Distinguishing Pro- and Harmful-Environmental Behaviours: The Roles of Motivation, Stages of Change, Basic Psychological Needs, and Nature Relatedness

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ABSTRACT

The degradation of the environment and climate change represent some of the most important environmental issues affecting our society today, and we need to better understand what can be done in order to mitigate the negative effects of human activity on the environment. The present program of research proposes to examine, through three studies, how the frequency of pro-environmental behaviours (PEB) and harmful-environmental behaviours (HEB) are related to self-determined (SDM) and non-self-determined motivation (NSDM), stages of change (SOC), the satisfaction versus the frustration of basic psychological needs as defined by Self-Determination Theory, and nature relatedness. In *Study 1* (N = 377), a scale was created to measure two distinct types of environmental behaviours, PEB and HEB, and the relationships between these types of environmental behaviours and SDM and NSDM were examined. Results demonstrated that both types of behaviours loaded on two distinct factors when conducting an exploratory factor analysis, that they were associated differently with environmental motivation, and that levels of motivation were different according to the reported frequency of adoption of PEB and HEB. In *Study 2a* (N = 266) and *2b* (N = 529), the role of stages of change (SOC) was introduced to determine whether environmental motivation and behaviours were different across SOC and to examine whether SOC played a mediating or moderating role in the relationship between environmental motivation and behaviours. Results indicated that people in the later SOC displayed higher levels of SDM and PEB while people in the earlier stages reported higher levels of NSDM and HEB. It was also observed that SOC partially mediated the relationship between environmental motivation and behaviours. In *Study 3* (N = 507) nature relatedness was compared to the satisfaction and frustration of basic psychological needs proposed by SDT to examine their respective roles in the association of motivation, SOC, PEB and HEB. Results

revealed that nature relatedness was incremental to need satisfaction and frustration with regard to levels of SDM. Also, nature relatedness was an important determinant of SOC and both types of environmental behaviours. As for the proposed model, it was demonstrated that high levels of nature relatedness were associated with higher PEB and lower HEB through partial mediation by SDM and SOC, while need frustration was linked to a higher reported frequency of HEB through mediation by NSDM. Overall this thesis expands on SDT research by highlighting the importance of including HEB in conjunction with PEB and by demonstrating the prominent roles that SOC and nature relatedness could play in the motivational process associated with environmental action.

"Some beautiful paths can't be discovered without getting lost"

Erol Ozan

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LEGEND

ANOVA – Analysis of Variance

BPNSFS – Basic Psychological Need Satisfaction and Frustration Scale

CFI – Comparative Fit Index

EFA – Exploratory Factor Analysis

HEB – Harmful-Environmental Behaviour(s)

HIT – Human Intelligence Task

ISPR – Integrated System for Participation in Research

KMO – Kaiser-Meyer Oklin

ML – Maximum Likelihood

MTES – Motivation Toward the Environment Scale

mTurk – Amazon's Mechanical Turk

NRS – Nature Relatedness Scale

NSDM – Non-Self-Determined-Motivation

PEB – Pro-Environmental Behaviour(s)

RMSEA – Root Mean Square Error of Approximation

SDI – Self-Determination Index

SDM – Self-Determined-Motivation

SDS – Social Desirability Scale

SDT – Self-Determination Theory

SEM – Structural Equation Modelling

SOC – Stages of Change

SRMR – Standardized Root Mean Square Residual

TLI – Tucker-Lewis Index

TTM – Transtheoretical Model

ULS – Unweighted Least Squares

Chapter 1

Introduction

The state of the planet's environment is degrading at a critical rate and this problem has become a cause for concern (Vlek & Steg, 2007). Many environmental issues such as global warming, air pollution, shortage of water, and biodiversity loss can be linked to unsustainable human practices (Winter & Koger, 2014; Gardner & Stern, 2002). Not only is the pollution brought on by humans bad for the survival of the planet, it also endangers the human population (Hoek et al., 2013). In fact, many studies have shown that air pollution alone can be linked to increases in hospital admissions due to asthma and chronic obstructive pulmonary disease as well as for cardiovascular disease and has been linked to an overall increased mortality rate (Brunekreef & Holgate, 2002). In addition, air pollution has also been shown to negatively affect the nervous system (e.g., Ratnaike, 2003), the digestive system (e.g., Kimbrough, Carter, Liddle, & Cline, 1977), the urinary system (e.g., Damek-Porawa & Sawicka-Kapusta, 2003; Boffetta, Merler, & Vainio, 1993), and the development of foetuses (e.g., Garza, Vega, & Soto, 2006). What should cause even more concern is that future consequences to the planet and to our health are inevitable in reason of the rapid growth of the population, a growth that leads to an estimation of a population of 11.2 billion humans by 2100 (UN Population Division, 2015). The individual contribution of humans, by engaging in pro-environmental behaviours (PEB) and reducing harmful-environmental behaviours (HEB), is therefore a prominent factor in mitigating the effects of human actions on the environment (Gifford, 2008).

Because we have long been aware that individual human behaviours are linked to the environmental destruction (Vlek & Steg, 2007), it would be expected that we would change our practices in order to improve the poor state of the environment. Yet, even if most people agree

that problems related to the current state of the environment are very serious, there is a large gap between the level of consciousness of the problem and the amount of PEB people actually engage in (Gifford, 2011; Kollsmsuss & Agyeman, 2002). For this reason, understanding what drives people to act in a way that is beneficial for the environment is of great importance.

However, the meaning of acting in a way that is beneficial for the environment is often considered as simply doing positive things for the environment, when in fact, it could mean two distinctively different things. To be more specific, it could mean doing behaviours that are responsible and good for the environment such as recycling, carpooling, volunteering for environmental organisms or buying environmentally friendly products. It could also mean reducing or eliminating behaviours that are harmful for the environment like drinking out of disposable bottles, overconsumption, leaving a car running for a long period or buying products with unnecessary packaging. Although it would make sense to believe that as people adopt more PEB they also stop doing the HEB, there is no evidence of such a relationship between these distinct types of behaviours as it has yet to be examined. That is, the studies in environmental psychology focus mainly on how different factors relate to a limited number of PEB, they rarely examine the factors associated with the reduction of HEB, and to the best of our knowledge, they don't examine how people's behavioural patterns evolve as people become more motivated to take care of the environment.

In light of this, several authors (Gifford, 2011; Pelletier, 2002; Vlek & Steg, 2007) suggest that motivation is one of the factors that can be linked to an increase in PEB. More specifically, self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2017) has been proposed as a key theoretical framework to study the underlying reasons why we engage or fail to engage in sustainable practices as it has shown to have considerable potential in explaining

why we adopt and maintain PEB (Pelletier & Aitken, 2014). However, it is not known whether motivation relates positively or negatively to the level of HEB. Therefore, in this program of research we propose to examine whether PEB and HEB represent two different categories of environmental behaviours and we propose to examine how different motivational orientations for the environment relate to both these types of behaviours. Following this first step, we propose to examine how two theoretical factors could explain the extent to which motivation relates to PEB and HEB. The first factor concerns the stages of change (SOC) that people go through when they consider implementing a new behaviour. According to the research on SOC, people move through a series of stages when they go from the realisation that a change is required to maintaining this change in behaviour (Pelletier, Guertin, & Rocchi, 2017). Yet to be tested, is the proposition (Pelletier & Sharp, 2008) that SOC could play an important role in the motivational processes associated with a higher frequency of PEB and possibly a lower frequency of HEB. The second factor that is in line with the research on SDT, is the satisfaction (versus the frustration) of basic psychological needs. However, the examination of the role of psychological needs will be done in light of new evidence suggesting that a fourth need, nature relatedness (Baxter & Pelletier, 2018), could play a critical role, above and beyond the three needs (autonomy, competence, and relatedness) proposed by SDT, in predicting the extent to which people have more or less internalized the regulation of their behaviour.

In the following section, motivation as defined by SDT is briefly presented. It is followed by four sections, one that focuses on the importance of considering the SOC when examining the relationships between motivation and behaviour, another one that focuses on the role played by the satisfaction of basic psychological needs in the development of self-determined motivation (SDM), a following section that examines the role of nature relatedness as

a basic psychological need. Finally, in the last section, the proposed model, program of research and goals of thesis study are presented.

Self-Determination Theory

SDT is an organismic theory of human motivation and behaviour stipulating that humans are active agents who are inclined toward positive personal development and striving (Deci & Ryan 1985, 2002; Ryan & Deci, 2017). This social motivation theory, as opposed to other theories (Bandura, 1996; Baumeister & Vohs, 2007), is built on the assumption that motivation does not vary only in terms of magnitude or quantity. Rather, it is proposed that motivation varies in terms of quality and source of origin, and that these factors influence outcomes and human behaviour (Deci & Ryan 2000, 2008; Ryan & Deci, 2017). These different sources can be categorized into three different types of motivation labelled amotivation, extrinsic motivation, and intrinsic motivation. In addition, these distinct types of motivation can further be divided into six different behavioural regulations that could be placed on a continuum of self-determination, from non-self-determined motives (low quality) to self-determined motives (high quality). More specifically, the quality of motivation is determined by the extent to which behaviours are internalized into the self in that fully internalized motives produce more desirable behavioural, cognitive, and affective outcomes than partially internalized and non-internalized motives.

Motivational Types and the Self-Determination Continuum

Within the SDT continuum proposed by Deci and Ryan (1985, 2000), the least self-determined type of motivation is called amotivation, which can be categorized as a lack of behaviour regulation and of internalization. It relates to experiences where there is a clear lack of understanding of the sources of behaviour regulation or its purpose, and an absence of

motivation or intention to act. In other words, when individuals don't know why they should adopt certain behaviours, they don't see the point in doing so, or they don't see how it could lead to a desired outcome (Pelletier, Dion, Tuson, & Green-Demers, 1999), they are experiencing amotivation. Next, the first type of extrinsic non-self-determined motivation (NSDM) is external regulation. It consists of behaviours intended to obtain rewards, avoid punishment, or to satisfy social pressure. For example, someone may enact certain behaviours in order to receive a monetary compensation. Introjected regulation is the first type of regulation where the internalization of behaviours is present. At this stage, behaviours are executed mainly to avoid negative emotions such as guilt or shame. Thus, someone engaging in certain behaviours in order to avoid feeling guilty is driven by introjected regulation. The first type of regulation on the self-determined end of the continuum is an extrinsic type of motivation called identified regulation. This type of regulation characterizes behaviours that are initiated and maintained because they are important to someone, or because they lead to the accomplishment of important personal goals. For example, someone who adopts behaviours because he values and understands their importance is displaying identified regulation. Next, there is integrated regulation, a more self-determined type of extrinsic motivation where behaviours are enacted for reasons that reflect a search for coherence and integrity among the different dimensions of one's self. For instance, as a result, integrated individuals will act because behaviours are considered to be part of their identity and they are coherent with their values and other behaviours that are important to them. Finally, the most self-determined type of motivation is intrinsic regulation. In this case, it is the pleasure and satisfaction of the activity that drive the behaviours. When intrinsically motivated, the simple fact of enacting certain behaviours brings pleasure to an individual when he or she is engaged in the particular activity. Thus, although amotivation, external regulation, and

introjected regulation could be high in terms of quantity they are considered types of motivation of lower quality, while identified regulation, integrated regulation, and intrinsic regulation are considered higher quality motivation. SDT proposes that humans have an innate tendency to be autonomous and self-determined, and that the satisfaction of three basic psychological needs of autonomy, competence and relatedness play a critical role in the development of SDM. The role of these needs will be discussed in a further section.

The Environment and Self-Determination Theory

The SDT framework has been studied within a vast number of domains including the environment and the adoption of PEBs. In fact, many studies have looked at the possible effects of SDM and NSDM on various environmental variables (Pelletier, 2002; Pelletier, Baxter, & Huta, 2011; Pelletier & Aitken, 2014; Pelletier & Lavergne 2016).

SDT perspective on environmental behaviours and attitudes. Pelletier, Tuson, Green-Demers, Noels, and Beaton (1998) provided the first empirical evidence that the different types of behavioural regulations proposed by SDT were correlated to various categories of PEBs. In the first of four studies, the authors demonstrated that the six different behavioural regulations proposed by SDT could be translated into six clear factors representing specifically amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation toward the adoption of PEB. Next, in the second study, they confirmed that the scale structure was solid and that it clearly measured the different types of motivation to engage in PEB. In the third study, the authors tested whether the different types of motivation would relate to various variables including different environmental constructs and numerous PEB. With regard to environmental constructs, SDM (i.e., intrinsic, integrated, & identified), in addition to introjected regulation, were positively related to environmental attitudes, perceived

competence for environmental behaviours as well as perceived importance of environmental problems and negatively related to environmental satisfaction. In contrast, external regulation and amotivation had all the opposite relationships with the environmental constructs, with the exception of external regulation not being linked to perceived competence for environmental behaviours. In relation to the PEB, SDM (i.e., intrinsic, integrated, & identified) had significant positive correlations with reuse behaviours (e.g., reusing the unused side of paper), recycling behaviours (e.g., encouraging friends to recycle), purchase behaviours (e.g., buying biodegradable products), and energy conservation behaviours (e.g., using environmentally friendly forms of transportation). In addition, introjected regulation had a positive relationship with a few of the same behaviours while external regulation had very few significant relationships, all negative, with the proposed behaviours. Also, results from their study demonstrated that there was a significant negative correlation between amotivation and the majority of the PEBs of all categories (Pelletier et al., 1998). In the fourth and final study, the internal consistency was confirmed with strong test-retest correlations for the subscales representing all six of the behavioural regulations in relation to PEB. This study, which was the first to thoroughly link motivation as defined by SDT to positive environmental behaviours and that can be considered a pillar for environmental motivation research lends support to the idea that SDT can be an important variable while trying to improve the state of the environment. However, the link between environmental motivation and HEB was not considered and could add significant value to the effects of fostering SDM toward the environment.

In a following study, it was demonstrated that amotivation related to the environment was negatively correlated to many environmental attitudes and feelings. In fact, when amotivation was high, perceived competence for environmental behaviours as well as perceived

problems in the local environment were low and negative feelings toward the environment in addition to self-related negative feelings when thinking about the environment were elevated (Pelletier, Dion, Tuson, & Green-Demers, 1999).

In another important study, Green-Demers, Pelletier, and Ménard (1997) set out to demonstrate that not only is SDM related to PEB, but that this relationship should increase as the difficulty of the behaviours increases. This means that individuals who are self-determined to be environmentally friendly should adopt PEB more frequently especially when these positive behaviours are difficult. As hypothesized, as SDM increased, so did the frequency of difficult behaviours versus average difficulty behaviours as well as the frequency of average behaviours versus easy behaviours. This idea was further investigated by Aitken, Pelletier, and Baxter (2016) who demonstrated that when it comes to transportation behaviours, SDM was associated with a more frequent participation in the behaviour when it was considered to be difficult, while the type of motivation had no impact on easy transportation behaviours.

Several other studies have linked SDT to environmental behaviours and attitudes. For example, Koestner, Houlfort, Paquet, and Knight (2001) aimed to measure the influence of introjected beliefs toward the environment on how vulnerable one is to counter arguments based on the attractiveness of the person arguing and the strength of their argument. They provided evidence that individuals with high introjected beliefs were more likely to be persuaded against recycling when the argument came from someone considered as attractive, regardless of the strength (weak or strong) of the argument. Furthermore, results also showed that individuals with low introjected beliefs were resistant to persuasion against recycling when presented with both weak or strong arguments. In a more recent study, de Groot and Steg (2010) set out to examine the predictive power of the six behavioural regulations proposed by SDT on intentions to choose

a car based on its environmental performance and intentions to donate to an environmental organization. The researchers demonstrated through their results that individuals high on integrated regulation and introjected regulation toward the environment were more likely to choose a car with high environmental performance whereas those who displayed high amotivation were more likely to choose a low environmental performance car. In a similar fashion, intrinsically motivated and integrated individuals had high intentions to donate to an environmental organization and those who were externally motivated to behave in a way that if beneficial for the environment had low intentions to donate (de Groot & Steg, 2010). Also, it was demonstrated through two studies (Sheldon, Wineland, Venhoeven, & Osin, 2016) that for individuals who consider themselves as environmental activists, integrated regulation is the strongest predictor of the commitment to be an activist and that intrinsic motivation was negatively linked to emotional exhaustion related to activism, while external regulation was positively linked to the activism exhaustion. To summarize, SDT has been studied in relation to environmental behaviours as described above in addition to a plethora of behavioural variables such as recycling and purchasing behaviours (e.g., Pelletier et al., 1998; Villacorta, Koestner, & Lekes, 2003), environmental activism (e.g., Séguin, Pelletier, & Hunsley, 1998), household energy-saving behaviours (e.g., Webb, Soutar, Mazzarol, & Saldaris, 2013; Joachain & Klopfert, 2014), employee green behaviours (e.g., Graves, Sarkis, & Zhu, 2013), and green information technology behaviours (e.g., Koo & Chung, 2014) as well as in a wide variety of countries including Canada (e.g, Pelletier et al. 1998), the United States (e.g., Sheldon et al. 2016), the Netherlands (e.g., de Groot & Steg, 2010), South Korea (e.g., Koo & Chung, 2014), China (e.g., Graves et al. 2013), Belgium (e.g., Joachain & Klopfert, 2013) Australia (Webb et al., 2013), and other countries. Finally, it has also been studied in different settings such as home (e.g., Webb et

al., 2013), the workplace (e.g., Graves et al., 2013), and the classroom (e.g., Darner, 2012; Legault & Pelletier, 2000).

The previous studies, as a whole, support the idea that SDM and NSDM are related to different outcomes in regard to environmental behaviours and attitudes. Self-determined types of motivation (intrinsic, integrated, & identified) being mostly related to positive outcomes and non-self-determined types of motivation (introjected, external, & amotivation) being mostly related to negative outcomes, with the exception of introjected regulation who has been linked to positive outcomes at times.

Limitations

The myriad of studies linking SDT to environmental behaviours and attitudes strongly suggests that motivation, as defined by SDT, is a key element in the adoption of several types of PEB, their maintenance and the execution of more difficult PEB (Gough & Pelletier, 2019). Despite all this evidence, there are some shortcomings in the literature on SDT and environmental behaviours. First, as previously stated, researchers have solely focused on the effects motivation has on positive environmental behaviours such as PEB. Yet, in order to mitigate the impact of humans on the environment and reach larger environmental benefit, we should also consider the importance of reducing behaviours that are harmful for the state of the planet. In order to address this limitation, we will integrate HEB to this program of research to determine whether SDM and NSDM play a critical role in the prediction of both PEB and HEB. Also, research has yet to consider how we change from being people who don't even think about how our actions have negative impacts on the environment to individuals who are genuinely concerned and behave in ways that are beneficial for the environment. We examine this point in the following section.

Stages of Change

Understanding what leads people to act in a way that is favourable for the environment is of great importance, and although SDT may represent a key theory to explain the extent to which people pay attention to an issue like the environment and how they initiate and then they maintain a set of behaviours, most individuals that behave in an environmentally friendly manner have most likely not always behaved that way. We believe the adoption of PEB and the reduction of HEB imply progressive behavioural changes for most people and these changes go far beyond simply adopting new PEB and dropping old habits considered as HEB. In other words, changing behaviour is not easy, it is a complex process that requires motivation.

Models of stages of change (SOC) posit that individuals move across different stages when they intend to initiate and maintain behaviours. In fact, many SOC models, such as the Transtheoretical Model (TTM; Prochaska & DiClemente, 1982) have been proposed in order to explain that behaviour change is a process through which individual cross a series of different stages rather than change simply happening in a single event. The majority of these models have been developed with the intention of understanding behaviour change related to our health. For example, it has been used in relation to smoking cessation (i.e., Farkas et al., 1996), physical activity (i.e., Woods, Mutrie, & Scott, 2002), and healthy eating (i.e., Glanz et al., 1994). Although these SOC models have shown considerable promise in understanding how people change their behaviours, a more recent model has been suggested by researchers (Pelletier et al., 2017; Pope, Pelletier, & Guertin, 2018). Their model consists of stages that can be categorized as the detection phase, the decision phase, the implementation phase, the maintenance phase, and the integration phase. In the first stage, the *detection stage*, individuals become aware, whether intentionally or unintentionally, that a problem is relevant to them. Next, in the *decision stage*,

people consider the problem to be real and try to decide what actions should be taken in order to mitigate the problem. The third stage, the *implementation stage,* follows the individual's decision that actions need to be taken to alleviate the problem and how as well as when and where these actions should be taken. The fourth stage, the *maintenance stage,* happens when behaviours have been initiated and must now be maintained in order to become part of the lifestyle or to lead to permanent behaviour change. Finally, in the *integration stage*, the change in behaviours has been sustained over a long period of time and has become part of the lifestyle. If the final stage is reached and behaviours are in fact maintained long enough to become part of the lifestyle, these behaviours become easier. However, it is possible for individuals to fail at any stage and regress to the previous phase (Prochaska & DiClemente, 1982). While these stages seem very simple, moving from one stage to another with the aim of transforming problem mitigating behaviours into habits seems to require a great deal of motivation. For this reason, SOC models have been studied in relation to SDT.

Motivation and Stages of Change

Mullan and Markland (1997) were the first to bridge SOC and SDT. They demonstrated, in regard to physical activity, that people who were further along in the SOC displayed more SDM when compared to individuals in the earlier stages. In addition, a few other studies revealed similar results (Daley & Duda, 2006; Thøgersen-Ntoumani & Ntoumanis, 2006) and some researchers also provided evidence, using a longitudinal design, that individuals who are able to move across the different stages of physical activity behaviour change experienced an increase in SDM while those who were unable to progress across the stages experienced a reduction (Fortier et al., 2012). Recently, the link between SDT and SOC has been made in the eating regulation context. In fact, Gough, Guertin and Pelletier (2018) demonstrated that when

trying to modify eating behaviours, individuals who are self-determined are more likely to be in the later stages, while non-self-determined people tend to fall in the earlier stages. Finally, mean differences between the different stages showed that intention stages (detection + decision) were lower on motivation than action stages (implementation + maintenance) and that action stages were lower on motivation than the habit stage. Even though there is not an abundance of studies linking SDT to SOC models, these studies provide evidence that internalization and self-determined motives could be strongly linked to behaviour change.

Stages of Change and the Environment

As mentioned previously, research on SOC has mostly focused on health-related behaviours. However, Pelletier and Sharp (2008) proposed that in order to be effective in motivating people to be more environmentally friendly, it is important to tailor the information they receive to where they find themselves in their process toward change. In simpler terms, individuals who are in the detection stage will probably not benefit in the same way from information that is useful for those in the implementation stage, the former needing information that simply makes them aware of the problem and the latter needing information on how and when to enact certain behaviours. These scholars made it clear that there is a link to be made between the process of behaviour change and environmental behaviours. As a first piece of evidence of a relationship between these two concepts, Semenza and collaborators (2008) have linked behaviour change to climate change. They did not measure how individuals move across stages for environmental behaviours, however, they examined if individuals concerned with the state of the environment considered that they had to modify their behaviours to improve the state of the environment. To be more specific, participants reported changing their energy consumption, their gasoline consumption and other behaviours such as recycling behaviours.

While this does not evidence that individuals move through different stages in order to modify their environmental behaviours and even less that SDM is linked to environmental behaviour change, it does demonstrate that behaviour modification is required for most people to adopt PEB and reduce HEB.

Limitations

Relative to SOC and environmental behaviours, we can't state the presence of great deal of limitations in the literature. Rather, we consider that the failure to integrate SOC in the environmental context and the fact that there have been no attempts to bridge SOC and SDT in order to shed some light on why and how people can become environmentally friendly, is an important limitation in itself. Following Pelletier and Sharp's (2008) proposition that SOC could play a key role in the adoption of PEB, research has yet to focus on the possible relationship between SOC and environmental behaviours. In addition, although there is some evidence of different stages being linked to behaviour change in different life domains, it has yet to be tested at which stage individuals start adopting PEB and eventually stop doing HEB. Finally, there is also a need to study the possible determinants of motivation as well as the ones that could facilitate behaviour change in relation to the environment.

Basic Psychological Needs

Humans are always striving toward personal flourishment and this has long been linked to basic psychological needs. These needs are like psychological nutrients that are essential in order to support human thriving and avoid harm (Ryan & Deci, 2017). Within the SDT framework, three basic psychological needs (autonomy, competence, and relatedness) have been shown to foster SDM and well-being when fulfilled and NSDM as well as ill-being when thwarted (Deci & Ryan, 1985; Deci & Ryan 2008). The need for autonomy represents the feeling

of being the cause of our own actions and knowing that the way we act is fully voluntary and conscious. Next, the need for competence refers to being effective in interactions with our physical and social environments as well having the feeling of being capable to reach our full potential. Finally, the need for relatedness is related to the idea that humans want to create and maintain deep and rich social bonds (Ryan and Deci, 2017).

The Role Played by Needs Within the Environmental Context

As basic psychological needs play a key role in the internalization process and the quality of motivation, research using needs within the SDT framework and the environment has also been conducted. One of the first studies of this type was done by Osbaldiston and Sheldon (2003). The aim of their study was to measure autonomy support in order to determine whether it had an impact on the level of internalized or SDM to adopt self-selected environmental goals and, in turn, how this motivation would affect their performance on these goals and their intentions to continue engaging in the selected behaviours. Participants were presented with the issue of environmental degradation, and after rating how autonomy-supportive the experimenter and the context were, they had to choose three environmental goals that they would have to perform in the next week. They demonstrated that perceived autonomy support was related to higher internalized motivation and that this motivation was, in turn, positively associated with goal performance and intentions to continue engaging to their self-selected goals. In another important study on the effects of need satisfaction on environmental motivation and the adoption of PEB, Lavergne, Sharp, Pelletier, and Holtby (2010) examined if perceptions regarding the government's approach to implement environmental policies (autonomy-supportive vs. controlling) was related to different types of motivation and frequency of PEB. As they predicted, individuals who considered the government as autonomy-supportive were more

autonomously motivated (intrinsic, integrated, & identified) and less amotivated while those who perceived the government as controlling displayed controlled motivation (introjected & external) and amotivation. In turn, the autonomous motivation toward the environment was associated with a higher frequency of PEB and amotivation to a lower frequency. These two previous studies are important because they demonstrated that the support of basic psychological needs proposed by SDT, specifically autonomy in this case, can lead to greater environmental goal performance and a higher frequency of PEB through the fostering of high quality motivation.

In another study, Kaplan and Madjar (2015) tested a similar model with Bedouin students in Israel. Using school moderators as well as parents as potential autonomy supporters in addition to self-perceived competence and relatedness, they measured the effect of all three basic psychological needs on autonomous motivation and, in turn, on *cleaning* behaviours (e.g., taking care of the neighborhood to keep clean), *preservation* behaviours (e.g., avoiding wasting water), and *activism* behaviours (e.g. participating in events organized by environmental organizations). Results were in line with Osbaldiston and Sheldon's (2003) as well as Lavergne et al. (2010) studies. More specifically, the moderators' and parents' autonomy support in addition to the self-perceived competence and relatedness all had a positive relationship with autonomous motivation to act in a way that is favourable for the environment. Also, in turn, the autonomous motivation was positively linked to cleaning, preservation and activism behaviours. This study adds to the results presented previously by providing evidence that all three of the needs proposed by SDT can have a positive effect on PEB, with high quality motivation acting as a mediator, and by replicating similar results outside of North America. In a more recent study, Cooke, Kelly, Fielding, and Louis (2016) used two samples to examine whether need support was mediated by SDM toward the environment in leading to easy and difficult PEB in addition

to a reduced carbon footprint. The results from the first sample suggested that the satisfaction of the need for autonomy and relatedness lead, through SDM, to more engagement in both easy and difficult PEB and that perceived relatedness was also directly related to difficult PEB. The model for the second sample was different as it included a carbon footprint variable (environmental impact). Results from this sample were the same as for the first sample, with the exception of two additional significant relationships. In this model, perceived competence, like autonomy and relatedness, was positively associated with SDM and SDM was, in turn, negatively related to the environmental impact (carbon footprint) in addition to leading to more engagement in easy and difficult PEB. Together, these studies support the proposition that the satisfaction of the three basic needs proposed by SDT, autonomy, competence, and relatedness, are key variables to consider when trying to foster high quality motivation and persuade people to be more environmentally friendly. However, a few authors (Baxter & Pelletier, 2018; Nisbet, Zelenski, & Murphy, 2009) have proposed that nature relatedness should represent a fourth psychological need that could add value to the SDT framework (Ryan & Deci, 2017), and that could foster the development of PEB.

Nature Relatedness

The concept of humans' connection to nature originally comes from Wilson's (1984) proposition that we have an innate desire to connect to other living things and to the natural environment. After many years of research, this idea has evolved into a more concrete construct referred to as nature relatedness. This concept has grown in popularity within environmental psychology research and can now be defined as our appreciation for our connection with all other living things and our natural environment, as well as our understanding of the importance of every aspect nature has to offer (Nisbet, Zelenski, & Murphy, 2009).

Environmentalism and Nature Relatedness, Connection, and Attachment

Just as with the three other needs proposed by SDT (autonomy, competence and relatedness), a category of behaviours and attitudes that has often been associated with nature relatedness is comprised of behaviours related to protect and benefit the environment. As a first piece of evidence of a relationship between nature and environmental behaviours, we can look at Kals, Schumacher, and Montada's (1999) study, which showed that emotional affinity toward nature was related in a positive manner to PEB (i.e. Willingness to sign public petitions for promoting nature protective measures). In addition, results were replicated two decades later by different researchers (Müller, Kals, & Pansa, 2009). To compare the effects of attachment to nature to other prominent factors, Brehm, Eisenhauer, and Krannich (2006) compared the effects of social attachment and nature attachment on different environmental protection attitudes. In contrast to social attachment, nature attachment was a significant predictor of positive attitudes toward the conservation of roadless areas and the implementation of new environmental policies. These studies underline the plethora of outcomes that can be related to humans' attachment or emotional affinity to nature.

With regard to connection to nature, Schultz, Shriver, Tabanico, and Khazian (2004) demonstrated that connection to nature was positively related to biospheric concerns (values related to the well-being of all other living things) and negatively related to egoistic concerns (self-oriented values). What is more, they found very similar results when they proceeded with a test/retest for an immediate, 1-week, and 4-week delay between the initial test and the retest. In a similar fashion, Dutcher, Finley, Luloff, and Johnson (2007) examined the relationship between connection to nature and environmental concern as well as environmental behaviour. Results from their study suggested that both environmental concern and behaviour had a significant

positive relationship with nature connectivity. Next, using farmers from northwestern Australia, Gosling and Williams (2010) studied the possible implication of farmers' connection to nature on their vegetation management. Consistent with the literature, their results demonstrated that elevated levels of connection to nature were related to increased levels of vegetation protection behaviour and thus showing the nature connectedness has a relationship with this type of PEB. In more recent study, Tam, Lee, and Chao (2013) tested the possible relationships between anthropomorphism of nature (assigning human qualities to the natural world), connection to nature and conservation behaviours. Through their results, they provided evidence that attributing human qualities to nature is positively related to conservation behaviour and that this relationship is fully mediated by the connection to nature. In other words, anthropomorphism of nature is associated with greater levels of nature connectedness and, in turn, high levels of connection to nature are related to increased levels of conservation behaviours.

In another set of studies, Nisbet, Zelenski, and Murphy (2009) first established the relationship between nature relatedness and several PEBs when validating their 21-item nature relatedness scale. In this case, their results suggested that nature relatedness could positively predict behaviours such as belonging to an environmental organization, self-identification as an environmentalist as well as purchasing organic and fair-trade products. Another important contribution from these researchers in this study is how they exposed that nature relatedness was significantly and positively related to both verbal commitment to engage in PEB and actual commitment to PEB. Nisbet and Zelenski (2013) followed up this evaluation of nature relatedness by testing how a 6-item scale would be associated with similar environmental behaviours and attitudes. Specifically, results were replicated in that nature relatedness was once more positively associated with verbal and actual commitment to PEBs in addition to having a

positive relationship with sustainable attitudes and self-reported behaviours related to transportation, recycling, activism, and purchasing patterns.

As a whole, the studies conducted by the previous researchers lend support to the hypothesis that nature relatedness is in fact related in many different ways to environmental behaviours and attitudes. In addition, the fact that it is related to both verbal and actual commitment to environmentally friendly behaviours makes it a promising factor in the effort to mend the gap between the level of consciousness of the environmental degradation and the adoption of behaviours aimed at mitigating this degradation.

