

Differentiating Habits for Pro-Environmental Behaviours

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Abstract

To help protect the environment people need to change current non-environmental behaviours into more sustainable behaviours. By understanding habits for pro-environmental behaviours, people can strive toward building a more sustainable future. The goal of this thesis was to identify different types of repeated pro-environmental behaviours and how to best foster strong habits for pro-environmental behaviours. To achieve this purpose we combined the theoretical framework of habits (Bargh, 1994; Verplanken, 2006) with the theoretical framework of self-determination theory (SDT; Deci & Ryan, 1985; 2000) to address current gaps in the habit literature.

The present thesis is comprised of two articles. The first article determined if the proposed indicators of habits (i.e., behaviour frequency, habit strength, and behaviour interference) could identify different patterns of repeated pro-environmental behaviours predicted by habit and self-determination theory using cluster analysis. The three studies provided support for the three proposed types of repeated behaviours: weak habits, repeated behaviours with interference, and strong habits. These results were very robust since the same pattern was found across three studies, three samples, and three different target behaviours.

The second article used the groups (i.e., weak habit, repeated behaviour with interference, and strong habit) in exploratory multinomial logistic regression analyses to identify factors related to pro-environmental behaviours which distinguished between the different types of repeated behaviours. Once again, the same three types of repeated behaviours were found across these three studies, with three new samples and two different target behaviours. Three predictors fairly consistently identified differences between the groups: autonomous motivation toward the environment, perceived importance of the environment, and the frequency of other pro-

environmental behaviours. The implications of the thesis findings are discussed in relation to self-determination theory and the study of habits.

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Organizational Note

This thesis is written in article format. To ease reading of this document the format is explained here. The thesis begins with a general introduction of the topic, literature, and presents the goals of this thesis. Next are two journal articles presented in their entirety, which contain the six studies conducted as part of this thesis. Each article has a separate introduction, methods, results, discussion and references section and has been formatted in the method necessary for the journals they were submitted. Following the two articles is a general discussion, which interprets the findings across all six studies in the thesis, presents limitation and future directions for this program of research. References from the general introduction and general discussion can be found in the references section following the general discussion.

General Introduction

Many of our daily behaviours are done without much thought (e.g., brushing our teeth, travelling to work, shutting down the computer at the end of the day), which saves mental resources for new or more difficult activities (e.g., meeting a new person or writing a report for work). Imagine all the good that could be accomplished if those everyday habits were aimed at protecting the planet. By understanding habits, people can strive toward building sustainable behaviours. To make a real change toward protecting the planet, it is not enough to do conservation-oriented or pro-environmental behaviours every once in a while, rather many behaviours must become consistent and persistent efforts. They must become habits. A special kind of motivation will be necessary to create these pro-environmental habits, to help create a sustained change in behaviours.

The purpose of this thesis was to identify different types of repeated pro-environmental behaviours and how to best foster strong habits for pro-environmental behaviours. To achieve this purpose we combined the theoretical framework of habits (Bargh, 1994; Verplanken, 2006) with the theoretical framework of self-determination theory (SDT; Deci & Ryan, 1985; 2000) to address current gaps in the habit literature.

The general introduction begins with an overview of habits and why they are an important topic for environmental psychological research. Three indicators of habitual behaviour are identified that can be used to differentiate types of repeated pro-environmental behaviours. The first habit indicator is the frequency the behaviour is performed, since habits are behaviours that are frequently performed. The second habit indicator is the strength of the habit, since habits are behaviours with high habit strength. The strength of a habit measures the automaticity of a behaviour, over and above the frequency of the behaviour. The frequency of a behaviour is an

important indicator of a habit but the strength of a habit is more essential for identifying habits. The third habit indicator is the internal conflict that happens as behaviours change, since current habits can interfere with newly developing habits.

According to SDT, internalization is the process of consolidating and embedding one's own beliefs, attitudes, values, and behaviours (Deci & Ryan, 1985; 2000; Wallis & Poulton, 2001). In the present thesis, we are proposing that differences between complete and incomplete internalization of a behaviour helps motivate different types of pro-environmental repeated behaviours and provides an explanation for the process involved in the behaviour interference habit indicator. Using SDT we are able to explain differences between three different types of repeated behaviours: behaviours that are not repeated, not automatic and not internalized (i.e., a weak habit), behaviours that are repeated, have some automaticity but not completely internalized (i.e., a repeated behaviour with interference), and behaviours that are repeated often, highly automatic, and completely internalized (i.e., a strong habit).

There are a number of factors related to pro-environmental behaviours that can be used to help explain differences between the three different types of repeated behaviours. Although many factors are important to pro-environmental behaviours, this research focused on motivation toward the environment, nature relatedness, environmental importance, frequency of other pro-environmental behaviours, and life satisfaction.

The general introduction of this thesis is followed by two journal articles. The first article presents the first three studies used to determine that different types of repeated pro-environmental behaviour could be identified using the three habit indicators identified in the habit and SDT literature (i.e., behaviour frequency, habit strength, behaviour interference). The second article presents the next three studies used to identify factors that could facilitate strong

habits for pro-environmental behaviours. Finally a general discussion concludes this thesis, which summarizes the results of all six studies and provides implications, limitations, and future research suggestions.

Pro-environmental Habits

Psychological approaches to behaviour change are often based upon models of reasoned action (e.g., theory of planned behaviour; Ajzen, 1991), with the expectation that behaviour outcomes are the result of deliberation, intention, controllability and self-efficacy. However, recent review and meta-analytic research has shown that only 25-35% of variance in behaviours is explained by intentions (Armitage & Conner, 2001; Godin & Kok, 1996; Webb & Sheeran, 2006). The low association between intentions and behaviour is well known in environmental psychology (Aitken, McMahon, Wearing, & Finlayson, 1994; Bamberg, 2013a; Gregory & Leo, 2003; Verplanken, Aarts, van Knippenberg, & van Knippenberg, 1994) and habitual behaviours have been proposed as one explanation for the low association, since habits are described as behaviours done automatically (i.e., without intention). Daily diary studies have shown that approximately 45% of daily behaviours are repeated in the same location, are non-intentional, and are considered to be habits (Wood, Quinn, & Kashy, 2002). Thus, habits are a critical part of the behaviour change process and are important to study, in addition to conscious intentional behaviours.

There is a small but growing body of literature exploring pro-environmental habits (e.g., Dahlstrand & Biel, 1997; Klöckner & Matthies, 2004; Klöckner, Matthies, & Hunecke, 2003; Verplanken, 2010a). For example, Bamberg and Schmidt (2003) compared the models for predicting pro-environmental behaviours from Ajzen (theory of planned behaviour; 1991), Triandis (theory of interpersonal behaviour; 1977), and Schwartz (norm activation model; 1977),

in the context of travel mode choice. They found that personal norms only explained 14% of the variance in performing the behaviour, whereas intention and habit combined explained 51% of the behaviour variance. In a final combined model, which integrated elements from all three models, only intention and habits directly predicted actual behaviour. The researchers identify the need for further research on how habit and intentions together influence the performance of a goal-directed behaviour.

Verplanken, Aarts, Knippenberg, and Moonen (1998) compared habitual and planned behaviours for travel mode choices over seven days and found that car use was predicted by both habits and theory of planned behaviour factors (i.e., attitude, subjective norm, perceived behavioural control, and behavioural intention). Moderation analysis suggested that conscious intentions were only statistically significantly related to car use behaviour when habits were weak in strength. In contrast, the moderation was not statistically significant when habits were strong. This research and others show that habits influence the intention-behaviour relationship and habits and intentions interact such that intentions predict behaviour for people who do not act out of habit and do not predict behaviour for people who do act out of habit (Aarts, Verplanken, & Knippenberg, 1998; Verplanken et al., 1998). These moderation effects are consistent with habit theory and suggest that when behaviour is habitual, the performance of the behaviour is less likely to depend on intentional processes (Bargh, 1994; Graybiel, 2008; Jog, Kubota, Connolly, Hillegaat, & Graybiel, 1999; Verplanken, 2006).

After reviewing the research related to habits for pro-environmental behaviours, studies on habitual transportation show that complicated behaviour patterns, like how people get around, are capable of becoming habitual, and that habits are important to measure because they influence the frequency of future pro-environmental behaviours. These findings highlight the

importance of incorporating pro-environmental habits into more comprehensive models of environmental psychology, which include both automatic behaviours and deliberate conscious action. Needed now is a better understanding of the definition of a pro-environmental habit. The next section will discuss three core indicators of habits: behaviour frequency, habit strength and behaviour interference.

