in the surroundings. Furthermore, Wyles and colleagues (2019) found that participants reported greater connection to nature and restoration effects after visiting coastal or rural locations rather than "urban green" environments. Thus, it seems that how wild or natural the environment is perceived to be may lead to different outcomes.

In contrast, Van den Berg, Jorgensen, and Wilson (2014) found no significant differences in perceived restoration between participants who viewed a virtual simulation of walking in three different types of "urban green spaces" varying in naturalness: an open parkland, a tended woodland, and wild woods; however, they found a significant effect of natural vs. urban environments. They also found an effect of perceived naturalness on vitality: participants who perceived the green spaces as "natural" or "very natural" showed an increase in vitality. Keyword analysis from the same study also indicated that participants used more "arousing" language when asked to explain the relatively wild setting (e.g., "refreshing" and "disorienting") compared to the more cultivated nature settings. However, it is important to note that these participants were only viewing a simulation. More research should be done looking at the effects of immersion in various types of natural environments to examine potential differences in other outcomes as well. In this particular study, we tested the effects of different types of natural environments on goal orientation.

Current Study

While research supports the idea that spending time in nature is good for well-being, more recent research shows a positive impact on other outcomes, such as valuing intrinsic goals. One possible reason for this effect is that individuals feel more closely connected to their fundamental human "essence" while in nature, and that they do not feel influenced by the social

context. Moreover, being in nature alone may exacerbate these effects. Experience of the dual-valuing process in nature should, in turn, lead to a shift in perspective toward valuing intrinsic goals relatively more than valuing extrinsic goals. In this study, we invited participants to take a series of walks (i.e., up to five during one workweek) in four different locations which represented a continuum of natural environments. Then, we measured their goal orientation at the end of the week. We predicted that participants who spent time in relatively natural environments would report relatively higher intrinsic goal valuing than participants who spent time in less natural environments (i.e., mixed nature/built settings and cultivated nature). We propose that this effect is due to our two proposed mediators, OVP activation and SVP non-activation. In line with the dual mediation model (see Figure 1), we proposed that this effect is due to (1) a heightened awareness of our connection to our organismic essence (i.e., activation of OVP) as well as (2) distancing oneself from the social context in more natural settings (i.e., non-activation of SVP).

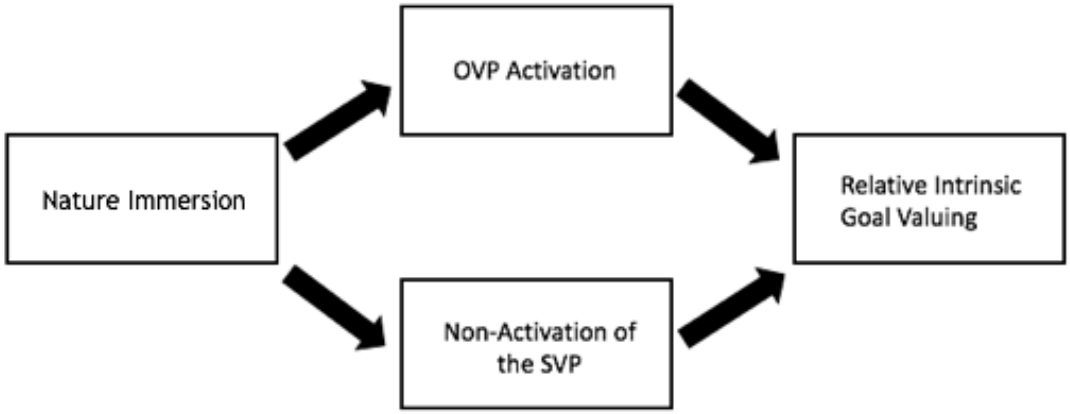

Figure 1 *Dual Mediation Model*

Note. Mediation model to explain the proposed effects of OVP and SVP activation experienced in relatively natural environments to account for the effects on relative intrinsic goal valuing.

Method

Participants

One hundred and eighty-six undergraduate students (80% female) were recruited from the University of Victoria using an online recruitment system for undergraduates enrolled in psychology courses. Participants' average age was 21.31 years (SD = 4.32), 72% self-identified as White, 18% as Asian. An a priori power analysis revealed that in order to detect an effect size of .10 with a power of .8 and a significance level of .05, we needed a total sample of 125 participants. All participants took part in exchange for bonus course credits for each separate part of the study.[1] Participants who completed all parts of the study received four credits in total. After a screening process for detecting problematic participants (see Results), a final sample of 75 (78% female) was used for analysis, with an average age of 21.53 years (SD = 4.7), 72% White, and 18% Asian. The final sample included 17 participants (3 male) in the indoor condition, 23 participants (6 male) in the campus condition, 17 participants (4 male) in the garden condition, and 18 participants (3 male) in the forest condition.

Procedure

Participants were invited to come to our computer lab on campus on Thursday or Friday to receive instructions and materials (i.e., a map and a booklet). They were told that the purpose of the study was to navigate through a route on campus and pay close attention to their surroundings. After participants completed a demographics survey on the computer, the study website randomly assigned an ID number which assigned them to one of four conditions: (1) an indoor route inside a building, (2) a route around the main campus (mixed environment), (3) a

[1] Participants received 0.5 credit for attending the first instruction session, 0.5 credit for each daily post-walk survey, 0.5 credit for completing the post-survey and 0.5 credit for attending the debriefing session when they returned their materials.

route within a cultivated garden, and (4) a route along a forest trail. Then, participants were brought into a separate room individually and given a detailed map of their corresponding location with their respective route highlighted. They also received a booklet which provided them with instructions and space to write down observations of their surroundings.[2] The booklet also included daily post-walk surveys. Participants were asked to take their map and booklet on the walks with them each day, but to not start the walks until the following Monday. Research assistants gave participants detailed instructions about the materials and answered any questions participants had about the study.