Nature Relatedness as a Basic Psychological Need

In light of all the benefits such as increased well-being (Nisbet, Zelenski, & Murphy 2011), lower levels of anxiety (Martyn & Brymer, 2016), and all other health benefits (see Frumkin, 2001 for a review) that can stem from connection to nature, the idea that nature relatedness is a basic psychological need seems promising. In fact, in a recent critical review, Baxter and Pelletier (2018) set out to determine whether nature relatedness could represent another basic psychological need. These researchers proceeded by using Baumeister and Leary's (1995) nine criteria proposed to evaluate potential basic psychological needs. Through a thorough examination of the literature, Baxter and Pelletier (2018) demonstrated that nature relatedness satisfied all nine criteria:

1. Nature relatedness has affective consequences: This was evidenced, for example, by how exposure to nature is related to increased positive affect and reduced negative affect (McMahan & Estes, 2015) in addition to how walks in a natural setting can lead to reduced tension, anxiety, fatigue and confusion (Park et al., 2011).

2. Nature relatedness promotes health and well-being: Partial evidence of this comes from Laumann, Gärling, and Stormarck (2003) who demonstrated that exposure to virtual nature settings is associated with greater stress recovery than exposure to urban settings.
3. Consequences arise when nature relatedness is thwarted: This is demonstrated, in part, by the comparison of identical twins living in different areas done by Cohen-Cline, Turkheimer, & Duncan (2015). Lower access to green space near the living area was shown to lead to greater depression and stress.
4. Nature relatedness is universal: The simple fact that conclusive studies on nature relatedness have been conducted in the United-Sates (e.g., Cohen-Cline et al., 2015), Canada (e.g., Zelenski & Nisbet, 2014), Sweden (e.g., Hartig, Böök, Garvill, Olsson, & Gärling, 1996), Italy (Berto, 2005), Spain (Jané et al., 2006), the Netherlands (Maas et al., 2009), England (e.g., Astell-Burt, Mitchell, & Hartig, 2014), and Japan (Park et al., 2011) speaks to the universality of this construct.
5. Nature relatedness is not derivative from other needs: Zelenksi and Nisbet (2014) provided some evidence for this criterion by demonstrating that nature relatedness is positively related to variables such life satisfaction, vitality, happiness, and other positive outcomes even when controlling for general connectedness and interpersonal connectedness.
6. Nature relatedness directs cognitive processing: Part of the evidence for this was presented by Greene and Oliva (2009) who demonstrated that humans had the fastest response time for a perceptual classification task when the scenes were nature versus urban settings.

7. Nature relatedness affects a variety of behaviours: Related to this idea, Nisbet et al. (2009) showed that nature relatedness was related to many different behaviours (e.g., pet ownership and vegetarianism) while Zhang, Piff, Iyver, Koleva, and Keltner (2014) evidenced the link between nature connection and generosity.
8. Nature relatedness occurs in a wide variety of settings: A variety of methods ranging from using nature photographs (Hartig et al, 1996) and videos (Berman, Jonides, & Kaplan, 2008) to actual walks in nature (Ryan et al., 2010), and presenting many different settings such as lakes, rivers, hills, or forests (Berto, 2005) have been used to gather empirical evidence on the effects of nature relatedness.
9. Nature relatedness elicits goal-directed behaviours: Indirect evidence for this criterion can be found through the results of Bringslimark, Hartig, and Patil's (2011) study. These authors showed that office workers from Norway who didn't benefit from a window view were more likely to decorate their office space using plants and pictures of nature. In addition, Staats and Harting (2004) provided evidence that participants with attentional fatigue were more likely to experience greater positive attitudes for walking in nature and reduced positive attitude for walking in an urban setting.

The evidence presented above, even if it represents only a small portion of the extensive review done by these researchers (see Baxter & Pelletier, 2018, for a full review), goes to show that nature relatedness should be considered a basic psychological need that could have a positive impact on environmental behaviours above and beyond the three needs proposed by SDT.

Limitations

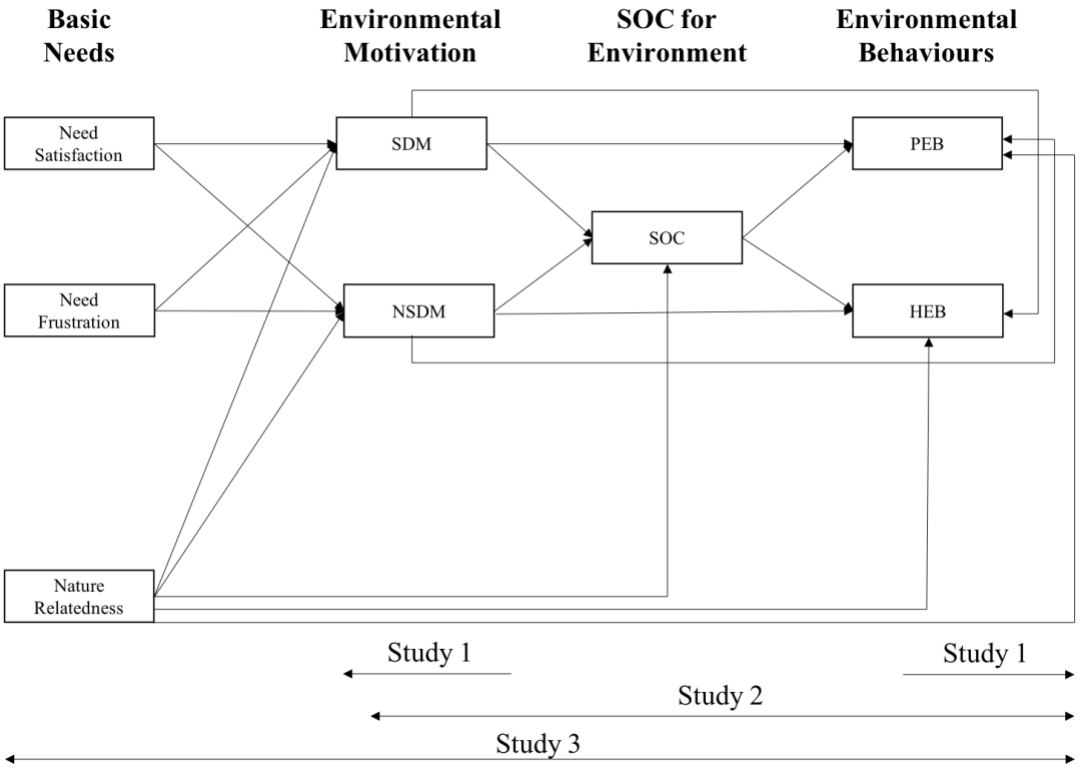
In line with this program of research, the integration of nature relatedness into the SDT framework could represent an important contribution. Despite the evidence suggesting that nature relatedness should be considered as a basic psychological need and that this need could lead to more PEB, researchers have yet to test the idea that nature relatedness could add value to the original basic psychological needs proposed by SDT in explaining motivation toward the environment. This could therefore be the important final variable in the model that includes basic needs (including nature relatedness), motivation toward the environment as defined by SDT, the process of behaviour change, as described by SOC models, and both PEB and HEB.

Current Research Program

Objectives

This proposed program of research aims to better our understanding of the motivational process involved in the adoption of PEB and the reduction of HEB. Specifically, the objectives are, first, to examine whether higher levels of SDM toward the environment are associated with both a high frequency of PEB and a low frequency of HEB. Second, one of the goals is to examine whether these associations between environmental motivation environmental behaviours are mediated or moderated by SOC. Third, it also aims to determine whether nature relatedness represents a variable that significantly explains environmental motivation above and beyond the other psychological needs proposed by SDT. Finally, it aims to examine the determinants of the environmental motivation, SOC, PEB and HEB, for the purpose of identifying the factors that are more likely to be associated with SOC, more PEB and less HEB.

Proposed Model



This model that is geared toward examining the motivational process involved in the adoption of frequent PEB and less frequent HEB will be based on theoretical frameworks of SDT, a SOC model, and nature relatedness.

Basic needs. This section of the model will be in line with Ryan and Deci (2017) and Deci and Ryan's (1985; 2002) SDT for the basic needs of autonomy, competence, and relatedness in addition to the concept of nature relatedness proposed by Nisbet, Zelneski, and Murphy (2009). The impacts of autonomy, competence and relatedness satisfaction on motivation have been well documented both in general and in the environmental context, whilst the effect of nature relatedness has never been considered as a basic psychological need in combination with three needs proposed by SDT (see Baxter & Pelletier 2018). For this particular reason, SDT needs and nature relatedness will be assessed separately in order to measure their

individual effect on SDM and NSDM toward the environment as well as compare the strength of their effects.

Nature relatedness. The concept of nature relatedness in this model is in accordance with the idea of our appreciation and connection to nature. This concept has been linked many times to positive environmental actions and attitudes (e.g., Nisbet, Zelenski, & Murphy, 2009). There is now a great deal of empirical evidence suggesting that it should be considered a basic psychological need (Baxter & Pelletier, 2018) and in addition, Ryan and Deci (2019) suggested the possibility that nature could add value to the SDT framework. Nature relatedness is included in this model in order to measure its impact on environmental motivation and compare its effect to the need for autonomy, competence and relatedness.

Need satisfaction and frustration. The satisfaction and frustration of basic psychological needs will be the sum of the needs presented within the SDT framework.

Autonomy. Here, autonomy is defined as the feeling that actions are done out of volition and in this specific context, we will be measuring if environmental behaviours are enacted due to pressure or simply personal desire. The current literature has already demonstrated that having the need for autonomy fulfilled is positively associated with SDM toward the environment as well as a higher frequency of PEB (e.g. Lavergne et al., 2010).

Competence. This need will be represented as the feeling of being capable of achieving full potential and desired outcomes. In this program of research, the idea of competence translates to feeling efficient in the actions done for the purpose of the environment. Although the evidence linking the need for competence with motivation toward the environment and adoption of PEB are not as substantial as for the need for autonomy, it has been shown to have positive impacts (Cooke, Kelly, Fielding, and Louis, 2016; Kaplan and Madjar, 2015).

Relatedness. In this model, relatedness is defined as the need to create and maintain deep and rich social bonds. Within the environmental context this relates to the idea of feeling a bond to someone regarding environmental actions. Like competence, the evidence linking relatedness to environmental motivation and PEB is not hefty, but it is present in the literature (Cooke, Kelly, Fielding, and Louis, 2016; Kaplan and Madjar, 2015).

Environmental motivation. Motivation toward the environment will be measured as contextual motivation in this model. It is considered as the domain motivation that should have the most important relationships with the other variables in the model. This section of the model will be based on the SDT framework.

Self-determined motivation. The three different behavioural regulations classified as SDM (identified, integrated, and intrinsic) will be assessed. This assessment of the different environmental motivations is based on the research conducted on the MTES (Pelletier et al.,1998) and the role played by SDM toward the environment as a variable positively associated with various PEB,

Non-self-determined-motivation. For this variable, the three different behavioural regulations considered to be NSDM (amotivation, external, and introjected) will be assessed. Again, this assessment will be based on the MTES (Pelletier et al.,1998) and the role played by NSDM as a variable negatively associated with these PEB.

Environmental motivation is therefore included in the model as a variable that should mediate the relationships between basic psychological needs, as described above, and the frequency of both PEB and HEB. In addition, motivation should impact PEB and HEB through full or partial mediation by the SOC.

Stages of change for environmental behaviours. If we consider the premise that individuals need to move through different stages in order to be successful in changing their behaviours that affect the environment (Pelletier & Sharp, 2008), assessing stages of change in parallel with the model's other variables is essential. To be more specific, the literature suggests that motivation (e.g., Mullan & Markland, 1997) may fluctuate throughout the different stages of behaviour change. Thus, including stages of change as a mediating variable in the model could provide important insights on the environmental motivation process.

Environmental behaviours. This part of the model represents behaviours adopted by individuals that have an influence on the state of the planet's environment.

Pro-environmental behaviours. As previously stated PEB are defined as behaviours that, when adopted, have a positive impact on the environment. This variable has been used many times as different outcomes of motivation toward the environment (e.g., Pelletier et al., 1998; Lavergne et al., 2010; Kaplan & Madjar 2015). In consequence, this variable is included in the model with the aim of seeing how it is related to environmental motivation, SOC, and basic psychological needs.

Harmful-environmental behaviours. HEB are behaviours that have a negative impact on the state of the environment. Unlike PEB, there is very little evidence that the frequency of HEB can be affected by environmental motivation, SOC, and/or basic psychological needs. Including this variable in the model as a possible outcome should allow us to test how SDM and NSDM in addition to SOC and psychological needs relate to these behaviours.

Overview of Studies

The current thesis is composed of three studies that aimed to test the model presented above and address the limitations in the environmental psychology literature. In *Study 1*, the

purpose was to distinguish PEB and HEB and to measure the differences in SDM and NSDM for people who adopt more PEB versus those who adopt more HEB. This study also examined how SDM and NSDM relate to both types of environmental behaviours. *Study 2* examined whether the results found in *Study 1* could be replicated and whether they are moderated or mediated by the different stages of behaviour change individuals find themselves in. Finally, in *Study 3*, basic psychological needs, including the proposed need for nature relatedness, were added to the model in order to evaluate the overall proposed model and to measure the contribution of basic psychological needs in the environmental motivation process tested in *Study 2*.

Anticipated Contributions

Theoretical Contributions

This program of research brings forth many new elements to the environmental psychology literature. To start, this research program will be, to the best of our knowledge, the first to examine the relationship between environmental motivation for both PEB and HEB. To date, researchers have only studied the link between this motivation and PEB. Next, although it has been proposed that SOC could play an important role in the motivational process involved in the adoption of environmental behaviours, this program will be the first systematically investigate the difference of motivation and environmental behaviours while considering SOC as a prominent variable. Finally, it will also be the first research to consider the effects of nature relatedness as being those of a basic psychological need in how it is related to environmental motivation and behaviours.

Applied Contributions

In terms of applied contributions, this program will have important implications for the strategies designed to improve the effects of positive human behaviours on the quality of the

environment. If our hypotheses are supported, the proposed studies will demonstrate that SDM is not only important in order to drive people to adopt PEB, but also to mitigate their HEB. As the combination of engagement in PEB and reduction of HEB are considered key in the fight against human pollution (Gifford, 2008), the results should push people to foster SDM and avoid NSDM toward the environment. In addition, if conclusions regarding the stages of environmental behaviour change are as expected, it would highlight the fact that different information should be given to people when trying to evoke a positive change toward the environment. Further research would be needed, but it should support Pelletier and Sharp's (2008) proposition that persuasive messages regarding the state of the environment should be framed in a self-determined manner and tailored to the specific stages where the individuals find themselves. Further, studying nature relatedness as a basic psychological need in this context will enable us to know more about the determinants of SDM toward the environment. It is probable that people need to feel autonomous, competent, and supported in their actions toward the environment, but also, that they need to feel a connection to and spend time in nature. With nature relatedness being an important element for both humans (as a basic psychological need) and for the planet (as a determinant of environmental motivation), protecting natural areas and spaces becomes extremely important. Finally, this research program provides a great deal of new information for possible interventions aimed at reducing the human carbon footprint. Interventions could now focus on increasing PEB and reducing HEB, by using information tailored for individuals' stages of change and by making connection to nature and time spent in nature a focal point in the battle to improve the quality of the environment.

Chapter 2

Study 1

In this first study, the aim is to address questions regarding the relationship between motivation, as described by SDT, and both PEB and HEB: Is motivation linked to HEB and is this relationship different from the one between motivation and PEB? To be more specific, the goals of this first study are threefold: (1) examine whether PEB and HEB are actually two distinct types of environmental behaviours, (2) examine whether SDM and NSDM toward the environment are associated differently to PEB and HEB, and (3) to determine whether the motivational orientation of individuals who report adopting PEB more frequently differ from the ones who report adopting HEB more frequently.

Related to these research objectives, the hypotheses were as follow: PEB and HEB will load on distinct factors and represent two types of environmental behaviours (*Hypothesis 1*). Next, we expect that SDM will have a positive association with PEB and that non-self-determined-motivation will have a negative association with PEB (*Hypothesis 2a*). It is also expected that self-determined-motivation will have a negative association with HEB, while NSDM will be positively associated with HEB (*Hypothesis* 2*b*). Regarding the mean differences, we anticipate that individuals who adopt PEB more frequently than HEB will have higher levels of SDM than those who adopt HEB more frequently than PEB (*Hypothesis 3a*) and that similarly, those who adopt more HEB will have higher levels of NSDM (*Hypothesis 3b*).

Methodology

Participants

The sample for this study was composed of students from the University of Ottawa's Integrated System for Participation in Research (ISPR), a subject pool composed of students

enrolled in introductory classes in psychology, communication, or linguistics (sample size N = 441). The mean age of participants was 20.04 years old (SD = 3.48, range = 17 – 46). The majority of participants were female (76.2%), while the rest of the sample was composed of males (23.1%), one person who preferred not to disclose their gender (0.2%), and two people who did not respond (0.5%). In addition, participants reported their ethnicity/origin as being Caucasian (54.3%), Afro-American or Afro-Caribbean (17.2%), Middle Eastern or Arab (6.8%), Asian (4.5%), preferred not to disclose (5.4%), did not answer (0.2%), or other (11.6%). Other than the two participants who did not report their gender and the participant who did not report his ethnicity, one participant did not report his age.

Procedures

Data collection was done through an online survey. First, participants had to register for the study on the ISPR platform. Once registered, an online link leading to the study was made available to them and they could take part in the one-time 30-minute survey from anywhere with internet access. When completing the survey, participants were first asked to read the information sheet and consent form to participate in the study and at this stage people who did not consent were automatically taken to the end of the survey while consenting participants could start completing the survey. Following the consent, they were asked to complete a questionnaire regarding their motivation to behave in a way that is favourable for the environment and one that related to the frequency to which they reported engaging in different PEB and HEB. Upon completion, participants were awarded one percent (1%) toward their first-year class and their data was securely stored on the password protected Qualtrics servers (servers located in Toronto, Ontario, Canada). From the Qualtrics servers, all data was available to download and use for analyses.

Measures

Environmental motivation. Participants first completed, the Motivation Toward the Environment Scale (MTES; Pelletier, Tuson, Green-Demers, Noel, & Beaton, 1998; See Appendix A) to assess the reasons why they do things for the environment. The MTES is composed of 24 items and is divided into six subscales of four items each which represent the six different types of regulations based in SDT. From the most self-determined to the least self-determined, the subscales represent intrinsic motivation (e.g., "For the pleasure I experience when I find new ways to improve the quality of the environment"), integrated regulation (e.g., "Because taking care of the environment is an integral part of my life"), identified regulation (e.g., "Because it's a way I've chosen to contribute to a better environment"), introjected regulation (e.g., "Because I would feel ashamed of myself if I was doing nothing to help the environment"), external regulation (e.g., "For the recognition I get from others") and amotivation (e.g., "Honestly, I don't know; I truly have the impression that I'm wasting my time doing things for the environment"). All items are scaled from 1 (Does not correspond at all) to 7 (Corresponds exactly) and participants have to state their level of agreement by selecting one of the scale points (from 1 to 7) for every item. This scale demonstrated evidence of validity in its initial validation through principal component analysis, confirmatory factor analysis, and its relationship with many constructs. It also demonstrated reliability through strong test-retest correlations and good internal consistency scores. For the purpose of analyses, mean scores were calculated to represent SDM and non-self-determined motivation NSDM. Specifically, for every participant, items from the intrinsic, integrated, identified subscales were averaged to produce a SDM score while items from the introjected, external, and amotivation subscales were averaged to produce a NSDM score. Regarding these mean scores, higher scores represent high levels of

SDM and NSDM. To ensure the internal consistency of these scores was adequate, Chronbach's alphas were computed. The composite scores for SDM and NSDM had alphas of .93 and .71 respectively.

Pro and Harmful-Environmental behaviours. Participants then filled out the Pro-Environmental and Harmful-Environmental Behaviours Questionnaire to assess the frequencies of the environmental behaviours (PEB and HEB) they usually adopt (See Appendix B). This scale comprises a list of environmental behaviours that should fall within two categories, those that represent the pro-environmental behaviours (e.g., "Shop with reusable bags" or "I donate to environmental organizations") and those that represent harmful-environmental behaviours (e.g., "I leave the lights on when I leave" or "I buy things I really don't need"). It is important to point out that the two categories of behaviours are not only behaviours defined as opposite of each other, but as distinct behaviours. The items were presented using a 7-point Likert scale ranging from 1 (Never) to 7 (Always). In order to assess the overall frequency of adoption of both PEB and HEB, mean scores for all positive behaviours were combined into an average score representing PEB while negative behaviours were averaged to represent a mean score for HEB where high scores indicate a higher frequency of adoption of positive and negative behaviours respectively. The internal consistency of the PEB and HEB subsacles were of .79 and .69 respectively.

Validation questions. The MTES and the environmental behaviours questionnaire contained one validation question each (i.e., "Answer "Always" if you have read this question"; question No. 12 in the MTES) and (i.e., "Please choose 4 (Corresponds moderately) to demonstrate you are reading the questions"; question No. 10 in Environmental Behaviours

Questionnaire). These questions were included in order to assess the quality of the participants' answers and in order to ensure the questions were read properly by participants.

Results

To test the multiple hypotheses related to the objectives of this first study, three different types of analyses were performed using IBM SPSS 25. More specifically, to distinguish PEB from HEB an exploratory factor analysis (EFA) was conducted, to measure the different relationships between SDM and NSDM with PEB as well as with HEB multiple regressions were performed, and the differences in levels of environmental motivation according the reported frequency of PEB and HEB was tested through analyses of variances. The results are therefore separated in a total of four sections. We start off with a section to describe the preparation of the data for the analyses which is followed by three sections that describe the adequacy of the data and the specific results for each of the analyses described above. Descriptive statistics and inter-variable correlations can be found in *Table 1*.

Table 1
Descriptive Statistics and Inter-Variable Correlations for Study 1

Variable	*M*	*SD*	Range	1	2	3	4
1. SDM	5.01	1.20	1.25-7.00	-	-.002	.59**	-.39**
2. NSDM	3.07	.768	1.00-5.50	-	-	.04	.32**
3. PEB	3.87	.994	1.67-7.00	-	-	-	-.34**
4. HEB	3.14	.835	1.44-5.67	-	-	-	-

Note. SDM = self-determined motivation, NSDM = non-self-determined motivation, PEB = pro-environmental behaviour, HEB = harmful-environmental behaviours.

*$p < .05$, **$p < .001$

Data Preparation

Missing data. The first step taken in the data preparation was to examine the missing data. A missing data analysis was conducted and results revealed that no variable had more than 2% of missing data and that no patterns could be found in the missing data which indicates that the data was missing completely at random (Little's MCAR: $\chi_{2(4018)} = 4050.57$, $p = .36$). Next, the data was imputed using the EM algorithm and in consequence, a new database with no missing data was created.

Removing participants. Participants were removed from the database on the basis of failed validation questions and the time taken to complete the questionnaire.

Validation questions. Regarding the failure to answer validation questions properly, a total of 54 participants were removed from the sample, because they had failed to reply correctly to at least one of the validation questions, resulting in a sample of N = 387.

Time taken to complete the questionnaire. After removing participants that failed the validation questions, none of the participants had completed the questionnaire fast enough to be considered suspicious. That is, after transforming the time variable into z-scores, no scores were lower than 3.29. Consequently, no participants were removed on the basis of time.

Outliers. In order to avoid biased results, the data was screened for both univariate and multivariate outliers on the individual items for the EFA and on the composite scores of SDM, NSDM, PEB, and HEB for the multiple regressions and ANOVAs. First, to examine whether there was the presence of univariate outliers for the individual items, all items were transformed into z-scores and compared to an extreme score of $z = \pm 3.29$ (Tabachnick & Fidell, 2007). A total of three outliers were detected and were winsorized to the closest value within the acceptable range of $z = \pm 3.29$. Next, in order to detect multivariate outliers, the Mahalanobis

distance was used as a measure (Tabachnick & Fidell, 2007). A total of seven multivariate outliers were found at $p < .001$ and were removed from the sample. The same process was done to detect outliers for the composite scores. Regarding univariate outliers, four were detected and winsorized to the closest acceptable value. As for multivariate outliers, a total three were detected and removed from the sample. As a result of the preliminary analyses, a total of 64 participants were removed, resulting in a final sample of N = 377 (109 males and 268 females).

Distinguishing PEB from HEB

Adequacy of Data for EFA. First, to conduct an EFA, the sample size must consist of at least 300 participants (Tinsley & Tinsley, 1987) or a total of 10 participants per item (Gorsuch, 1983; Tinsley & Tinsley, 1987). This requirement was met as the final sample for this study is N = 377 and that 18 items (18 x 10 = minimum N = 180) were used distinguish PEB and HEB. Next, the data needs to be considered as factorable. The factorability of the items was tested using Bartlett's (1950) test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy where a significant chi-square test and a value greater than .6 are respectively required to confirm factorability. Results from Bartlett's test ($\chi^2_{(153)} = 1573.89$, $p < .001$) and the KMO measure (.802) indicated that the data from the sample was adequate for EFA.

Main analyses. The EFA was conducted using the 18 items representing both types of environmental behaviours (9 PEB and 9 HEB). The chosen extraction method was Unweighted Least Squares (ULS) in order to minimize the effect of the skewness and kurtosis of certain items because ULS does not rely on assumption about the distribution (Briggs & MacCallum, 2003). An orthogonal rotation was applied in reason of the low enough correlation between factors when conducting the analysis with an oblique rotation ($r = -.27 < .32$) as described by

Tabachnick and Fidell (2007). Finally, as two types of behaviours are proposed, the analysis was conducted using a fixed two-factor solution where values below .2 were suppressed.

With regard to distinguishing PEB from HEB, items representing PEB all loaded on Factor 1 with one item having negative cross-loadings on Factor 2 while items representing HEB all loaded on Factor 2 without cross-loading on Factor 1. To be more specific, PEB loaded on the first factor with values ranging from .77 for "I search for information about what can be done to help the environment" to .26 for "I shop using reusable bags", and "I recycle recyclable materials" had a value of -.38 on the second factor. As for HEB, items loaded on the second factor with values ranging from .55 for "I throw away plastic bags or containers after one use" to .31 for "I drink beverages out of disposable bottles or mugs" (*Table 2*). In addition to a clear 2-factor solution, the internal consistency of the PEB and HEB items were of .79 and .69 respectively.

The results from the EFA confirm that *Hypothesis 1* is supported in that PEB can actually be distinguished from HEB and thus supporting that both types of behaviours warrant consideration when conducting research on motivation and environmental behaviours.

Table 2
Results from EFA for Study 1

Items	Factor	
	1	2
1. Search for information about what can be done to help the environment.	.771	
2. Communicate information to friends and family on what can be done to help the environment.	.769	
3. Tell others when their behaviour is harmful or bad for the environment.	.641	
4. Buy products or materials made from recycled products.	.566	
5. Donate to environmental organizations.	.480	
6. Volunteer for environmental organizations.	.471	
7. Pick up litter off the ground to throw it out.	.441	
8. Recycle recyclable materials.	.304	-.375
9. Shop with reusable bags.	.263	
10. Throw away plastic bags/containers after one use.		.547
11. Buy items with a lot of packaging.		.538
12. Discard paper without using both sides of the sheet.		.532
13. Do not recycle or compost when away from home.		.452
14. Leave the appliances on when not in use.		.436
15. Leave the lights on when I leave.		.430
16. Buy things I really don't need.		.419
17. Put compostable materials in the trash.		.381
18. Drink beverages out of disposable bottles or mugs.		.306

Note. Item 8 was moved up between items 7 and 9 in order facilitate the understanding of results.

Relationships between Motivation and Environmental Behaviours

Adequacy of data for multiple regression. In order to run multiple regressions and determine the relationships between variables, the data must first meet certain assumptions. First, the data must be normally distributed. This assumption was tested using the residuals for PEB as well as HEB, and the residuals for neither variable showed significant skewness or kurtosis. Next, there must be an absence of multicollinearity in order to ensure the independence of the predictors in the model. To conclude that there is an absence of multicollinearity correlations between predictors should be lower than r = .9 (Tabachnick and Fidell, 2007) and the tolerance ($1 – R_2$) should be greater than .10 (Kline, 2010). With regard to SDM and NSDM, there was no significant correlation between the two variables (r = -.002, p = .97) and the tolerance was of 1.00 which lead to the conclusion that the predictors were in fact independent of each other. The next assumptions are the absence of heteroscedasticity and the presence of linear relationships, assumptions that can be tested graphically using residuals. First, the standardized residuals were plotted against the standardized predicted values and the resulting scatter was not fan-shaped and did not have a big spread of data points, this for both PEB and HEB. Next, the standardized residuals were plotted against the unstandardized predicted values of PEB and HEB. There was an absence of a significant curvature in the data. All preliminary analyses lead to the conclusion that the data was normally distributed, that there was an absence of multicollinearity and of heteroscedasticity, and that there was the presence of linear relationships. Thus, the sample was considered adequate for multiple regression.

Main Analyses. Multiple regressions using SDM and NSDM as independent variables and, PEB and HEB, individually, as dependent variables were conducted to determine the nature and strength of the relationships between the two motivational orientations and the two types of

environmental behaviours. The results from the first regression demonstrated that SDM and NSDM, as a set, were significantly associated with the variability in PEB: $F_{(2, 371)} = 101.01$, $p < .001$. More specifically, SDM was related to a higher reported frequency of PEB ($\beta = .59$, $p < .001$) while NSDM had no effect ($\beta = .04$, $p = .32$) and a total of 35% of the variability in PEB was accounted for by the regression model. As for the second regression, results showed that SDM and NSDM significantly associated with the variability in HEB: $F_{(2, 371)} = 63.04$, $p < .001$. In agreement with our hypothesis, SDM was negatively linked to the reported frequency of HEB ($\beta = -.39$, $p < .001$) while NSDM was positively associated with the reported frequency of HEB ($\beta = .32$, $p < .001$) and the model accounted for a total of 25% of the variability in HEB.

With respect to the hypotheses related to the multiple regressions, results partially support *Hypothesis 2a* as SDM was positively related to the reported frequency of PEB, but NSDM, was not associated with the reported frequency of PEB. In addition, *Hypothesis 2b* was fully supported in that SDM was negatively associated with HEB while NSDM was positively associated with HEB. Thus, these results add to the results from the EFA by demonstrating that not only can PEB be distinguished from HEB but that they have different relationships with environmental SDM and NSDM.

Comparing Motivation Levels According to Environmental Behaviours

Levels of motivation were compared according to the reported frequency of PEB and HEB adopted by individuals. In order to separate participants into two groups, the mean score of HEB was subtracted from the mean score of PEB. The resulting score, if positive, identified individuals who report adopting a higher frequency of PEB than they do of HEB and negative scores, those who report having a higher average frequency of adoption of HEB. Thus, positive scores were coded as a group representing the PEB group and negative scores the HEB group.

Adequacy of data for ANOVA. To confirm the adequacy of data for ANOVAs, the normality of the dependent variables (SDM and NSDM) in the different groups and homogeneity of variances across the different cells were assessed. Regarding normality, as per criteria suggested by Tabachnick and Fidell (2007), the scores for both SDM and NSDM were free of significant skewness and kurtosis at $p < .001$ in the PEB and HEB groups. Next, the F_{max} test was used to examine the variances across the different groups. The ratio of smallest to largest variances for SDM and NSDM respected the suggested limit (< 10; Tabachnick and Fidell, 2007) at 1.19 and 1.57 respectively, indicating homogeneity of variances. Considering these tests, the fact that all cases of univariate and multivariate outliers had been dealt with beforehand and that independence of errors was guaranteed by each participant only being in one group, the data was adequate for ANOVAs.

Main analyses. Two separate one-way ANOVAs were conducted. First, the levels of SDM were compared according to the frequency of environmental behaviours. Results from this first comparison demonstrated that there was a significant difference in the levels of SDM for those who have a higher average frequency for PEB ($M = 5.42$; $SD = 1.03$) compared to those with a higher average frequency for HEB ($M = 4.25$; $SD = 1.13$): $F_{(1, 372)} = 101.71$, $p < .001$. In fact, individuals in the PEB group displayed largely higher levels of SDM toward the environment ($\eta^2 = .21$). Second, the levels of NSDM were compared in the same way. Results from the second ANOVA showed that levels of NSDM were significantly different for people with higher levels of PEB ($M = 2.99$; $SD = .67$) than those with higher levels of HEB ($M = 3.23$; $SD = .87$): $F_{(1, 372)} = 8.40$, $p = .004$. Similarly, people with higher HEB had slightly higher levels of NSDM than those with higher PEB ($\eta^2 = .02$). With regard to our hypotheses, results supported *Hypothesis 3a* as individuals with higher average PEB than HEB had higher levels of

SDM and *Hypothesis 3b* in that people with higher average HEB than PEB had higher levels of NSDM. Consequently, these results lend additional support to the idea that PEB and HEB are linked differently to environmental motivation.

Discussion

The overarching purpose of this first study was to address one of the limitations in the current environmental motivation literature. Specifically, our goal was to determine whether it was possible to distinguish PEB from HEB and determine how these two types of environmental behaviours are linked differently to motivation. This objective was achieved through testing three different hypotheses. First of all, it was hypothesized that PEB and HEB could be distinguished using factor analysis and that they could clearly separate on different factors. Next, it was expected that SDM would be positively associated with the reported frequency of PEB and negatively related to the reported frequency of HEB and that NSDM would be negatively linked to PEB and positively associated with HEB. Lastly, it was hypothesized that individuals who, on average, report adopting PEB more frequently than HEB would display higher levels of SDM while those who report a higher average frequency of HEB than PEB would have higher levels of NSDM.