Indicators of Habits

Behaviour frequency. Habits are behaviours that an individual often repeats frequently. Thus, an important indicator of habitual behaviour is how often a behaviour is performed. Many studies use past behaviour frequency as the sole indicator of habitual behaviour (e.g., Fujii & Kitamura, 2003; Kahle & Beatty, 1987; Klöckner & Matthies, 2004; Webb & Eves, 2007a; 2007b; Wittenbraker, Gibbs, & Kahle, 2006). Measures of past behaviour frequency consistently predict future behaviour, over and above behaviour antecedents like attitudes and intentions (e.g., Sutton, 1994; Verplanken, 2006). Ouellette and Wood (1998) found from a meta-analysis that more frequent past behaviour (i.e., habitual) was better able to predict future behaviour when the context of the behaviour was consistent. Infrequent behaviours performed in inconsistent contexts were better predicted by intentional behaviours. Ouellette and Wood (1998) concluded that the frequency of past behaviour may be the best indicator of future daily behaviour.

Habit strength. Frequent behaviour repetition is a necessary condition for a habitual pro-environmental behaviour but it is not the only condition. The automaticity of a behaviour is the essential indicator of the strength of a habit. Generally, a habit is thought to have four characteristics related to automaticity: a lack of awareness while performing the behaviour, difficulty in controlling the behaviour, performing the behaviour without intention, and reduced attentional resources when performing the behaviour (Bargh, 1994; Schneider & Shiffrin, 1977;

Verplanken, 2006; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). Measuring the level of automaticity provides a sense of the strength of the habit over and above the frequency of performing the behaviour (Ajzen & Fishbein, 2000; Bargh, 1994; Verplanken & Orbell, 2003).

The process from a conscious behaviour to a habitual behaviour frees up mental resources for other tasks that might require more effort and allows the habitual behaviour to be performed automatically (Bargh, 1994). Thus, a habit is more than just a repeated behaviour, it is an automatic response to a behaviour cue built upon a history of successful pairings between the cue and the behaviour (Bargh, 1994; Wood et al., 2002). From this perspective, a measure of frequency is an important indicator of a habit but an indicator of the habit strength provides a more direct measure of the automaticity of the behaviour (Ajzen & Fishbein, 2000; Wood, Tam, & Witt, 2005).

Verplanken, Aarts, and colleagues have conducted a variety of studies that explore sustainable transportation habits (Aarts & Dijksterhuis, 2000a; 2000b; Verplanken et al., 1994; Verplanken et al., 1998). A central part of their research is aimed at differentiating the strength of a habit from the frequency of the behaviour. Since there are many potential reasons for behaviour to be repeated, outside of habits, there needs to be independent measures of the frequency of behaviour and the strength of the habit (Aarts et al., 1998; Bamberg, Ajzen, & Schmidt, 2003). By measuring the strength of a habit it is possible to more directly assess habitual behaviours over and above what is measured with frequency alone. By including both measures, researchers can explore how behaviour frequency and automaticity interact. Thus, a validated measure of habit strength is an important habit indicator to include, in addition to a measure of behaviour frequency, in research identifying habits.

Behaviour interference. The final proposed indicator of pro-environmental habits is the internal conflict that happens as behaviours change, due to current habits interfering with new habits. Current habits may interfere with people's ability to develop new habits (Verplanken, 2010b). This concept of interference is particularly relevant for the current research since many pro-environmental behaviours have conflicting non-environmental behaviours that are often already habitual (e.g., throwing paper in the garbage instead of in the recycling).

Behaviour interference can be described by the uncertainty inherent in deciding what to do and whether the choice of one alternative behaviour was correct when neither behaviour is fully habitual (Hofer, 2007; Wood et al., 2005). Experiencing interference between two potential behaviours in the same context forces some deliberation about the behaviour and suggests it is not fully internalized or fully habitual. Garvill, Marell, and Nordlund (2003) and Fujii, Gärling, and Kitamura (2001) both studied how a car-use habit can be broken and changed into a habit of using public transport. In a field experiment, Garvill and colleagues (2003) assumed drivers had a habit for car-use. To disrupt the automatic travel choice of driving a car, participants were forced to deliberate on their travel choice before travelling. Participants with a strong car-use habit showed a temporary decrease in car use after the intervention. Supporting these findings, Fujii and colleagues (2001) found that forcing a change in participants' routines for driving to work, due to a temporary freeway closure, led participants to be more aware of other alternatives like public transportation. This research shows it is possible to disrupt non-environmental habits, at least temporarily, but the change from the non-environmental behaviour to the pro-environmental behaviour is defined by a level of cognition during the change.

The characteristics that make behaviour habitual also make the behaviour difficult to change (Jager, 2003; Lally, van Jaarsveld, Potts, & Wardle, 2010). Dahlstrand and Biel (1997)

studied a process of behaviour change from a habitually non-environmental behaviour to a habitually pro-environmental behaviour. They found that current habits could impede the development of new more environmentally friendly habits. This interference between habits for opposite competing behaviours (e.g., buying non-environmentally friendly detergents compared to buying environmentally friendly detergents) was found to impede the internalization of the pro-environmental behaviour and inhibited progression to the later stages of new habit development for the participants.

The interference between behaviours will be present during behaviour change but will be reduced once the pro-environmental behaviour has become habitual. Just as goal conflict can interfere with goal integration (Emmons & King, 1988), habit conflict can interfere with habit integration (Dahlstrand & Biel, 1997). When attempting to create a habit (i.e., target habit), people are confronted with the challenge to also change existing habits (i.e., current habit; Jager, 2003; Verplanken, 2010a). This behaviour change process includes a decrease in the perceived interference between the current behaviour and the target behaviour as the new target pro-environmental behaviour becomes internalized and habitual (Dahlstrand & Biel, 1997; Lally et al., 2010). Thus, a measure of behaviour interference should be included as an indicator of habitual pro-environmental behaviour. Together these three indicators of habits (i.e., behaviour frequency, habit strength, behaviour interference) will help identify different types of repeated pro-environmental behaviours depending on the levels of each indicator present.

Internalizing Habits

Creating pro-environmental habits should require the internalization of the target behaviour. Many theories describe an internalization process through which people identify, consolidate, and embed beliefs, attitudes, values, and behaviours (e.g., Rogers, 1963; Scott,

1972; Vygotsky, Cole, John-Steiner, Scribner, & Souberman, 1980; Wallis & Poulton, 2001).

The internalization process helps to overcome the interference between competing behaviours as the behaviour becomes fully internalized. Although the pro-environmental habit literature identifies internalization and behaviour interference as important factors for habits, it does not provide a detailed description of the process of by which a habit becomes internalized. It does not explain differences in the internalization process that could potentially produce different types of repeated behaviours. For example, behaviours that are strong habits and those that are merely repeated are two types of possible repeated behaviours that could develop from different internalization processes. Finding differences between different types of repeated behaviours could help explain why some habits can sometimes be in conflict with other habitual behaviours and produce differences in one's ability to maintain a pro-environmental behaviour over time and across context.

Other areas of psychology, outside the habit framework, have theorized on the internalization process of behaviours. By combining previous research on internalization with habit research, it is possible to create testable hypotheses about how, when, and why pro-environmental behaviours internalize into strong habits or remain only repeated behaviours. The next section will discuss the role of motivation and internalization in pro-environmental behaviours to help describe the successful integration of strong pro-environmental habits.

Self-Determination Theory and Internalization

Self-determination theory (SDT; Deci & Ryan, 1985; 2000) is a theory of motivation that is concerned with supporting individuals' inherent tendencies to behave in effective and healthy ways. This theory suggests that people should be motivated toward positive behaviour change and therefore it could explain why people want to develop positive habits. This striving to

become more self-determined is strongly influenced by three psychological needs: autonomy (i.e., feeling free to act), competence (i.e., feeling capable) and relatedness (i.e., feeling connected; see Deci & Ryan, 2000; Ryan, 1995 for reviews). The satisfaction of the three basic needs through social contexts and interpersonal behaviours are hypothesized to facilitate the internalization process.

The focus of this theory is the degree to which peoples' behaviours are self-motivated or self-determined and the process that leads a behaviour to be self-determined (or not). SDT defines six different ways in which behaviour is regulated; from least to most self-determined these types are; amotivation, external regulation, introjection, identification, integration, and intrinsic regulation (see Figure 1).

Behaviour	Non self-determined			Self-determined		
Type of Motivation	Amotivation	Extrinsic				Intrinsic
		Controlled		Autonomous		
Type of Regulation	Non-regulation	External regulation	Introjected regulation	Identified regulation	Integrated regulation	Intrinsic regulation
Example	<i>Behaviour not done</i>	<i>To obtain reward/avoid punishment</i>	<i>To feel proud/avoid guilt/shame</i>	<i>Behaviour is considered important</i>	<i>Behaviour is congruent with goals/identity</i>	<i>Behaviour is rewarding in and of itself</i>

Figure 1. Motivation and behaviour regulation continuum as theorized by self-determination theory (Deci & Ryan, 2000).