Participants were asked to navigate through routes on the University of Victoria campus alone each day for up to five days of the work week.[3] They were asked to pause their walk at two varying "checkpoints" to make written observations of their surroundings. This was done to ensure a sense of immersion in the environment. Participants were also asked to complete the daily post-walk surveys in the booklet after each walk. This post-walk survey included manipulation check questions as well as items corresponding to OVP and SVP activation (see Measures). They were then asked to transfer this information to an online version of the survey in order to get credit for the walk. Participants were able to submit their responses to the online survey throughout the day until a 9pm deadline to ensure they were not going for walks after dark. We sent participants email reminders every day to go for the walks as well as to update them on important announcements about the study.

On the Saturday and Sunday after the participants had gone on the walks, they were invited to complete an online post-survey that included a measure of goal valuation. Then, they

[2] This writing task was used solely to ensure immersion; we had no hypothesis related to this task and thus the task was not further analyzed in this thesis.
[3] The study took place in late September/early October in Victoria, B.C. Taking place in "early Fall", the weather was generally cool to mild with occasional light rainfall.

were asked to return to the lab on the following Monday or Tuesday to return the booklet and map and to give general feedback regarding their experiences. Any participants who had not completed the post-navigation survey during the weekend completed the survey in the lab.

Measures

Activation of the OVP

We included four items to measure activation of the organismic valuing process. Participants were asked the question "How did you feel during the walk?" and they responded to all subsequent items on a 5-point scale ranging from 1 (not at all) to 5 (very much), including: "Embedded within the broader natural world", "A kinship to plants and animals", "Aware of being a living organism" and "Grounded in the earth". The first two items were inspired by the Connectedness to Nature Scale (CNS; Mayer & McPherson Frantz, 2004) based on its relevance to the construct, the other two items were created by the current researchers.[4]

Activation of the SVP

We also created the following four items to measure how aware they were of the broader social context to measure SVP activation on a 5-point scale ranging from 1 (not at all) to 5 (very much): "Aware of how I am being perceived by others", "Aware of being a student on the campus", "Concordant with society's expectations", and "Embedded within the social world".

Intrinsic/Extrinsic Goals

An adaptation of the Aspiration Index (AI) by Grouzet and colleagues (2005) was used to measure goal valuation at the end of the week. In this measure, participants were asked to rate how much importance they give to either intrinsic or extrinsic goals on a scale ranging from 1

[4] Design and measures have been developed in collaboration with the Principal Investigator (F. Grouzet). For the purposes of this thesis, we did not run a confirmatory factor analysis on the newly developed OVP and SVP scale. Therefore, internal factor structure of this measure is currently not known.

(not at all) to 9 (extremely). In order to replicate the results from Weinstein and colleagues (2009), we first ran an analysis using only the four types of intrinsic and extrinsic goals used in their study (i.e., for intrinsic: affiliation and community/generativity, for extrinsic: financial success and popularity). However, we also performed an analysis including two additional types of intrinsic goals (i.e., self-acceptance and physical health) and two other types of extrinsic goals (i.e., image and conformity) to account for other types of goals not used in the Weinstein study. [5] An example of an intrinsic goal was "I will have insight into why I do the things I do" (i.e., self-acceptance); an example of an extrinsic goal was "I will be financially successful" (i.e., financial success). For intrinsic goal subscales, Cronbach's alphas were as follows: affiliation = .74, community feeling = .77, self-acceptance = .79, physical health = .79. For extrinsic goals, Cronbach's alphas were as follows: financial success = .75, popularity = .84, image = .85, conformity = .72. Relative intrinsic goal valuing was determined by calculating the difference score of intrinsic goals and extrinsic goals, with higher values demonstrating valuing higher intrinsic goals than extrinsic goals.

Manipulation Check and Screening Variables

Task difficulty. The point was for participants to feel immersed in the surroundings and to not struggle with the navigation task itself. We asked participants three questions to control for overall task difficulty: "How was the actual route to follow?" on a scale from 1 (very easy) to 7 (very difficult), "Did you get lost?" on a scale from 1 (not at all) to 7 (very much), and "How much did you use/rely on the map?" on a scale from 1 (not at all) to 7 (very much). We averaged participants' responses on all three questions to get an overall task difficulty score.

[5] Other goal types were included in the measures but not included in the present thesis.

Immersion. In order to check whether participants felt immersed in the environments, participants answered a single item: ("how immersed did you feel in the environment?") on a scale from 1 (not at all) to 7 (extremely).

Number of people seen during the walk. We selected the walk locations based on wildness and also based on the number of people normally seen in each place to ensure our manipulation was valid. Participants were also asked to estimate how many people they saw while on the walk, with possible answers: 0-3, 4-6, 7-9, 10-14, 15-19, 20-24, 25-29, and 30+.

Weather. We asked participants to report what the weather was like during their walks to ensure there was an even distribution across the conditions. Their choices were: "very rainy", "slightly rainy", "cloudy", "partly cloudy", and "sunny".