First, our results showed PEB and HEB could be distinguished as they clearly loaded on separate factors. Second, SDM was positively related to the reported frequency of PEB and negatively associated with the reported frequency of HEB while NSDM had a positive link with HEB. Third, when comparing those who report adopting PEB more frequently to those who report adopting HEB more frequently, levels of motivation were significantly different in that higher levels of SDM were displayed in the PEB group while higher levels of NSDM were found in the HEB group. In other words, these findings demonstrate that behaving in an

environmentally friendly manner may comprise two important dimensions, that is, doing things that are positive for the environment and trying to reduce behaviours that have a negative impact on the state of the planet. Also, our results suggest that the SDT framework may possibly be applied to HEB in addition to PEB. In fact, according to our results, individuals who are more self-determined toward the environment might not only be more likely to adopt PEB but they may also be more likely to do less HEB than people who report NSDM toward the environment.

As a whole, our results provide support for two important elements regarding the motivation for environmental behaviours. First, they suggest that doing something for the environment could mean undertaking actions that could have a positive impact on the environment and reducing actions that could have a negative impact on the environment. These two dimensions of environmental behaviours are relatively distinct from each other. That is, some people may report doing some positive behaviours toward the environment while doing, at the same time, behaviours that could be harmful for the environment. In other words, doing something for the environment may not mean only adopting a positive behaviour it might also mean reducing the behaviours that could be harmful.

Second, when we consider the distinction between PEB and HEB, people's motivational orientation also matters. Although some may say that the source of motivation for environmental behaviours may not matter as long as people are doing something, our results suggest that being self-determined, in contrast to being non-self-determined, could make a difference for two reasons. First, people that report being self-determined toward the environment seem to be more likely to do more PEB possibly less likely to do HEB. In opposition, people that report being non-self-determined don't only seem less likely to engage in PEB, they might be more likely to do HEB.

This research fills an important gap in the research on environmental behaviours while providing support for SDT. It suggests that when studying environmental action, the focus should not only be on PEB but also on HEB. It also suggests that the motivation that is being promoted to encourage people to be more active toward the environment could be of great importance in that we might want to favour the promotion of SDM over NSDM.

This study contributes to the literature by establishing how PEB and HEB relate differently to individuals' motivational orientations. However, this preliminary investigation of environmental behaviours and motivation, specifically in this first study, is subject to some notable limitations. That is, the sample was solely composed of first year undergraduate students from a Canadian university. Next, the majority of the sample was composed of female participants, which leads to interrogations regarding gender differences within the environmental context. However, early research on the topic of gender differences in relation to environmental concern has revealed only very slight differences between men and women (McStay & Dunlap, 1983). In addition, the results from *Study 1* lead to further interrogation on the subject. Accordingly, additional research is needed to determine what construct could explain this relationship between motivation and environmental behaviours. The second study of this program of research was designed in order to examine such interrogations by including SOC as possible mediator or moderator in the relationship between motivation and environmental behaviours.

Chapter 3

Study 2a and Study 2b

In *Study 1*, we demonstrated that PEB and HEB should be studied as two distinct types of behaviours and that they are associated differently with individuals' environmental motivation. In the second study, we aimed to replicate the findings from the first study and to address the sampling limitation by using two different samples. In addition, we also aimed to examine whether the relationships between motivation and environmental behaviours are moderated or mediated by a construct of behaviour change. The study of behaviour change in conjunction with self-determination has received considerable attention over the past decades (e.g. Mullan and Markland, 1997; Daley & Duda, 2006; Fortier et al., 2012). However, very little research has focused on how these constructs are linked within the environmental domain. Thus, the SOC variable was introduced in the model as it would make sense, at least conceptually, that environmental motivation and behaviours are linked to SOC.

Within the environmental context, it has been demonstrated that behaviour change is involved in the adoption of PEB (Semeza et al., 2008) and it has been proposed that the different SOC may be related differently to the adoption of PEB (Pelletier & Sharp, 2008). Despite these propositions and the evidence surrounding the link between motivation and SOC, SOC and PEB, and motivation and PEB, we have yet to move forward and examine the idea that all three variables are linked.

For this reason, *Study 2a* and *Study 2b* aimed to address these shortcomings and interrogations, and extend the findings from *Study 1* by examining the amount of motivation as well as PEB and HEB across the various SOC in addition to studying all three variables within moderation and mediation models. More specifically, the objectives were: (1) to determine the

differences in SDM and NSDM across the different SOC, (2) to determine the difference in the reported frequency of PEB and HEB across the different SOC, and (3) to examine whether the link between SDM and NSDM and the reported frequency of PEB and HEB is moderated by SOC or (4) if it is mediated by SOC.

In line with the first two research objectives, we hypothesize, for both studies, that: When comparing levels of SDM, means will be higher in the later SOC than in the earlier SOC (*Hypothesis 1a*), that levels of NSDM will be higher in the earlier SOC than in the later SOC (*Hypothesis 1b*), the reported frequency of PEB will be higher in the later stages than in the earlier SOC (*Hypothesis 2a*), and that the reported frequency of HEB will be higher in the earlier SOC than in the later SOC (*Hypothesis 2b*). We also expect, with regard to the third and fourth objectives, that: SDM and SOC will have positive main effects on the reported frequency of PEB (*Hypotheses 3a* and *3b*) and that the effect of SDM will be greater as SOC increase (*Hypothesis 3c*); that SDM and SOC will have negative main effects on the reported frequency of HEB (*Hypotheses 4a* and *4b*) and that the effect of SDM will increase as SOC increase; that NSDM will have a negative main effect while SOC will have a positive main effect on the reported frequency of PEB (*Hypotheses 5a* and *5b)* and that there will be no significant interaction (*Hypothesis* 5c); that NSDM will have a positive main effect whereas SOC will have negative main effect on the reported frequency of HEB (*Hypotheses 6a* and 6*b)* and that there will be no significant interaction (*Hypothesis 6c)*; that SDM will be related to a higher reported frequency of PEB (*Hypothesis 7a*) and lower reported frequency of HEB (*Hypothesis 7b*) through partial mediation by SOC; and finally, that NSDM will not be mediated by SOC and will be linked to lower PEB (*Hypothesis 8a*) and higher HEB (*Hypothesis 8b*) directly.

With regard to *Study 2a* and *Study 2b*, they only differ on sampling and procedures. Consequently, they will have separate participants and procedures sections as well as distinct results sections.

Methodology

Participants

Study 2a. *Study 2a*'s sample was composed of students from the University of Ottawa's ISPR (sample size $N = 322$). The mean age of participants was 20.15 years of age ($SD = 4.91$, range = 16 – 72). Female participants (75.5%) composed the majority of the sample, while the rest of the sample was composed of males (23.6%), two people who preferred not to disclose their gender (0.6%), and one person who did not respond (0.5%). Participants in this sample reported their ethnicity/origin as being Caucasian (48.8%), Asian (16.2%), Afro-American or Afro-Caribbean (8.7%), Middle Eastern or Arab (8.7%), preferred not to disclose (4.7%), did not answer (0.3%), or other (12.6%).

Study 2b. The sample for *Study 2b* was composed of individuals from the general population recruited through *Amazon's Mechanical Turk* (mTurk) recruitment service ($N = 680$). In this sample, the average age of participants was 37.57 years ($SD = 12.40$, range = 19 – 82). Regarding the gender of participants, the sample was composed of approximately half males (53.0%) and half females (46.5%), of one person who preferred not to disclose their gender (0.1%), and two people who did not answer (0.4%). Participants reported being Caucasian (52.7%), Asian (29.8%), Afro-American or Afro-Caribbean (6.9%), Latino or Hispanic American (4.3%), other (4.7%), preferred not to disclose (1.3%), or did not answer (0.3%).

Procedures

Study 2a. The procedures for *Study* 2a were identical to the procedures for the first study with the addition of one questionnaire. That is, data collection was done through an online survey where participants had to register for the study on the ISPR platform in order to gain access to an online link leading to the one-time 30-minute survey that could be completed from anywhere with internet access. Participants were asked to read the information sheet and consent form to participate in the study and at this stage people who did not consent were automatically taken to the end of the survey while consenting participants could start completing the survey. They were asked to complete a questionnaire regarding their environmental motivation, the frequency to which they engage in different PEB and HEB, and about how they identify to the different environmental SOC. Upon completion, participants were awarded one percent (1%) toward their first-year class and their data was securely stored on the password protected Qualtrics servers (servers located in Toronto, Ontario, Canada). From the Qualtrics servers, all data was available to download and use for analyses.

Study 2b. For this portion of the study data collection was done through mTurk. To be more specific, a *Human Intelligence Task* (HIT) was created and a total of 680 assignments for this HIT were pre-purchased (at 1 USD each). Once the purchase was approved, the HIT could now be made available to individuals with an mTurk worker's account. In order for the workers to be able to view this HIT, they had to have a success rate of at least 96% for at least 1000 different assignments. These inclusion criteria were established in order to ensure the collection of the best data possible. Workers who respected these criteria could then sign up for the study and get a link to the survey. Just as with *Study 2a* individuals first gave consent, and then completed the one-time 30-minute survey where they were asked to answer questions about their environmental motivation, the frequency to which they adopt PEB and HEB, and how they

related to the different environmental SOC. Upon completion of the survey, an automatic random code was generated for them to submit in their mTurk account in order to confirm the completion of the survey. Participants who submitted their random code were compensated (1 USD) for their participation. Data was securely stored on the password protected Qualtrics servers (servers located in Toronto, Ontario, Canada). From the Qualtrics servers, all data was available to download and use for analyses.

Measures

Environmental motivation. As in *Study 1*, participants were asked to complete the Motivation Toward the Environment Scale (MTES; Pelletier, Tuson, Green-Demers, Noel, & Beaton, 1998; See Appendix A) in order to assess their motivation toward the environment. With respect to the internal consistency across these two studies, the indices for SDM were of .92 and .94 while for NSDM they were of .73 and .82 for *Studies 2a* and *2b*.

Pro and harmful-environmental behaviours. Participants also filled out the Pro-Environmental and Harmful-Environmental Behaviours Questionnaire to assess the frequencies of the environmental behaviours (PEB and HEB) they usually adopt (See Appendix B). Chronbach's alpha values were computed for PEB (.78 and .87) and for HEB (.66 and .83) in both samples.

Stages of change for environmental behaviours. Participants then completed the Stages of Change for Environmental Behaviours (adapted from: Pope, Pelletier, & Guertin, 2018). This scale was used in order to identify at what stage of environmental behaviour change participants find themselves (See Appendix C). The scale comprises two different subscales that measure stages at a within-person and between-person level respectively. In the within-person portion of the scale, participants were asked to indicate how frequently the thoughts related all the different

stages cross their mind (e.g.: “I want to know how to do different pro-environmental behaviours”) using a scale from 1 (Never) to 7 (Almost always/Always). In the between-person portion of the scale, participants were asked to choose among the five statements representing the different stages of change the one that best represented where they found themselves. They had to choose between the *detection* phase (“I am trying to determine if the current state of the environment is critical or not”), the *decision* phase (“I am debating if I will start doing more pro-environmental behaviours”), the *implementation* phase (“I want to know more about how I can do different pro-environmental behaviours”), the *maintenance* phase (“I want to know how to integrate the various pro-environmental behaviours into my lifestyle”), and the *integration* phase (“The various pro-environmental behaviours are already integrated into my lifestyle”). For the moderation analyses, a SOC index score was created by summing answers to every SOC and giving a weight of one to five. To be specific, a summed score was created after scores for the detection phase were multiplied by one, scores for the decision phase by two, scores for the implementation phase by three, scores for the maintenance phase by four, and score for the integration phase by five. The creation of this index score was based on the procedures used to create the self-determination index (SDI; Blais, Sabourin, Boucher, & Vallerand, 1990) and was created to integrate SOC in the model in the most parsimonious matter. The index scores can range from 15 to 105 where lower scores (closer to 15) represent individuals who identify as being in the earlier stages of environmental behaviour change and where higher scores (closer to 105) represent people who consider they are in the later stages of environmental behaviour change. The internal consistency of the SOC index (items representing all five SOC) was adequate at .74 and .77 for *Study 2a* and *Study 2b* respectively.

Social desirability. Participants were also asked to complete an adapted short version of the *Marlowe-Crowne Social Desirability Scale* (SDS; Crowne & Marlowe, 1960) that was developed by Reynolds (1982) (see Appendix D). This scale was used in order to control for possible biased responses given by individuals who might have answered questions about their environmental motivation and behaviours in way they feel is socially desirable. The scale is composed of 13 true or false items. For this scale, a total sum score was computed by adding responses to all 13 items in the following matter: Scores of "1" for a "true" response and "0" for a "false" response were attributed for items where we would expect that an honest response would be "false" (e.g., "No matter who I'm talking to, I'm always a good listener.") and scores of "1" for a "false" response and "0" for a "true" response were attributed for items where we would expect that an honest response would be "true" (e.g., "It is sometimes hard for me to go on with my work if I am not encouraged."). The social desirability score can range from 0 to 13 and high values indicate high probability of socially desirable responses while low values indicate a low probability. The internal consistency was assessed for both true and false items with resulting values of .88 and .83 in *Study 2a* and of .86 and .80 in *Study 2b*.

Validation questions. Validation questions were included in the MTES (i.e., "Answer "Always" if you have read this question"), in the environmental behaviours questionnaire (i.e., "Please choose 4 (Corresponds moderately) to demonstrate you are reading the questions"), and in the stages of change questionnaire (i.e., "Please select 1 (Never) to demonstrate you are paying attention. These questions were included in order to assess the quality of the participants' answers and in order to ensure the questions were read properly by participants.

Results

The second study (*Study 2a* and *Study 2b*) had multiple objectives and hypotheses. First, EFAs, multiple regressions, and ANOVAs were used in order to determine whether results from *Study 1* could be replicated. Next, ANOVAs with Tukey post-hoc tests were conducted to examine whether the means of SDM, NSDM, PEB, and HEB differed significantly across the different SOC. Finally, moderation and mediation analyses were conducted in order to determine whether the relationships between the environmental motivations and the environmental behaviours was moderated or mediated by the participants' SOC. All analyses were conducted using IBM SPSS 25 and the PROCESS Macro V 3.3 (Hayes, 2017). The results are divided into two distinct but similar sections, for *Study 2a* and *Study 2b* respectively. Descriptive statistics and inter-variable correlations can be found in *Table 3*.

Table 3
Descriptive Statistics and Inter-Variable Correlations for Studies 2a and 2b

Study 2a								
Variable	*M*	*SD*	Range	1	2	3	4	5
1. SDM	4.81	1.15	1.08-7.00	-	.15*	.51**	-.38**	.59**
2. NSDM	3.24	.773	1.00-5.08	-	-	.08	.12	.19**
3. PEB	3.78	1.01	1.67-7.00	-	-	-	-.28**	.54**
4. HEB	3.21	.858	1.11-6.56	-	-	-	-	-.27**
5. SOC	63.66	18.80	15.00-105.00	-	-	-	-	-
Study 2b								
Variable	*M*	*SD*	Range	1	2	3	4	5
1. SDM	5.01	1.28	1.08-7.00	-	.17**	.66**	-.21**	.76**
2. NSDM	3.42	1.05	1.00-6.50	-	-	.32**	.54**	.33**
3. PEB	4.41	1.36	1.00-7.00	-	-	-	.02	.65**
4. HEB	3.39	1.27	1.00-7.00	-	-	-	-	-.02
5. SOC	66.93	19.82	15.00-105.00	-	-	-	-	-

Note. SDM = self-determined motivation, NSDM = non-self-determined motivation, PEB = pro-environmental behaviour, HEB = harmful-environmental behaviours, SOC = Stages of Change Index.

*$p < .05$, **$p < .001$

Study 2a

Data preparation. Before proceeding to analyses, the data was first prepared by screening and cleaning for missing values, validation question violations, and outliers.

Missing data. In order to determine the nature of the missing data in the sample, a missing values analysis was conducted. The analysis suggested that data was missing completely at random (Little's MCAR: $\chi^2(15750) = 15884.09$, $p = .22$) and the data was imputed using the EM algorithm.

Removing participants. Participants were removed on the basis of two criteria. First, we removed participants who did not answer at least one of the validation questions properly. Next, we checked for any participants with very fast completion times.

Validation questions. In the survey completed by participants, three validation questions were inserted. Any participants who did not answer at least one of these questions correctly were removed from the sample. In consequence, 53 participants were removed on the basis of validation question violations, resulting in a sample of $N = 269$.

Time taken to complete the questionnaire. After transforming the time to complete the survey into standardized scores, no participant had taken less than 3.29 z-scores in terms of time and in consequence, no participants were removed.

Outliers. The sample was also screened for both univariate and multivariate outliers. Using an extreme score limit of ± 3.29 (Tabachnick & Fidell, 2007) for individual environmental behaviours and the composite scores for SDM, NSDM, PEB, HEB, and SOC. In total, eight (3 for environmental behaviours items + 5 for composite scores) univariate outliers were identified and winsorized to the next acceptable value (z-score = ± 3.29). Regarding multivariate outliers, a

total of three were identified (all composite scores) at $p < .001$ using the Mahalanobis distance (Tabachnick & Fidell, 2007) and were removed from the sample.

Following these preliminary analyses, a new sample size of $N = 266$ (55 males, 208 females, 2 prefer not to disclose, and 1 no gender selected) was used.

Replication of Study 1. The first set of analyses was conducted in order to determine whether results from *Study 1* could be replicated with a similar sample.

Distinguishing PEB from HEB.

Adequacy of data for EFA. All the same criteria as in the first study were used to determine whether the sample was adequate to run an EFA. First, the sample had at least 10 participants per item included in the EFA (Gorsuch, 1983) in that 18 items were tested (18 x 10 = minimum $N = 180$) and the sample size was of $N = 266$. The factorability of the items was confirmed using Bartlett's (1950) test of sphericity ($\chi_2(153) = 1017.35$, $p < .001$) and the KMO measure (.784).

Main analyses. The exact same options as in the first study were used to conduct this EFA. That is, the chosen method of extraction was ULS, the rotation used was orthogonal, the analysis was conducted using a fixed two-factor solution, and values below .2 were suppressed from the output.

Items representing PEB and HEB separated adequately on the rotated solution. To be more specific, all items representing PEB loaded on the first factor and three of these items had negative cross-loadings on the second factor. Values for Factor 1 ranged from .82 for "I communicate information to friends and family on what can be done to help the environment" to .24 for "I shop using reusable bags". With regards to the second factor, all items representing HEB loaded on Factor 2, with the exception of "Drink out of disposable bottles or mugs" that

was suppressed from the output (value of .18), and none of the items cross-loaded on the first factor. Values for Factor 2 ranged from .59 for "I throw away plastic bags or containers after one use" to .38 for "I leave the lights on when I leave" (*Table 4*). Finally, the internal consistency of the PEB and HEB items was .78 and .66 respectively.

Although not identical, the results from *Study 2a* mostly confirm results from *Study 1* and the idea that PEB and HEB should be studied as distinct behaviours.

Table 4
Results from EFA for Study 2a

Items	Factor	
	1	2
1. Communicate information to friends and family on what can be done to help the environment	.824	
2. Search for information about what can be done to help the environment.	.752	
3. Tell others when their behaviour is harmful or bad for the environment.	.678	
4. Donate to environmental.	.658	
5. Volunteer for environmental organizations.	.458	
6. Buy products or materials made from recycled products. organizations.	.451	-.238
7. Pick up litter off the ground to throw it out.	.295	
8. Recycle recyclable materials.	.250	-.430
9. Shop with reusable bags.	.240	-.206
10. Throw away plastic bags/containers after one use.		.588
11. Buy items with a lot of packaging.		.538
12. Leave the appliances on when not in use.		.480
13. Discard paper without using both sides.		.444
14. Do not recycle or compost when away from home.		.418
15. Put compostable materials in the trash.		.399
16. Buy things I really don't need.		.381
17. Leave the lights on when I leave.		.380
18. Drink beverages out of disposable bottles or mugs.		.179[1]

Note. Item 8 was moved up between items 7 and 9 in order facilitate the understanding of results.
[1] This item was suppressed from the output because it had a value < .2.

Relationships between motivation and environmental behaviours.

Adequacy of data for multiple regression. The assumptions for multiple regression were tested using the same criteria as in *Study 1*. Using the residuals for both PEB and HEB, no significant skewness or kurtosis was identified and the data was assumed to be normally distributed. The absence of multicollinearity was assumed in reason of the tolerance being greater than .10 and the correlation between the predictors being smaller than .9 (Tabachnick & Fidell, 2007). In addition, it was graphically determined that the data was homoscedastic and that there was a presence of a linear relationship in that plots were not fan-shaped and did not display significant curvature.

Main analyses. In total, two multiple regressions were conducted in order to replicate findings from the first study. The first regression suggested that, like in *Study 1*, SDM and NSDM were significantly associated the reported frequency of PEB: $F_{(2, 263)} = 43.31$, $p < .001$. In more detail, the regression model accounted for 26% of the variability and SDM was related to a higher reported frequency of PEB ($\beta = .51$, $p < .001$) whereas NSDM had no relationship with PEB ($\beta = -.003$, $p = .95$). As for the second regression, SDM and NSDM were significantly associated with the reported frequency of HEB $F_{(2, 263)} = 27.27$, $p < .001$ and accounted for 17% of the variability in HEB. In line with results from the first study, SDM was linked to a lower reported frequency of HEB ($\beta = -.40$, $p < .001$) and NSDM related to a higher reported frequency of HEB ($\beta = .18$, $p = .002$).

With regard to results from *Study 1*, this first portion of this second study completely supports the conclusion drawn in the first study. With the exception of slight changes in the amount of variability accounted for by the models and small variations in the standardized coefficients, results are exactly the same. That is, SDM was associated with a higher reported

frequency of PEB and a lower reported frequency of HEB while NSDM was only related to a higher HEB.

Comparing motivation levels according to environmental behaviours. For these analyses, two groups were created following the same steps as in the first study. The mean score for HEB was subtracted from the mean score for PEB and individuals with a negative score were included in the HEB group while those with a positive score were placed in the PEB group.

Adequacy of data for ANOVA. For the analyses of variance, homogeneity of variance, normality, independence of errors, and absence of outliers were confirmed before proceeding. The variance ratios for SDM and NSDM in both the PEB and HEB groups, respectively, were of 2.09 and 1.64, respecting the suggested limit of 10 (Tabachnik & Fidell, 2007). Next, SDM and NSDM scores did not show significant skewness or kurtosis in either the PEB or the HEB group. Finally, all outliers had been dealt with previous to theses analyses and the independence of errors was ensured by participants only being in one of the two groups.

Main analyses. The first ANOVA confirmed that individuals who adopted PEB more frequently had significantly higher levels of SDM ($M = 5.18$; $SD = 1.09$) than those who adopted HEB more frequently ($M = 4.27$; $SD = 1.02$): $F_{(1, 264)} = 47.08$, $p < .001$. In fact, there was a large difference between the levels of SDM reported by both groups ($\eta_2 = .15$). However, the second ANOVA demonstrated that there was no difference in the reported levels of NSDM between the PEB ($M = 3.21$; $SD = .76$) and HEB ($M = 3.30$; $SD = .80$) groups: $F_{(1, 264)} = .969$, $p = .33$.

These results partially replicate the findings from the first study in that differences in the levels of SDM between the groups were identified while no differences were found for the levels of NSDM.

All in all, with regard to the first study, we can say that most of the results can be replicated with a similar sample. In fact, we were able to distinguish PEB from HEB using an EFA, we were able to draw the same conclusion for the association of the reported frequency of PEB and HEB with SDM and NSDM, and demonstrate that at least the levels of SDM are different for individuals who report a higher frequency of PEB than HEB. In a further section (results for *Study 2b*), an attempt to replicate results with a different sample is discussed.

Environmental motivation and behaviours across SOC. Following the replication of the results from the first study, *Hypotheses 1a*, *1b*, *2a*, and *2b* were tested through ANOVAs with post-hoc tests for the significant omnibus tests. In this sample, 40 participants reported being in the detection stage, 21 in the decision stage, 61 in the implementation stage, 102 in the maintenance stage, and 42 in the integration stage. Due to slightly unequal sample sizes across the five different SOC groups, ratio of 4.86 between the largest and smallest group, the Tukey HSD post-hoc was used because it controls adequately for type family-wise type I error rates under these conditions (Sauder & DeMars, 2019).

Adequacy of data for ANOVA. Just as for previous analyses of variance, homogeneity of variance, normality, independence of errors, and absence of outliers was assessed and confirmed prior to the analyses.

Environmental motivation. Two separate one-way ANOVAs were conducted in order to compare the levels of SDM and NSDM for individuals who reported being in either the detection, decision, implementation, maintenance, or integration stage and determine whether significant differences could be identified. With respect to levels of SDM and NSDM across groups, significant overall group differences were revealed for both SDM ($F_{(4, 261)} = 18.11$, $p < .001$; $\eta^2 = .22$) and NSDM ($F_{(4, 261)} = 3.17$, $p = .014$; $\eta^2 = .04$). Tukey's HSD post-hoc tests were

then conducted for both types of environmental motivation. For SDM, individuals in the implementation stage reported significantly higher levels than those in the detection stage (ΔM = 1.05, $p < .001$) while those in the maintenance and integration stages displayed significantly higher levels of SDM than those in the detection ($\Delta M = 1.35$, $p < .001$; $\Delta M = 1.61$, $p < .001$) and decision stages ($\Delta M = 1.00$, $p = .001$; $\Delta M = 1.25$, $p < .001$). As for NSDM, individuals in the implementation and maintenance stages had slightly lower levels of NSDM than those in the decision stage ($\Delta M = -.681$, $p = .004$; $\Delta M = -.502$, $p = .049$).

Relating these results to our hypotheses, we can conclude that, even if at times mean differences were small, *Hypothesis 1a* is supported in that those in the later stages like implementation, maintenance, and integration seem to be significantly more self-determined to act in a way that is favourable for the environment than those in the earlier stages like detection and decision. As for *Hypothesis 1b*, results only lend partial support to the idea that those in the later stages are less non-self-determined than those in the earlier stages. In fact, only those in the implementation and maintenance stages displayed lower levels of NSDM, and this, only when compared to individuals in the decision stage. In brief, there is some evidence that levels of environmental motivation can be different depending on which SOC people find themselves at.

Environmental behaviours. In the same way, ANOVAs were conducted to determine whether the reported frequency of PEB and HEB were different for people in the five different SOC. The presence of overall group differences was demonstrated for PEB ($F_{(4, 261)} = 8.43$, $p < .001$; $\eta^2 = .11$) and HEB ($F_{(4, 261)} = 12.65$, $p < .001$; $\eta^2 = .16$). Following these omnibus tests, Tukey's HSD post-hoc tests revealed significant differences between the different groups. With regard to the reported frequency of PEB, participants in the maintenance stage had a higher frequency than those in the detection ($\Delta M = .724$, $p = .001$) and decision ($\Delta M = .731$, $p = .013$)

stages while those in the integration stage had a higher frequency than those in detection (ΔM = .998, $p < .001$), decision (ΔM = 1.01, p = .001), and implementation (ΔM = .553, p = .034) stages. Regarding the frequency of HEB, individuals in the implementation and maintenance stages reported a lower frequency than those in the decision stage (ΔM = -.588, p = .029; ΔM = -.664, p = .005), and those in the integration stage had a lower frequency than those in the detection (ΔM = -1.01, $p < .001$), decision (ΔM = -1.29, $p < .001$), implementation (ΔM = -.700, $p < .001$), and maintenance (ΔM = -.623, $p < .001$) stages.

These results are in line with *Hypothesis 2a* in that individuals who find themselves at the later stages have a higher average of adopted PEB than those in the earlier stages. We can also conclude that *Hypothesis 2b* is supported. In fact, people in the later stages reported a lower frequency of adoption of HEB than those in the earlier stages. This is especially true for those who were at the integration stage as they adopt a lower frequency than those in all four of the earlier stages. Similar to the results for environmental motivation, it seems that being in the later stages of environmental behaviour change may be linked to a higher reported frequency of PEB and a lower reported frequency of HEB.

For both environmental motivation and environmental behaviours, significant differences were found when comparing individuals at the initial stages of the process to those who are further along. A summary of the means for SDM, NSDM, PEB, and HEB as well as identification of homogeneous subsets can be found in *Table 5*.

Table 5

Mean Differences for Motivation and Environmental Behaviours Across the Five Stages of Change for Study 2a

	Stages of change				
	Detection	Decision	Implementation	Maintenance	Integration
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
SDM	3.77_{a} (1.03)	4.13_{a} (.905)	4.81_{b} (.972)	5.12_{b} (.965)	5.38_{b} (1.28)
NSDM	3.29_{ab} (.900)	3.74_{a} (.723)	3.06_{b} (.616)	3.24_{b} (.750)	3.25_{b} (.835)
PEB	3.24_{a} (.699)	3.25_{a} (.930)	3.69_{ab} (1.00)	3.97_{b} (1.02)	4.24_{b} (.942)
HEB	3.85_{a} (.723)	3.57_{ab} (.710)	3.26_{b} (.776)	3.18_{b} (.870)	2.56_{c} (.708)

Note. Stages of change with the same superscript letters are part of the same homogeneous subsets and do not differ significantly at $p < .05$.

Moderated relationships between environmental motivation and behaviours. One of the objectives of this study was to determine whether the relationships between motivation and behaviours are moderated by the SOC people find themselves at. In other words, this section is dedicated to identifying if the relationships between environmental motivation and behaviours change according to SOC. The first and second models tested the relationships and possible interaction between SDM and SOC on PEB and HEB respectively, and the third and fourth models tested the relationships and possible interaction of NSDM and SOC on PEB and HEB (Model 1; Hayes, 2017; bootstrapping samples = 5000)

Adequacy of data for moderated regressions. The assumptions for these types of analyses are the same as for multiple linear regression. In line with this idea, the residuals were normally distributed, no collinearity was identified between SDM and SOC (tolerance = .65) or between NSDM and SOC (tolerance = .962) and the residuals confirmed the absence of heteroscedasticity and the presence of linear relationships.

Preliminary analyses. Before proceeding to the moderated regression analyses, two possible covariates, age and social desirability, were correlated with PEB and HEB in order to determine whether their effects should be considered in the model. Age was correlated with PEB ($r = .15$, $p = .012$) and HEB ($r = -.19$, $p = .002$) whereas social desirability was not significantly correlated with either PEB ($r = -.11$, $p = .068$) or HEB ($r = .001$, $p = .986$). Consequently, age was added to the moderated regression models in order to control for its effect on both types of behaviours.

Main analyses. The first moderated regression revealed a significant regression model ($F_{(4, 261)} = 39.30$, $p < .001$). That is, SDM ($b = .25$, $t = 4.73$, $p < .001$) had a significant main effect and SOC ($b = .02$, $t = 6.26$, $p < .001$) had relativily small significant main effects on the

reported frequency of PEB. In addition, a significant interaction was found between SDM and SOC in the relationship with PEB (b = .007, $t = 3.48$, $p < .001$). While the reported frequency of PEB increased with levels of SDM for individuals who are scored moderately (b = .27, $t = 4.94$, $p < .001$) and those who scored high (b = .37, $t = 5.71$, $p < .001$) on the SOC index, there was no effect for those who score low (b = .12, $t = 1.84$, $p = .067$); see *Figure 2* for are visual representation of the main effects and interaction. The second model was also significant ($F_{(4, 261)} = 14.84$, $p < .001$) and showed that SDM had a significant main effect on HEB (b = -.24, $t = -4.51$, $p < .001$) whereas SOC (b = -.004, $t = -1.32$, $p = .19$) did not. There was also the presence of a significant interaction between SDM and SOC in the relationship with HEB (b = -.006, $t = -3.06$, $p = .003$). The reported frequency of HEB significantly decreased as levels of SDM increased for people who scored moderately (b = -.25, $t = -4.69$, $p < .001$) and those who scored high (b = -.34, $t = -5.31$, $p < .001$) on the SOC index, and no significant effect was found for those who scored low (b = -.12, $t = -1.91$, $p = .057$); see *Figure 3* for are visual representation of the main effects and interaction. The third model was significant ($F_{(4, 261)} = 28.35$, $p < .001$) and only SOC had a significant main effect on the reported frequency of PEB (b = .029, $t = 10.06$, $p < .001$). NSDM had no effect on the frequency PEB (b = -.012, $t = -.169$, $p = .866$) and no interaction effect was found (b = .005, $t = 1.35$, $p = .178$); see *Figure 4* for visual representation of the main effect. The fourth and final model was also significant ($F_{(4, 261)} = 8.88$, $p < .001$) and a significant main effect was found for both independent variables. That is, NSDM (b = .175, $t = 2.58$, $p = .011$) had significant link and SOC (b = -.013, $t = -4.58$, $p < .001$) was slightly related to the reported frequency of HEB. There was, however, no significant interaction (b = .002, $t = .554$, $p = .580$); see *Figure 5* for a visual representation of the main effects.