These types of behaviour regulation are considered regulatory processes that people use to pursue the various goals or outcomes in their lives. The behaviour regulations can be divided into controlled and autonomous regulations (Deci & Ryan, 2000; Ratelle, Guay, Vallerand,

Larose, & Senécal, 2007). Autonomous motivation (e.g., intrinsic, integrated, identified; acting out of choice and pleasure) is more self-determined and internally regulated, whereas controlled motivation (e.g., introjected and external; acting for reward, behaving to avoid punishment, or trying to avoid feelings of guilt) is less self-determined and is externally regulated.

SDT also proposes an internalization process that explains how behaviour goes from being externally regulated, to becoming an internally regulated behaviour that is fully endorsed and supported by the individual (Ryan, 1995; Weinstein, Przybylski, & Ryan, 2013). Many behaviours, pro-environmental or otherwise, are not enjoyable in and of themselves (i.e., intrinsically enjoyable) but are thought to be important and required by the social world (e.g., buying groceries, driving to work, turning lights off). According to SDT, internalization is the active process of transforming uninteresting (e.g., not intrinsic) but important activities, into personally endorsed behaviours that are valued. The internalization process is how people synthesize behavioural regulations that were originally external, into integrated regulations, allowing for greater autonomy and effective functioning of the behaviour (Deci & Ryan, 2000; Deci, Eghrari, Patrick, & Leone, 1994; Wallis & Poulton, 2001). Osbaldiston and Sheldon (2003) studied the importance of the internalization process in motivating people to perform pro-environmental behaviours. The more internalized the motivation, the more likely participants were to perform their self-selected pro-environmental behaviours during the following week, which in turn predicted intentions to keep doing the behaviour after the study was over. De Groot and Steg (2010) found that autonomous types of motivations may be based on the internalization of the biospheric value orientation, and that these motivations toward the environment were important predictors for pro-environmental intentions.

The degree to which the internalization process is more or less successful can result in different types of self-regulation for behaviour; externally regulated, non-integrated, or integrated. External regulation is when behaviour is not internalized and people perform the behaviour to gain rewards or avoid punishments (Deci & Ryan, 2000). The motivator for the behaviour is external to the person. Non-integrated internalization is when the internalization process is partially successful and the regulation of the behaviour is not fully assimilated into one's sense of self and/or is not endorsed as one's own. In SDT introjection and to some extent identification, represent non-integrated internalizations (Deci & Ryan, 2000; Koestner, Losier, Vallerand, & Carducci, 1996; Ryan, 1995). When behaviours are internalized through introjection people perceive the value of performing the behaviour, but do not accept the behaviour as their own. When behaviours are internalized through identification people have adopted the value of the behaviour as one of their own, but it may not be totally congruent with all aspects of the self or other behaviours. Integrated internalization is when the internalization process is complete and the regulation of the behaviour has been incorporated into one's sense of self, and accepted as one's own (Deci et al., 1994; Ryan & Deci, 2000; Weinstein et al., 2013). With integration, the value and the importance of the behaviour become part of the individual and it is coherent and congruent with other aspects of one's self-identity.

The state of self-congruence associated with integration occurs when there is harmony between people's needs and their activities (e.g., achieving self-determined goals for self-determined reasons; Sheldon & Elliot, 1998; Sheldon & Schöler, 2011). To fully integrate a behaviour a person needs to understand the importance of the behaviour and then actively incorporate the meaning related to the behaviour into the other values, attitudes, and motivations already part of the self in a congruent manner (Deci & Ryan, 1985; 2000). One way to determine

the level of internalization of a behaviour is to measure how congruent it is with other behaviours, since greater congruence is related to more integrated and autonomous behavioural regulation (Legault & Inzlicht, 2013). In principle, when the regulation of a behaviour is fully integrated; values, attitudes and behaviours are aligned and experienced as harmonious (Soenens, Berzonsky, Dunkel, Papini, & Vansteenkiste, 2011). Non-integrated and controlled behavioural regulation should be associated with greater interference with other behaviours because these types of regulations remain external and not fully internalized (Deci & Ryan, 2000). In other words, unless a behaviour is fully integrated, values, attitudes, and behaviours are compartmentalized and are experienced as incompatible. Thus, having a measure of the congruence or interference of a behaviour is an important indicator of internalized behaviours.

Having a measure of behaviour interference will help identify different types of repeated pro-environmental behaviours in two ways. First, the level of reported interference in the habit literature represents the conflict that happens as current non-environmental habits interfere with the new pro-environmental habits (Emmons & King, 1988; Jager, 2003; Verplanken, 2010a). As a behaviour changes there will be some interference between the competing behaviours, whereas a fully integrated pro-environmental habit will show a reduced level of interference.

Second, the level of reported congruence or interference in the SDT literature represents an indicator of how harmonious a pro-environmental behaviour is with a person's thoughts, feelings, and actions (Deci & Ryan, 1985; 2000; Sheldon & Elliott, 1999). A behaviour at the early stage of internalization should be associated with some interference between the competing non-environmental and pro-environmental behaviours; whereas once it becomes a fully integrated pro-environmental habit it should be associated with a lack of interference between the competing behaviours and a congruence with similar behaviours. Thus, by combining the

indicators of habitual behaviours and SDT framework we are proposing that behavioural interference should represent a particularly important and meaningful indicator of different types of repeated pro-environmental behaviours. In the current thesis we propose to include a measure of interference between competing behaviours to help differentiate types of repeated pro-environmental behaviours.

Differentiating Types of Repeated Pro-environmental Behaviours

Based on the habit theory and SDT, three types of repeated pro-environmental behaviours should be detectable. The first type, weak habits, would be behaviours that are somewhat repeated but are weakly associated with indicators of a habit. Those with a weak habit for the target pro-environmental behaviour will be characterized by low behaviour frequency, a low habit strength score, and a low interference with the opposite competing non-environmental behaviour. The second type would be behaviours that may be repeated but will have a lack of congruence. They are repeated behaviour with interferences. Those with a repeated behaviour with interference for the target pro-environmental behaviour will be characterized by a moderate behaviour frequency, a moderate habit strength score, but a high interference with the opposite competing non-environmental behaviour. The third type would represent strong habits. Those with a strong habit for the target pro-environmental behaviour will be characterized by a high behaviour frequency, a high habit strength score, and a low interference with the competing non-environmental behaviour.

The predicted three types of repeated pro-environmental behaviours may be the result of how the behaviour was internalized, as predicted by SDT (Deci & Ryan, 1985; 2000; Ryan, 1995). When a behaviour is fully internalized it can be experienced as self-determined, personally endorsed, repeated over the long-term, congruent with the self, and congruent with

other behaviours. When a behaviour is only partially internalized it may be repeated often but because of a continuing extrinsic influence or lack of congruence with other behaviours it limits one's ability to develop a strong habit, resulting in a repeated behaviour with interference. When a behaviour is not yet internalized but regulated by external forces it may be repeated to some extent as long as the source of external regulation is present but it could terminate if the external motivation is removed. Having an external motivator for the behaviour limits the behaviour frequency and automaticity, leading to a relatively weak habit or possibly no habit at all.

The current thesis is specifically interested in researching differences between a strong habit for a pro-environmental behaviour and a behaviour that is merely repeated, something that has been confounded in previous research. A person who is merely repeating a pro-environmental behaviour and a person who has a strong habit for a pro-environmental behaviour will both often perform the target pro-environmental behaviour, leading to both types of repeated behaviour having a positive effect on the environment. A strong pro-environmental habit has the added benefit of being performed more frequently, it is done without thinking, saving conscious processing for new behaviours, and it is more completely internalized and congruent with different aspects of the self and other behaviours. It is therefore desirable to integrate and habituate positive pro-environmental behaviours. The current thesis aims to identify these three different types of repeated behaviour (i.e., weak habit, repeated behaviour with interference, strong habit) and then to build on this research by exploring how *determinants* and *consequences* of pro-environmental behaviours can help differentiate between the three types of repeated behaviours.

Determinants and Consequences of Pro-environmental Habits

SDT provides a useful theoretical explanation of how behaviours are internalized, it also posits the factors necessary for successful internalization, and outlines the consequences of successful or unsuccessful internalization. Identifying the determinants and consequences of successful internalization of pro-environmental behaviours will provide information on what factors are important in facilitating strong habits and the benefits that could result from having strong habits. The next section identifies the determinants of pro-environmental behaviours used in this thesis: types of motivation toward the environment, perceived importance of the environment, and nature relatedness. In the following section, important consequences of pro-environmental behaviours discussed are frequency of doing other pro-environmental behaviours and life satisfaction.

Determinants of Pro-environmental Behaviours

Types of motivation toward the environment. As explained previously, SDT defines different ways in which behaviour is regulated along a continuum from less to more self-determined, characterized by the extent the person feels actions are determined by external (controlling type motivation) and internal (autonomous type motivation) factors (Deci & Ryan, 1985, 2000; Ratelle et al., 2007; Ryan & Deci, 2000). Controlled motivations for behaviours (i.e., pressured and directed by external forces - introjected and external regulation) are extrinsic motivations that are external to one's self. Controlled type motivations are based on external demands and rewards or to prevent negative feelings like guilt. Autonomous motivations for behaviours (i.e., voluntary, freely pursued, and fully endorsed by the self - intrinsic, integrated, and identification regulation) are internalized motivations that are coming from within one's self. Autonomous type motivations are based on valuing the behaviour or deliberate reasoning and reflection to accommodate the behaviour.