Timing of walks. Participants were also asked to report approximately how long the walks took, and what time they went on the walks during each day to test whether these variables were evenly distributed across conditions.

Accuracy of Responses. Participants were asked to report whether their responses on all of the measures were accurate and reflected true responses based on their experiences.

Followed Instructions. Participants were also asked whether they followed our instructions, specifically, whether went on the walks alone or used their phone for texts, calls, or music while on the walks.

Materials

We overlaid walking routes on maps of four different areas around the UVic campus (see Figure 2). In the Indoor condition, participants received a map with a route leading them around inside the Clearihue Building at the University of Victoria, which has four floors and two "wings" which interconnect on the 2nd, 3rd, and 4th floors. This condition represented zero nature

immersion, as participants were not exposed to any natural elements along the route. In the Campus condition, the route was around the outdoor areas of campus where there is plenty of greenery, which is still embedded within and situated around campus buildings, representing a mixed nature/built condition. Therefore, this condition, although taking place outside, is considered to be the least natural outdoor environment as there are also many buildings and many people around. Participants in the garden condition walked in a cultivated botanical garden environment, Finnerty Gardens, near campus. Although filled with plant life, it is a very structured natural environment with benches, fences and numerous pathways. In the Forest condition, participants walked along the Mystic Vale forest trail and other similar trails around campus, which have little human influence. We considered this condition to be the most untouched natural of the conditions and it also had the least amount of people (see Figure 3 for actual depictions of the different conditions). Pilot studies were done prior to running this study to ensure that factors such as difficulty of route, length of walk, familiarity of location, and strenuousness were fairly consistent across the locations.

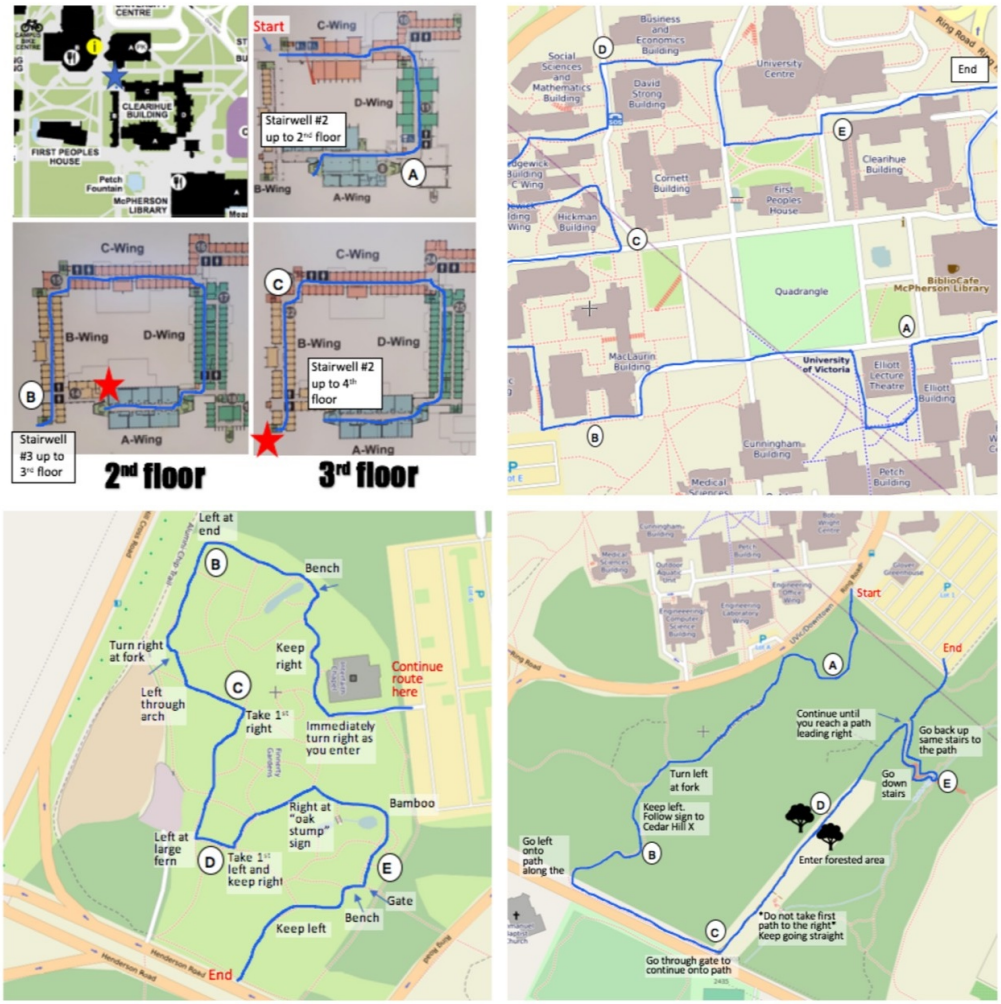

Figure 2 *Maps for Each Condition*

Note. Maps and routes participants were given. The first condition included a series of maps because of different floors in the building. The picture above depicts the route for the first half of the walk.

Figure 3 *Photos of Each Condition*
Note. Top left = Indoor, top right = Campus, bottom left = Garden, bottom right = Forest.