With respect to our hypotheses, most were supported by the results. In fact, *Hypotheses 3a* to *3c* were supported as both SDM and SOC had significant main effects on the reported frequency of PEB, and SDM was moderated by SOC in the relationship with PEB. Moreover, the fact the SDM had a negative relationship on HEB and that this relationship was moderated by SOC supported *Hypotheses 4a* and *4c*. For the fifth set of hypotheses, the positive effect of SOC on PEB and the absence of an interaction between NSDM and SOC supported *Hypotheses 5b* and *5c*. Finally, *Hypotheses 6a* to *6c* were supported as NSDM had a positive relationship with the reported frequency of HEB while SOC was negatively associated and they did not interact in the relationship with HEB.

Mediated relationships between environmental motivation and behaviours. The final objective of this study was to determine whether the different types of motivation are associated with the environmental behaviours through mediation by SOC. A total of four models were tested where the first and second models tested the effects and possible mediation by SOC of SDM on PEB and HEB respectively, and the third and fourth models tested the effects and possible mediation by SOC of NSDM on PEB and HEB (Model 4; Hayes, 2017; bootstrapping samples = 5000). The assumptions were the same as for the moderated regressions and the same control variable was used.

Main analyses. For the first model, results revealed that SDM was associated with both SOC (b = 9.67, t =11.70, $p < .001$) and PEB (b = .43, t = 9.17, $p < .001$), in addition, SOC was also related to PEB (b = .02, t =5.90, $p < .001$). The direct effect of SDM on PEB was significant (b = .24, t = 4.44, $p < .001$) and the indirect effect through SOC was also significant (b = .19, BootCI [.121, .265]), suggesting partial mediation of the relationship between SDM and PEB by SOC. Results from the second model suggested that only SDM was linked to HEB (b = -.26, t =

-6.05, $p < .001$) and in consequence there was no mediation as only the direct effect was significant (b = -.23, t = -4.27, $p < .001$) while the indirect effect was not (b = -.03, BootCI [-.089, .025]). As for NSDM, the third model revealed that NSDM was associated with SOC (b = 5.19, t = 3.49, $p < .001$) and SOC was associated with PEB (b = .03, t = 9.96, $p < .001$). The direct path from NSDM to PEB was not significant (b = -.03, t = -.37, p = .71), but the indirect path through SOC was (b = .15, BootCI [.061, .239]), thus suggesting a full mediation of NSDM on PEB by SOC. For the fourth and final model, NSDM was associated with both SOC (b = 5.19, t = 3.49, $p < .001$) and HEB (b = .17, t = 2.52, p = .012), and SOC was also associated with HEB (b = -.01, t = -4.76, $p < .001$). The direct effect of NSDM on HEB was significant (b = .17, t = 2.52, p = .012) in addition to the indirect effect through SOC (b = .15, BootCI [.061, .239]), revealing a partial mediation.

With respect to our hypotheses, only *Hypothesis 7a* was supported by the results as SDM was partially mediated by SOC in the relationship with PEB, but not HEB, and because NSDM was fully mediated by SOC in the relationship with PEB and partially mediated in the association with HEB.

Taking all these results into consideration, the role of SOC in the relationship between environmental motivation and behaviours remains ambiguous as results suggested it could act as a moderator or a mediator. An attempt to clarify the role of SOC will be done by replicating these analyses in *Study 2b* and *Study 3*.

Figure 2. Visual Representation of the Main Effects and Interaction for SDM and SOC in the Relationship with PEB for Study 2a

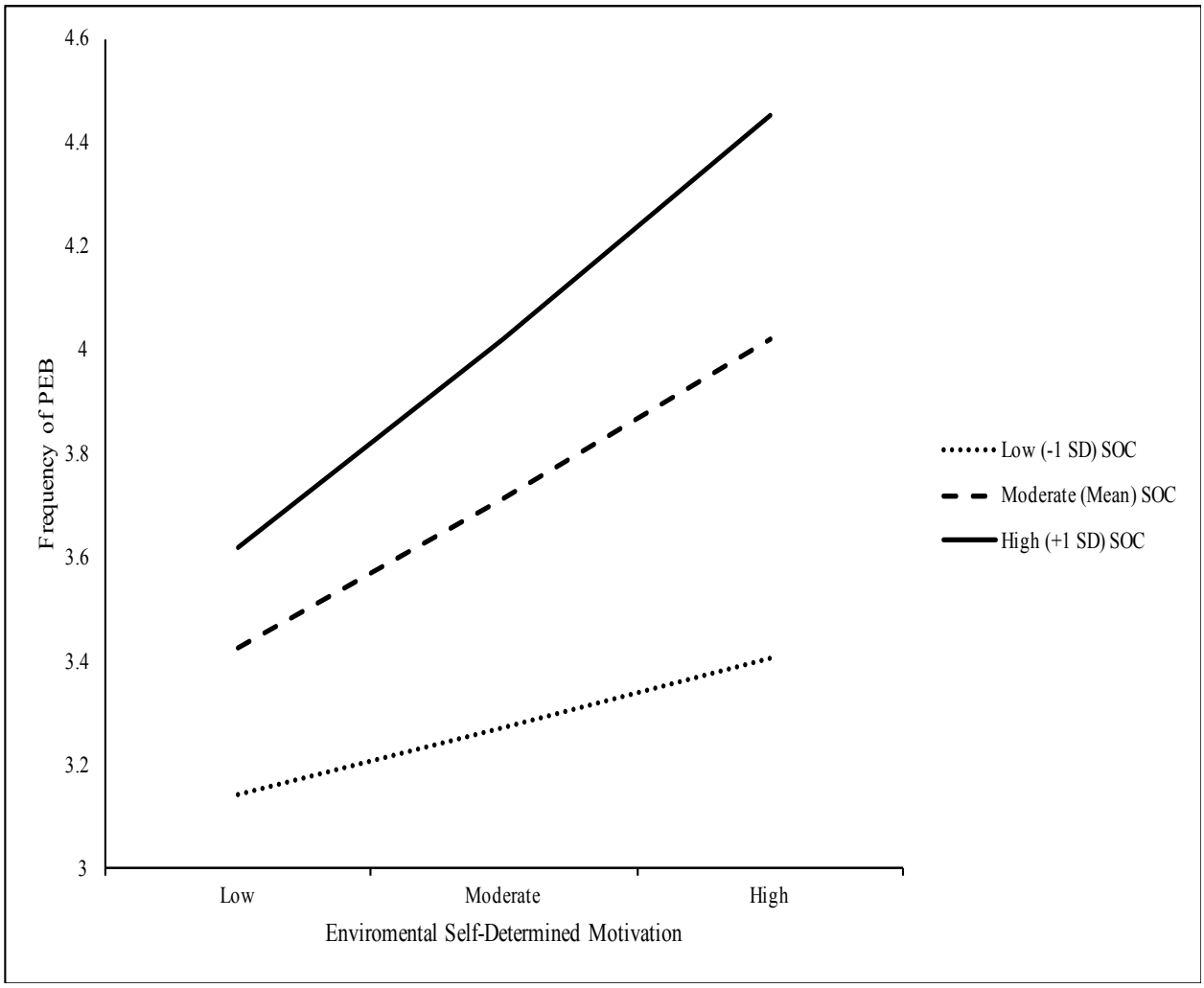


Figure 2. N = 266. The moderating role of stages of change in the relationship between self-determined motivation toward the environment and the frequency of pro-environmental behaviours adopted.
Note. SOC = Stages of change; PEB = Pro-environmental behaviours.

Figure 3. Visual Representation of the Main Effects and Interaction for SDM and SOC in the Relationship with HEB for Study 2a

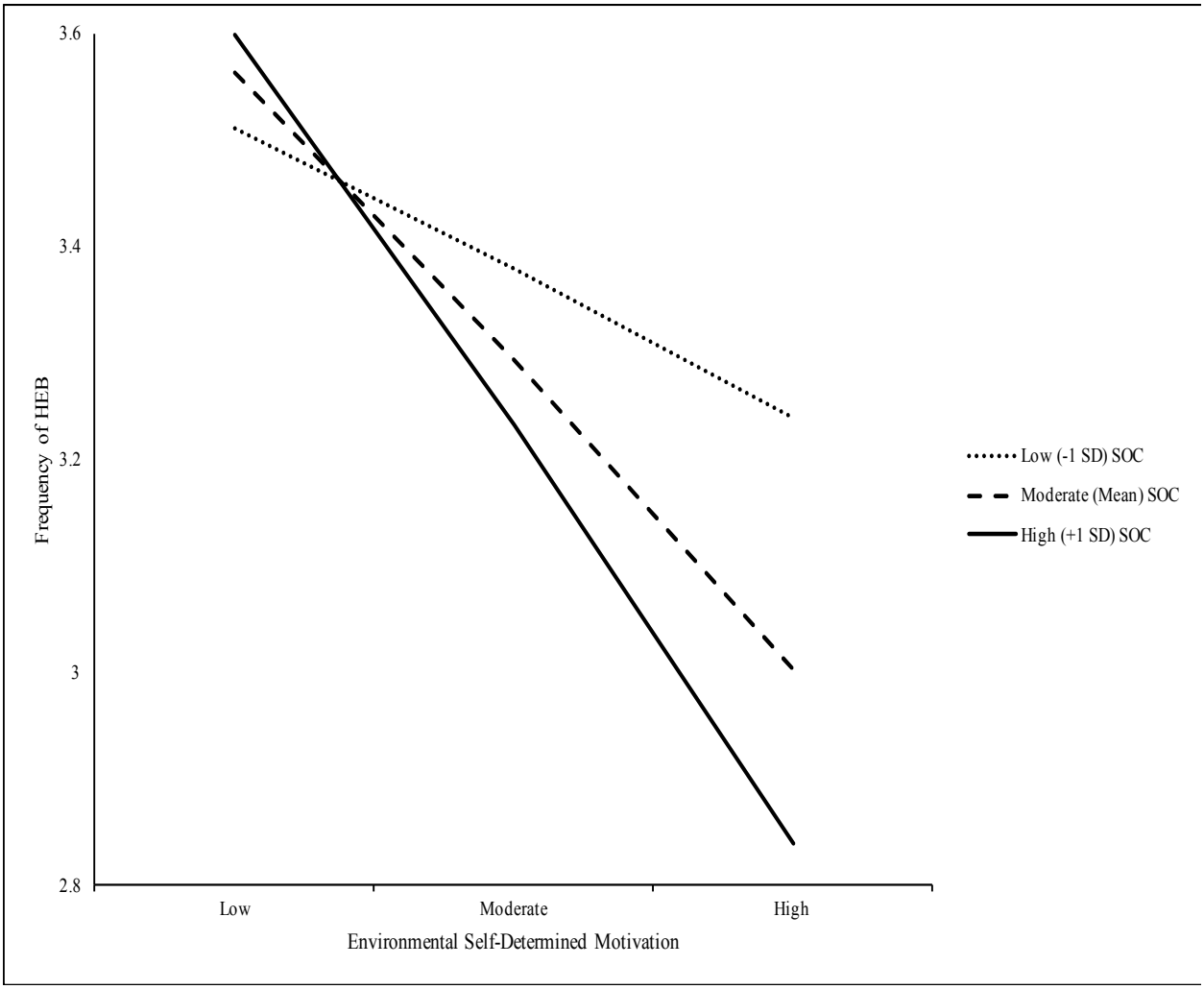


Figure 3. $N = 266$. The moderating role of stages of change in the relationship between self-determined motivation toward the environment and the frequency of harmful-environmental behaviours adopted.
Note. SOC = Stages of chance; HEB = Harmful-environmental behaviours.

Figure 4. Visual Representation of the Main Effect of SOC in the Relationship with PEB for Study 2a

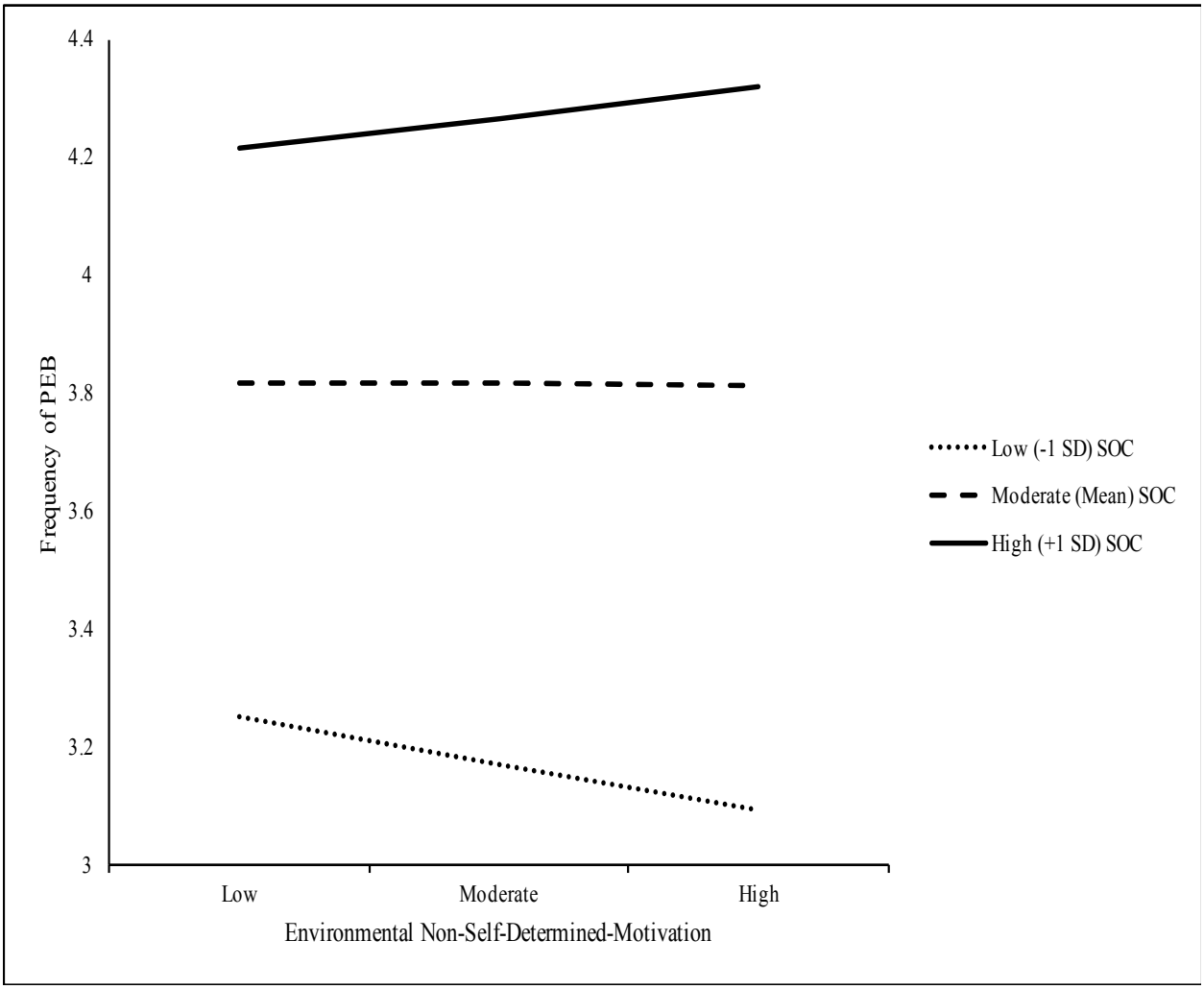


Figure 4. N = 266. The main effect of stages of change on the frequency of pro-environmental behaviours adopted.
Note. SOC = Stages of change; PEB = Pro-environmental behaviours.

Figure 5. Visual Representation of the Main Effects for NSDM and SOC in the Relationship with HEB for Study 2a

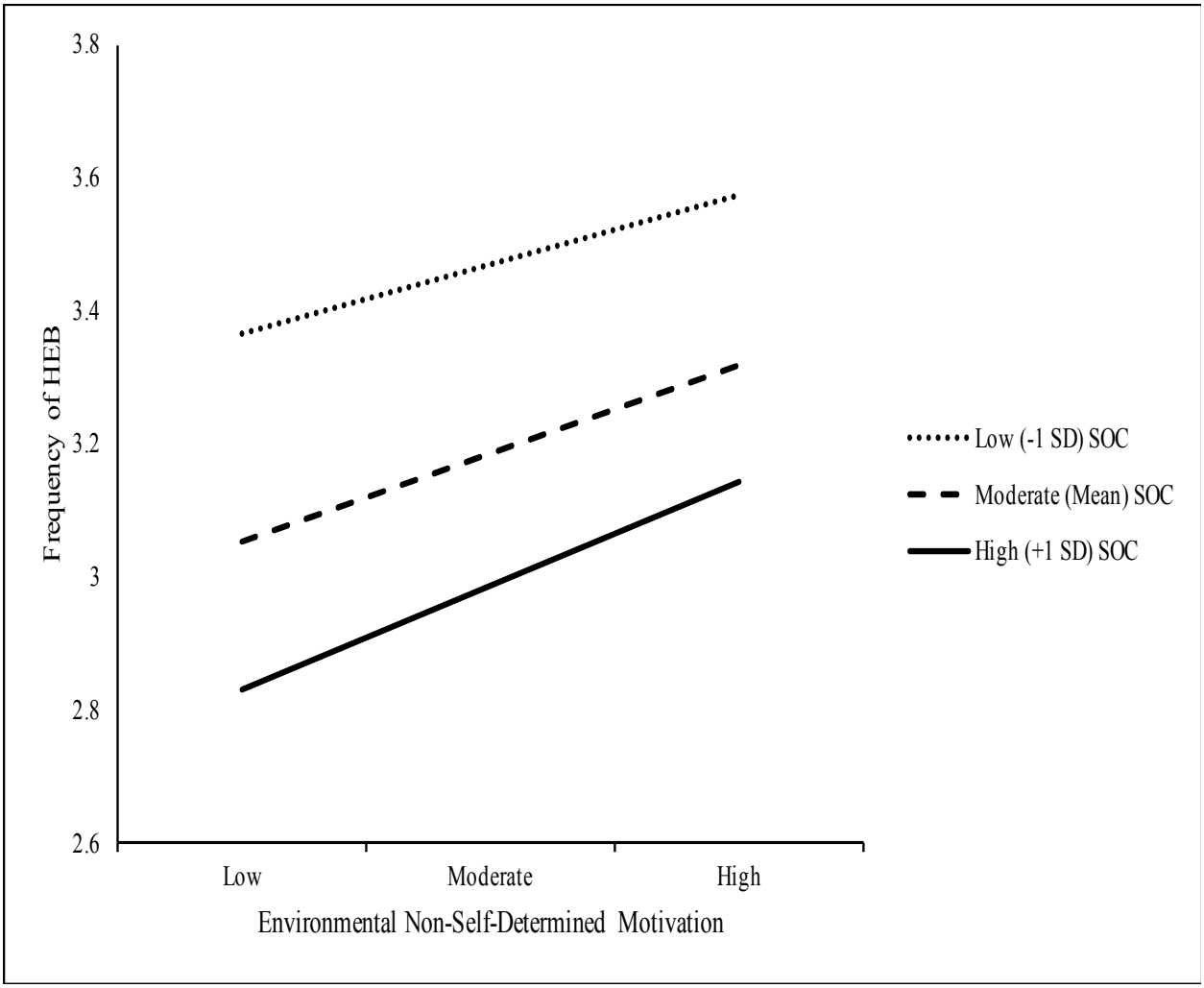


Figure 5. N = 266. The main effects non-self-determined motivation toward the environment and of stages of change in the relationship on the frequency of harmful-environmental behaviours adopted.
Note. SOC = Stages of chance; HEB = Harmful-environmental behaviours.

Study 2b

This portion of the second study comprises all the same analyses but aims to determine whether results from *Study 1* and *Study 2a* can be replicated with a sample who has not been drawn from a population of Canadian undergraduate students. It's important to note that because of the identical set of analyses as in *Study 2a*, the assumptions are not discussed, but have been confirmed prior to all analyses.

Data preparation. The data was prepared by screening and cleaning for missing values, validation question violations, and outliers.

Missing data. A missing values analysis was conducted in order to determine the nature of the missing data. According to the analysis, the data was missing completely at random (Little's MCAR: $\chi_2(42732) = 42976.96$, $p = .20$) and the data was imputed using the EM algorithm.

Removing participants. First, we removed participants who did not answer at least one of the validation questions properly. Next, we checked for any participants with very fast completion times.

Validation questions. Any participant who did not answer at least one of the three validation questions correctly was removed from the sample. A total of 137 participants were removed on the basis of failing to answer at least one validation question properly, resulting in a sample of $N = 543$.

Time taken to complete the questionnaire. No participant had taken less than 3.29 z-scores in terms of time and no participants were removed on the basis of time.

Outliers. The sample was also screened for both univariate and multivariate outliers. Using z-scores of ± 3.29 as maximum and minimum values (Tabachnick & Fidell, 2007) for

individual environmental behaviours and the composite scores for SDM, NSDM, PEB, HEB, and SOC, a total of 19 (12 for environmental behaviours items + 7 for composite scores) univariate outliers were identified and winsorized to the next acceptable value within ± 3.29. As for multivariate outliers, 14 were identified (all composite scores) at $p < .001$ using the Mahalanobis distance (Tabachnick & Fidell, 2007) and were removed from the sample.

A new sample size of $N = 529$ (265 males, 262 females, and 1 no gender selected) was used for the analyses.

Replication of Study 1. Again, the first set of analyses was conducted in order to determine whether results from *Study 1* could be replicated with a different sample.

Distinguishing PEB from HEB.

Main analyses. To conduct the EFA, the same options were selected as in *Study 1* and *Study 2a*. Therefore, ULS was chosen as the method of extraction, an orthogonal rotation was used, the analysis was conducted using a fixed two-factor solution, and values below .2 were suppressed from the output.

The rotated solution demonstrated that behaviours representing both types of environmental behaviours separated clearly on the two factors. All items representing PEB loaded on the first factor and only one item slightly cross-loaded on the second factor. Values for Factor 1 ranged from .83 for "I search for information about what can be done to help the environment" to .42 for "I recycle recyclable materials". As for the second factor, all items representing HEB loaded on Factor 2 with the absence of cross-loadings on the first factor. Values for Factor 2 ranged from .74 for "I buy items with a lot of packaging" to .42 for "I put compostable materials in the trash" (*Table 6*). What is more, the internal consistency of the PEB and HEB items were of .87 and .83.

The replication portion of the results for *Study 2b* provide additional support to the idea that both PEB and HEB should be considered when studying environmental behaviours. The structure was replicated for a third time and evidence was provided that PEB and HEB can be distinguished outside of a Canadian undergraduate sample.

Table 6
Results from EFA for Study 2b

Items	Factor	
	1	2
1. Search for information about what can be done to help the environment.	.834	
2. Communicate information to friends and family on what can be done to help the environment.	.803	
3. Tell others when their behaviour is harmful or bad for the environment.	.730	
4. Donate to environmental organizations.	.694	
5. Volunteer for environmental organizations.	.664	.287
6. Buy products or materials made from recycled products.	.633	
7. Shop with reusable bags.	.546	
8. Pick up litter off the ground to throw it out.	.493	
9. Recycle recyclable materials.	.424	
10. Buy items with a lot of packaging.		.742
11. Discard paper without using both sides.		.704
12. Buy things I really don't need.		.670
13. Leave the appliances on when not in use.		.668
14. Throw away plastic bags/containers after one use.		.648
15. Leave the lights on when I leave.		.628
16. Do not recycle or compost when away from home.		.522
17. Drink beverages out of disposable bottles or mugs.		.420
18. Put compostable material in the trash.		.417

Relationships between motivation and environmental behaviours.

Main analyses. The same two multiple regression models were tested in order to further explore the relationships between environmental motivation and behaviours. In the first model SDM and NSDM were significantly associated with the reported frequency of PEB: $F_{(2, 526)} = 242.06$, $p < .001$. Again, SDM was positively linked to the reported frequency of PEB ($\beta = .62$, $p < .001$), but for this sample, as opposed to *Study 1* and *Study 2a*, NSDM was also positively linked to PEB ($\beta = .21$, $p < .001$). In total, the model accounted for 48% of the variability in the reported frequency of PEB. Looking at results for the second regression model, SDM and NSDM were significantly associated with the reported frequency of HEB $F_{(2, 526)} = 164.39$, $p < .001$ and accounted for 39% of the variability.

As for the effect of motivation, SDM was related to a lower reported frequency of HEB ($\beta = -.31$, $p < .001$) and NSDM with a higher reported frequency of HEB ($\beta = .60$, $p < .001$).

When considering results from the first study and part *a* of the second study, three out of the same four hypotheses were supported. To be more specific, SDM had the same relationship with PEB and HEB by being positively associated with the former and negatively with the latter, and NSDM had the same positive relationship with HEB, but also had a significant positive association with PEB.

Comparing motivation levels according to environmental behaviours. Again, a PEB and HEB group were created by subtracting the mean score of HEB from the mean score of PEB.

Main analyses. Results first demonstrated that individuals who adopt PEB more frequently have significantly higher levels of SDM ($M = 5.44$; $SD = 1.01$) than those who adopted HEB more frequently ($M = 4.13$; $SD = 1.35$): $F_{(1, 527)} = 155.19$, $p < .001$; $\eta_2 = .23$). The second ANOVA demonstrated that there was no difference in the reported levels of NSDM

between the PEB group (M = 3.38; SD = .99) and HEB group (M = 3.50; SD = .1.16): $F_{(1, 527)}$ = 1.70, p = .19).

These results are partially in line the findings from the first study and completely in line with results from *Study 2a* as only the levels of SDM varied significantly between the PEB and HEB groups.

Environmental motivation and behaviours across SOC. For the second set of analyses, 120 participants were in the detection stage, 46 in the decision stage, 131 in the implementation stage, 113 in the maintenance stage, and 119 in the integration stage. Again, because the sample sizes were slightly unequal across the five different SOC groups, that is to say that there was a ratio of 2.85 between the largest and smallest group, the Tukey HSD post-hoc was chosen.

Environmental motivation. Individuals in all of the SOC groups were compared on their levels of SDM and NSDM. Results revealed significant overall group differences for both SDM ($F_{(4, 524)}$ = 30.49, p < .001; η^2 = .19) and NSDM ($F_{(4, 261)}$ = 16.96, p < .001; η^2 = .11). Tukey's HSD post-hoc tests demonstrated, for SDM, that individuals in the implementation and maintenance stages reported significantly higher levels than those in detection (ΔM = .962, p < .001; ΔM = 1.14, p < .001) and decision stages (ΔM = .758, p = .001; ΔM = .935, p < .001) while those in integration stages displayed significantly higher levels than those in the detection (ΔM = 1.48, p < .001), decision (ΔM = 1.28, p < .001), and implementation (ΔM = .518, p = .004) stages. As for NSDM, individuals in the implementation and maintenance stages displayed significantly lower levels than those in the detection (ΔM = -.395, p = .014; ΔM = -.538, p < .001) and decision (ΔM = -.565, p = .008; ΔM = -.708, p < .001) stages. In addition, people in the integration stage had lower levels of NSDM than those in the detection (ΔM = -.902, p < .001),

decision (ΔM = -1.07, p < .001), implementation (ΔM = -.507, p = .001), and maintenance (ΔM = -.364, p = .041) stages, only slightly for the latter.

In the same way as in *Study 2a, Hypothesis 1a* is supported by the data. Indeed, individuals who found themselves at the later stages such as implementation, maintenance, and integration display higher levels of SDM than those who are in the earlier stages of the process like detection and decision. However, while *Study 2a* only partially supported *Hypothesis 1b,* these results completely support the idea that people who found themselves further along in the process of change displayed lower levels of NSDM than those who were at the earlier steps.

Environmental behaviours. A second ANOVA with post-hoc tests was conducted to examine the reported frequency of PEB and HEB across all five stages. Overall group differences were found for PEB ($F_{(4, 524)}$ = 8.43, p < .001; η^2 = .06) and HEB ($F_{(4, 524)}$ = 38.69, p < .001; η^2 = .23). Regarding specific group differences for the reported frequency of PEB, participants in the maintenance stage had a slightly higher frequency than those in the detection (ΔM = .495, p = .035) stage while those in the integration stage had a higher frequency than those in detection (ΔM = .881, p < .001) and decision (ΔM = 969, p < .001) stages, and a slightly higher frequency than those in the implementation (ΔM = .483, p = .032) stage. For the reported frequency of HEB, individuals in the implementation and maintenance stages reported a lower frequency than those in the detection (ΔM = -.607, p < .001; ΔM = -.845, p < .001) and decision (ΔM = -.748, p = .001; ΔM = -.986, p < .001) stages, and those in the integration stage had a lower frequency than those in the detection (ΔM = -1.61, p < .001), decision (ΔM = -1.75, p < .001), implementation (ΔM = -1.01, p < .001), and maintenance (ΔM = -.767, p < .001) stages.

Results from *Study 2a* were completely replicated by these results and we can conclude that *Hypotheses 2a* and *2b* are fully supported. Individuals in the later part of the process

demonstrated, again, a higher reported frequency of adoption of PEB and a lower reported frequency of HEB than those in the early stages.

A summary of the means for SDM, NSDM, PEB, and HEB as well as identification of homogeneous subsets can be found in *Table 7*.

Table 7

Mean Differences for Motivation and Environmental Behaviours Across the Five Stages of Change for Study 2b

	Stages of change				
	Detection	Decision	Implementation	Maintenance	Integration
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
SDM	4.18_{a} (1.44)	4.38_{a} (.996)	5.14_{b} (1.04)	5.32_{bc} (.938)	5.66_{c} (1.22)
NSDM	3.99_{a} (1.21)	3.82_{ab} (1.09)	3.42_{bc} (.944)	3.28_{cd} (.989)	2.92_{d} (.701)
PEB	3.93_{a} (1.58)	4.02_{ab} (1.30)	4.42_{abc} (1.22)	4.51_{bc} (1.16)	4.90_{c} (1.28)
HEB	4.21_{a} (1.23)	4.07_{a} (1.12)	3.46_{b} (1.23)	3.23_{b} (1.10)	2.46_{c} (.859)

Note. Stages of change with the same superscript letters are part of the same homogeneous subsets and do not differ significantly at $p < .05$.

Moderated relationships between environmental motivation and behaviours. Once more, the possible moderation of environmental motivation by SOC in the relationship with environmental behaviours was examined. Using the PROCESS macro (Model 1; Hayes, 2017) with bootstrapping (samples = 5000) the effects and possible interaction of SDM and SOC on PEB and HEB were tested in the first and second models while the effects and possible interaction of NSDM and SOC on PEB and HEB were tested in the third and fourth models.

Preliminary analyses. Age and social desirability were considered as possible covariates and were correlated with PEB and HEB in order to determine whether their effects should be considered in the model. Age was significantly correlated with HEB ($r = -.33$, $p < .001$) and social desirability was significantly correlated with both PEB ($r = -.19$, $p < .001$) and HEB ($r = -.17$, $p < .001$). Both age and social desirability were added to the moderated regression models in order to control for their effect on the environmental behaviours.

Main analyses. The first moderated regression model was significant ($F_{(5, 523)} = 102.51$, $p < .001$). Main effects on the reported frequency of PEB for SDM ($b = .42$, $t = 8.02$, $p < .001$) and SOC ($b = .02$, $t = 6.83$, $p < .001$) were found, but no significant interaction was revealed ($b = -.0002$, $t = -.129$, $p = .897$); see *Figure 6* for a visual representation of the main effects. The second model was also significant ($F_{(5, 523)} = 24.15$, $p < .001$) and showed that both SDM ($b = -.39$, $t = -6.22$, $p < .001$) and SOC ($b = .016$, $t = 4.16$, $p < .001$) had significant main effects on HEB in addition to an absence of a significant interaction ($b = -.002$, $t = -1.25$, $p = .211$); see *Figure 7* for a visual representation of the main effects. The third model was significant ($F_{(5, 523)} = 84.93$, $p < .001$) and found main effects on the reported frequency of PEB for NSDM ($b = .21$, $t = 4.18$, $p < .001$) and SOC ($b = .039$, $t = 15.44$, $p < .001$). Again, no interaction effect was found for this model ($b = -.004$, $t = -1.77$, $p = .078$); see *Figure 8* for a visual representation of

the main effects. The fourth and final model was also significant ($F_{(5, 523)} = 8.88$, $p < .001$) and significant main effects were found for both independent variables in addition to a significant interaction. That is, both NSDM (b = .63, $t = 12.51$, $p < .001$) and SOC (b = -.009, $t = -3.69$, $p < .001$) were linked the reported frequency of HEB and interacted (b = .009, $t = 4.53$, $p < .001$). The effect of SOC on HEB was inverted as levels of NSDM increased. While high SOC index scores (b = .80, $t = 14.27$, $p < .001$) were associated with lower HEB than moderate (b = .65, $t = 13.19$, $p < .001$) and then low SOC index scores (b = .47, $t = 7.02$, $p < .001$) for individuals with low levels of NSDM, those with lower SOC index scores reported a lower frequency of HEB than those with moderate followed by high SOC index scores for people who displayed higher levels of NSDM; see *Figure 9* for a visual representation of the main effects and interaction.