Compared to controlled motivation, autonomous motivation has been reliably associated with more frequent pro-environmental behaviours. For example, Pelletier, Tuson, Green-Demers, Noels, and Beaton (1998) found in Study 3 that controlled motivations toward the environment were negatively related or not strongly positively related to frequency of participation in pro-environmental behaviours whereas, autonomous motivations toward the environment were generally strongly positively related to frequency of participation in pro-environmental behaviours. Villacorta, Koestner, and Leks (2003) found that autonomously motivated individuals reported stable pro-environmental attitudes over time, a greater number of environmental behaviours, and higher levels of well-being compared to individuals with controlled motivation toward the environment. Séguin, Pelletier, and Hunsley (1998) showed a direct link between autonomous motivation toward the environment and self-reported participation in pro-environmental behaviours in a structural equation model based on the responses of 761 community participants. Compared to controlled motivation, autonomous motivation has been associated with increased behaviour persistence as well as increased behaviour frequency (Deci & Ryan, 2008; Ortis et al., 2007; Sheldon & Elliot, 1998; Sheldon & Houser-Marko, 2001). Behaviours that are intrinsically motivated and autonomously motivated have been shown to have a longer maintenance period (De Young, 1986a; Pelletier, 2002).

Although there is research related to the internalization process and types of motivation, there is no research that looks at this in relation to habits, especially pro-environmental habits. Since autonomous type motivation is necessary for the complete internalization of behaviours through the integrated process, it is expected that autonomous type motivation would be associated with people who have a strong habit for the target pro-environmental behaviours. Since controlled type motivation is associated with incomplete, non-integrated internalization, it

is expected that controlling type motivation would be associated with people who have a repeated behaviour with interference for the target behaviour and a weak habit for pro-environmental behaviours.

Perceived environmental importance. Consistent with SDT and the theory of planned behaviour (Ajzen, 1991; Deci & Ryan, 2000), if an individual believes that protecting the environment is important and values the natural environment, then the individual will often take actions that correspond with these beliefs (Christensen, Rothberger, Wood, & Matz, 2004; Pelletier et al., 1998; Séguin et al., 1998, Sparks & Shepherd, 1992; Whitmarsh & O'Neill, 2010). It is expected that people with strong habits for the target pro-environmental behaviours would have greater perceived environmental importance compared to those with repeated behaviour with interferences and weak habits.

Nature relatedness. According to SDT there are three basic needs (i.e., autonomy, competence, relatedness) that should facilitate the internalization of behaviours (Deci & Ryan, 2000; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Ryan, 1995). When peoples' needs are met, then behaviour regulation is based on internal and autonomous factors and the behaviour becomes integrated. When peoples' needs are not met, then behaviour regulation is based on external and controlling factors and the behaviour does not become integrated.

The current research has focused on the need for relatedness because SDT states it is important for facilitating the internalization process and to explore if other types of connections (e.g., connections with nature) can help satisfy the relatedness need. Relatedness need satisfaction promotes internalization and autonomous regulation for behaviours (e.g., Grolnick & Ryan, 1989). In fact, relatedness has been identified as '*absolutely essential*' to the internalization process of behaviours (Ryan & Deci, 2000; Vallerand, 1997). The particular focus of the current

research on pro-environmental behaviour is somewhat different than the usual behaviours SDT research typically targets (e.g., motivation at work or in the classroom), and requires expansion of the relatedness construct. Usual behaviours studied in SDT (e.g., school achievement) are influenced directly by interpersonal relationships as a means of relatedness need satisfaction, whereas pro-environmental behaviours require people to have a relationship with the planet. This wider sphere of influence is why it is important to expand the concept of need for relatedness to include a connection to the natural environment (e.g., nature relatedness).

Nature relatedness is how connected an individual feels to the natural environment (Nisbet, Zelenski, & Murphy, 2009). Nature relatedness has been shown to be associated with differences in pro-environmental attitudes, behaviours, intrinsic aspirations, autonomy and well-being (Brown & Kasser, 2005; Kasser & Ahuvia, 2002; Nisbet et al., 2009; Ryan et al., 2010; Sparks, Hinds, Curnock, & Pavey, 2014; Weinstein, Przybylski, & Ryan, 2009; Zelenski & Nisbet, 2014). However, only a little work has been done using the concept of nature relatedness within the SDT framework to predict strong habits for pro-environmental behaviours (Ryan et al., 2010). Having a higher nature relatedness may be helping to satisfy the need for relatedness, which will facilitate more complete internalization of pro-environmental behaviours. It is expected that greater nature relatedness would be associated with people who have a strong habit for the target pro-environmental behaviour compared to the other two types of repeated behaviour. In contrast, lower nature relatedness would be associated with people who have a repeated behaviour with interference and a weak habit for the target pro-environmental behaviour. The next section will look at two of the major consequences of pro-environmental behaviours: frequency of doing other pro-environmental behaviours and satisfaction with life as an indicator of well-being.

Consequences of Pro-environmental Behaviours

Pro-environmental behaviours. More autonomously motivated individuals reported stable pro-environmental attitudes over time and have been shown to participate in greater numbers of different pro-environmental behaviours in addition to performing behaviours more frequently (Green-Demers, Pelletier, & Ménard, 1997; Villacorta et al., 2003). The harmonious alignment of pro-environmental identities, autonomous motivations, values and actions can lead to greater performance of similar behaviours (Renaud-Dube, Taylor, Lokes, & Guay, 2010; Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Thøgersen & Ölander, 2003) and environmental activism where people are more actively committed to improving the quality of the environment (Séguin et al., 1998).

Including a measure of the frequency people participate in other pro-environmental behaviours shows this research is consistent with previous findings. It is expected that people with strong habits would have complete internalization and congruence with several pro-environmental behaviours. People who have fully internalized the target pro-environmental behaviour may perform the habitual behaviour more often but would also participate in other pro-environmental behaviours that correspond to the internalized pro-environmental values and identity of the individual. People with repeated behaviour with interferences would have incomplete internalization and interference with other pro-environmental behaviours. People who have not fully internalized the target pro-environmental behaviour may still perform the single target behaviour but the likelihood of participating in other related pro-environmental behaviours would be reduced.

Life satisfaction. According to SDT, integration of behaviours can lead to more vitality, self-motivation, and well-being (Deci & Ryan, 2000; Johnston & Finney, 2010). In contrast, non-

integration of behaviours can lead to lower motivation, performance, and well-being (Batholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Deci & Ryan, 2000; Ryan, Deci, Grolnick, & La Guardia, 2006). Research shows that autonomous motivation and more internalized behaviours are related more strongly to eudaimonic types of well-being rather than solely by hedonic conceptions of 'happiness' (Ryan & Deci, 2001; Ryan, Huta, & Deci, 2008). Thus, the eudaimonic well-being aspect of general life satisfaction has been identified as an important consequence to be included in the current research. It is expected that people with a strong habit will have more satisfaction with life due to more complete internalization resulting from greater need satisfaction and greater autonomous motivation for the target pro-environmental behaviours. People who have not completely internalized the behaviour will have less satisfaction with life.

Summary and Goals of this Research

The habit literature (Bargh, 1994; Verplanken, 2006) does not distinguish between the simple repetition of a behaviour and the repetition of a behaviour that has been internalized and integrated completely. It therefore does not provide an account of the internalization process, nor does it provide specific criteria to define the quality of the internalized behaviour. A framework that can address these issues is provided by SDT (Deci & Ryan, 1985; 2000). The current thesis thus uses SDT to help differentiate different types of repeated pro-environmental behaviours using the identified indicators of habits (i.e., behaviour frequency, habit strength, behaviour interference). Overall, the literature outlined above suggests that there should be at least three different types of repeated behaviour: weak habits, repeated behaviour with interferences, and strong habits. The first type, weak habits, will be the result of external motivation with little to no internalization of the behaviour and would not be considered a repeated behaviour. These

behaviours are not internalized and will not strongly exhibit any of the three indicators of habitual behaviour. A second type, repeated behaviour with interferences, will be behaviours that have been incompletely internalized. These behaviours will exhibit moderate levels of the habit indicators, particularly frequent repetition and behaviour interference. The third type, strong habits, will be behaviours resulting from full internalized through the integration process. These behaviours will have high habit indicators of frequency and habit strength, and low interference indicating the congruence that defines a strong habit. The aim of the current thesis is to identify these three different types of repeated pro-environmental behaviours (i.e., weak habit, repeated behaviour with interference, strong habit).