Results

Application of Inclusion/Exclusion Criteria

We applied seven inclusion criteria to ensure that all participants followed proper instructions given by research assistants and participated in all parts of the study. First, we excluded 6 participants who did not receive the correct map or did not receive the right instructions from experimenters in the first session. Second, we excluded 24 participants who did not complete the post-survey. Third, it was essential that participants went on the walks alone, therefore, we excluded 22 participants who said they went on the walks with others “sometimes”, “often” or “always”. Fourth, we excluded 14 participants who were explicitly made aware of the different conditions (i.e., either because of experimenter error or because they reported having spoken to other participants about the different maps) to avoid potential bias in their responses. Fifth, we excluded 9 participants who reported using their phone for texts or calls or who reported listening to music while on the walks “often” or “always”. Sixth, 15 participants were excluded because they reported that their responses were not accurate or truthful. Finally, participants were included if they went for at least four (out of five) walks during the week. Pilot testing revealed that it took participants at least two days to get accustomed to the route, so the goal was to ensure participants had enough time to get used to the route and spent enough time in the environments to feel immersed. Therefore, an additional 18 participants were excluded who went on three or fewer walks. In total, 108 participants were excluded before analyses for these reasons.

Data Screening[6]

For participants that went on four or five walks, we considered the first two walks to be "practice" walks and thus did not include them in our analysis. We averaged participants' responses on all daily variables from their final two or three walks, depending on whether participants went on four or five walks, respectively. We also averaged participants' responses on each subscale of the AI to calculate their total score on each variable separately (e.g., affiliation, financial success, etc.). For the AI, six participants were missing a response on one item and no participants were missing any more than one item on the entire AI. Regarding univariate outliers, we excluded two participants who reported consistent problems with navigating along the routes, with very high scores on task difficulty and getting lost. We also excluded one participant who was identified as a multivariate outlier on all of the manipulation check variables (K = 5) for exceeding the critical chi-square value of 20.52 according to Mahalanobis distance calculations in R (Revelle, 2018).

We ran regression analyses in R using orthogonal Helmert contrasts[7] to determine if there were any significant differences across conditions in terms of task difficulty, perceived length of walk, what time participants went on the walks, and number of rainy days experienced (see Table 1 for descriptive statistics). The Garden walk was found to be the most difficult overall. Specifically, participants reported significantly higher difficulty navigating through the route (b = .17, t = 2.5, p = .01), more likely to be lost (b = .11, t = 2.4, p = .02), and more likely to rely on the map in the garden condition (b = .13, t = 2.4, p = .02) than in any other condition. Participants were significantly less likely to use the map in the campus condition than in any

[6] Regression coefficients that are reported in this section are non-standardized.
[7] Helmert contrasts compare the second level with the first, the third with the average of the first two, and so on. Means were compared to interpret the significant contrasts.

other condition (b = -.29, t = 2.4, p = < .01). However, participants reported taking the longest to complete the walk in the Campus condition than in the other conditions (b = .36, t = 2.3, p = .02). Contrast analysis revealed that the campus walk was significantly more immersive than the indoor walk (b =.34, t = 2.4, p = .02). Also, participants reported being more immersed in the Garden condition than participants in the other conditions (b =.22, t = 2.6, p = .01). Time of day of the walks and weather (i.e., number of rainy walks experienced) were not significantly different across the conditions. Due to these findings, we controlled for level of difficulty in the main analysis, as it was the most likely control variable to affect the results.

In addition, we found that the number of people seen while on the walk was positively related to SVP activation while controlling for condition (b = .12, t = 2.11, p = .04), but not related to OVP activation while controlling for condition (b = -.04, p = .59). When not controlling for condition, the relationship between people seen and OVP activation approached significance (b = -.08, p = .06).

Table 1 *Means Across Conditions for All Manipulation Check Variables*

	Indoor	Campus	Garden	Forest
Difficulty	1.67 (.51)[a]	1.49 (.63)[a]	2.08 (.62)[b]	1.65 (.92)[a]
Lost	1.19 (.36)[a]	1.09 (.21)[a]	1.43 (.58)[b]	1.23 (.49)[a]
Relied on Map	2.05 (.36)[a]	1.47 (.46)[b]	2.16 (.53)[c]	1.73 (.83)[b]
Length	2.78 (.91)[a]	3.51 (1.03)[b]	2.65 (.87)[a]	2.69 (1.05)[a]
People Seen	6.58 (1.44)[a]	7.46 (.79)[b]	4.70 (1.8)[c]	3.41 (1.12)[d]
Rainy Walks	6	8	4	9
Immersion	2.56 (.89)[a]	3.24 (.89)[b]	3.57 (.83)[c]	3.23 (.86)[b]

Note. Scores are participants' average across all of the days considered in the analysis (except for number of rainy walks, which was the sum in each condition). Standard deviation is included in parentheses.

Main Mediation Model[8]

Following the Baron and Kenny (1986) four-step approach of mediation, we first conducted simple regressions to predict relative intrinsic goal valuing, using both the short and long forms of the AI, from wild nature immersion (i.e., c path). We then conduced simple regressions to predict whether there were any effects of nature immersion on both OVP and SVP activation (i.e., a paths). Then, we performed a regression analysis including OVP and SVP activation as predictors of relative intrinsic goal valuing (i.e., b paths). If these analyses were significant, we planned to conduct a full multiple regression analysis with nature immersion and both mediators predicting relative intrinsic goal valuing. We controlled for difficulty in all models. We entered nature immersion (i.e., condition) as a continuous variable to reflect the linear nature of the manipulation.