If we consider *Hypotheses 3a-c* to *6a-c*, eight out of the 12 were supported by the results. Specifically, both SDM and SOC had a positive link with the reported frequency of PEB (*Hypotheses 3a* and *3b*) and a negative effect on the reported frequency of HEB (*Hypotheses 4a* and *4b*) in the first two models. In the third model, SOC once again had a positive effect on PEB (*Hypothesis 5b*) and the effect of NSDM was not moderated by SOC (*Hypothesis 5c*). Finally, in the fourth model, NSDM had a positive association with HEB (*Hypothesis 6a*) and SOC had a negative link with HEB (*Hypothesis 6b*). Some unanticipated, however, interesting results were found in the relationship between NSDM and environmental behaviours. As opposed to what was expected, NSDM had a positive effect on the reported frequency of PEB and the effect of NSDM was moderated by SOC in the relationship with the reported frequency of HEB. Some of the same tendencies as in *Study 2a* were identified in that SDM and SOC had the same main effects on environmental behaviours and NSDM was, again, related to a higher reported

frequency of HEB. However, the third study will shed more light on what effects will hold in a third sample.

Mediated relationships between environmental motivation and behaviours. Again, four models were tested to further examine the possible mediating role of SOC (Model 4; Hayes, 2017; bootstrapping samples = 5000). The assumptions were the same as for the moderated regressions and the same control variables were used.

Main analyses. First, results suggested that SDM was associated with both SOC (b = 11.71, t =26.36, $p < .001$) and PEB (b = .69, t = 19.69, $p < .001$) in addition to SOC also being associated with PEB (b = .02, t = 6.88, $p < .001$). Both the direct effect of SDM on PEB (b = .24, t = 4.44, $p < .001$) and the indirect effect through SOC (b = .19, BootCI [.121, .265]) were significant, revealing a partial mediation. Results from the second model revealed that SDM was associated with both HEB (b = -.17, t = -4.26, $p < .001$) and SOC (b = 11.71, t =26.36, $p < .001$) and that SOC was also related to HEB (b = .02, t = 4.31, $p < .001$). The direct (b = -.37, t = -6.09, $p < .001$) and indirect effect (b = .20, BootCI [.104, .289]) were significant, thus suggesting the presence of a partial mediation. For the third model, NSDM was linked to both SOC (b = 7.11, t = 8.39, $p < .001$) and PEB (b = .48, t = 8.28, $p < .001$), and SOC was also associated with PEB (b = .04, t = 16.59, $p < .001$). The direct effect of NSDM on PEB was significant (b = .19, t = 3.89, $p < .001$) in addition to the indirect effect through SOC (b = .28, BootCI [.212, .363]), revealing a partial mediation. The fourth and final model, had results that suggested, again, that NSDM was associated with both HEB (b = .59, t = 12.21, $p < .001$) and SOC (b = 7.11, t = 8.39, $p < .001$) in addition to SOC being associated with HEB (b = -.01, t = -5.10, $p < .001$). Once more, a partial mediation was suggested as both the direct (b = .68, t = 13.49, $p < .001$) and indirect (b = -.09, BootCI [-.143, -.043]) effects were significant.

In this sample, *Hypotheses 7a* and *7b* were supported by the results as SDM was partially mediated by SOC in the relationship with both PEB and HEB. In addition, NSDM was again mediated, partially, by SOC in its relationship with PEB and HEB.

If we compare these results to those from *Study 2a*, the role of mediator seems to be drawn out more than the one of moderator for SOC as only one model demonstrated a significant interaction between environmental motivation and SOC in the relationships with environmental behaviours (NSDM x SOC) while all four models demonstrated a partial mediation of the relationship between environmental motivation and behaviours. Results from the third study will help us shed more light on the role of SOC as these analyses will be conducted once more and a full mediation model including all variables from this program of research will be assessed.

Figure 6. Visual Representation of the Main Effects for SDM and SOC in the Relationship with PEB for Study 2b

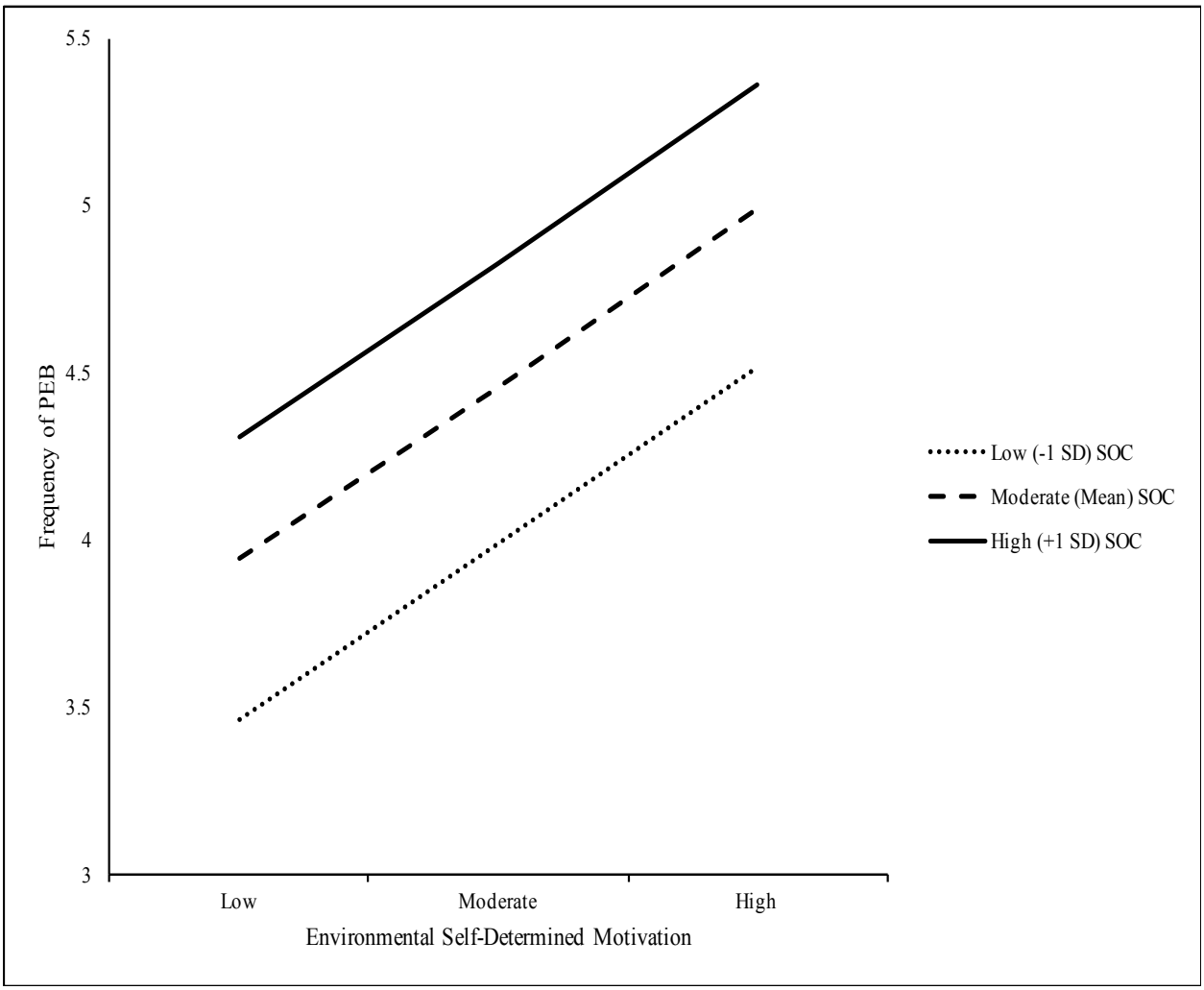


Figure 6. N = 529. The main effects of self-determined motivation toward the environment and stages of change on the frequency of pro-environmental behaviours adopted.
Note. SOC = Stages of change; PEB = Pro-environmental behaviours.

Figure 7. Visual Representation of the Main Effects for SDM and SOC in the Relationship with HEB for Study 2b

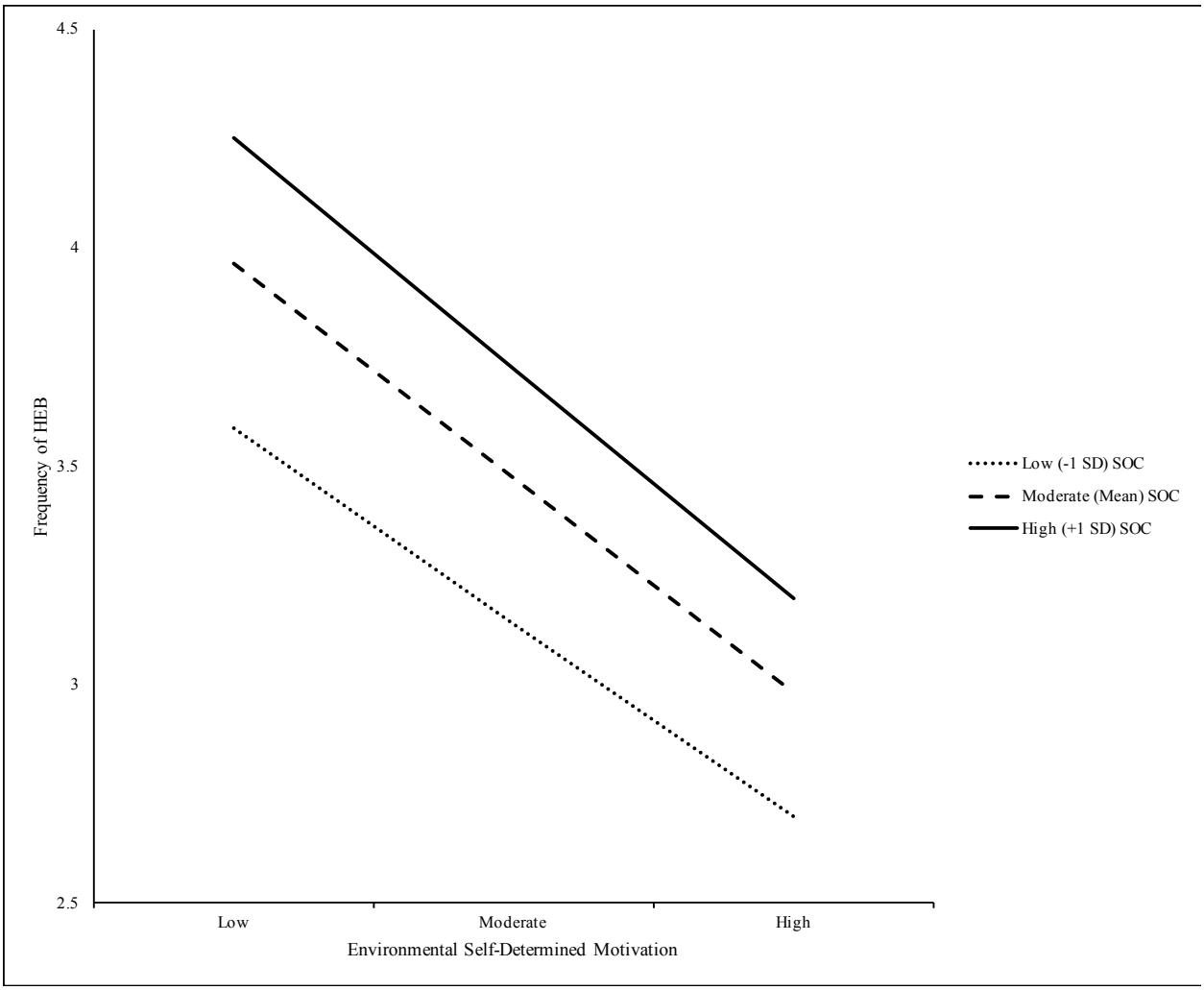


Figure 7. N = 529. The main effects of self-determined motivation toward the environment and stages of change on the frequency of harmful-environmental behaviours adopted.
Note. SOC = Stages of chance; HEB = Harmful-environmental behaviours.

Figure 8. Visual Representation of the Main Effects of NSDM and SOC in the Relationship with PEB for Study 2b

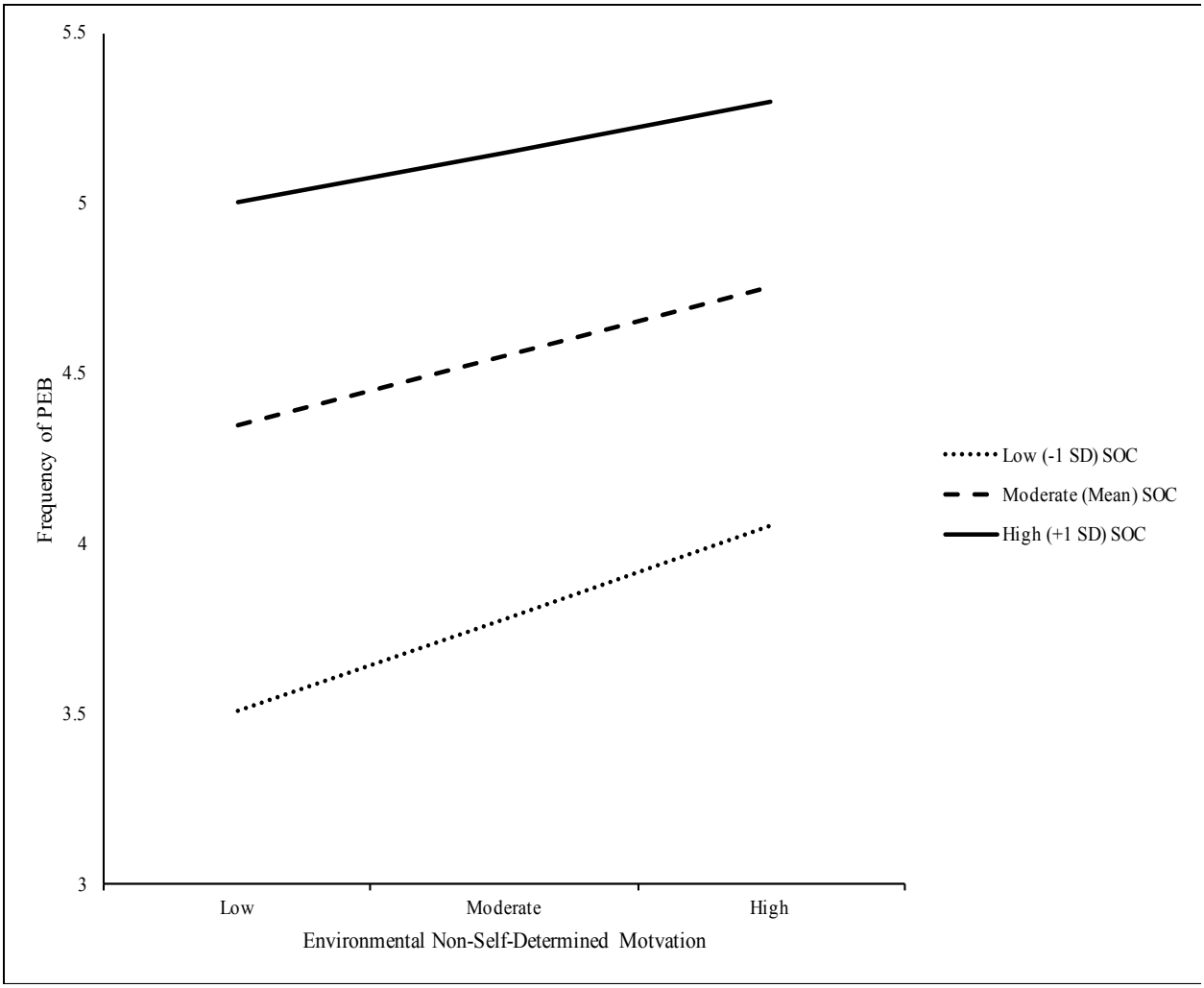


Figure 8. N = 529. The main effect of non-self-determined motivation toward the environment and stages of change on the frequency of pro-environmental behaviours adopted.
Note. SOC = Stages of change; PEB = Pro-environmental behaviours.

Figure 9. Visual Representation of the Main Effects and Interaction for NSDM and SOC in the Relationship with HEB for Study 2b

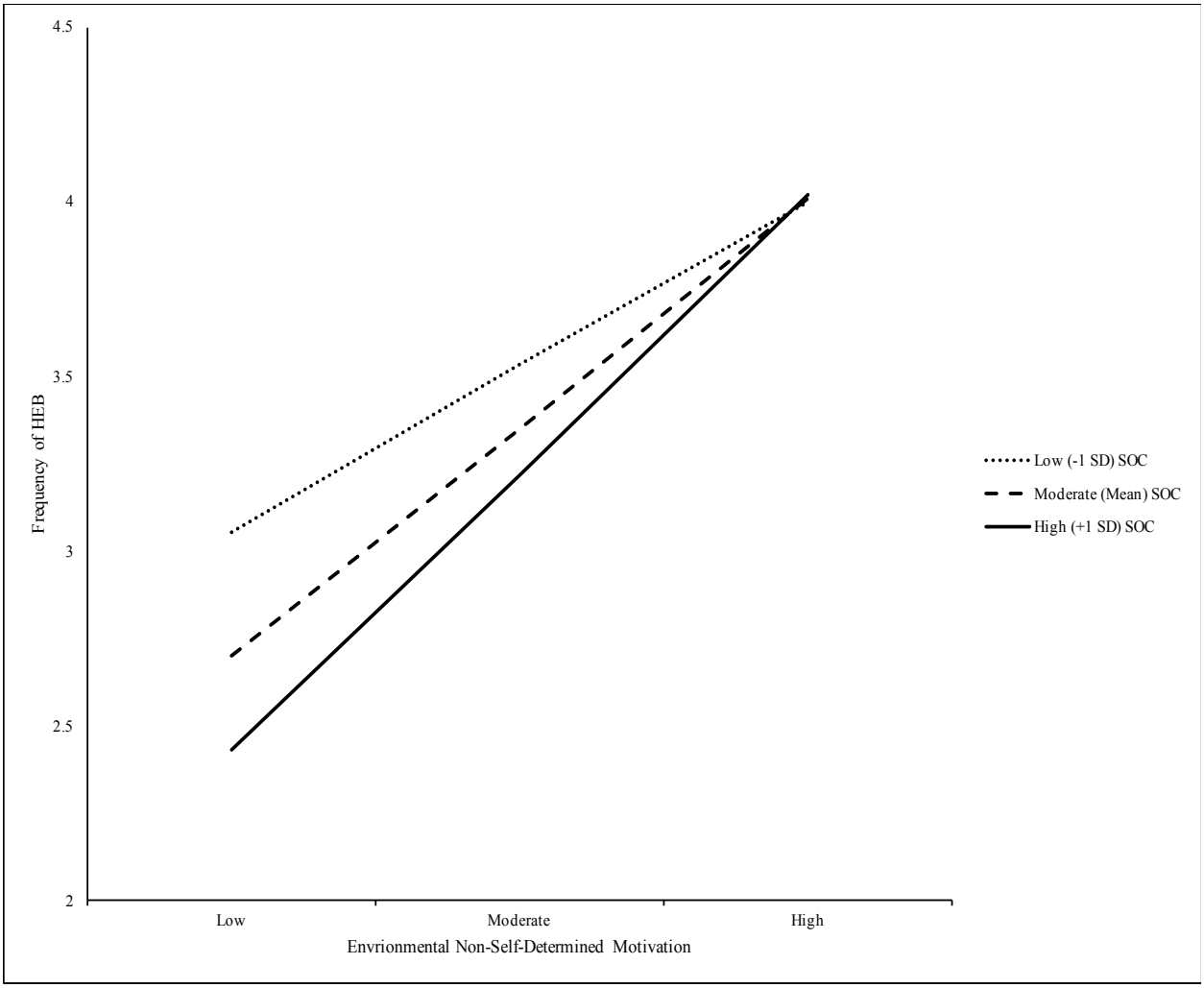


Figure 9. N = 529. The moderating role of stages of change in the relationship between non-self-determined motivation toward the environment and the frequency of harmful-environmental behaviours adopted
Note. SOC = Stages of chance; HEB = Harmful-environmental behaviours.

Discussion

As a whole, the results of the two studies presented in this chapter provide further support and go beyond findings from the first study. They aimed to replicate results in samples drawn from a similar population and a different population as well as to explore the idea that SOC could play a key role in relation to environmental motivation and behaviours. Accordingly, the purpose of *Studies 2a* and *2b* was in line with ideas from Pelletier and Sharp (2008) and Semeza and his collaborators (2008) as it was to determine whether differences in environmental motivation and behaviours can be identified across the different SOC as well as to examine whether SOC would moderate or mediate the relationships between motivation and behaviours. It was therefore hypothesized that levels of SDM and PEB would be greater in the later SOC while levels of NSDM and HEB would be lower. It was also hypothesized that in addition to the effects of SDM and NSDM on PEB and HEB, SOC should be related to both types of behaviours. Finally, we considered the possibility that SOC would moderate the relationship between SDM and these behaviours in that the effect would increase as people progress on the SOC, but expected SOC to mediate some of the relationships between motivation and behaviours.

With respect to the first set of analyses for *Studies 2a* and *2b* that aimed to replicate results from *Study 1*, most of the hypotheses were supported in the same way. In both samples, a clear distinction was made between PEB and HEB, thus reinforcing the idea that positive and negative behaviours should both be considered as outcomes. With regard to the relationship of motivation with both types of behaviours, like in the first study, results were very similar in that SDM was positively related to the reported frequency of PEB and negatively related to the reported frequency of HEB, and NSDM was linked in a positive manner to HEB. However, in

the second sample, NSDM had a positive relationship with PEB. While this might lead us to think that NSDM can promote a greater reported frequency of PEB, it is important to note that the relationship is much smaller than the one SDM has with PEB. In addition, the positive association of NSDM with HEB is much greater than the one with PEB. Consequently, if we consider these results, NSDM could possibly have a slight positive impact on positive behaviours, but not without also possibly promoting a much greater frequency of negative behaviours. Finally, when we compared individuals who tend to adopt PEB more frequently than HEB to their opposites, only the results for levels of SDM replicated in *Study 2a* and *Study 2b*. That is, people who adopted PEB more frequently than HEB displayed higher levels of SDM but did not differ on levels of NSDM. All in all, these results are important as they highlight how important it is to study both positive and negative behaviours as the relationship with environmental motivation appears to differ from one type of behaviour to the other. Another important facet of these findings is that the relationship with SDM seems to be more consistent than the relationship with NSDM. This gives more weight to the argument that when trying to promote greater environmental impact, it may be important to focus on fostering SDM as opposed to trying to promote it using guilt and shame, pressure, incentive, or punishment and thus fostering NSDM. With the tendencies identified in the first study being mostly confirmed, the next step involved exploring the possible key role of SOC in the quest for greater environmental impact. Results from the second set of analyses for *Studies 2a* and *2b* provided some insight relative to this idea.

Findings regarding the role of SOC supported hypotheses for *Study 2a* and partially supported them for *Study 2b*. In fact, reported levels of SDM and PEB were significantly higher while NSDM and HEB were significantly lower when participants were further along the process

of environmental behaviour change. To be more specific, in both studies, people at the implementation, maintenance, and integration stages mostly differed from those in the detection and decision stages. In the second sample, those at the integration stage also differed from those at the implementation stage on the levels of SDM and the reported frequency of PEB in addition to having a significantly lower reported frequency of HEB than people at all other stages. These results are in line with previous research for the levels of SDM (Mullan & Markland, 1997; Daley & Duda, 2006; Thøgersen-Ntoumani & Ntoumanis; 2006; Fortier et al., 2012) and add to the literature by demonstrating similar tendencies for NSDM as well as for positive and negative behaviours. What is more, these results lend support to the idea that motivation and behaviours might differ across SOC within the environmental context. It seems that reaching the implementation stage, at the very least, may be important in order to notice differences in the levels of motivation and the frequency of behaviours that people adopt, and that the greatest difference may be noticeable once they reach the integration stage.

Results from *Studies 2a* and *2b* supported all hypotheses pertaining to the main effects of SDM, NSDM, and SOC on PEB and HEB with the exception of NSDM in the second sample who, as opposed to what was expected, had a low but positive relationship with PEB. These findings simply support previously stated conclusions that SDM and SOC could be very important for the adoption of more PEB and less HEB and that NSDM, even if positive at times for PEB, seems to be mostly related to higher HEB. One noteworthy finding from these studies relates to the relationship between SDM and SOC. Results entertain the possibility of SOC playing the role of moderator or mediator in the relationship between environmental motivation and behaviours. Regardless of the definite role, this highlights the importance of both frameworks in the environmental context.

There is a very important implication of considering SOC when examining the relationship between environmental motivation and behaviours. If individuals are not distinguished by the stage they find themselves at, we might be wrongly estimating the effects of motivation on behaviours. In some instances, someone who is only recently highly motivated to be more environmentally friendly might not have had the time to progress from the early stages to the later stages, while in other cases individuals could have sustained this motivation for a long enough period to allow them to have progressed through the different stages. This distinction is important as it could help guide what dependent variables should be used in research. For example, when in the earlier stages such as the detection and decision stages, people have yet to actually change their behaviour, hence, a good option might be to measure their intentions to act. If we take those at the implementation stage, we could consider the extent to which they plan on adopting more PEB or reducing HEB as well as the measure of the frequency of easy behaviours. In the same way, those at the maintenance and integration stages should actually be enacting their planned behaviours and adopting the most difficult PEB. Thus, it is when considering the people in these final stages that the frequency of PEB and HEB should be measured.

When studying the effects of motivation on environmental behaviours, it is, thus, important to distinguish people according to SOC and it might also be advisable to consider adding different types of measures for behaviours such as intentions to act and behaviour planning to further measure the effect of motivation.

Finally, not only does SDM have the potential to promote a higher frequency of PEB and a lower frequency of HEB, but it appears to do so, partially, by pushing people to progress on the SOC continuum. Therefore, in order to get the most out of individuals when it comes to being

environmentally friendly, we might want to focus on fostering SDM and helping them progress in the behaviour change process by tailoring the information they receive to where they find themselves in this process.

These studies contribute to the literature by emphasizing the importance of high quality motivation and the progression on the change process in the fight to preserve the environment. It does, however, open up the discussion on what might help foster such high-quality motivation and the progression in SOC in addition to what might help prevent low quality motivation. The third study of this program was put together in order to determine whether basic psychological needs could play the role of determinants of motivation, SOC, and behaviours. We therefore added measures of nature relatedness, autonomy, competence, and relatedness to *Study 3* in order to explore this idea.

Chapter 4

Study 3

In the first two studies we aimed to demonstrate that positive and negative environmental behaviours are linked in a different way to environmental motivation and that SOC play a key role in this relationship, either as mediator or a moderator. In this third study, we aim to replicate findings from the second set of studies and to further examine the role of SOC in order to better determine whether it should be considered as a mediator or a moderator in the relationship between environmental motivation and behaviours. Specifically, for *Study 3*, the first objective is to introduce basic psychological needs as defined by SDT, including nature relatedness, as determinants of environmental motivation to measure and compare their effects. Next, we also aim to test a full path model comprised of basic psychological need satisfaction and frustration, nature relatedness, SDM, NSDM, SOC, PEB, and HEB in an attempt to understand what is associated with change as well as with a higher frequency of PEB and a lower frequency of HEB.

Through the first two studies, we demonstrated that SDM, NSDM, SOC, PEB, and HEB are associated. The integration of basic psychological needs into the model, as it has often been shown to play a key role in the adoption of PEB (e.g., Lavergne et al., 2010), makes theoretical and conceptual sense. In addition, given the recent findings on nature relatedness on its positive impact on humans and within the environmental context, its inclusion as a determinant that possibly impacts environmental motivation, change, and behaviours directly or indirectly seems like a coherent addition to the model.

In relation to the first specific objective of the third study, the hypotheses were the following: That need satisfaction would have a positive relationship with SDM (*Hypothesis 1a*)

while need frustration would have a negative one (*Hypothesis 1b*) and that need satisfaction would be negatively associated with NSDM (*Hypothesis 2a*) whereas need frustration would be positively associated (*Hypothesis 2b*); that nature relatedness would positively related to SDM (*Hypothesis 3a*) and that it would explain a significant amount of additional variability than needs (*Hypothesis 3b*); that nature relatedness would be negatively linked to NSDM (*Hypothesis 4a*) and that it would explain a significant amount of additional variability than needs (*Hypothesis 4b*). With regard to the second specific objective, the full path model, the hypotheses were as follow: that nature relatedness would have a direct effect on SDM (*Hypothesis 5a*), NSDM (*Hypothesis 5b*), SOC (*Hypothesis 5c*), PEB (*Hypothesis 5d*), and HEB (*Hypothesis 5e*) in addition an indirect effect on PEB (*Hypothesis 6a*) and HEB (*Hypothesis 6b*); that need satisfaction would have an indirect effect on PEB (*Hypothesis 7a*) and HEB (*Hypothesis 7b*); and the need frustration would have an indirect effect on PEB (*Hypothesis 8a*) and HEB (*Hypothesis 8b*). The hypothesized path model can be found in *Figure 10*.

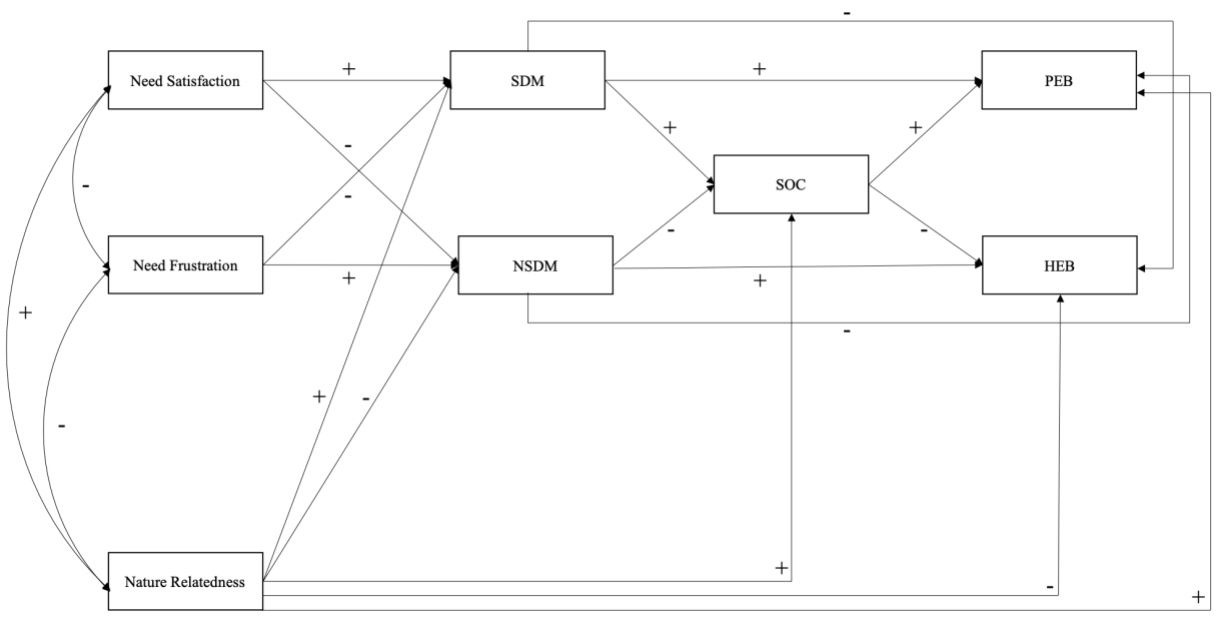


Figure 10. Hypothesized model for Study 3

Methodology

Participants

The sample for the third study was composed of students from the University of Ottawa's ISPR (sample size $N = 542$). The participants' average age was of 19.13 years ($SD = 2.63$, range = 17 – 42). The sample was composed mostly of female participants (77.3%) and rest of the sample was composed of males (22.1%), one person who preferred not to disclose their gender (0.2%), one person who did not respond (0.2%), and one person who did not answer the gender question (0.2%). In this sample, participants reported being Caucasian (48.9%), Asian (19.4%), Middle Eastern or Arab (12.2%), Afro-American or Afro-Caribbean (7.0%), preferred not to disclose (1.5%), did not answer (0.4%), or other (10.6%).