SDT also provides predictions of how important determinants and consequences will be related to the three different types of repeated pro-environmental behaviours. It is expected that autonomous motivation toward the environment will be positively related to the strong habitual pro-environmental behaviours since this type of motivation helps cultivate more complete internalization. Complete internalization and more autonomous motivation depend on the satisfaction of the three basic needs (i.e., autonomy, relatedness, competence) but we argue that a wider concept of relatedness (i.e., nature relatedness) is particularly important for pro-environmental behaviours. Nature relatedness is expected to relate positively to the strong habitual pro-environmental behaviours. People who place more importance on the environment will also relate positively to the strong habitual pro-environmental behaviours. When a behaviour has been internalized through integration and is autonomously motivated, the single behaviour will align with the values and identity of the person, and the behaviour will be in congruence with other behaviours that support the person's values and identity. This congruence will be reflected in a greater number of similar behaviours performed by a person. Finally, it is expected

that the more internalized a behaviour is, the more life satisfaction the person will have, since people with more internalized behaviours report greater need satisfaction and greater well-being.

Research Goals

This program of research had three goals. The first goal was to measure pro-environmental habits using the habit indicators identified in the literature (i.e, behaviour frequency, habit strength, behaviour interference), and to differentiate types of repeated behaviours (i.e., weak habit, repeated behaviour with interference, strong habit). The second goal was to find support for differences between strong habits and behaviours that are merely repeated. The third goal was to explore potential determinants and consequences of pro-environmental behaviours and identify factors that predict strong habits.

To achieve these goals, this program of research combined the theoretical framework of habits with the theoretical framework of SDT to address current gaps in the literature. The specific internalization process of habits has not been well examined in the habit literature nor in the SDT literature. The current program of research fills this gap as it incorporates constructs from both theories. By combining the literature on habits with the proposed internalization processes of SDT it will be possible to explain differences in types of pro-environmental repeated behaviours. Differentiating types of repeated behaviours is important because it will expand our understanding of the behaviour change process and habit development. Building from theoretical expectations and identified gaps in the literature, this program of research will provide a better understanding of pro-environmental habits and will identify which factors support or thwart optimal internalization of strong pro-environmental habits.

Overview of the studies. This thesis is comprised of six studies. The purpose of the first three studies was to determine if repeated pro-environmental behaviours could be measured

using the three proposed indicators of habitual behaviours and to identify differences between strong habits and repeated behaviour. Using a model of study replication (Kline, 2013), each of the three studies used the same method and measures but varied the samples and target pro-environmental behaviour (e.g., recycling) as a way to test the robustness of the findings.

Study 1 used a cross-sectional online survey study design with a convenient university sample. We expected to find three types of repeated pro-environmental behaviours (i.e., weak habit, repeated behaviour with interference, strong habit) for the target pro-environmental behaviour using public transportation. Study 2 builds on Study 1 by using an adult sample to show that the findings are repeatable with a community sample. The study also used a new pro-environmental behaviour (i.e., recycling) to show that the results are generalizable to a different type of pro-environmental behaviour. Study 3 builds on Study 2 by using the same target pro-environmental behaviour recycling but used a convenient student sample to show that results are consistent across samples. The stability of the hypothesized three types of repeated pro-environmental behaviours will be showcased by measuring the habit indicators across diverse samples and across diverse behaviours. These three studies are presented in the first empirical article entitled “Integration of habit indicators and self-determination theory: Differentiating types of repeated pro-environmental behaviours”.

In sum, Studies 1 to 3 show that there are differences between types of repeated pro-environmental behaviours when they are measured with the three habit indicators using a person-centred approach (i.e., cluster analysis). However, these studies do not explain factors that could facilitate more complete internalization of integrated strong pro-environmental habits. The purpose of the last three studies presented in the second manuscript was to determine if differences could be identified between different types of repeated pro-environmental behaviours

based on determinants and consequences of pro-environmental behaviours predicted to aid in successful internalization of behaviours. Study 4 used a cross-sectional online survey study design with a new convenient university sample. We expected once again to identify the three types of repeated pro-environmental behaviours using cluster analysis. Then the likelihood of group membership in each of the three types of repeated behaviours was tested using determinants and consequences predicted by previous environmental psychology research and SDT (i.e., types of motivation toward the environment, connection to nature, environmental importance, frequency of pro-environmental behaviours and life satisfaction). The goal was to identify factors associated with people who had a strong habit for the target pro-environmental behaviour double sided printing compared to the other two types of repeated behaviours. Study 5 builds on Study 4 by using a new target pro-environmental behaviour (i.e., recycling) and a new sample to show that results are consistent across different types of pro-environmental behaviours. Study 6 builds on Study 5 by using the same target pro-environmental behaviour (i.e., recycling) and a new sample to show that results are consistent with the same behaviour across samples. These three studies are presented in the second empirical article entitled “What predicts habits for pro-environmental behaviours: An analysis of the determinants and consequences of pro-environmental behaviours”.

The two articles are presented in their entirety next in this document and are followed by a discussion of the thesis findings as a whole, including limitations and directions for future research. Overall, these two articles addressed the goals of this thesis and have added to the literature a new understanding of what pro-environmental habits are, how they are different from repeated behaviours, and how we can foster internalization of pro-environmental behaviours to help create a sustainable future for the planet.

**Integration of Habit Indicators and Self-Determination Theory:
Differentiating Types of Repeated Pro-Environmental Behaviours**

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Abstract

The goal of this research was to measure pro-environmental habits using identified indicators. The theoretical frameworks of habits (Bargh, 1994; Verplanken, 2006) and self-determination theory (SDT; Deci & Ryan, 2000) were combined to differentiate different types of repeated behaviours: behaviours not repeated often, behaviours repeated but in some conflict with other behaviours, and behaviours that are repeated, automatic, and lack interference with other behaviours. Three cross-sectional survey studies provide strong support for the types of repeated behaviours: weak habit, repeated behaviour with interference, and strong habit. Results from the cluster analyses were robust across three studies, three samples, and three different target behaviours. The level of interference between competing behaviours was a unique habit indicator for differentiating between a behaviour merely repeated and a strong habit. The implications of the findings are discussed in relation to SDT and the study of habits.

Keywords: Habits, pro-environmental behaviours, internalization, self-determination theory, cluster analysis

Integration of Habit Indicators and Self-Determination Theory:

Differentiating Types of Repeated Pro-Environmental Behaviours

As the human population increases, it is having a larger impact on the exploitation of the earth's resources. Individual behaviour change is one way to help improve the situation, making it an important topic for psychological research (Gifford, 2008; Karl, Melillo, & Peterson, 2009). Pro-environmental behaviours are behaviours that can help slow the detrimental effects of climate change and environmental degradation. Various strategies for increasing pro-environmental behaviours have been researched and proposed (for reviews see: Arbuthnott, 2009; Dwyer, Leeming, Cobern, Porter, & Jackson, 1993, Gifford, 2011; 2014; Steg & Vlek, 2009; Stern, 2000; and also a number of meta-analyses Bamberg & Möser, 2007; Hines, Hungerford, & Tomera, 1987; Osbaldiston & Schott, 2012) but lack of behavioural maintenance and the integration of behaviours in one's lifestyle remain a challenge to achieving environmental sustainability and sustainable behaviour change (Lehman & Geller, 2004; Osbaldiston & Sheldon, 2003). Some researchers have been successful at obtaining temporary increases of pro-environmental behaviours, but they lack the ability to achieve behaviour maintenance (De Young, 1993; Katzev & Johnson, 1983). Since single instances of pro-environmental behaviours are unlikely to reduce the impact of human behaviour on the environment, models of pro-environmental behaviour change should target maintained repeated behaviours. Habits offer a potential mechanism for long-term maintenance of pro-environmental behaviours (Gregory & Leo, 2003; Rothman, Sheeran, & Wood, 2009). There is a small but growing body of literature exploring pro-environmental habits (e.g., Dahlstrand & Biel, 1997; Gregory & Leo, 2003; Klöckner & Matthies, 2004; Klöckner, Matthies, & Hunecke, 2003; Knussen & Yule, 2008; Maréchal, 2010; Verplanken, 2010a). Our research looks to differentiate

between different types of repeated pro-environmental behaviour. Specifically, we are differentiating people who do not carry out pro-environmental behaviours, from those who simply repeat pro-environmental behaviours, from those who have a habit that is integrated into their lifestyle and sense of self.

Pro-environmental Habits

Sustained behaviour change is not an easy process. Several researchers have proposed that the process of changing behaviour involves progressing from carrying out a behaviour once, to adopting a behaviour, to repeating/maintaining a behaviour, and finally to developing a habit which is integrated into one's daily life and sense of self (e.g., Bamberg, 2013; Dahlstrand & Biel, 1997; Gollwitzer, 1990; Prochaska & DiClemente, 1986; Schwarzer, 2008). Our research is interested in the latter part of this behaviour change process and will focus on pro-environmental habits that are integrated into one's lifestyle.