We found no significant effect for wild nature immersion on relative intrinsic goal valuing for both the short form ($b = 0.12$, $p = 0.34$) as well as the long form ($b = 0.13$, $p = 0.36$). However, we did find a positive relationship between nature immersion and OVP activation ($b = 0.36$, $p < 0.01$). We also found a significant negative relationship between nature immersion and SVP activation ($b = -0.22$, $p < 0.01$; see Figure 3 for graphs corresponding to these significant relationships). We found no significant effects of either mediator on relative intrinsic goal valuing using either the short form, $F(3,71) = .71$, $p = .55$, or the long form, $F(3,71) = 1.86$, $p = .14$. Since there were non-significant effects for two of the three steps of the mediation, we did not run a full mediational analysis. However, means for relative intrinsic goal valuing were in the predicted direction using both short and long forms (i.e., they seem to increase in relatively natural environments; see Table 2).

[8] Regression coefficients that are reported in this section are non-standardized.

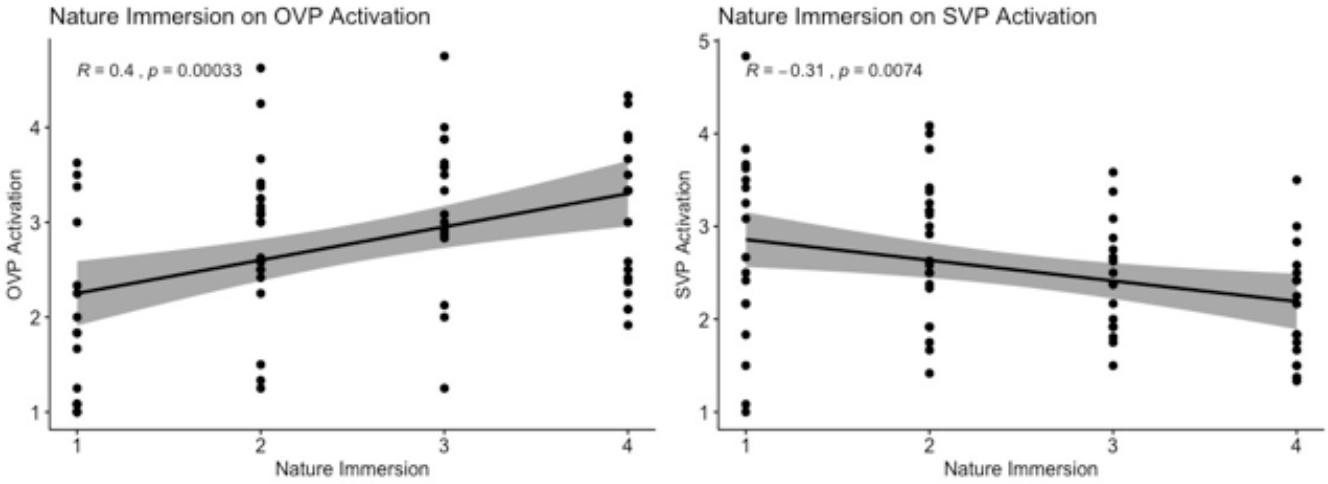

Figure 4. ***Effects of Nature Immersion on OVP and SVP Activation***
Note. These graphs depict the significant effect of nature immersion (entered as continuous variables) on OVP and SVP activation. 1 = Indoor, 2 = Campus, 3 = Garden, 4 = Forest.

Table 2
Means and Standard Deviations Across Conditions on Main Variables

	Indoor	*Campus*	*Garden*	*Forest*
OVP	1.94 (0.94)[a]	2.86 (0.82)[b]	3.19 (0.84)[b]	3.04 (0.79)[b]
SVP	2.74 (1.05)[a]	2.76 (0.74)[a]	2.43 (0.74)[a]	2.13 (0.61)[b]
4-Goal Index	2.19 (1.1)	2.44 (1.38)	2.28 (0.99)	2.64 (1.59)
8-Goal Index	2.30 (0.83)	2.83 (1.32)	2.60 (1.03)	2.76 (1.59)

Note: OVP = Organismic Valuing Process, SVP = Sociocognitive Valuing Process. OVP and SVP values are averages calculated across all days for each group. Goal values are the difference score between intrinsic and extrinsic goals. Standard deviations are in parentheses.

Post-Hoc Analyses

We also tested whether there was a general "indoor" vs. "nature" difference by treating the conditions as categorical variables and performing orthogonal Helmert contrasts testing the difference between the Indoor condition and the other conditions. We found no significant differences using the short form of goal valuing, $F(4,70) = 0.50$, $p = .73$, and for the long form, $F(4,70) = 1.06$, $p = .38$, controlling for overall difficulty.