Procedures

This study was an in-laboratory questionnaire study. Participants who did not take part in any of the first two studies could register for an available time slot for the study on the ISPR platform, 24 hours prior to the time slot at the latest. Once registered, participants received an email the day prior to the study in order to remind them of their participation and the location of the study. The day of the study, participants had to present themselves at the INSPIRE laboratory in the University of Ottawa's school of psychology hall where a research assistant was waiting for them. The study was loaded on all computers using Qualtrics prior to the participants' arrival. The participants were asked to read the instructions and let the research assistant know if they had any questions. They were asked to complete a questionnaire that included measures of their environmental motivation, the frequency to which they engage in different PEB and HEB, the different environmental SOC, the satisfaction and frustration of their basic psychological needs, and their relatedness to nature. Upon completion, the research assistant explained the purpose of

the study in greater detail and let all participants know that they could contact the researcher if they had any questions. They were also awarded one percent (1%) toward their first-year class and their data was securely stored on the password protected Qualtrics servers (servers located in Toronto, Ontario, Canada). From the Qualtrics servers, all data was available to download and use for analyses.

Measures

Participants completed the same questionnaires as in the first two studies with the addition of a questionnaire to assess need satisfaction and frustration as well as nature relatedness.

Environmental motivation. As in the previous studies, participants completed the Motivation Toward the Environment Scale (MTES; Pelletier, Tuson, Green-Demers, Noel, & Beaton, 1998; See Appendix A) in order to assess their motivation toward the environment. With respect to the internal consistency of the subscales, values were of .92 and .72 for SDM and NSDM respectively.

Pro and harmful-environmental behaviours. Participants were also asked to fill out the Pro-Environmental and Harmful-Environmental Behaviours Questionnaire to assess the frequencies of the environmental behaviours (PEB and HEB) they usually adopt (See Appendix B). For PEB and HEB the internal consistency was assessed and values were of .76 and .69.

Stages of change for environmental behaviours. Participants then completed the Stages of Change for Environmental Behaviours (adapted from: Pope, Pelletier, & Guertin, 2018; See Appendix C) in order to determine how they identify to the different stages of change related to the environment. The Chronbach'a alpha value for the scale was .78 in this study.

Social desirability. Participants completed the adapted short version of the *Marlowe-Crowne Social Desirability Scale* (SDS; Crowne & Marlowe, 1960) that was developed by Reynolds (1982) (see Appendix D). For both the true and false items, the internal consistency was good at .83 and .82.

Basic psychological needs. Next, the *Basic Need Satisfaction and Frustration Scale* (BPNSFS; Chen et. al., 2015; See Appendix E) was used in order to assess the extent to which their basic needs are being satisfied or frustrated. The BPNSFS is composed 6 subscales containing 4 items each where participants have to report their level of agreement with the statements on the 7-point Likert scale ranging from 1 (not true at all) to 7 (completely true). These subscales represent autonomy satisfaction (e.g., "I feel a sense of choice and freedom in the things I undertake"), autonomy frustration (e.g., "Most of the things I do feel like "I have to""), competence satisfaction (e.g., "I feel confident that I can do things well"), competence frustration (e.g., "I have serious doubts about whether I can do things well"), relatedness satisfaction (e.g., "I feel that the people I care about also care about me") and relatedness frustration (e.g., "I feel excluded from the group I want to belong to"). This scale was assessed and demonstrated evidence of validity across four different cultures (i.e. Belgium, China, United-States, and Peru). For the purpose of the analyses, mean scores were computed for all the satisfaction subscales and all the frustration subscales where high scores represented elevated need satisfaction or frustration and low scores represented lower levels of need satisfaction or frustration. Internal consistency values were of .91 and .89 for satisfaction and frustration respectively.

Nature relatedness. Finally, the participants completed the Nature Relatedness Scale (NRS; Nisbet, Zelenski, & Murphy, 2009; See Appendix F) in order to assess their level of

relatedness to nature. The NRS is composed of 21 items and is divided into three subscales that refer to the self, perspective and experience. The self subscale includes eight items (e.g., "I always think about how actions affect the environment"), the perspective subscale has seven items (e.g., "Some species are just meant to die out or become extinct") and the experience subscale is composed of six items (e.g., "I enjoy being outdoors, even in unpleasant weather"). Initial validation of this scale was performed by the authors and they demonstrated adequate evidence of construct and criterion related validity. The overall nature relatedness score is calculated by averaging all items after doing the appropriate reverse scoring for specific items and high scores indicate high levels of nature relatedness while low scores indicate a low levels of nature relatedness. The internal consistency value for the overall nature relatedness scale was .86.

Validation questions. Once more, validation questions were included the questionnaire. In fact, there was one in the MTES (i.e., "Answer "Always" if you have read this question"), in the environmental behaviours questionnaire (i.e., "Please choose 4 (Corresponds moderately) to demonstrate you are reading the questions"), in the stages of change questionnaire (i.e., "Please select 1 (Never) to demonstrate you are paying attention, and in the NRS (i.e., "Please leave this answer blank to demonstrate you are paying attention. These questions were included in order to assess the quality of the participants' answers and in order to ensure the questions were read properly by participants.

Results

In this third study the objectives were, first, to test the same hypotheses as in the second study to determine whether results were replicated and determine whether SOC should be considered a mediator or a moderator. Next, we wished to determine whether the basic needs

proposed by SDT have an effect on environmental motivation and if nature relatedness has an effect above and beyond these needs, and, finally, to test a full model where needs, including nature relatedness, are associated with motivation, in turn this motivation is related to SOC, and finally SOC is linked to the reported frequency of environmental behaviours. In order to replicate findings from the second study, ANOVAs with Tukey post-hoc tests using IBM SPSS 25 and moderated and mediated regression analyses using the PROCESS Macro V3.3 (Hayes, 2017) were conducted. For the objectives specific to the third study, hierarchical regressions were used to determine the possible incremental effect of nature relatedness on environmental motivation in IBM SPSS 25. Finally, the full model was tested using Mplus v7 (Muthen & Muthen, 2012). Descriptive statistics and inter-variable correlations can be found in *Table 8*.

Table 8
Descriptive Statistics and Inter-Variable Correlations for Study 3

Study 3											
Variable	*M*	*SD*	Range	1	2	3	4	5	6	7	8
1. SDM	4.78	1.13	1.00-7.00	-	.17**	.56**	-.32**	.66**	.61**	.19**	-.13**
2. NSDM	3.20	.744	1.17-5.67	-	-	.05	.17**	.08	-.02	-.18**	.33**
3. PEB	3.83	.943	1.33-6.89	-	-	-	-.32**	.59**	.51**	.11*	-.09*
4. HEB	3.29	.856	1.33-6.00	-	-	-	-	-.33**	-.36**	-.15**	.21**
5. SOC	65.11	19.55	15.00-105.00	-	-	-	-	-	.59**	.10*	-.03
6. NR	4.59	.854	2.10-6.67	-	-	-	-	-	-	.22**	-.18**
7. NS	5.37	.927	2.33-7.00	-	-	-	-	-	-	-	-.66**
8. NF	3.17	1.14	1.00-6.75	-	-	-	-	-	-	-	-

Note. SDM = self-determined motivation, NSDM = non-self-determined motivation, PEB = pro-environmental behaviours, HEB = harmful-environmental behaviours, SOC = stages of change index, NR = nature relatedness, NS = need satisfaction, NF = need frustration.

*$p < .05$, **$p < .001$

Data Preparation

Prior to conducting any of the planned statistical analyses, data was screened and cleaned. Missing data was evaluated, validation question violations and time take to complete the study were considered, and outliers were dealt with.

Missing data. Once again, a missing values analysis was done in order to identify the nature of the missing data. The analysis suggested that data was not missing completely at random, $\chi_2(37881) = 38931.87$, $p < .001$, and in reason of no item having more than 2% of missing data, the data was imputed using the EM algorithm.

Removing participants. Participants that were screened as problematic relative to validation question and time taken to complete the questionnaire were removed from the sample.

Validation questions. Participants who failed to answer even one of the validation questions, were considered as inattentive and removed from the study. Consequently, 32 participants were removed because they failed at least one validation question, leaving us with a new sample size of $N = 510$.

Time taken to complete the questionnaire. Once again, time was transformed into standardized scores and any participant who had taken less than -3.29 standard deviations to complete the questionnaires were removed as they were considered to have completed the questionnaire too quickly. A total of two participants completed the questionnaire in a time that was deemed too quick and were removed from the sample, resulting in a sample size of $N = 508$.

Outliers. Both univariate and multivariate outliers were considered in the screening process. For the univariate outliers, values who fall outside of the suggested ± 3.29 z-score range were winsorized to the next acceptable value within the suggested range. In total, 25 univariate

outliers were detected and winsorized. As for multivariate outliers, only one was detected using the Mahalanobis distance at $p < .001$ and was removed from the sample for this study.

After the screening and cleaning process, a new sample of $N = 507$ (106 males, 399 females, 1 who reported other, and 1 with no selection) was available to proceed with the analyses.

Replication of Study 2

The following analyses, ANOVAs with Tukey post-hoc and moderated and mediated regressions, were conducted to determine whether results for the sample of *Study 3* would be similar to those from *Studies 2a* and *2b*.

Environmental motivation and behaviours across SOC. In this sample, 84 people reported being in the detection stage, 77 in the decision stage, 160 in the implementation stage, 157 in the maintenance stage, and 29 in the integration. As the sample sizes for the different groups were unequal, ratio of 5.5 when comparing the implementation stage to the integration stage, the Tukey HSD post-hoc was used once more to increase control for family-wise type I error (Saunder & Demars, 2019).

Adequacy of data for ANOVA. Just as with all other analyses we confirmed normality of the data, homogeneity of variances across groups, the absence of outliers, and independence of errors before conducting the tests.

Environmental motivation. One-way ANOVAs were used for both means of SDM and NSDM to compare individuals in the different SOC. Overall group differences were identified for SDM ($F_{(4, 502)} = 18.54$, $p < .001$; $\eta_2 = .13$), but not for NSDM ($F_{(4, 502)} = 1.67$, $p = .155$; $\eta_2 = .01$). Regarding the specific differences in the levels of SDM across the different SOC, individuals in the implementation, maintenance, and integration stages had significantly higher

levels of SDM than those in the detection ($\Delta M = .908$, $p < .001$; $\Delta M = .893$, $p < .001$; $\Delta M = 1.26$, $p < .001$) and decision stages ($\Delta M = .742$, $p < .001$; $\Delta M = .727$, $p < .001$; $\Delta M = 1.10$, $p < .001$). With respect to results in the second set of studies, results for environmental SDM are supported in that, again, people in the later stages displayed significantly higher levels of motivation than those in the earlier stages, while results for environmental NSDM do not correspond to results or hypotheses for the second set of studies.

Environmental behaviours. Just as for environmental motivation a pair of one-way ANOVAs were conducted and revealed overall group differences across SOC for both PEB ($F_{(4, 502)} = 18.26$, $p < .001$; $\eta^2 = .13$) and HEB ($F_{(4, 502)} = 10.55$, $p < .001$; $\eta^2 = .08$). Specifically, for PEB, participants in the implementation, maintenance, and integration stages had significantly higher reported frequency of PEB than those in the detection ($\Delta M = .758$, $p < .001$; $\Delta M = .849$, $p < .001$; $\Delta M = .829$, $p < .001$) and decision ($\Delta M = .550$, $p < .001$; $\Delta M = .642$, $p < .001$; $\Delta M = .621$, $p < .001$) stages. In the same way, those in the implementation, maintenance, and integration stages had significantly lower reported frequency of HEB than those in the detection ($\Delta M = -.514$, $p < .001$; $\Delta M = -.569$, $p < .001$; $\Delta M = -.840$, $p < .001$) and decision stages ($\Delta M = -.319$, $p = .043$; $\Delta M = -.374$, $p = .010$; $\Delta M = -.645$, $p = .003$).

These results strongly support hypotheses and results from *Studies 2a* and *2b* as, once again, the reported frequency of PEB was higher while the frequency for HEB was lower for people in the later stages than those in the earlier stages.

A summary of the means and homogeneous subsets can be found in *Table 9*.

Table 9

Mean Differences for Motivation and Environmental Behaviours Across the Five Stages of Change for Study 3

	Stages of change				
	Detection	Decision	Implementation	Maintenance	Integration
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
SDM	4.12_{a} (1.14)	4.28_{a} (1.12)	5.03_{b} (.890)	5.01_{b} (.1.06)	5.38_{b} (1.51)
NSDM	3.33_{a} (.949)	3.27_{a} (.681)	3.12_{a} (.685)	3.22_{a} (.697)	3.02_{a} (.752)
PEB	3.24_{a} (.912)	3.45_{a} (.839)	4.00_{b} (.835)	4.09_{b} (.874)	4.07_{b} (1.20)
HEB	3.70_{a} (.964)	3.51_{ab} (.800)	3.19_{bc} (.767)	3.13_{bc} (.816)	2.86_{c} (.822)

Note. Stages of change with the same superscript letters are part of the same homogeneous subsets and do not differ significantly at $p < .05$.

Moderated relationships between environmental motivation and behaviours. In *Study 2a* the relationships between SDM and PEB and HEB were moderated by SOC while in *Study 2b* the relationship between NSDM and HEB was moderated by SOC. It was therefore important to run the same analyses on the sample for the third study in order to further examine whether SOC possibly plays a moderating role in the relationship between environmental motivation and behaviours. Again, four models were tested where the first pair of models tested the effects and possible interaction of SDM and SOC on PEB and HEB, and the second pair of models tested the effects and possible interaction of NSDM and SOC on PEB and HEB (Model 1; Hayes, 2017; bootstrapping samples = 5000).

Adequacy of data for moderated regressions. The assumptions for multiple linear regression were considered before testing the models. In fact, the residuals were normally distributed, there was no collinearity between SDM and SOC (tolerance = .56) or between NSDM and SOC (tolerance = .99), and the residuals confirmed the absence of heteroscedasticity and the presence of linear relationships.

Preliminary analyses. Age and social desirability were considered as possible covariates and were correlated with PEB and HEB in order to determine whether their effects should be considered in the model. Age did not correlate with PEB (r = -.03, p = .44) or HEB (r = .02, p = .59) while social desirability was significantly correlated with both PEB (r = .17, $p < .001$) and HEB (r = -.33, $p < .001$). We therefore included social desirability in the moderated regression models in order to control for its effect on both types of behaviours.

Main analyses. The regression model for the relationship between SDM and PEB was significant ($F_{(4, 502)} = 82.28$, $p < .001$). In fact, the main effects of SDM (b = .24, $t = 6.24$, $p <$ .001) and SOC (b = .02, $t = 8.33$, $p < .001$) on the reported frequency of PEB were significant.

These variables, however, did not interact in the relationship with the reported frequency of PEB (b = .0005, t = .013, p = .68); see *Figure 11* for are visual representation of the main effects. In the same way, the second model was also significant ($F_{(4, 502)}$ = 31.50, p < .001) and revealed significant main effects for SDM (b = -.09, t = -2.27, p = .02) and SOC (b = -.010, t = -4.12, p < .001). There was no significant interaction between SDM and SOC in the relationship with HEB (b = -.001, t = -.903, p = .37); see *Figure 12* for a visual representation of the main effects. Next, the third model was significant ($F_{(4, 502)}$ = 68.86, p < .001) and only significant effect was the main effect of SOC on the reported frequency of PEB (b = .028, t = 15.68, p < .001). NSDM had no effect on the frequency PEB (b = .060, t = 1.25, p = .21) and no interaction effect was identified (b = .004, t = 1.77, p = .08); see *Figure 13* for visual representation of the main effect. Finally, the fourth model was also significant ($F_{(4, 502)}$ = 32.86, p < .001). Both independent variables, NSDM (b = .154, t = 3.17, p = .002) and SOC (b = -.013, t = -7.52, p < .001), were associated HEB, but they did not interact (b = .002, t = .554, p = .580); see *Figure 14* for a visual representation of the main effects.

With respect to results from the second set of studies, they are very similar when we consider the main effects, but do not support the idea that the relationship between environmental motivation and behaviours is moderated by SOC. That is, SDM and SOC were linked to positive outcomes in that they had a positive relationship with the reported frequency of PEB and a negative relationship with the reported frequency of HEB while NSDM was linked to a higher reported frequency of HEB, and these effects of SDM and NSDM on PEB and HEB did not fluctuate with changing levels of SOC. These results suggest that the role of SOC in the relationship between of environmental motivation on environmental behaviours is more likely to be one of a mediator, which will be tested in the mediated regressions and in the full path model.

Figure 11. Visual Representation of the Main Effects for SDM and SOC in the Relationship with PEB for Study 3

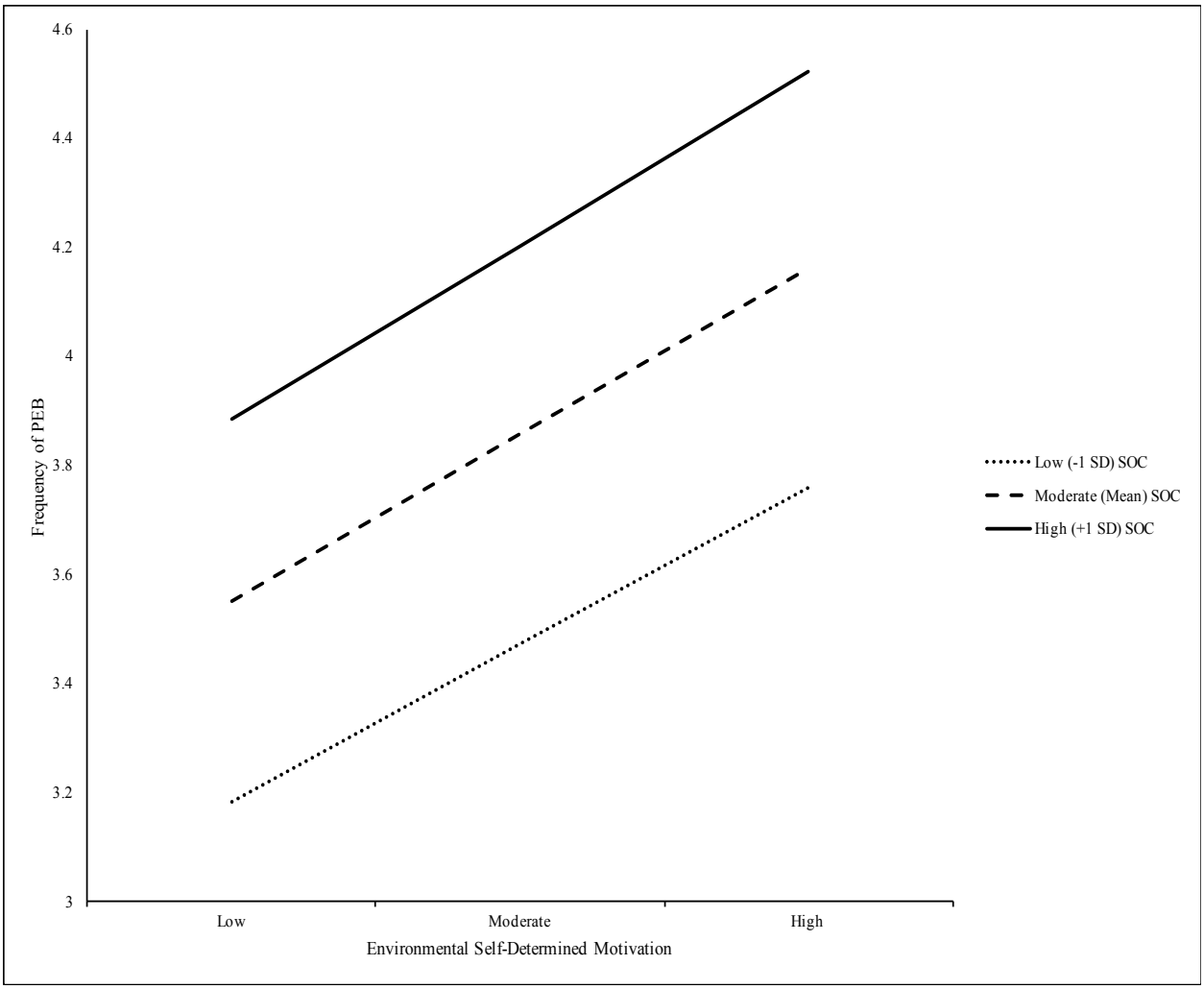


Figure 11. $N = 507$. The main effects of self-determined motivation toward the environment and stages of change on the frequency of pro-environmental behaviours adopted.
Note. SOC = Stages of change; PEB = Pro-environmental behaviours.

Figure 12. Visual Representation of the Main Effects for SDM and SOC in the Relationship with HEB for Study 3

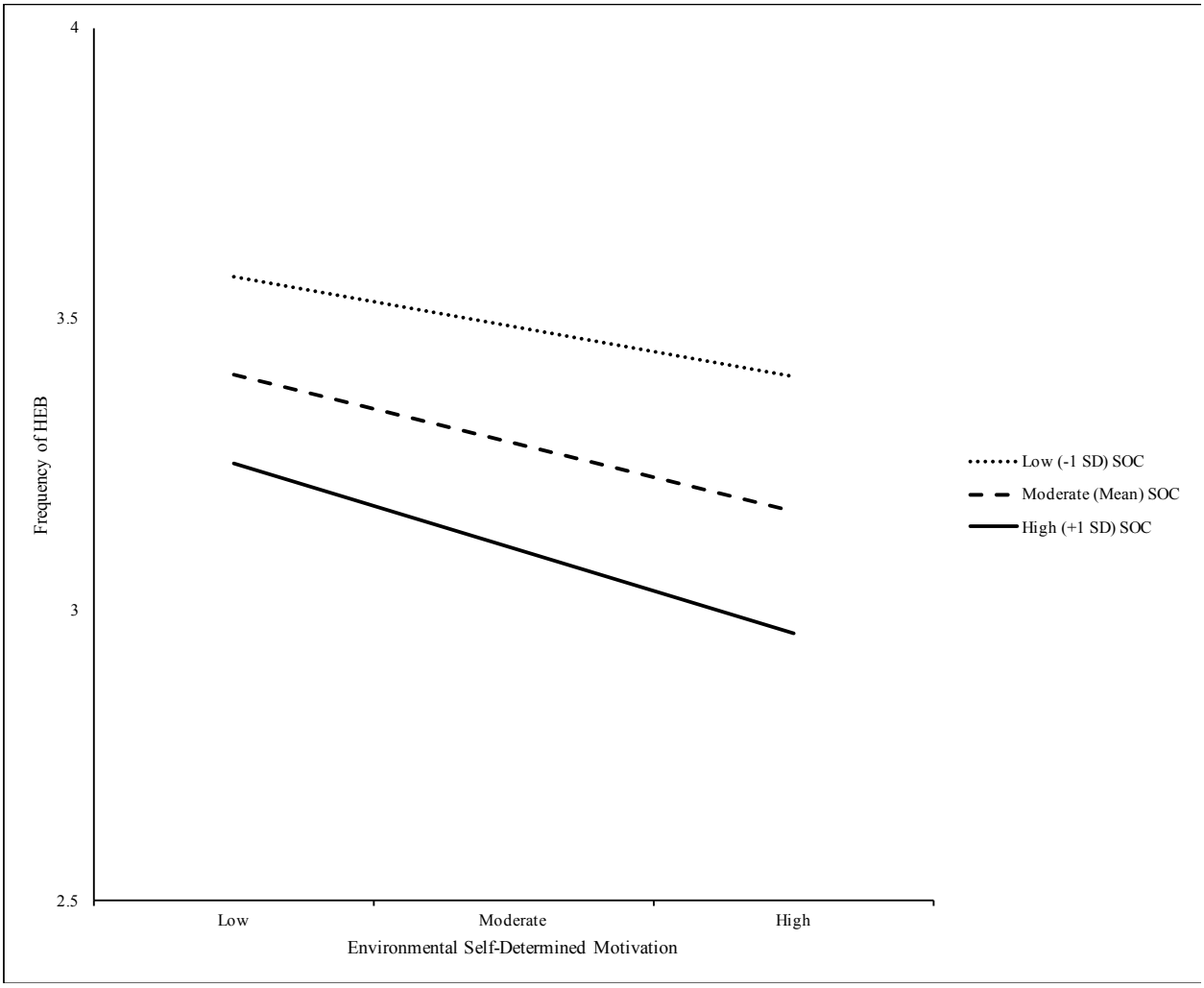


Figure 12. N = 507. The main effects of self-determined motivation toward the environment and stages of change on the frequency of harmful-environmental behaviours adopted.
Note. SOC = Stages of chance; HEB = Harmful-environmental behaviours.

Figure 13. Visual Representation of the Main Effect of SOC in the Relationship with PEB for Study 3

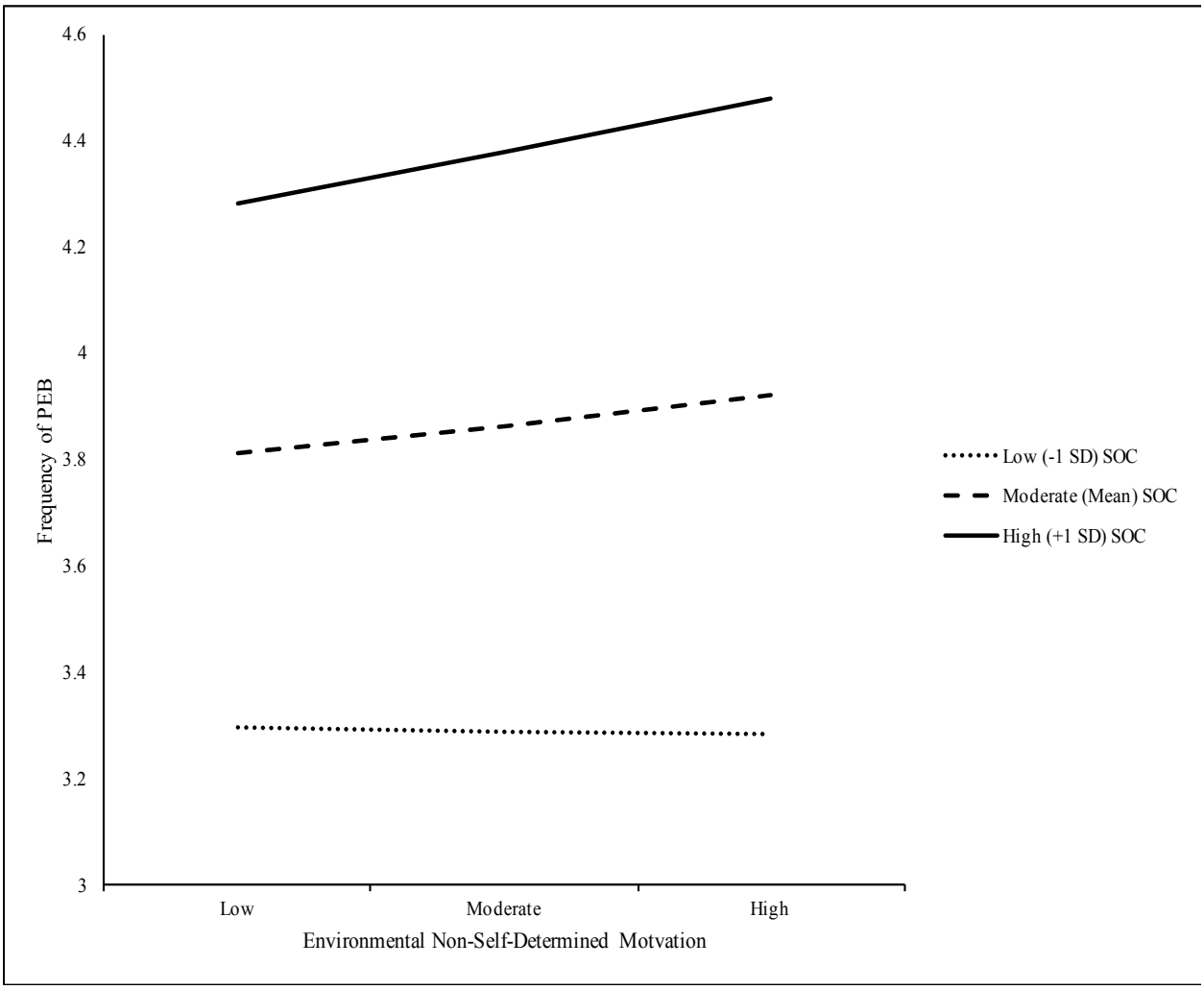


Figure 13. N = 507. The main effect of stages of change on the frequency of pro-environmental behaviours adopted.
Note. SOC = Stages of change; PEB = Pro-environmental behaviours.

Figure 14. Visual Representation of the Main Effects for NSDM and SOC in the Relationship with HEB for Study 3

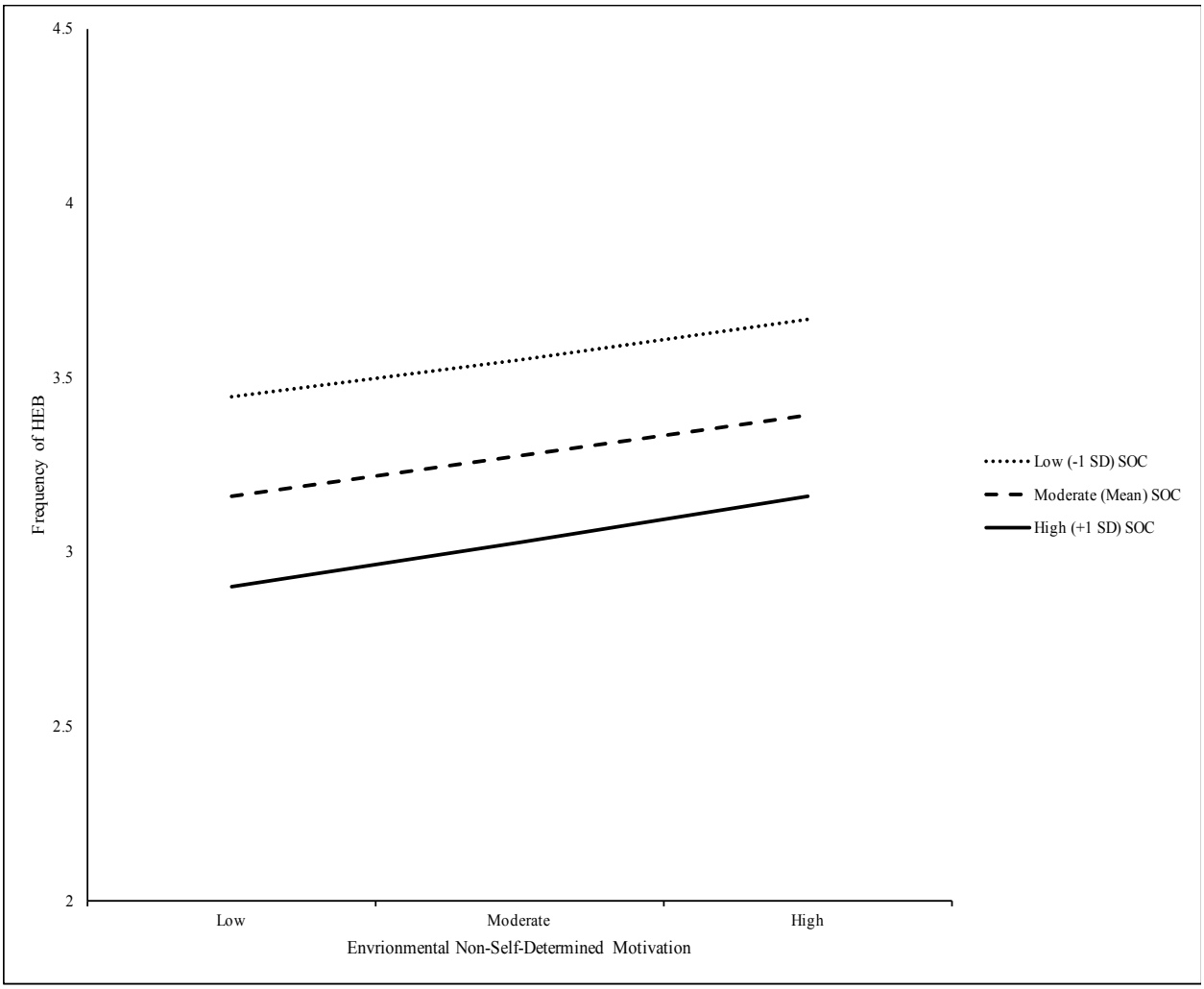


Figure 14. N = 507. The main effects of non-self-determined motivation toward the environment and stages of change on the frequency of harmful-environmental behaviours adopted.
Note. SOC = Stages of chance; HEB = Harmful-environmental behaviours.

Mediated relationships between environmental motivation and behaviours. The same four mediation models as in *Studies 2a* and *2b* were tested in order to confirm the mediating role of SOC in the association between environmental motivation and behaviours (Model 4; Hayes, 2017; bootstrapping samples = 5000). The assumptions were the same as for the moderated regressions and the same control variable were used.