Habits are acquired behaviours patterns that are frequently done, often automatically (Aarts & Dijksterhuis, 2000; Orbell & Verplanken, 2010; Verplanken, 2006). The current understanding of habitual behaviour includes three main indicators: (1) habitual behaviour is developed with behaviour repetition that is prompted (i.e., behaviour frequency), (2) habitual behaviour has qualities of automaticity (i.e., strength of habit), and (3) established habitual behaviour will interfere with developing habits (i.e., behavioural interference). These three aspects of repeated behaviour help indicate if a behaviour has become a habit.

Indicators of Habits

Behaviour frequency. Pro-environmental habits are often behaviours that a person repeats frequently. Many studies use behaviour frequency as an indicator of future habitual behaviour and of current habitual behaviour (e.g., Fujii & Kitamura, 2003; Kahle & Beatty,

1987; Klöckner & Matthies, 2004; Webb & Eves, 2007a; 2007b; Wittenbraker, Gibbs, & Kahle, 2006). For example, Ouellette and Wood (1998) explored the mechanisms through which past behaviour predicted future behaviour using a meta-analysis of automatic behaviours and intentional behaviours. The majority of studies defined the stability of habits by how frequently the behaviour was performed; the more frequently a person performed the behaviour, the more stable the habit was considered to be. Studies included in the meta-analysis showed past behaviour had a strong direct effect on future behaviour for behaviours that were performed on a daily or weekly basis and in a stable context. This pattern was reversed when the behaviours were done infrequently and in inconsistent contexts. Ouellette and Wood (1998) concluded that the frequency of past behaviour reflects the stability of a habit and that past behaviour may be the best indicator of future daily behaviour.

Habit strength. Frequent behaviour repetition is a necessary condition for a habitual pro-environmental behaviour but it is not the only condition. The automaticity of a behaviour is the essential indicator of the strength of a habit. Generally, for a behaviour to be considered a habit, it should show four characteristics related to automaticity: a lack of awareness while performing the behaviour, difficulty in controlling the behaviour, the behaviour is performed without intention, and mental efficiency in performing the behaviour (Bargh, 1994; Schneider & Shiffrin, 1977; Verplanken, 2006; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). It is possible to measure these characteristics of automaticity to establish a sense of the strength of the habit over and above the frequency of performing the behaviour (Ajzen & Fishbein, 2000; Bargh, 1994; Verplanken & Orbell, 2003).

Since there are many potential reasons for behaviour to be repeated, outside of habits, there needs to be independent measures of the frequency of behaviour and the strength of the

habit (Aarts, Verplanken, & Knippenberg, 1998; Bamberg, Ajzen & Schmidt, 2003). By measuring the strength of a habit it is possible to more directly tap into the habit construct over and above what is possible with only a measure of the frequency.

Behaviour interference. The final proposed indicator of pro-environmental habits is the internal conflict that happens as behaviours change, due to current habits interfering with new habits. Current habits may be obstacles to behaviour change and people's ability to develop new habits (Verplanken, 2010b). This interference is an important concept for the current research because many pro-environmental behaviours have conflicting non-environmental behaviours that are often already habitual (e.g., throwing paper in the garbage instead of in the recycling).

The characteristics that make a behaviour habitual also make the behaviour difficult to change (Jager, 2003; Lally, van Jaarsveld, Potts, & Wardle, 2010). Dahlstrand and Biel (1997) studied a process of behaviour change from a habitually non-environmental behaviour to a habitually pro-environmental behaviour. They showed that current habits can impede the development of new more environmentally friendly habits. This interference between habits for opposite competing behaviours (e.g., buying non-environmentally friendly detergents compared to buying environmentally friendly detergents) was found to impede the internalization of the pro-environmental behaviour and hampered progression to the development of new habits for the participants.

Behaviour interference can be characterized by the uncertainty inherent in deciding what to do and whether the choice of one alternative behaviour was the right one when neither behaviour is fully automatic (Fujii, Gärling, & Kitamura, 2001; Garvill, Marell, & Nordlund, 2003; Hofer, 2007; Wood, Tam, & Witt, 2005). Experiencing interference between two potential behaviours in the same context forces some deliberation about the behaviour and suggests it is

not fully internalized or fully habitual. Just as goal conflict can interfere with goal integration (Emmons & King, 1988), habit conflict can interfere with habit integration (Dahlstrand & Biel, 1997). When attempting to create a habit (i.e., target habit), people are confronted with the challenge to also change existing habits (i.e., current habit; Jager, 2003; Verplanken, 2010a). This process includes a reduction in the perceived interference between the current behaviour and the target behaviour as the new target behaviour becomes internalized and habitual (Dahlstrand & Biel, 1997; Lally et al., 2010). Together these three indicators of habits will help identify different types of repeated pro-environmental behaviours depending on the levels of each indicator.

Internalizing Habits

Creating pro-environmental habits requires the internalization of the target behaviour. Theories within multiple traditions have described an internalization process through which a person identifies, consolidates, and embeds one's own beliefs, attitudes, values, and behaviours (e.g., Rogers, 1963; Scott, 1972; Vygotsky, Cole, John-Steiner, Scribner, & Souberman, 1980; Wallis & Poulton, 2001). Unfortunately, the pro-environmental habit literature is not able to explain differences in the internalization process that could potentially produce different types of repeated behaviours. For example, fully internalized behaviours resulting in strong habits and behaviours that are merely repeated are two potential types of repeated behaviours. Finding differences between different types of repeated behaviours could help explain why habits can sometimes be in conflict with other habitual behaviours and produce differences in one's ability to maintain a pro-environmental behaviour over time and across context.

Motivational psychology has focused on the internalization process of behaviours providing an improved understanding about what differentiates the internalization processes for

repeated behaviour and habitual behaviour. By combining this research with the habit research, it is possible to create testable hypotheses about how, when, and why pro-environmental behaviours internalize into strong habits or remain only repeated behaviours. The next section will discuss the role of motivation and internalization in pro-environmental behaviours in order to identify different types of repeated pro-environmental behaviours.

Self-Determination Theory

People are motivated to perform pro-environmental behaviours for a number of different reasons. Some of these reasons are external to the person (e.g., incentive programs for increasing recycling behaviours). Other reasons are internal to the person (e.g., recycling because protecting the planet is believed to be an important goal). Interventions that focus on increasing pro-environmental behaviours using external motivators are often able to create an initial change, but have been unsuccessful at achieving a sustained change in behaviour (De Young, 1993; Katzev & Johnson, 1983); whereas, internalized behaviours, which are regulated internally, are more likely to be maintained over the long-term (e.g., de Groot & Steg, 2010; Deci, Eghrari, Patrick, & Leone, 1994; Osbaldiston & Sheldon, 2003). Self-determination theory (SDT) proposes a continuum of motivation from external to internal behaviour regulation, which can be categorized by the level of self-determination of the motivation (Deci & Ryan, 1985, 2000). Autonomous motivation (e.g., acting out of choice and pleasure) is more self-determined and internally regulated, whereas controlled motivation (e.g., acting for reward, behaving to avoid punishment, or trying to avoid feelings of guilt) is less self-determined and is externally regulated.

SDT also proposes an internalization process that explains how a behaviour goes from being externally regulated, to becoming an internally regulated behaviour that is fully approved

of by the individual (Ryan, 1995; Weinstein, Przybylski, & Ryan, 2013). According to SDT, internalization is the active process of transforming uninteresting (e.g., not intrinsic) but important activities, into personally endorsed values. The internalization process is how people synthesize behavioural regulations that were originally external, into integrated regulations (Deci & Ryan, 2000; Wallis & Poulton, 2001).

The degree to which the internalization process is successful will result in different types of self-regulation for behaviours; integrated, non-integrated, or externally regulated. Integrated internalization is when the process is complete and the regulation of the behaviour has been incorporated into one's sense of self and accepted as one's own (Weinstein et al., 2013). With integration, the value and the importance of the behaviour become part of the individual, and it is coherent and congruent with other aspects of one's self-identity. Non-integrated internalization is when the process is partially successful and the regulation of the behaviour is not fully incorporated into one's sense of self and/or is not accepted as one's own. In SDT identification and introjection represent non-integrated internalizations (Deci & Ryan, 2000; Koestner, Losier, Vallerand, & Carducci, 1996; Ryan, 1995). When behaviours are internalized through identification people have adopted the value of the behaviour as one of their own, but it may not be totally congruent with all aspects of the self. When behaviours are internalized through introjection people perceive the value of performing the behaviour, but do not accept the behaviour as their own. External regulation is when a behaviour is not internalized and people perform the behaviour to gain rewards or avoid punishments.