Due to the significant linear relationships between wild nature immersion and OVP/SVP activation, we ran specific orthogonal contrasts testing whether certain conditions were driving these effects. Using Helmert contrasts to detect the effect of condition on OVP activation, we found that the Campus condition was significantly higher than the Indoor condition (b = .43, t = .31, p < .01), and that the Garden condition was significantly higher when compared to the Indoor and Campus condition combined (b = .29, t = 3.39, p = <.01). However, contrasts using Difference Coding[9] showed that the Campus and Garden condition were not significantly different from each other (t = -.01, p = .99), and the Garden and Forest condition were not significantly different from each other (t = .76, p = .44). For SVP activation, specific user-defined contrasts (i.e., ½, ½, -½, -½) revealed that the Indoor and Campus conditions combined were significantly higher than the Garden and Forest conditions combined (t = 2.5, p = .02). However, there were no other significant contrasts except for the specific contrast (i.e., ¼, ¼, ¼, -¾) between the Forest condition and the other conditions combined (b = -.13, t = 2.51, p = .01), and the Difference contrast between Indoor and Forest individually (b = -.31, t = 3.27, p = .02). Moreover, scores on the OVP and SVP were not significantly related (b = .1, p = .48).

Based on significant weather effects found in a previous study (Spence, Logan, & Grouzet, 2019), we looked at whether there were any specific effects of weather (i.e., number of rainy days experienced) on any of the main variables. We entered this weather variable as a predictor for OVP activation, controlling for condition, and found no significant effect (b = .07, p = .72). We did find a significant positive relationship of weather and SVP activation when controlling for condition (b = .39, p = .04). The effect remained after controlling for overall difficulty (b = .40, p = .04). Regarding goals, we did not find a significant effect of weather on

[9] In this coding system, the mean of the dependent variable for one level of the categorical variable is compared to the mean of the dependent variable for the next (adjacent) level.

relative intrinsic goal valuing using the long form of the AI, controlling for Condition (b = .36, p = .23), but we did find a significant effect for weather using the short form of the AI (b = .6, p = .049). This effect remained after controlling for overall difficulty (b = .62, p = .04).

Discussion

According to the dual-valuing process model (Grouzet, 2013), spending time in natural environments may act as an "organismic call" and also gives individuals the opportunity to step away from their everyday routines to engage in self-reflection. By creating a continuum of natural environments and assigning participants to go on daily walks in these different environments for one work week, we found support for the positive relationship between nature immersion on OVP activation and for the negative linear relationship between nature immersion and SVP activation but no effect of any of these variables on relative intrinsic goal valuing.

Wild Nature Immersion and Goals

We predicted that activation of the OVP and non-activation of the SVP experienced in relatively natural settings would facilitate a shift in goals, that is, the more untouched natural the environment a participant spends time in, the higher the participants' relative intrinsic goal valuing. However, we did not find any support for this mediation, or for the direct effect of nature immersion on relative intrinsic goal valuing. We failed to detect these relations regardless of whether we entered condition as a continuous variable or by running separate analyses based on post-hoc contrasts looking at the typical "indoor"/"outdoor" distinction. Thus, we were not able to replicate the findings from Weinstein and colleagues (2009) that nature immersion significantly affected goal orientation. However, Weinstein and colleagues chose to look at intrinsic and extrinsic goals independently from each other whereas we used relative goal valuing. Some research suggests that relative goal valuing may be more informative than absolute valuing (Kasser & Ryan, 1996, 2001; Schmuck et al., 2000). However, the means for relative goal orientation were in the predicted direction.

Lack of True "Immersion"

It is possible that while OVP and SVP activation are necessary conditions for this shift in goals, they still may not be sufficient to produce a significant effect if the person does not feel completely immersed. This study took place in various locations around campus. Although participants felt a connection to their organismic nature and felt separated from social world, several participants still reported in the debriefing session that they found it hard to not think about their schoolwork, which could have weakened the effect of natural environments on a goal shift. In other words, it is possible that they were not able to fully immerse themselves in the environments due to academic distractions. One of the reasons for participants going for a walk multiple times was to increase the chance that there would be opportunities for them to fully immerse in these environments. Although immersion was significantly different across conditions, overall scores were still in the low to moderate range (2.56-3.57 on the 7-point immersion scale). It is possible that students on campus during the semester may not be the best sample to detect an effect of nature immersion, as they are bound to have other commitments and stressors like deadlines that they may find difficult to distance themselves from.

There is evidence to suggest that a "culmination" of factors may lead to transformative or "peak" experiences, which is what may need to occur for goal orientation to be affected. Borrie and Roggenbuck (2001) sampled wilderness visitors during a visit to the Okefenokee National Wildlife Refuge in the U.S. and found participants showed greater focus on the "self/environment" dimension as well as on the "self/introspection" dimension, and less focus on "others/social acceptance" at the end of the visit, which seems to be in support of our hypotheses. However, they also found that scores on the "humility/primitiveness/oneness" dimension were higher during immersion as well as at the end. This dimension included items such as "I was in

awe of nature's creation" and "I was feeling totally immersed in nature". Moreover, Davis (2014) found that participants reported "transformative" and "peak" experiences while in an actual wilderness setting. It is possible that in our study not all participants achieved this "peak", as they were still on campus and clearly were not on a retreat or vacation. It is worth noting that, for the outdoor conditions, the only condition that was significantly different from the other outdoor conditions for non-activation of SVP was the forest, which is also the condition which was the furthest from campus. Although there was a significant negative relationship for wild nature immersion and SVP activation, the forest condition seemed to be driving this effect.