Main analyses. The first model revealed that SDM was associated with SOC (b = 11.37, t = 19.30, $p < .001$) and PEB (b = .45, t = 14.44, $p < .001$) with also SOC being associated with PEB (b = .02, t = 6.88, $p < .001$). The direct effect of SDM on PEB (b = .24, t = 6.23, $p < .001$) in addition to the indirect effect through SOC (b = .21, BootCI [.161, .265]) were significant, thus revealing a partial mediation. The second model revealed that SDM was related to both HEB (b = -.20, t = -6.31, $p < .001$) and SOC (b = 11.37, t = 19.30, $p < .001$) as well as that SOC was associated with HEB (b = -.01, t = -4.05, $p < .001$). The direct (b = -.09, t = -6.31, p = .03) and indirect effect (b = -.11, BootCI [-.161, -.055]) were both significant, a partial mediation was, therefore, identified. For the third model, NSDM was linked to SOC (b = 3.16, t = 2.65, p = .008) and PEB (b = .13, t = 2.29, p = .02) while SOC was related to PEB (b = .03, t = 15.50, $p <$ .001). The direct effect of NSDM on PEB was not significant (b = .04, t = .94, p = .35) whereas the indirect effect through SOC was (b = .09, BootCI [.013, .160]), revealing a full mediation. Finally, the fourth model suggested that NSDM was associated with HEB (b = .11, t = 2.17, p = .03) and SOC (b = 3.16, t = 2.65, p = .008), and that SOC was also associated with HEB (b = -.01, t = -7.61, $p < .001$). A partial mediation was revealed as both the direct (b = .15, t = 3.16, p = .002) and indirect (b = -.04, BootCI [-.081, -.005]) effects were significant.

The results from this third study are very much in line with the results from the previous set of studies as SOC acts as a mediator in all four models just as in *Study 2b* while it did so in three models in *Study 2a*.

The replication of the moderation and mediation models that were assessed in *Studies 2a* and *2b* confirms that SOC may act more as mediating than moderating variable in the relationship between environmental motivation and behaviours. While no moderation was identified in any of the four tested models, all models revealed a significant mediating relationship (3 partial and 1 full). Thus, these results support the idea of including SOC as a mediating variable in the full path model used to assess the relationship between all variables included in this program of research. Using SOC as mediating variables in the model also allows us to determine whether it can mediate other relationships, such as the ones including nature relatedness, needs and environmental behaviours. This will be further discussed in the following sections.

Needs, Nature Relatedness and Environmental Motivation

Next, specific objectives for *Study 3* were to confirm the role of general need satisfaction and frustration in individuals' environmental motivation, and to determine whether nature relatedness could contribute as a need by explaining significant additional variability in both types of motivation. In order to explore this idea, two three-step hierarchical multiple regressions were conducted where the first block had social desirability (control variable) as an independent variable as well as SDM and NSDM as dependent variables, the second block had general need satisfaction and frustration in addition to social desirability the independent variables and both types of motivation as dependent variables, and in the third block, nature relatedness was added

to the three previous independent variables to measure its possible incremental effect on SDM and NSDM.

Adequacy of data for multiple regression. Once more, it was confirmed that all independent variables in the three blocks of the regression had acceptable tolerance levels (> .10) and that collinearity was not an issue. In addition, normality, homoscedasticity, and linear relationships were all assessed and found to be acceptable for multiple regressions.

Main analyses. The first three-stage hierarchical multiple regression was conducted for SDM. In the first step, social desirability contributed significantly to the model $F_{(1, 505)} = 28.78$, $p < .001$, accounted for 4.4% of the variability in SDM and had a positive relationship with SDM ($\beta = .21$, $p < .001$). In the second step, need satisfaction and frustration were added to the control variable, resulting in a significant regression model $F_{(3, 503)} = 14.30$, $p < .001$. This addition of the needs explained an additional 2.2% of the variability in SDM and this change in R^2 was significant $F_{(2, 503)} = 5.81$, $p = .003$. In this model, social desirability ($\beta = .19$, $p < .001$) and need satisfaction ($\beta = .18$, $p = .002$) were positively related to SDM, and need frustration had no effect ($\beta = .06$, $p = .30$). Finally, in the third step of the regression, nature relatedness was added to the model and all four independent variables, as a whole, contributed significantly to the model $F_{(4, 502)} = 61.57$, $p < .001$. The addition of nature relatedness explained an extra 30.7% of the variation in SDM and this change in R^2 was also significant $F_{(1, 502)} = 251.99$, $p < .001$. In this stage of the regression, social desirability continued to be positively related to SDM ($\beta = .09$, $p = .015$), but nature relatedness was the only need to be significantly related to SDM ($\beta = .58$, $p < .001$) as need frustration remained non-significant ($\beta = .06$, $p = .24$) and need satisfaction became non significant ($\beta = .07$, $p = .12$).

The next three-step multiple regression was conducted in the same way for NSDM. The initial stage, with only social desirability, was a significant regression model $F_{(1, 505)} = 35.38$, $p < .001$, it accounted for 6.5% of the variability in NSDM, and social desirability had a negative relationship with NSDM ($\beta = -.26$, $p < .001$). When need satisfaction and frustration were introduced in the model, an additional 6.7% of the variability in NSDM was accounted for and this change in R_2 was significant $F_{(2, 503)} = 19.41$, $p < .001$. In this second step, social desirability maintained its negative relationship with NSDM ($\beta = -.15$, $p = .001$), even if slightly reduced, need frustration had a positive relationship with NSDM ($\beta = .32$, $p < .001$), and need satisfaction was non significant ($\beta = .07$, $p = .21$). In the final step of this hierarchical multiple regression, nature relatedness was added to the model and this addition only provided an additional 0.4% of variability explained, a change in R_2 that was not significant $F_{(1, 502)} = 1.96$, $p = .16$. The relationships between the variables from the second step were maintained as social desirability was negatively related ($\beta = -.16$, $p = .001$) and need frustration was positively related to NSDM ($\beta = .32$, $p < .001$) while need satisfaction ($\beta = .06$, $p = .29$) and nature relatedness ($\beta = .06$, $p = .16$) had no significant relationships.

Relating these results to our hypotheses, we can say that half were supported by the data. To be more specific, *Hypotheses 1a* and *2b* were supported as need satisfaction positively related to SDM while need frustration positively related to NSDM, the opposite, however, was not found. What is more, the fact the nature relatedness was positively linked and was the only independent variable associated with SDM in addition to accounting for significant additional variability supported *Hypotheses 3a* and *3b*. However, it was not incremental to NSDM as only need frustration was related to this type of motivation.

Nature relatedness may be a very important addition to the SDT framework in terms of psychological needs as it explained a significant amount additional variability in environmental SDM. Although it did not contribute significantly to NSDM, the fact that it contributes to SDM is very important in that SDM was positively related to PEB and negatively related to HEB, and in consequence, it could contribute to environmental action at least indirectly. In the next section of the results these indirect effects in addition to possible direct effects will be tested in a full path model in order to determine the overall contribution of all the variables that have been considered up to this point. That is, a model including need satisfaction, need frustration, nature relatedness, environmental SDM and NSDM, SOC for the environment and PEB as well as HEB will be fitted and tested.

Full Path Model

The final objective of this third study and of the program of research was to test the integrative path model proposed in the introduction in order to determine the relationships between all variables. A link between SDM and NSDM was added to the model. As suggested by Kline (2010), associations that are not part of the hypothesized model can be added to achieve adequate model specification if it is theoretically and empirically relevant. Regarding empirical relevance, both motivation variables were correlated in the sample. As for theoretical relevance, autonomous and controlled motivation have been associated in past research (e.g, Lavergne et al., 2010; Lavergne & Pelletier, 2015; Aitken, Pelletier, & Baxter, 2016). Consequently, the association between environmental SDM and NSDM in this sample appeared to be relevant, and both variables were correlated in the path model.

Path analysis conducted through structural equation modelling (SEM) was chosen to test the hypotheses related to this objective and the model was assessed with Mplus V7 (Muthen &

Muthen, 2012). As using maximum likelihood (ML) as the estimator is one of the most widely recognized techniques for fitting SEM models, ML was used to assess the fit of the path model. When assessing model fit, the chosen fit indices are an important consideration. The fit indices chosen to assess the fit of our model are discussed below.

Fit indices. The model was assessed using recommendations from Hu and Bentler (1999). To be more specific, the chi-square fit statistic ($\chi 2$), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the Tucker-Lewis index (TLI) were used. When considering the chi-square fit statistic, non-rejection of the null hypothesis indicates a good model fit, but this test is sensitive to sample size and will often result in the null hypothesis being rejected even if the model has good fit, and it is therefore important to consider additional fit indices to properly assess to model. The RMSEA acts as an indicator of poor fit where high values imply poor fit and low values indicate a good fit and this statistic also adjusts in function of the model complexity by taking degrees of freedom into account. The SRMR for its part, informs us on the discrepancy between observed model results and expected model results by covariance matrices. For both RMSEA and SRMR a value below .08 indicated an adequate model fit while a value below .06 implied excellent fit. Next, the CFI and TLI compare hypothesized model fit to a baseline model fit and values above .90 are indicative of adequate/good fit and values over .95 represent excellent fit.

Adequacy of data for path analysis. As path analysis is a relatively complex way of testing a series of hypotheses many considerations about the data must be made prior to analyses. Therefore, before proceeding to analyses, the data was screened for issues relative to sample

size, multivariate normality, and multicollinearity in addition to all missing data and outliers being dealt with before previous analyses.

When conducting path analysis, a large enough sample size is needed in order to have reliable results. The general rule for the sample size is to have at least 200 cases or at least 20 cases per variable included in the model (Kline 2010). As the tested model contains a total of eight variables and we are using a total 507 cases, the suggested 20 to 1 ratio of cases to variables (8 x 20 = 160) and minimum suggested sample size of 200 were met.

Next, multivariate normality must be confirmed in order to proceed. As most violations of multivariate normality can actually be detected via univariate normality, the skewness and kurtosis of all eight variables were assessed. As large sample sizes tend to reduce the standard error of skewness and kurtosis and lead to significance being reached in more cases (Kline, 2010; Tabachnick & Fidell, 2007) the ratio of skewness to its standard error should be no greater than 3.00 while the ratio of kurtosis to its standard error should be no greater than 8.00. Using these guidelines, SDM (-.360/.108 = -3.33), SOC (-.360/.108 = -4.08), and need satisfaction (-.407/.108 = -3.77) were negatively skewed while HEB (.509/.108 = 4.71) and need frustration (.343/.108 = 3.18) were positively skewed. Furthermore, no variables were identified as having significant kurtosis. In reason of multivariate normality being violated, we proceeded by using bootstrapping (bootstrap = 5000 samples) as it has been proposed to address situations of non-normal data (Yung & Bentler, 1996).

Finally, multicollinearity was considered. Multicollinearity refers to very high correlations between variables, making them redundant and increasing the risk of unstable solutions (Tabachnick & Fidell, 2007). Using guidelines provided by Tabachnick & Fidell

(2007) where correlations between variables must be lower than .90, it was determined that there was no multicollinearity between the variables in this sample.

Once, missing data and outliers had been dealt with, the sample size was deemed sufficient, multicollinearity was ruled out, and bootstrapping was determined as a way to compensate for multivariate non-normality, we proceeded with assessing the model using path analysis through SEM.

Controlling for social desirability. As for previous analyses, we aimed to control for the effect of social desirability. The control variable was initially included in the model in order to control for its effect on both types of environmental behaviours. However, the inclusion of social desirability resulted in poor model fit which would have, in turn, lead to bias estimations. To address this issue, without simply excluding social desirability from the analyses, we proceeded by removing participants with high levels of social desirability to compare model fit and estimation of coefficients to the model with all participants. As no specific cut-off could be found in the literature for the questionnaire used herein, we removed participants who scored higher than 8/13 (approximately the highest 40%). Overall, there was a slight increase in model fit ($\chi_2(6) = 6.63$, $p = .36$, $CFI = 1.00$, $TLI = 1.00$, $RMSEA = .016$ $CI_{90}[.000, .067]$, $SRMR = .016$) and there were no noticeable differences in the relationships between variables in that they all remained significant and in the same direction. Because the results were essentially the same for the models with and without participants who had high social desirability, we proceeded by reporting results with all participants (see Appendix G for alternative model without participants with high social desirability).

Main analyses. Results from the path analysis revealed a good overall model fit for the hypothesized model ($\chi_2(6) = 8.46$, $p = .21$, $CFI = 1.00$, $TLI = .99$, $RMSEA = .028$ $CI_{90}[.000,$

.069], *SRMR* = .015). Moreover, most of the predicted paths were significant and in the hypothesized direction, with the exception of need satisfaction not being related to SDM or NSDM, NSDM not being associated with SOC or PEB, and nature relatedness not being related to NSDM. Therefore, a total of 11 of the paths were significant and in the predicted direction. Results for total, direct, and indirect effects are detailed in *Table 10* and summarized in *Figure 15*.

Table 10

Decomposition of Effects for Hypothesized Model of Study 3

	Endogenous Variables														
	SDM			NSDM			SOC			PEB			HEB		
Exogenous Variables	UST	SE	ST	UST	SE	ST	UST	SE	ST	UST	SE	ST	UST	SE	ST
Need Satisfaction															
Total effect	.088	.064	.072	.049	.047	.060	.727	.538	.034	.028	.021	.027	-.002	.013	-.003
Total indirect effects	-	-	-	-	-	-	.727	.538	.034	.028	.021	.027	-.002	.013	-.003
Direct effect	.088	.064	.072	.049	.047	.060	-	-	-	-	-	-	-	-	-
Need Frustration															
Total effect	.021	.050	.021	.247**	.038	.380	.152	.477	.009	.004	.020	.005	.055*	.017	.073
Total indirect effects	-	-	-	-	-	-	.152	.477	.009	.004	.020	.005	.055*	.017	.073
Direct effect	.021	.050	.021	.247**	.038	.380	-	-	-	-	-	-	-	-	-
Nature Relatedness															
Total effect	.789**	.052	.594	.033	.041	.038	13.25**	.875	.579	.559**	.042	.506	-.358**	.044	-.357
Total indirect effects	-	-	-	-	-	-	6.59**	.680	.288	.362**	.039	.328	-.156**	.044	-.156
Direct effect	.789**	.052	.594	.033	.041	.038	6.66**	1.02	.291	.197**	.049	.178	-.201**	.062	-.201

Note. * $p < .05$, ** $p < .001$; SMD = self-determined environmental motivation, NSDM = non-self-determined environmental motivation, SOC = stages of change, PEB = pro-environmental behaviours, HEB = harmful-environmental behaviours; UST = unstandardized, SE = standard error; ST standardized.

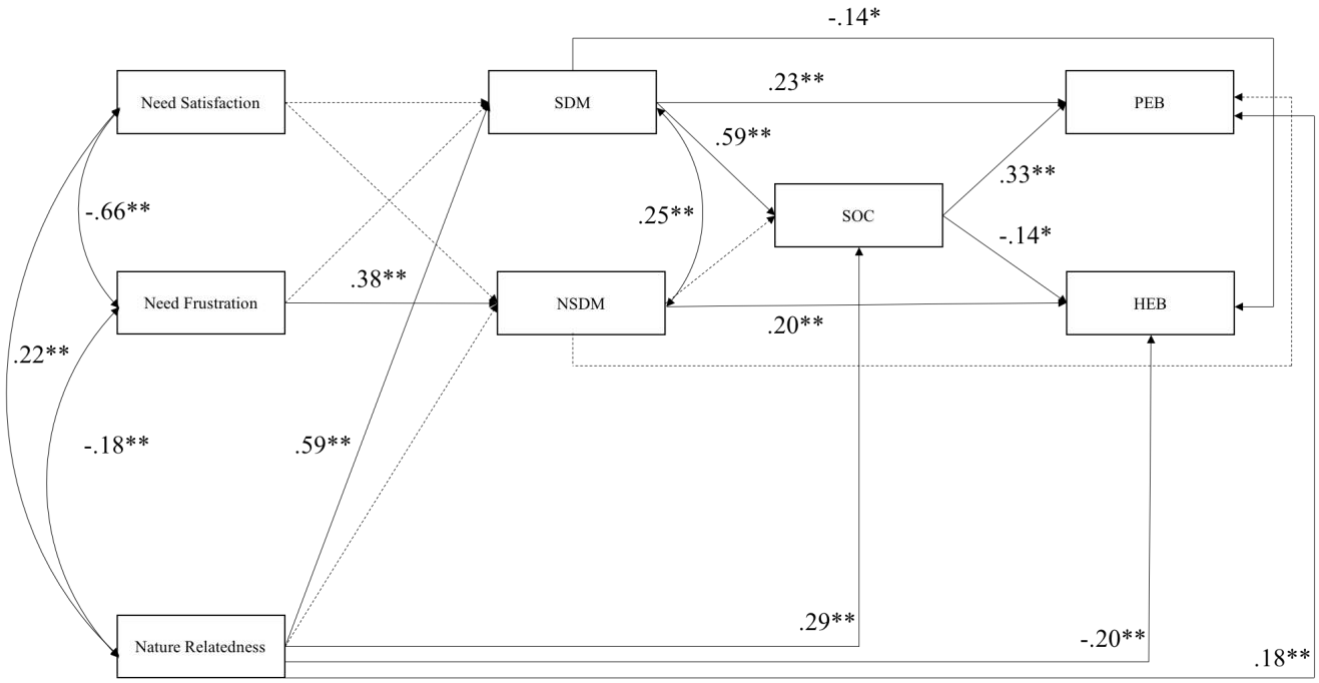


Figure 15. Tested model with standardized coefficients for Study 3.

Effects on SDM. As expected, the levels of environmental SDM were directly associated with nature relatedness. Overall, 37.1% of the variability in levels of SDM was explained by the model.

Effects on NSDM. Like SDM, the variability in environmental NSDM was only explained by one exogenous variable. In fact, need frustration had a direct positive association with levels of NSDM. For this type of motivation, the model accounted for 11.5% of its variability.

Effects on SOC. The score representing where individuals find themselves in the SOC process was explained by nature relatedness directly and indirectly. First, high levels of nature relatedness were directly associated with high SOC and, second, nature relatedness positively related to levels of SDM which, in turn, was associated with higher SOC. This direct and indirect effects of nature relatedness with SOC accounted for 49.1% of its variability.

Effects on PEB. A number of variables helped explain variance in reported PEB. First, it was directly affected by nature relatedness in that higher levels of nature relatedness related to a higher reported frequency of PEB. Next, nature relatedness had an indirect association to PEB through SOC where high nature relatedness was linked to a higher SOC score which, in turn, was associated with a higher reported frequency of PEB. In a similar way, nature relatedness had indirect effects on PEB via SDM which then affected PEB through SOC and directly. While nature relatedness was associated with PEB, neither need satisfaction nor frustration had indirect effects on the reported frequency of PEB. All in all, the direct and indirect effects explained a total of 41.2% of the variability in the reported frequency of PEB.

Effects on HEB. Like with PEB, several variables explained the variability in the reported frequency of HEB. Starting with nature relatedness, it had a direct effect on HEB in that

high levels of nature relatedness related to a lower reported frequency of HEB. Nature relatedness also affected HEB indirectly through SOC as nature relatedness was positively linked to SOC and SOC then related to HEB negatively. In addition, HEB was affected indirectly by nature relatedness through SDM in two ways. First, nature relatedness associated with higher levels of SDM which in turn directly related to a lower reported frequency of HEB and, second, nature relatedness was associated with higher levels of SDM which were then related to high SOC, and in turn, SOC was associated with a lower reported frequency of HEB. Finally, need frustration had an indirect effect on HEB as high frustration was linked to higher NSDM which was then related to a higher reported frequency of HEB. In total, 20.0% of the variability in the reported frequency of HEB was explained by the direct and indirect effects.

If we consider the hypothesized model, we can say that *Hypotheses 5a, 5c, 5d,* and *5e* are supported by the fact the nature relatedness had a direct effect on SDM, SOC, PEB, and HEB. We can also confirm that, because nature relatedness had indirect effects on both PEB and HEB, *Hypotheses 6a* and *6b* are supported. Finally, *Hypothesis 8b* is supported as the reported frequency of HEB was indirectly impacted by need frustration. In total, seven out of the 11 original hypotheses are supported by the path model.

It seems that nature relatedness may not only be related to environmental SDM above and beyond need satisfaction and frustration, it might also be a key variable in the process of behaviour change and in the adoption of positive and negative environmental behaviours. As depicted through these analyses and results, the SOC process and adopting more PEB as well as less HEB is not simple. However, relating to nature seems to be a prominent variable in these processes and it reinforces the proposition that it might be a significant psychological need, in the environmental context at least.

Discussion

This study had several goals. First, it aimed to further investigate the role of SOC in the relationship between environmental motivation and behaviours. As such, moderated and mediated regression models were tested, once more, in order to better determine its role. The models revealed that SOC was better suited as a mediator than a moderator and thus, the proposed full path model where SOC is considered and tested as a mediator was supported by our results. The aim of the third study was also to explore the role of basic psychological needs, including nature relatedness, as possible determinants that could provide insight on what leads to change and to good patterns of environmental behaviours. Accordingly, it was hypothesized, in this third study, that nature relatedness could contribute to environmental motivation above and beyond need satisfaction and frustration. In addition, we had also proposed that nature relatedness should have a positive association to the SOC process and on the reported frequencies of PEB and HEB. Through hierarchical regressions and path analysis, most of our hypotheses were supported.

If we consider the findings from the hierarchical multiple regressions where nature relatedness was included in the model in the step following need satisfaction and frustration, we can see that nature relatedness appears to play a key role in explaining environmental SDM. While it didn't contribute to the variability accounted for in NSDM as only need frustration was linked, positively, to this type of motivation, nature relatedness explained a very large amount of additional variability in SDM. These results strongly support the idea that nature relatedness may play an important role in the environmental context and that it is a strong candidate for fourth a basic psychological need. Another noteworthy finding from these analyses is that even though need satisfaction was positively associated with SDM, this association disappeared when nature

relatedness was included in the model and its effect was accounted for. If we consider this in a purely statistic manner, we can consider that when it comes to environmental SDM, nature relatedness could, potentially, represent a more important need . Looking at results from the first and second studies and considering the full path model, the inclusion of nature relatedness is very promising as it seems to be positively related to SDM and we have demonstrated that SDM can have the desired association with PEB and HEB, directly and through SOC. In addition, nature relatedness may also be related the process of change and the adoption of environmental behaviours directly. Results from the path analysis model provided a better understanding of its role in the SOC process and the adoption of environmental behaviours.

The path analysis model was proposed and tested in an attempt to better understand the role of each variable in this program of research (need satisfaction, need frustration, nature relatedness, SDM, NSDM, SOC, PEB, HEB) and untangle the links between them. In the model, need satisfaction and frustration in addition to nature relatedness were set as exogenous variables indirectly associated with behaviours through motivation and SOC, and, also, directly in the case of nature relatedness. First, it was proposed that need satisfaction would be linked to higher reported PEB and lower reported HEB indirectly through motivation and SOC, and that need frustration would be related to lower reported PEB and higher reported HEB indirectly through motivation and SOC. While need satisfaction had no effect in the model, need frustration, mediated by NSDM, was associated with higher reported HEB. In fact, higher levels of need frustration related to higher levels of NSDM which, in turn, were linked to higher reported HEB. These results for the basic needs were to be expected if we consider results from the first part of this study. Because nature relatedness was included in the model, need satisfaction had no effect SDM and, in turn, on PEB. Next, when we look at the novel need proposition that is nature

relatedness and what it contributes to the model, we can consider, again, that it may play a prominent role. To be more specific, it was positively associated with PEB and negatively to HEB through serial mediation (partial), simple mediation (partial), and directly. For PEB, nature relatedness was associated with higher levels of SDM, these levels of SDM were associated with being further in the SOC process, and in turn SOC related to a higher reported frequency of PEB. Next, nature relatedness was also associated with a higher reported frequency of PEB by being linked to higher SDM and SOC, which, in turn, directly related higher reports of PEB respectively. Finally, nature relatedness, in addition to being associated with more PEB through mediations, also related to a higher reported frequency of PEB directly. As for, HEB, the same direct and indirect effects were found. That is, high nature relatedness was directly associated with lower reported HEB, but it also related to lower reported HEB through SDM and SOC, which were then individually and directly linked to HEB, and by association with high levels of SDM, which was associated with being further in SOC, which, in turn, was associated negatively to HEB.

These results are in line with the first two studies with regard to the associations between both motivation and SOC and environmental behaviours. In addition, although research had yet to examine the link between nature relatedness, motivation and SOC, results are in line with the literature that supports the idea that nature relatedness is linked to PEB (e.g., Nisbet et al., 2009; Nisbet & Zelenski, 2013), positive attitudes toward the environment (e.g., Brehm et al., 2006), and environmental concern (e.g., Dutcher et al., 2007). Based on all the positive impacts of nature relatedness that have been previously demonstrated in past research, it is no surprise that it might play such a prominent role in influencing environmentally related variables.

In brief, if we look at the role of the psychological needs, need satisfaction doesn't seem to play a significant role in the context of environmental change and behaviours while need frustration could be associated with higher HEB. The key element in this model, is without a doubt, nature relatedness. This potential need was associated with environmental SDM, SOC, and behaviours, thus lending support to the idea that connecting to nature might, not only motivate people to act in more environmentally friendly manner, but also it might help them move along in the process of change and, possibly, lead them to do more PEB and less HEB.

The current study contributes to the environmental psychology literature and self-determination theory literature. By showing that nature relatedness has such a large relationship with environmental SDM, the SOC process, and behaviours, it underlines the critical role of nature relatedness. Not only does it demonstrate that connecting to nature is extremely important, but also it suggests that the conservation of our natural environment and the creation of green spaces could play an important role in facilitating the connection to nature. By protecting our natural environment and creating more green spaces, we could be enabling and facilitating higher levels of nature relatedness, which could help people become more motivated, help them change, lead them adopt more behaviours that are good for the environment, and help them reduce behaviours that are harmful for the environment.

All in all, these three studies, while in need of replication and cross-context validation, provide a plethora of new information that is relevant, now more than ever, to better understand how to preserve the environment.

Chapter 5

General Discussion

The research presented in this thesis had, as an overarching purpose, to better understand what are the two different facets of environmental behaviours and to explore the role that SOC and nature relatedness play within the SDT framework associated with environmental action. Namely, one of the key elements of this thesis was to demonstrate that environmental action is not only about increasing positive behaviours (PEB), but also about reducing negative behaviours (HEB). As concerns for the state of the environment continue to increase day after day and efforts to counteract the effects of human behaviour on the environment are on the rise, the distinction between PEB and HEB becomes increasingly important. In the same way, as new key variables such as SOC and nature relatedness are proposed in the literature, it becomes equally important to understand the roles they play within the environmental context as variables that could possibly foster PEB and reduce HEB. As such, the research presented herein focused on three major themes. Firstly, providing evidence that PEB and HEB are not only distinct types of behaviours, but that they are also related differently to environmental motivation. Secondly, to demonstrate that SOC may play an important role in the relationship between environmental motivation and behaviours. Thirdly, to evidence that nature relatedness might play an important role as a determinant of environmental motivation, SOC, PEB, and HEB, this above and beyond the roles played by basic need satisfaction and frustration as defined by SDT. The findings from all three studies provided some innovative insights that are discussed below.

Summary of Findings

Study 1. Results from this research provided us with very interesting information in relation to all three themes explored by this thesis. The first study supported the distinction

between positive and negative environmental behaviours. First, this distinction was made psychometrically by demonstrating that PEB and HEB load on separate factors. Second, it was made theoretically by demonstrating that SDM had a positive link to PEB and negative link to HEB while NSDM had a positive link to HEB and no apparent link to PEB, and by demonstrating that individuals with higher PEB displayed higher levels of SDM and those with higher HEB displayed higher levels of NSDM.

Study 2. The second study expanded on the first study by integrating SOC in the relationship between environmental motivation and behaviours using two different samples. In a first step, we examined if levels of SDM and NSDM in addition to the reported frequency of PEB and HEB were different for people who found themselves at different SOC. Results provided evidence that individuals in the later SOC displayed significantly higher levels of SDM and a higher reported frequency of PEB in addition to having significantly lower levels of NSDM and a lower reported frequency of HEB than those in the earlier SOC, this was true for both samples used in this second study. Next, SOC was tested as both a moderator and a mediator in the relationship between environmental motivation and behaviours in order to better understand its role. In the first sample (*Study 2a*), SOC positively moderated the relationship between SDM and PEB (positive effect) as well as the relationship between SDM and HEB (negative effect) in that the effect of SDM on these behaviours was increased as SOC increased. As for the second sample (*Study 2b*), SOC only moderated the relationship between NSDM and HEB, where the positive effect was increased with the positive change in SOC. With respect to mediation, in the first sample, SOC partially mediated the relationship between SDM and PEB as well as the relationship between NSDM and HEB in addition to fully mediating the relationship between NSDM and PEB. In the second sample, all relationships, SDM with PEB, SDM with

HEB, NSDM with PEB, and NSDM with HEB were partially mediated by SOC. These results demonstrated that stages of behaviour change likely plays a mediating role in the relationship between environmental motivation and behaviours, this was supported in the third study as SOC had no significant moderation effect, while partial or full mediation was revealed in all relationships between motivation and behaviours.

Study 3. In the third and final study, nature relatedness, need satisfaction, and need frustration were added in order to determine their roles as possible determinants of environmental motivation, SOC, PEB, and HEB. In the first part of this study, the proposed incremental effect of nature relatedness on SDM and NSDM was tested and partially confirmed. While nature relatedness explained a significant amount of additional variance in SDM over need satisfaction and frustration, it was not incremental to their effect on NSDM. The second part of this study aimed to test a model that included all variables from the proposed model in order to replicate and confirm findings from all studies, and to examine the effect of nature relatedness on all endogenous variables. The model provided support for most of the original hypotheses. First, nature relatedness was the only determinant to be associated with SDM while need frustration was the only determinant associated with NSDM. Next, SOC was affected directly and indirectly by nature relatedness as levels of nature relatedness were directly associated with high SOC and nature relatedness positively related to levels of SDM which, in turn, were linked to higher SOC. As for PEB, nature relatedness had positive direct and indirect effects by being associated with a higher reported frequency of PEB. In addition to being directly related to a higher reported frequency of PEB, it was also associated through SDM and SOC in a serial and direct fashion. Finally, nature relatedness also negatively related to HEB directly and indirectly through both SDM and SOC (direct and serial) while need frustration had a positive

indirect effect on HEB via mediation by NSDM. Although some of the hypotheses were not supported, these results were consistent with the results from previous studies and analyses. Namely, the fact that need satisfaction and frustration had no impact on SDM and that need satisfaction and nature relatedness were not associated with NSDM was in line with results from the hierarchical regressions. In the same way, the possibility that NSDM would not be related to SOC or PEB was consistent with the results from the first and second studies.

Altogether, the findings from the current program of research provide us with a better understanding of the motivational process associated with environmental action. Based on past SDT research within the environmental context, results lend support to the idea that nature relatedness, basic psychological needs, motivation, stages of behaviour change, and environmental behaviours may be strongly interconnected in this process. These findings lead to important theoretical implications which are discussed next.

Theoretical Implications

A new way to define environmental action. Naturally, one of the first important theoretical implications that stems from this research is the dichotomy between positive and negative environmental behaviours. While most consider that environmental action entails people doing things that are good for the environment, it is actually the combination of more positive actions and less negative actions that have the potential for the greatest environmental impact. PEB and HEB seem to be very similar in the sense that they should be both related to most of the same variables. They, however, seem to be very different in how they are related to these variables. Often, what may lead to a higher frequency of PEB, may also lead to lower frequency of HEB, and vice-versa. To be more specific, just as most research has demonstrated, high quality motivation is linked to more PEB, but at the same time it seems to be associated

with less HEB. In a similar optic, while low quality motivation, in most cases is not related to PEB, it appears to be, almost systematically, associated with more HEB. This distinction is important as it demonstrates that if we only consider PEB, NSDM doesn't seem to be something we should try to avoid, but when we acknowledge HEB, we better understand the possible adverse impact of being non-self-determined. In the same way, moving along the SOC for the environment and high levels of nature relatedness seem to have beneficial effects for the frequency of PEB and HEB adopted by individuals. The inclusion of HEB in conjunction with PEB could therefore be a non-negligible component of research on environmental action and behaviours.

The SOC process within the environmental context. Behaviour change as proposed in SOC models, posits that people change over time by moving from stage to stage. Now, although SOC models have been shown to be effective in explaining behaviour modification in the health context (e.g., Glanz et al., 1994; Farkas et al., 1996; Woods et al., 2002), research had yet to examine the proposition made by Pelletier and Sharp (2008) that it could play a key role within the environmental context. This research strongly supports that SOC may play an important part in environmental action. Not only were individuals in later stages more self-determined and less non-self-determined, they also reported adopting more PEB and less HEB than those in the earlier stages, thus providing support for the importance of SOC models in the motivational process associated with environmental action.