Different types of internalization might be the reason for different types of repeated behaviour (Deci et al., 1994; Deci & Ryan, 2000; Levesque, Copeland, & Sutcliffe, 2008). When people fully internalize and integrate a behaviour, they are more likely to perform the behaviour

well, persist at it over the long term, and it will be congruent with other behaviours and the self (e.g., Deci, et al., 1994; Williams & Deci, 1996). When a behaviour is non-integrated, the internalization processes is incomplete so the behaviour may be repeated, but it is not integrated. The reasons for engaging in the behaviour are potentially external to the person or interfering with other behaviours or other personal values (Deci & Ryan, 2000). Thus, having a measure of the congruence or interference of a behaviour is an important indicator of internalized behaviours.

In agreement with SDT there should be three types of repeated behaviours. The first type, weak habits, represents behaviours that have not begun to be internalized and are being regulated by external forces (e.g., incentive programs) resulting in a low behaviour frequency, a low habit strength score, and a low interference with the opposite competing non-environmental behaviour. The second type, repeated behaviours with interference, represents behaviours that have an incomplete internalization, which represents a form of motivation that may be internally regulated but not fully integrated resulting in a moderate behaviour frequency, a moderate habit strength score, but a high interference with the opposite competing non-environmental behaviour. The third type, strong habit for the behaviours, represents behaviours that have been completely internalized, which represents a form of autonomous motivation that is internally regulated and harmonious within the person, thus the behaviour has been fully integrated. These behaviours should be characterized by a high behaviour frequency, a high habit strength score, and a low interference with the competing non-environmental behaviour.

Pro-environmental behaviours that have been integrated will be self-determined, personally endorsed, repeated over the long-term, congruent with the self, and congruent with other behaviours; whereas, pro-environmental behaviours that have only been partially

internalized through a non-integrated process may also be repeated but they will not be fully self-determined because of the continuing extrinsic influence or conflict with other behaviours, values or identities. Pro-environmental behaviours that have not been internalized at all will only be performed as long as an external motivator is present.

Purpose

The goal of this research was to measure pro-environmental habits using the indicators identified in the habit and SDT literature (i.e., behaviour frequency, habit strength, and behaviour interference). Using the habit and SDT frameworks, behavioural profiles were predicted based on different types of repeated behaviour with a particular focus on identifying differences between behaviours that are simply repeated and strong habitual behaviours. As described above, three unique types of repeated behaviours were predicted; weak habits, repeated behaviours with interference, and strong habits.

Once the profiles were created, differences between the groups were validated using different psychological and behavioural antecedents and consequences of pro-environmental behaviours. Specifically, motivation for pro-environmental behaviours and nature relatedness are antecedents of pro-environmental behaviours that should identify differences between the groups of repeated pro-environmental behaviours. Guided by the principles of SDT, autonomous motivation should be more related to those with a strong habit, and controlled motivation should be more related to those who do not have a strong habit for the pro-environmental behaviour (Green-Demers, Pelletier, & Ménard, 1997; Osbaldiston & Sheldon, 2003; Pelletier & Aitken, 2014; Pelletier Tuson, Green-Demers, Noels, & Beaton, 1998). Nature relatedness is a measure of how connected a person is to nature and is a reliable predictor of pro-environmental attitudes and behaviours (Arbuthnott, Sutter, & Heidt, 2014; Nisbet, Zelenski, & Murphy, 2009; Ryan et

al., 2010; Sparks, Hinds, Curnock, & Pavey, 2014; Zelenski & Nisbet, 2014). It is expected that people with a strong habit for the target pro-environmental behaviours would have greater nature relatedness.

In terms of consequences, it is expected that there will be differences between the repeated behaviour groups based on the intention to increase the behaviour and frequency of performing other pro-environmental behaviours. Since people are likely to have favourable intentions about behaviours they have performed frequently in the past (Bem, 1972; Festinger, 1962; Ouellette & Wood, 1998), it is expected that those with a strong habit would have a high intention for behaviours they are performing and a low intention for behaviours they are not performing. This pattern is expected to be reversed for those in the weak habit group. According to SDT, when a behaviour is integrated, it is congruent with other behaviours (Sheldon & Elliot, 1998; 1999). It is expected that a greater frequency of other pro-environmental behaviours would be associated with the strong habit group for the target pro-environmental behaviours as an indication of this congruence.

General Method

Overview of the Procedure

Three studies were conducted to explore and verify the proposed three types of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit) based on the theoretical indicators of habits (i.e., behaviour frequency, habit strength, and interference with competing behaviours). Since replication in research is important (Kline, 2013), the same procedure was used for all three studies and it is described in full here. All data were collected through an online survey system (i.e., limesurvey) that could be accessed by participants from any computer with Internet access and were completed at the convenience of the participants.

Participants voluntarily signed up to participate in the survey titled “How habits are made” via the online survey system. The survey included measures presented in the following order; demographics, behaviour frequency, habit strength, behaviour interference, motivation toward the environment, nature relatedness, intention to increase the behaviour, and frequency of pro-environmental behaviour composite scale. Completion of the survey took on average 32.51 minutes. Scale items were displayed in random order and responses were associated with unique codes rather than personal names to ensure confidentiality.

Participants were told the purpose of the study was to explore habits. A cover story was provided to hide the pro-environmental purpose of the study and help prevent self-selection bias. Participants were told they would be answering questions about their intentions and habits for three everyday office behaviours that had been randomly selected from a pool of 25 possible behaviours. In fact, the behaviours were not randomly selected but were the same for all participants in each study. Each of the three studies used a different sample and targeted different pro-environmental behaviour to assess habits using measures of the three habit indicators (i.e., behaviour frequency, habit strength, and behaviour interference between competing behaviours). Study 1 used a university sample and targeted transportation behaviours. Study 2 replicated Study 1 with a new behaviour (i.e., paper disposal) and with a new adult sample to ensure the results could generalize to other behaviours and beyond university students. Study 3 replicated Study 2 with a new university sample but targeted the same disposal behaviour to ensure the results could be replicated consistently.

Overview of Cluster Analysis

Cluster analysis was chosen to address the study goals because it can identify different profiles based on the proposed theoretical indicators of habitual behaviour. Cluster analysis is a

person-centred statistical method that classifies individuals into groups, called clusters, based on the similarity within groups and the difference between groups. The benefit of using a person-centred approach like cluster analysis is the ability to identify a person specific, intra-individual organization of psychological processes and behaviours (Gore, 2000). For a comparison of person-centred and variable-centred approaches see Asendorpf (2013). Since the current research looks to differentiate between different types of repeated behaviour along a continuum of internalization, cluster analysis is particularly apt (Gore, 2000). Clusters are identified using variables selected by the researcher (Aldenderfer & Blashfield, 1984; Burns & Burns, 2009). Variables selected for use in our research included the three identified indicators of habitual behaviour: behaviour frequency, habit strength, and interference with competing behaviours. Cluster solutions in our studies were selected based on three criteria: (a) the most theoretically interpretable/meaningful, (b) the most parsimonious, and (c) had the highest measure of cohesion and separation without compromising the first two criteria (Burns & Burns, 2009; Mooi & Sarstedt, 2011).

To promote reliability and validity of the generated cluster groups, each cluster analysis was conducted in two distinct phases (Gore, 2000; Martinent, Nicolas, Gaudreau, & Campo, 2013). Phase one included a Ward's method two-step hierarchical cluster analysis to identify the optimal number of clusters to retain based on the distances between cases. Phase two involved a k-means cluster analysis which sets the cluster centers generated from the Ward's method as the initial seed points for the analysis. A k-means cluster allows for cases to be reassigned during analysis, creating more stable clusters but requiring the number of clusters to be set in advance (Burns & Burns, 2009). The k-mean algorithm continually reclassifies cases and resets the means until there is very little difference and cases are assigned to their permanent group (Norušis,

2011). This allows cases to be reclassified into the best fitting group, unlike in the Ward's method two-step hierarchical cluster analysis which locks cases into a group at the start. Cluster analysis is a collection of algorithms for exploratory analysis and does not involve hypothesis testing, as such, it does not have assumptions but it is sensitive to outliers and multicollinearity (Gore, 2000; Tabachnick & Fidell, 2001).

In order to further validate the final cluster solutions, the cluster groups were compared to other variables to show that the different repeated behaviour groups created were related to other constructs in a predictable way (Gore, 2000). Validation variables were selected to showcase differences between the groups on antecedents of pro-environmental behaviours (i.e., motivation toward the environment and nature relatedness) and consequences of pro-environmental behaviours (i.e., intention to increase the behaviour and frequency of performing other pro-environmental behaviours).

Measures

A variety of scales were used to measure pro-environmental habits and validate the cluster groups across the three studies. This section describes all the measures that were used in this research.

Demographic profile. A set of basic demographic questions about the individual (e.g., age, sex, first language) were collected.

Habit. For this research a habit was operationalized as a behaviour that has been integrated into the person, is an integral part of her life, congruent with the self and other behaviours. Habits were measured using: behaviour frequency, habit strength, and level of interference between opposite competing behaviours.