Lack of a "True Effect"

Another possible explanation for the failure to find an effect of condition on goals is that there really was no strong relationship between the mediating variables. Connecting to one's organismic nature or feeling separated from the social world are not related to goal orientation. In support of this, Dopko (2017) had participants attend to either "elements of nature" or "elements of architecture" for 20 minutes per day for 12 days and found no effect of attending to nature on relative intrinsic goal valuing. While participants were instructed to go to different types of natural environments, overall "wildness" was not manipulated or controlled for in this study. Although no definitive conclusion can be made, previous research has suggested that there could be a difference in how we respond to cultivated vs. wild environments. For example, Davis and Gatersleben (2013) found that when participants were exposed to wild nature, they were more likely to state the experience was "awe-inspiring," whereas they felt "calmer" in cultivated nature. Therefore, it is likely that not any kind of natural environment will produce this awe-inducing effect: only environments that are truly perceived as being relatively distant or are relatively uncultivated.

Nature Immersion on OVP and SVP Activation

We found support that our manipulation of nature immersion predicted OVP and SVP activation. Although we predicted that participants in the Forest condition would report the highest values of OVP activation overall as a result of this condition being the most natural, there was no significant difference between the Garden and Forest conditions on OVP activation. It is possible that the Garden condition was perceived as being unique in that it had the largest variety of biodiversity in a smaller space whereas the forest condition is more "vast" and contains more natural biodiversity. While individuals seem to have a preference for wild natural environments (Wyles et al., 2019), they also appreciate having a wide variety of natural elements to attend to (Windhorst & Williams, 2015). Therefore, the garden scenery could be perceived by individuals as being more "complex" or "rich" in biodiversity than the forest scenery. Previous studies have shown that visits to environments with greater species richness and abundance resulted in greater restoration (Dallimer et al., 2012; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007).

Although the overall linear relationship between nature immersion and SVP activation was significantly negative, individual contrasts revealed that the Forest condition was the only one that was significantly lower than the other conditions. This is not surprising as this condition is the furthest away from campus, is the quietest, and was reported by participants as having the least amount of people. The fact that these significant effects occurred from participants going on short walks for just one week supports the idea that types of natural environments can have different effects on the way people think. It also suggests that you may not have to go very far in order to "disconnect" for a while. These results seem to suggest that while both the Garden and Forest conditions were more or less equally effective at activating the OVP, the most effective way to disengage from the SVP was the Forest condition. This could have been for a few

possible reasons: there were still too many people around in the Garden environment, or the complexity of the environment was itself a distraction. Therefore, to truly experience effects of both OVP activation and SVP non-activation, one may need to immerse themselves in natural environments that "feel" more distant from regular life.

OVP Activation or "Nature Relatedness"

We suggest that immersing in a natural environment connects people to their inner organismic nature. However, it is possible that immersing in nature facilitated a broad sense of "relatedness", or connecting to something larger than oneself, whether this is to the natural world or to other humans in general. For example, Puhuakka (2014) relates intimate nature experiences to meditative experiences, which fundamentally act to rehabilitate a "severed" connection between "self and other." According to Puhuakka (2014), this is fundamentally why nature has healing properties. On the one hand, this suggestion resonates with the idea of activating the OVP due to the importance placed on reconnecting individuals to a shared fundamental humanity. However, OVP relates to more of a "focusing inward"/self-reflection perspective, whereas Puhuakka's perspective relates to more of a "focusing outward/expanding the self" perspective. Weinstein and colleagues (2009) attributed the relationship between nature immersion and goal orientation to a feeling of "relatedness" as defined by self-determination theory. Future researchers may want to compare "social relatedness" as it relates to self-determination theory with "nature relatedness" to determine whether they are distinct constructs or whether they fall under the same broad umbrella of experiencing a sense of "relatedness".

The Silence of Nature and Being Alone

There are many elements of nature that may have distinct effects on an individual, therefore it is often difficult to tease apart what exactly is causing positive effects. Part of what

gives natural environments their appeal to many people is the experience of relative silence compared to urban areas. Research points to the experience of silence as having many positive effects on well-being and mental health (Valle, 2019). Moreover, experiencing silence either indoors or outdoors has been associated with relaxation but experiencing silence in a natural environment was found to be related to an orientation toward the present and a reduced orientation toward the past (Pfeifer, Fiedler, & Wittmann, 2019). These authors also relate the altering effects of silence in nature to meditation.

In addition to experiencing silence, the feeling of being alone has distinct effects on an individual's experience in nature. As mentioned in the introduction, Staats and Hartig (2004) found that going out into nature alone was more beneficial to restoration than being with another person. Although Korpela and Staats (2014) report that being alone in nature is usually generally restorative for urban citizens of different ages, they acknowledged that some individuals may not always feel comfortable being alone, especially if personal safety is a concern. In an essay, the writer and literary critic Deresiewicz (2009) claimed that in this age of constant connection, being alone can be frightening: "The more we keep aloneness at bay, the less we are able to deal with it and the more terrifying it gets." More psychological research should be done looking at the experience of being alone in nature, especially in different kinds of natural environments. In one recent study, Pasanen, Neuvonen, and Korpela (2018) found that going into nature to be alone was related to lower positive emotional well-being overall, but if the visit led to an increased focus on one's own thoughts, it was related to a more positive mental state. Therefore, it may not be the intention to be alone that is important, but rather that actual self-reflection occurred while in nature.

OVP Activation: A Positive or Negative Experience?