These results demonstrated that motivation, stages of behaviour change, and environmental action are all related, but it was unclear how this process actually works. If we rely on findings from this thesis, we can rule in the possibility that SOC is actually an important mediating variable. Moving from the early stages where one has yet to decide if his behaviours

are problematic to the later stages where individuals are trying to maintain their changed behaviours seems to have the potential to increase positive behaviours and decrease negative ones. In itself, this is very important as it demonstrates that when people have moved toward environmental action, the reported frequency of PEB is higher while the reported frequency of HEB is lower. What is even more interesting, however, is what can possibly lead to people wanting to change and actually changing. In the case of stages of behaviour change in the environmental context, two possible key elements were revealed in this research, the first being SDM and the second being nature relatedness. This means that moving through SOC may have the potential to increase environmental action, but in order to move across these different stages, people might have to want to be environmentally friendly because of their understanding of the importance of these actions, because they feel that behaving in such a way is part of who they are, or because of the pleasure that it brings to them. In a similar way, in order to facilitate the progression through the SOC, it seems that we must also feel a connection to the natural environment.

These findings have the potential to help us better understand how motivation can relate to different outcomes. The original proposition that being self-determined is related to more positive outcomes and less negative outcomes while being non-self-determined leads to the opposite remains true. However, this association appears to partially go through people moving from stage to stage. In other words, behaviour change is a complex process that is associated with more PEB and less HEB, but moving through this complex process seems to require high quality motivation.

In the same way, just as much research has evidenced the importance of nature relatedness for the adoption of PEB (e.g., Nisbet et al., 2009; Nisbet & Zelenski, 2013), SOC

could potentially improve our understanding of how this relationship unfolds. As nature relatedness is linked to more PEB and less HEB, this also is partially explained by the process of SOC. It seems that when people feel a deeper connection the natural environment, it could help them move across the stages for environmental behaviour change.

Understanding how SOC mediates these relationships between SDM and environmental behaviours as well as between nature relatedness and environmental behaviours is important as it might explain some discrepancies between the theory and actual results. For example, people can report high levels of SDM or a deeper connection with nature, it is, however, possible that we might not observe greater environmental action. While we might originally have thought that these results do not support our hypotheses, it is possible that these individuals simply have not yet had the time to move across the different SOC. However, once the levels of SDM and connection to nature are maintained over time, they could be more likely to lead to higher PEB and lower HEB as people would have had the time to move from the early stages to mid or late SOC.

The concept and process of behaviour change, therefore, seem to be more important and interconnected to other variables than we might originally have thought. In a time where environmental behaviour change is a necessity for the preservation of the environment, it is important to understand that SOC are related to environmental action, but also that in order to move along theses SOC, it appears that one must be self-determined and feel connected to nature.

Nature relatedness as a basic psychological need. This thesis also provided support for the possibility that nature relatedness may represent a basic psychological need. Although, Baxter and Pelletier (2018) provided a great amount of evidence for this claim, research had yet

to directly compare nature relatedness to other well-established basic psychological needs as defined by SDT. In the context of this research, we aimed to compare the effects of nature relatedness to the effects of need satisfaction and need frustration as proposed within the SDT framework. To be more specific, the role of nature relatedness was compared to the roles of satisfaction and frustration of the needs for autonomy, competence, and relatedness, as a whole, in order to determine whether it could make a significant contribution to environmental motivation. Supported by the findings was the idea that nature relatedness can explain a significant amount of additional variability in the levels of environmental SDM. In fact, although it seemed that need satisfaction was actually associated with higher levels of SDM, this effect was suppressed when we accounted for the effect of nature relatedness on SDM. While it did not contribute the levels of NSDM measured in individuals, its incremental effect on SDM was quite remarkable. With such a positive relationship with SDM, that goes above and beyond the satisfaction and frustration of the needs proposed by SDT, we provide some theoretical support to answer the interrogation with regard to nature relatedness potentially being a basic psychological need that was highlighted by Ryan and Deci (2019). This, was only done within the environmental context and results are in need of replication, however, results underline nature relatedness as a strong candidate for a fourth basic psychological need.

As a candidate basic psychological need, nature relatedness was considered to have the potential to affect motivation, it was, also, considered that it could be a direct determinant of SOC and environmental behaviours. In addition to being a determinant of environmental SDM, which is associated with SOC and environmental behaviours, nature relatedness also had significant direct associations to stages of behaviour change and environmental behaviours. Our findings suggest that having a deeper connection to the natural environment might be an

important variable in the SOC process. As discussed previously, high levels of nature relatedness were associated with individuals being further in the change process, which had a positive effect in that it was related to more PEB and less HEB. What is more, having a deeper connection with nature may also be directly related to a higher frequency of PEB and a lower frequency of HEB.

The various roles that nature relatedness seems to play in the motivational process associated with environmental action speak to its importance in theory and in practice. Not only could this key variable provide us with a better understanding of why some people are dedicated to preserving the environment while some can't seem to do anything about this very imminent and present problem, it might also play a key role within different contexts.

Although, through the findings in this thesis, theoretical support is provided for the idea that nature relatedness could be a basic psychological need, no causal inferences could be made regarding its effects on environmental motivation, SOC, and behaviours. That is to say, to substantiate these theoretical findings and conclude that nature relatedness is a basic psychological need, experimental and longitudinal designs are necessary to demonstrate that nature relatedness is responsible for changes in environmental motivation, SOC, and behaviours, these ideas are discussed further in the discussion. What is more, in order to be deemed as a basic psychological within the SDT framework, some of Ryan and Deci's (2017) propositions would need to be tested. To be more specific, it would be important to demonstrate that nature relatedness satisfaction leads to wellness above and beyond the satisfaction of autonomy, competence, and relatedness in addition to showing that nature relatedness thwarting leads to ill-being when controlling for the effects of these same three needs. As more research is needed to demonstrate the causal effects of nature relatedness and its effects within the SDT framework,

results presented in this thesis are a non-negligible initial step in demonstrating that nature relatedness is a basic psychological need.

Summarizing theoretical contributions. The research presented herein provided novel insights that contribute to the environmental psychology and SDT literature. To put it simply, it is now evident that both positive and negative behaviours should be considered when studying environmental action as they appear to be affected differently by environmental motivation. Next, the inclusion of the process of SOC is noteworthy as it has the potential to partially explain the relationship between environmental motivation and behaviours. Finally, nature relatedness could be a very important determinant of environmental SDM and SOC in addition to being one for both PEB and HEB. This thesis therefore expands on environmental SDT models by including negative behaviours, SOC, and nature relatedness. All these theoretical implications also make way for practical implications, some of which will be mined next.

Practical Implications

One important aim of this thesis was to contribute to theoretical knowledge on the motivational process associated with environmental action. We also think that the present program of research provides knowledge and insights that can have practical implications and applications to real-world situations.

Promotion of PEB and HEB. For the past decades, the conversation about the preservation of our environment has grown exponentially. From people telling their friends and family what can be done to save the planet to the development of governmental policies, celebrities producing documentaries, and social media activism, we have undoubtedly all come into contact with information on the state of the environment and its implications for the degradation of our planet. While this is an important step in the right direction, this information

has strongly focused on the importance of adopting positive behaviours. This, however, is only part of the solution. As demonstrated by results from this research, in order to be as effective as possible in mitigating the effects of human behaviour on the environment, we must combine this thrive toward PEB with one to reduce HEB. While information is very important in relation to climate change, it can be hard to find concrete information from reliable sources. For example, the *Paris Agreement* documents (UN, 2015) mostly state that parties are responsible for reduction of greenhouse gas emissions whereas *Environment and Climate Change Canada* (EC, 2019) suggests action such as volunteering, inspiring youth, taking part in surveys, or donating in order to protect the natural environment. Some reliable sources such as the *David Suzuki Foundation* (2018) and the *Pact for Transition* (2019) have started to share ways to contribute that involve the reduction of negative behaviours. On top of all the positive actions suggested, we can find suggestions that pertain to reduction of HEB like reducing meat and dairy product consumption, reducing food waste, reducing travel by air if possible, or to stop investing in non-environmentally responsible companies. As highlighted by our findings, this is another noteworthy step in the right direction. This is, however, only a start and we must expand on these findings in order to share the equal importance reducing HEB through as many platforms as possible. For example, when information about the environment is shared, regardless of the source or the intended audience, breaking down environmental action into two clearly distinct sections representing positive things that can be done and negative things that can be reduced would increase knowledge on action by reduction of HEB.

All in all, information on negative behaviours has started to see the light, the focus, however, remains on positive behaviours and as such, we must shift part of the focus on the reduction of negative behaviours if we hope to increase our impact on the mitigation of human

pollution. Sharing the knowledge on the distinction between PEB and HEB is of great importance while promoting both an increase in PEB and a decrease in HEB requires additional knowledge on quality of motivation.

Fostering quality motivation to promote environmental action. Past research has demonstrated time and again that fostering SDM over NSDM has beneficial effects in the promotion and adoption of PEB. The findings in this research strongly reinforce this idea by demonstrating that in addition to the frequency of PEB being linked to motivation, the frequency of HEB may also be associated with motivation. While SDM is systematically related to higher PEB and NSDM seems to have a slight or no effect on the same positive behaviours, the real novelty is that SDM and NSDM seem to always be linked to the frequency of HEB, SDM being associated with less HEB and NSDM to more HEB. In practice, this is very important as it demonstrates that the quality of motivation we foster when trying to promote environmental action is crucial. We should first try to convince people about the importance of their actions by providing a rationale and explaining why environmental action is so important, by demonstrating to them that these actions are indirectly related to them as the state of the environment affects us all, and by showing them how it is possible to feel joy and pleasure by contributing to the environment. In addition, we have also seen that helping people to have a deeper connection to the natural environment could help foster this higher quality motivation to commit to environmental action. By doing so, we would possibly increase the frequency of PEB while simultaneously reducing the frequency of HEB people adopt. What is more, when this type of motivation is fostered, it may have the potential to help people progress through environmental SOC which could also contribute to more PEB and less HEB, lending even more credence to the importance of SDM in the environmental context. What is equally important, is the fact that we

should avoid fostering lower quality motivation (NSDM) as this could have adverse effects on the environment by possibly increasing the adoption of HEB and leading to no PEB. This means that, trying to promote environmental action by creating internal feelings of pressure and guilt in people as well as by providing incentives do not seems to be productive strategies. Further, findings also support the idea that need frustration should be avoided as a way to reduce low quality motivation. Thus, it is important to avoid contributing to people feeling they don't have a sense of choice, feeling incompetent, and not feeling connected to others as this could indirectly lead to more HEB.

In brief, we have long known that high quality motivation is better avenue than low quality motivation in the environmental context. However, by considering both PEB and HEB, this statement increases in importance. When trying to promote environmental action, it should always be kept in mind that fostering SDM is important, but that avoiding fostering NSDM is just as important. What is said to people and how it is said can strongly impact how motivated they are and the actions that will be taken.

Needing the nature to save nature. Applications relative to this thesis also extend beyond motivation and behaviours. That is, with the important implications of nature relatedness that were revealed in this research, the preservation of our natural environment becomes crucial as it is not only the aim of the efforts to mitigate human pollution, but also a key element in promoting environmental action. It could therefore be very important to help individuals create a deeper connection to the natural environment.

A first thought in line with this idea is the creation of green spaces. In a society where a great deal of people are living within the confines of the city, connecting to nature might not always be simple. The creation of green spaces that are easily accessible even for people who

live within the city could allow individuals to spend time in these spaces, thus reminding them of the beauty of nature and the importance of trying to preserve it. Investing in such projects might be more effective than investing in campaigns that ultimately can have the effect of pressuring people and lead to adverse effects. While creating green spaces in cities is no easy task, it is, however, possible. With cities creating green rooftops, green walls, and converting old concrete and urban areas into green spaces, we are probably only scratching the surface on innovations that could make cities greener. Of course, the creation of green spaces seems warranted, however, before creating new green spaces, it is important to protect the ones we already have.

Another way to help deepen the connection to the natural environment would be to implement programs and policies that encourage students and workers to spend time outdoors in nature. For example, in schools, a period of time could be reserved simply to spend time in nature in between long stretches of classes. In a similar way, workers could have a set amount of time where they can spend time outdoors, this might seem challenging for those who work in urban cities which brings us back to the importance of creating green spaces even in urban areas. While this does take some time out of students' and workers' day, if we consider that research actually points to the fact that spending time in nature is linked to increases in vitally and well-being, these individuals could actually become more efficient.

There is no perfect way to preserve all our natural environment, to create more green spaces, or to have the opportunity to spend time in nature. One thing, however, is very clear, if we want to save our natural environment we actually need our natural environment. That is why, we need to further test the ideas presented in this thesis in order to replicate the findings and share these novel insights.

Limitations

Although the research presented herein was successful overall and provided a great deal of valuable information, it is not without its limitations.

The first limitation that deserves attention, is the absence of an experimental design. In reason of the novelty of this research, correlational designs were used as a way to, first, confirm links between the variable of interest. This is noteworthy as despite the propositions that needs and nature relatedness affect motivation, stages of behaviour change, and behaviours, no causal effects can be confirmed. Even so, most of the hypothesized relationships were established and provide a strong foundation for future hypotheses which involve causal effects between these variables.

Next, another limitation to this research is that the samples were mostly composed Canadian undergraduate students. In fact, with the exception of the sample for *Study 2b*, samples for all three studies were composed of undergraduate students from the University of Ottawa. This can be an issue as it may affect the external validity and in consequence, the generalizability of our results. While the sample from *Study 2b* provided us with very similar, albeit not identical results to *Studies 1* and *2a*, findings should be interpreted with caution in terms of generalizability.

Related to the previous limitation, is the fact that the age difference between *Studies 2a* and *2b* was substantial. This leads to the interrogation of whether the results were affected by these differences. Because environmental concern and action are very timely topics and that the implication of the younger generations seems to be increasing, this limitation deserves further investigation. With regard to age differences, a recent meta-analysis (Wiernik, Ones, & Dilchert, 2013) demonstrated, overall, that only negligibly small differences between older and younger individuals could be found. Specifically and maybe surprisingly, older individuals seem to be

more likely to avoid environmental harm, to conserve raw materials and natural resources, and to engage with nature. In light of these small differences, it is not very likely that the differences in the results from both studies (e.g. difference in the relationship between NSDM and PEB) are related to age differences. However, the meta-analysis included studies from 1970 to 2010 and in consequence, results might not be in line with today's reality. What is more, the fact that older individuals seem to be more likely to engage with nature leads us to wonder if results from the third study could be different with regard to the effects of nature relatedness. The question about age differences related to environmental concern and behaviours is very interesting and future studies would need to investigate this idea further, perhaps by studying differences across generations.

As one of the objectives of this thesis was to examine whether nature relatedness should be considered as a basic psychological need, one obvious limitation is the restriction of this idea to the environmental context. Results clearly demonstrated that within the environmental context, nature relatedness warrants consideration as a basic psychological need, they, however, do not allow us to confirm this in general. In order to expand on its incremental effect on need satisfaction and frustration, we would have needed to determine whether nature relatedness is associated with motivation above other well-established needs across different contexts (e.g., work, school, family, general). It is possible that results would be different across contexts that are not related to the natural environment, but results provided a first glance at the potential effect that nature relatedness has when it measures up to needs from a respected theoretical framework such as SDT.

The next two limitations are related to the measures used in this research. The first being that we used self-reported environmental behaviours to measure the frequency of PEB and HEB.

While this is not a perfect way to measure behaviour as it is subject to bias responses by participants, using objective observed environmental behaviours is not an easy task when conducting correlational research. Research, however, has shown that self-reported knowledge seems to predict actual PEB fairly well (Fielding & Head, 2012). In addition, using the same self-reported behaviours for all participants across the three studies was probably beneficial for external validity. Future research could consider integrating a computerized task to measure environmental behaviours in a slightly more objective manner. The second limitation with regard to the measures was the use of an index score for the SOC. An index score was chosen as a parsimonious way to compute a score for a theoretical framework that is, in reality, considered to be a process. In future research, it could be interesting to see the relationships between nature relatedness, needs, motivation, behaviour change, and environmental action over time.

The limitations presented above do lead us to interpret results from the research presented in this thesis with more caution. Nevertheless, findings provide support for our hypotheses and should not be totally eclipsed by these limitations. All in all, we consider these findings to be a significant contribution to the literature relative to environmental psychology, SDT, SOC, and nature relatedness. Ultimately, this research was the first to consider HEB in addition to the roles of SOC and nature relatedness, and to establish links between these variables in the context of environmental motivation and environmental action. In fact, the insights brought about in this thesis lead to empirical evidence that opens the door for future research.

Directions for Future Research

Other than the knowledge generated by the present research, ideas for future research also stemmed from the findings and the limitations discussed herein.

As discussed previously, one very important avenue to explore is the comparison of nature relatedness to other needs, such as the one's presented by SDT, across different contexts. First, it would be interesting to explore the idea that nature relatedness could be related to motivation, above and beyond autonomy, competence, and relatedness, in other specific contexts. For example, if nature relatedness were to be related to the quality of motivation in domains such as sports, work, or school**,** it would certainly give more support for the importance of nature relatedness within SDT research. In doing so, we would be able to establish if a deeper connection to nature is incremental to basic psychological needs that have proven to have a positive effect on motivation time and again. In the same vein, comparing nature relatedness to other needs when it comes to other positive outcomes such as vitality and well-being would be interesting. As basic psychological needs and nature relatedness have already been shown to contribute to peoples' wellness, comparing their effects would be an additional step in demonstrating that nature relatedness warrants attention as a basic psychological need. Providing evidence that nature relatedness is related to motivation and positive outcomes across different contexts is, without a doubt, one of the very important next steps in demonstrating that nature relatedness should be considered as a basic psychological need.

Another direction that should be considered in future research is the exploration of nature relatedness as basic psychological need through experimental design. Although controlling for one's connection to nature is no simple task, there are some options to consider in the environmental context and across other contexts. For instance, levels of motivation, SOC, and behaviours could be measured for different groups. In the experimental group individuals could be taken on an outdoor walk in a green space while those in the control group could simply watch an unrelated video. Assuming that time spent in nature actually increases levels of nature relatedness,

which would need to be confirmed through manipulation checks, it would be possible to compare levels of motivation, behaviour change, and reported behaviours for people whose need for nature relatedness has been satisfied to those where nothing was done to satisfy this need. This is in no way a perfect design as there is no way to know if individuals in the control group have high levels of nature relatedness or have recently spent time in nature. However, since there is no real or ethical way to prevent people from connecting to nature, considering time spent outdoors as a covariate would be a considerable option to increase the strength of the design in this situation. In the same optic, an experimental design could be used to compare the effects of nature relatedness to the satisfaction and frustration of other needs. Conditions where; 1. nature relatedness is supported by time spent in a green space, 2. the autonomy, competence, and relatedness of participants are thwarted by interactions with an experimenter, and 3. autonomy, competence, and relatedness are supported by interactions with an experimenter; could be created. Such as design would allow for a better comparison of the effects of nature relatedness and other basic psychological needs. Many different ideas could be generated to test nature relatedness experimentally, the key take away here, is that using an experimental design would allow us to attribute the positive effects to nature relatedness as a way to expand on the positive associations that were revealed in this thesis.

One noteworthy avenue to explore is the one of examining the model presented herein using a longitudinal design. As the key variables considered in this research have to potential to fluctuate, a longitudinal examination seems like an essential future step. Relationships between variables could be measured individually or altogether. Regardless, it would be interesting to consider daily, weekly, or monthly fluctuations to determine whether the associations demonstrated in our findings fluctuate together. For example, the enumerated propositions could

all be tested: does environmental motivation increase when levels of nature relatedness increase over a short period of time; do people progress on the SOC as soon as nature relatedness and motivation are increased; once people move from one SOC to the next, how long does it take to notice an increase in PEB or a decrease in HEB; do decreases in motivation and nature relatedness levels, or regression on the SOC lead to a decrease in PEB and an increase in HEB quickly, over time, or at all; is the effect of nature relatedness incremental to need satisfaction overtime. Such research would not only allow us to identify if variables fluctuate together, it would also allow for a better assessment of SOC as a process within the environmental context.

Finally, replication of these results across various samples using a similar cross-sectional correlational design would provide additional external validation for knowledge generated by this program of research.

Concluding Remarks

Altogether, it is our hope that the research presented herein has shed some light on the motivational process involved in environmental action and that future research will expand on these results to further understand how we can have the greatest environmental impact. All small discoveries play an important part in this big problem that we are facing, and by having a better understanding of the key roles of nature and behaviour change, maybe we can start to tackle this problem with more confidence and efficiency.

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APPENDICES

Appendix A

Motivation Toward the Environment Scale (Studies 1, 2a, 2b, 3)

There are many things that one can do for the environment. For example, some people recycle old bottles, different types of containers, newspapers, paper, etc. Listed below are several statements concerning possible reasons why people may adopt pro-environmental behaviours. Using the scale from 1-7 below, please indicate the degree to which the proposed reasons correspond to your reasons for adopting pro-environmental behaviours by selecting the appropriate number to the right of the item.

Why are you doing things for the environment?

Does not correspond at all			Corresponds moderately			Corresponds completely
1	2	3	4	5	6	7

1. For the pleasure I experience while I am mastering new ways of helping the environment.	1	2	3	4	5	6	7
2. Honestly, I don't know; I truly have the impression that I'm wasting my time doing things for the environment.	1	2	3	4	5	6	7
3. For the pleasure I experience when I find new ways to improve the quality of the environment.	1	2	3	4	5	6	7
4. Because it is a reasonable thing to do to help the environment.	1	2	3	4	5	6	7
5. Because I like the feeling I have when I do things for the environment.	1	2	3	4	5	6	7
6. I don't really know; I can't see what I'm getting out of it.	1	2	3	4	5	6	7
7. I think I'd regret not doing something for the environment.	1	2	3	4	5	6	7
8. I wonder why I'm doing things for the environment; the situation is simply not improving.	1	2	3	4	5	6	7
9. For the pleasure I get from contributing to the environment.	1	2	3	4	5	6	7
10. Because it's a sensible thing to do in order to improve the environment.	1	2	3	4	5	6	7
11. Because it's a way I've chosen to contribute to a better environment.	1	2	3	4	5	6	7
12. Because other people will be upset if I don't	1	2	3	4	5	6	7
13. For the recognition I get from others.	1	2	3	4	5	6	7
14. Because I would feel bad if I didn't do anything for the environment.	1	2	3	4	5	6	7
15. Because taking care of the environment is an integral part of my life.	1	2	3	4	5	6	7
16. Because my friends insist that I do it.	1	2	3	4	5	6	7
17. Because it seems to me that taking care of myself and taking care of the environment are inseparable.	1	2	3	4	5	6	7
18. Because I would feel guilty if I didn't.	1	2	3	4	5	6	7

19. Because being environmentally-conscious has become a fundamental part of who I am.	1	2	3	4	5	6	7
20. Because it's part of the way I've chosen to live my life.	1	2	3	4	5	6	7
21. Because I would feel ashamed of myself if I was doing nothing to help the environment.	1	2	3	4	5	6	7
22. Because I think it's a good idea to do something about the environment.	1	2	3	4	5	6	7
23. To avoid being criticized.	1	2	3	4	5	6	7
24. I don't know; I can't see how my efforts to be environmentally-conscious are helping the environmental situation.	1	2	3	4	5	6	7

Appendix B

Pro-Environmental and Harmful-Environmental Behaviours Questionnaire (Studies 1, 2a, 2b, 3)

Daily Environmental Habits

Using the scale below, please indicate how frequently you adopt the following behaviours.

What are you doing for the environment?

I…

Never			Sometimes			Always
1	2	3	4	5	6	7

1. Leave the lights on when not in the room	1	2	3	4	5	6	7
2. Recycle recyclable materials	1	2	3	4	5	6	7
3. Volunteer for environmental organisms	1	2	3	4	5	6	7
4. To be sure that you are paying attention to the items that you are reading, please indicate 7 for this item	1	2	3	4	5	6	7
5. Buy things I really don't need	1	2	3	4	5	6	7
6. Leave the appliances on when not in use	1	2	3	4	5	6	7
7. Pick up litter off the ground to throw it out	1	2	3	4	5	6	7
8. Put compostable materials in the trash	1	2	3	4	5	6	7
9. Do not recycle or compost when away from home	1	2	3	4	5	6	7
10. Drink beverages out of disposable bottles or mugs	1	2	3	4	5	6	7
11. Donate to environmental organisms	1	2	3	4	5	6	7
12. Buy items with a lot of packaging	1	2	3	4	5	6	7
13. Shop with reusable bags	1	2	3	4	5	6	7
14. Discard paper without using both sides of the sheet	1	2	3	4	5	6	7
15. Communicate information to friends and family on what can be done to help the environment	1	2	3	4	5	6	7
16. Search for information about what can be done to help the environment	1	2	3	4	5	6	7
17. Tell others when their behavior is harmful or bad for the environment	1	2	3	4	5	6	7
18. Throw way plastic bags/containers after one use	1	2	3	4	5	6	7
19. Buy products or materials made from recycled products	1	2	3	4	5	6	7

Appendix C

Stages of Change for the Environment (Studies 2a, 2b, 3)

The environment refers to the current state of the natural environment and its current state of degradation. Pro-environmental behaviours aim at protecting, preserving, or restoring the environment. They include behaviours such as recycling, composting, conserving energy, buying products that are biodegradable or good for the environment, using public transportation, environmental activism, etc.

Please indicate how frequently the thoughts represented in each statement currently cross your mind. Please rate the following five items using the scale provided.

	Never			Sometimes			Almost always/ Always
1. I am trying to determine if the current state of the environment is critical or not.	1	2	3	4	5	6	7
2. I am debating whether I should be doing something about the environment.	1	2	3	4	5	6	7
3. I want to know more about how I can do different pro-environmental behaviours.	1	2	3	4	5	6	7
4. I want to know how to integrate the pro-environmental behaviours into my lifestyle.	1	2	3	4	5	6	7
5. The various pro-environmental behaviours are already integrated into my lifestyle.	1	2	3	4	5	6	7

Please read the following statements. Choose the one that best applies to your current situation regard the environment. **Choose only one statement.**

I am at the stage where…

	1. I am trying to determine if the current state of the environment is critical or not.
	2. I am debating whether I should be doing something about the environment.
	3. I want to know how to do the different pro-environmental behaviours
	4. I want to know how to integrate the pro-environmental behaviours into my lifestyle.
	5. The various pro-environmental behaviours are already integrated into my lifestyle.

Appendix D

Social Desirability 13-item short form (Studies 2a, 2b, 3)

Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is true or false as it pertains to you.

	True	False
1. It is sometimes hard for me to go on with my work if I am not encouraged.	1	2
2. I sometimes feel resentful when I don't get my own way.	1	2
3. On a few occasions, I have given up doing something because I thought too little of my ability.	1	2
4. There have been times when I felt like rebelling against people in authority even though I knew they were right.	1	2
5. No matter who I'm talking to, I'm always a good listener.	1	2
6. There have been occasions when I took advantage of someone.	1	2
7. I'm always willing to admit when I make a mistake.	1	2
8. I sometimes try to get even, rather than forgive and forget.	1	2
9. I am always courteous, even to people who are disagreeable.	1	2
10. I have never been irked when people expressed ideas very different from my own.	1	2
11. There have been times when I was quite jealous of the good fortune of others.	1	2
12. I am sometimes irritated by people who ask favours of me.	1	2
13. I have never deliberately said something that hurt someone's feelings.	1	2

Appendix E

Your basic psychological needs (Study 3)

Below, we ask you about the kind of experiences you actually have in your life. Please read each of the following items carefully. You can choose from 1 to 7 to indicate the degree to which the statements are true for you at this point in your life.

Not at all true 1 2 3 Somewhat true 4 5 6 Very true 7

1. I feel a sense of choice and freedom in the things I undertake	1	2	3	4	5	6	7
2. Most of the things I do feel like "I have to"	1	2	3	4	5	6	7
3. I feel that the people I care about also care about me.	1	2	3	4	5	6	7
4. I feel excluded from the group I want to belong to.	1	2	3	4	5	6	7
5. I feel confident that I can do things well.	1	2	3	4	5	6	7
6. I have serious doubts about whether I can do things well.	1	2	3	4	5	6	7
7. I feel that my decisions reflect what I really want.	1	2	3	4	5	6	7
8. I feel forced to do many things I wouldn't choose to do.	1	2	3	4	5	6	7
9. I feel connected with people who care for me, and for whom I care.	1	2	3	4	5	6	7
10. I feel that people who are important to me are cold and distant toward me.	1	2	3	4	5	6	7
11. I feel capable at what I do.	1	2	3	4	5	6	7
12. I feel disappointed with many of my performance.	1	2	3	4	5	6	7
13. I feel my choices express who I really am.	1	2	3	4	5	6	7
14. I feel pressured to do too many things.	1	2	3	4	5	6	7
15. I feel close and connected with other people who are important to me.	1	2	3	4	5	6	7
16. I have the impression that people I spend time with dislike me.	1	2	3	4	5	6	7
17. I feel competent to achieve my goals.	1	2	3	4	5	6	7
18. I feel insecure about my abilities.	1	2	3	4	5	6	7
19. I feel I have been doing what really interests me.	1	2	3	4	5	6	7
20. My daily activities feel like a chain of obligations.	1	2	3	4	5	6	7
21. I experience a warm feeling with the people I spend time with.	1	2	3	4	5	6	7
22. I feel the relationships I have are just superficial	1	2	3	4	5	6	7
23. I feel I can successfully complete difficult tasks.	1	2	3	4	5	6	7
24. I feel like a failure because of the mistakes I make.	1	2	3	4	5	6	7

Appendix F

Nature relatedness (Study 3)

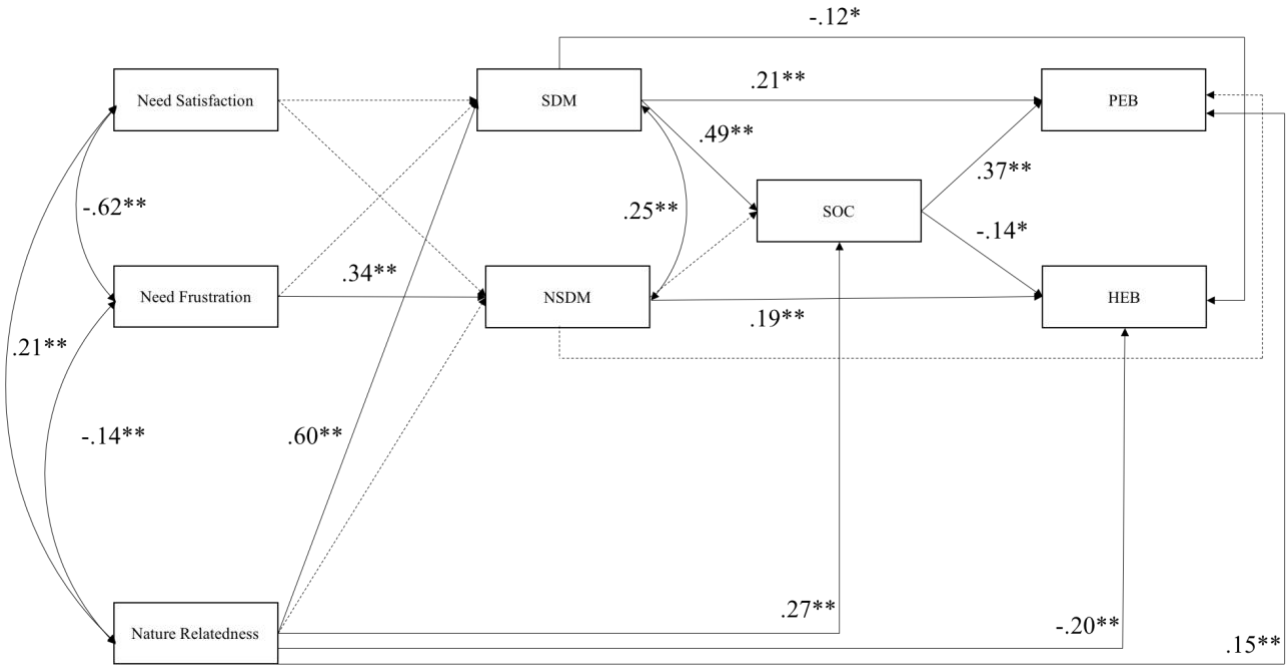
For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 7 below. Please respond as you really feel, rather than how you think "most people" feel.

Do not at all agree 1 2 3 Somewhat agree 4 5 6 Strongly agree 7

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

Appendix G

Alternative Model for Study 3



Appendix G. Alternative model without participants with high social desirability ($N = 412$). Model fit: ($\chi^2(6) = 6.63$, $p = .36$, $CFI = 1.00$, $TLI = 1.00$, $RMSEA = .016$ $CI_{90}[.000, .067]$, $SRMR = .016$).