Part of what it means to connect to one's organismic nature is to realize that our fundamental humanity is similar to that of other non-human animals in that we are condemned to our mortality. Thus, OVP activation as experienced in nature may be in conflict with terror management processes that try to cope with this awareness (Greenberg, Pyszczynski, & Solomon, 1986). Moreover, this anxiety may even lead to individuals pursuing extrinsic goals as a distal defense mechanism. For example, Koole and Van den Berg (2005) found that wild environments inspired more thoughts about death than cultivated nature or urban environments. Moreover, Gatersleben and Andrews (2013) found that exposure to a dense wooded environment lead to increased levels of stress and fear in participants, because participants felt like the environment was low in prospect (i.e., the ability to see what is going on around them) and refuge (i.e., no places to hide). Similarly, Milligan and Bingley (2007) found that while some participants reported feeling calm and restored in a woodland setting, for others it created anxiety and uncertainty. Therefore, while participants may experience a connection to their fundamental organismic nature, being alone in a relatively untouched natural setting may not be a "pleasant" experience for everyone. Individual differences may play a role in whether this experience leads to a shift towards intrinsic or extrinsic goals. Although pilot studies revealed relatively equal ratings of familiarity across the conditions, future research could specifically control for feelings of anxiety or discomfort felt in wild settings, and whether this leads to different effects on goal orientation.

Impact of Weather

Although weather was not one of our main variables in this particular study, we noticed in the debriefing session that several participants expressed that the weather influenced how

much they enjoyed the walking activities. We found that the number of rainy days experienced affected SVP activation as well as the goals difference score from the 4-goal index of the AI (i.e., affiliation and community/generativity vs. financial success and popularity). It is possible that experiencing rainy days made the walks less enjoyable for some participants, which led participants to respond differently from other participants on these variables overall. Some research suggests there could be a wide range of individual differences in how weather affects mood, with some people reporting more of a "hatred for rain" than others (Klimstra et al., 2011). Moreover, Denissen and colleagues (2008) found in a daily diary study looking at the effects of weather on mood that lack of sunlight, specifically, was positively related to negative affect. Future research could delve further into how experiencing rain or other weather phenomena while in nature impacts other outcomes such as goal orientation.

Limitations and Future Directions

This study is the first to have actually manipulated type of natural environment to examine different effects on goal valuing. The non-significant trend of nature immersion on relative intrinsic goal valuing in this study suggests that there could exist a small effect. However, there were some notable limitations of the study that should be addressed. Although we asked participants to stop at different locations to include some variety in their daily walk experiences, their routes were the same each day. In the debriefing session, some participants reported feeling "bored" by the end of the week. Perhaps by including some variation in the actual walking routes, we would have kept participants more engaged and immersed throughout the study.

We also realize having participants respond to the OVP and SVP items each day may have been primed them to think in a certain way. After answering these questions on the first

day, participants may have continued to have these ideas in their minds during the subsequent walks. It could be that these thoughts did not necessarily originate from participants themselves. Perhaps using other, or indirect, ways of measuring OVP and SVP activation could be used to test whether participants felt these effects without prompting them.

Moreover, it is possible that the effect of nature immersion on goal shift is moderated by one's prior goal orientation. For example, perhaps participants who already have a high relative intrinsic goal orientation are not as affected by nature immersion as those who value intrinsic and extrinsic goals more equally. Since we did not measure participants' relative goal valuing before participants began the study, we could not examine this possibility. We chose to not take a measure of goal valuation at the beginning of the study in order not to prime the participants in making an association between nature immersion and goals.

Finally, it is possible that our inability to find a significant difference of nature immersion on relative intrinsic goal valuing was due to limitations related to our low statistical power. Technically, the fact that we split up the credits for the different parts of this study may have made it more likely for participants to "skip" certain parts, including completing the post-survey and going on three or less walks. Since we lost many participants due to these issues, it may be in the best interest in future research using this daily walking paradigm to combine credits in order to avoid losing as many participants.

By using many inclusion criteria, we tried to control for as many variables as possible that could have introduced noise to our manipulation. For example, by asking participants whether they actually went on the walks alone, used their phone for personal purposes or listened to music during the walks, we wanted to ensure that participants in the final sample experienced the different conditions as we intended. However, given that the main part of the study occurred

outside of the lab, it is difficult to control for every possible variable that could impact the findings. In the end, we lost approximately 100 participants by using these criteria to filter participants. In future research using similar methods, it would be beneficial to recruit a much larger sample to account for this or place more emphasis on certain instructions in the initial session (e.g., walking alone, not using their cellphone). It may also be beneficial to recruit non-student participants to have more of a general sample, since participants reported being distracted by academic responsibilities and deadlines. We plan to take advantage of this natural continuum present on the UVic campus and continue to run studies using this walking paradigm. However, due to the time it took participants to "get used to the route" and fairly low immersion scores overall, we might consider methods of inducing immersion in natural environments other than framing it as a navigation task.

Conclusion

Many mechanisms have been proposed to explain the relationship between being in nature and various positive outcomes. We proposed that activation of the organismic valuing process and non-activation of the sociocognitive valuing process could mediate the relationship between nature immersion and a preference for intrinsic (vs. extrinsic) goals. Although we did not find a significant main effect of nature immersion and relative intrinsic goal valuing, we were able to detect significant relationships of the natural environment continuum on OVP and SVP activation. Participants seemed to experience a heightened awareness of an organismic essence and a separation from the social context in more untouched natural settings, even though all of the environments were located on the UVic campus. Future research could assist in determining whether the lack of a mediation effect was due to limitations of the current study, such as low power, or whether alternative mechanisms could better explain the potential relationship between immersion in nature and goal orientation.

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