Behaviour frequency. The frequency of performing the target behaviour was measured on a scale from 0-10. For example, the measure created for the public transportation behaviour stated “In an average WEEK, how many ONE WAY trips do you take on public transportation?”. The measure created for the paper recycling behaviour stated “In an average WEEK, how often do you recycle your paper products?”.

Habit strength. The strength of a behavioural habit is based on those features identified in the habit literature as being essential to the construct (i.e., difficulty controlling the behaviour, the lack of awareness, efficiency, and identification with the behaviour) and were measured with the 12-item Self-Report Habit Index (Verplanken & Orbell, 2003). Items complete the statement “Behaviour XX is something...” and an example item is “I do automatically”. The items are measured on a 7-point response scale that is anchored by 1 (*Disagree*) to 7 (*Agree*). A higher score on the scale indicates a stronger habit for the target behaviour (Gardner, de Bruijn, & Lally, 2011). In the Verplanken and Orbell (2003) study the validity and reliability of the Self-Report Habit Index was tested over four studies. Construct validity of the scale was demonstrated by exploratory factor analysis, reliability was shown using a 3-week test-retest method and the scale exhibited high levels of internal consistency.

Behaviour interference. When there is low interference between opposite competing behaviours (i.e., congruence) this is an indicator of habitual behaviour, whereas high interference indicates the behaviour has not been fully integrated. A question related to the target behaviour's interference was developed for this research. For example, public transportation interference question asked “To what extent does your current form of transportation XX¹ interfere or conflict with your preferred form of transportation XX?” using a 7-point scale ranging from 1 (*No*

¹ The current and preferred transportation behaviours were self-identified earlier in the survey.

conflict) to 7 (*Strong conflict*). The paper recycling interference question asked “To what extent does your current form of paper disposal XX² interfere or conflict with your preferred form of paper disposal XX?” using a 7-point scale ranging from 1 (*No conflict*) to 7 (*Strong conflict*).

Higher scores indicate a higher level of interference between behaviours.

Antecedents and consequences of pro-environmental behaviours. Validation variables were selected to showcase differences between the cluster groups on antecedents of the target behaviour and consequences of the target behaviour.

Motivation toward the environment. Environmental motivation propels people to behave in environmentally friendly ways. The Motivation Toward the Environment Scale (Pelletier et al., 1998) includes 24 items that answer the question "Why are you doing things for the environment?" and reflect the motivational constructs specified by SDT. Example items include “for the pleasure I get from contributing to the environment” and “for the recognition I get from others”. Participants were asked to indicate the extent to which each item corresponded to their reasons for engaging in pro-environmental behaviours on a 7-point scale ranging from 1 (*Does not correspond at all*) to 7 (*Corresponds exactly*). Higher scores indicate a higher level of motivation. The validity and reliability of the Motivation Toward the Environment Scale was tested over multiple studies (Pelletier et al., 1998; Villacorta, Koestner, & Lekes, 2003). Validity of the scale was demonstrated by exploratory and confirmatory factor analyses, reliability was shown using a 5-week test-retest method, and the scale exhibited high levels of internal consistency (Pelletier et al., 1998). For ease of interpretation, two sub-scales were created to reflect participants' level of controlled motivation toward the environment (i.e., external and

² The current and preferred disposal behaviours were self identified earlier in the survey.

introjected) and their autonomous motivation toward the environment (i.e, identified, integrated, and intrinsic) as per previous SDT research (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007).

Nature relatedness. Individual differences in how connected a person is to the natural environment were measured with the Brief Nature Relatedness Scale (Nisbet & Zelenski, 2013). The scale has 6-items that measure the sense of closeness with nature for a person emotionally and physically. An example item is “I take notice of wildlife wherever I am”. Higher scores indicate a stronger connection to nature. The validity and reliability of the nature relatedness scale was tested over four studies (Nisbet & Zelenski, 2013). Factor analysis was used to demonstrate the validity of the scale. The scale exhibited high levels of internal consistency and concurrent validity was shown by correlations with established environmental and personality measures. Reliability was shown using a 4-week test-retest method on a diverse sample.

Behaviour intention. Intention to increase the target behaviour and the competing behaviour was measured. For example, the transportation intention item asked “Think about your transportation behaviour over the last year and how you currently think about the way you choose to get around. Do you intend to increase how much you use public transportation?” using a 7-point scale ranging from 1 (*No intention*) to 7 (*Strong intention*). The same question was asked about the opposite competing behaviour “Do you intend to increase how much you drive a motor vehicle?”. The recycling intention item asked “Think about how much paper you put in the recycling over the last year and how you currently think about the way you choose to dispose of waste. Do you intend to increase how much you put paper in the recycling?” using a 7-point scale ranging from 1 (*No intention*) to 7 (*Strong intention*). The same question was asked about the opposite competing behaviour “Do you intend to increase how much you put paper in the garbage?”. Higher scores indicate a higher level of intention to increase the behaviour.

Pro-environmental behaviours. This scale measures the frequency of various pro-environmental behaviours and was developed based on items used in previous studies (Pelletier, Legault, & Tuson, 1996; Pelletier et al., 1998; Statistics Canada, 2011). There were 16 items in Study 1, 10 items in Study 2, and 28 items in Study 3. All items were rated on a 7-point scale ranging from 1 (*Not very often*) to 7 (*Very often*). Higher ratings are associated with a higher frequency of participating in pro-environmental behaviours. Example items include “participate in events organized by ecological groups” and “turn off lights when you leave a room”.

Study 1

The goal of the first study was to distinguish different types of repeated behaviours, particularly a difference between repeated behaviours with interference and strong habitual behaviours using the three indicators of habits identified (e.g., behaviour frequency, habit strength, and level of interference between opposite competing behaviours). A cross-sectional online survey study design was used with a convenient university sample. As hypothesized, we were expecting to find three types of repeated behaviours. One group will consist of people with no habit or a weak habit for the target pro-environmental behaviour. These people will not perform the behaviour very frequently, will have a low score on the habit strength measure, and will report low interference with the competing behaviour. A second group will consist of people with a strong habit for the target behaviour that is integrated. These people will repeat the behaviour very frequently, will score high on the habit strength measure, and will report low interference with the competing behaviour. A third group is expected, one that is unique from the strong habit group and supports the hypothesis that there is a difference between habits and repeated behaviours. This group will have a frequency and a habit strength score somewhere

between the other two groups but the level of interference will be high, an indication of the lack of integration of the behaviour.

Target behaviour. Transportation behaviour was used as the target behaviour, with taking public transportation as the target pro-environmental behaviour and driving a motor vehicle the competing non-environmental behaviour. The transportation sector in the USA and Canada accounts for approximately 33 percent of total carbon dioxide emissions from fossil fuel combustion; approximately 60 percent of the total emissions result from personal vehicle use (IEA, 2009). Thus, targeting behaviour change of transportation behaviours can produce a positive environmental impact. Plus, transportation to school or work is a behaviour repeated by people on a relatively daily basis, so the potential influence of habits on this behaviour is high (Wood, Quinn, & Kashy, 2002). Due to the introduction of a university sponsored bus pass at the time of the study, there was a large population of individuals with reduced barriers to participating in the target behaviour.

Results

Participants for this study were undergraduate students ($N = 303$; 77% females and 23% males) enrolled in a psychology course at a Canadian university. They voluntarily completed an online survey in exchange for partial credit as per the rules and regulations of the participant pool. Participants' ages ranged from 16 to 34 years ($M = 19.07$, $SD = 2.43$). All measures were completed in English and 79% spoke English as their first language. Prior to data analysis participants with no valid driver's license were removed from the sample leaving only participants able to both drive and take public transportation ($N = 254$).

Descriptive statistics for the habit indicators can be seen in Table 1. Overall people were not likely to report taking the bus, as seen by the low means for the bus indicators. As expected,

there was a strong positive correlation between the habit strength and frequency indicators. In this study the interference indicator was not correlated to the frequency of bus trips and was statistically significantly positively related to bus habit strength.

Cluster Analysis

Phase one. A Ward's method two-step hierarchical cluster analysis was performed using behaviour frequency (e.g., average number of bus trips per week), habit strength for taking the bus, and behaviour interference (e.g., To what extent does your current form of transportation XX interfere or conflict with your preferred form of transportation XX?). In the current sample 18 cases were removed as outliers and 24 cases were removed due to incomplete responses resulting in a usable sample size of 212³.

In this first phase, the analysis was set free to create cluster groups automatically based on the algorithm's analysis of differences between cases rather than constrained to a specific number of cluster groups. Ward's method produced a spontaneous 3-cluster solution for the public transportation behaviour. Solutions were then compared across 2-cluster solutions, 3-cluster solutions and 4-cluster solutions to determine the best cluster solution based on the criteria (a) the most theoretically interpretable/meaningful, (b) the most parsimonious, and (c) had the highest measure of cohesion and separation without compromising the first two criteria.

A 3-cluster solution produced the most theoretically meaning solution with the fewest groups based on the means of the three indicator variables. See Table 2 for the means. The first group had consistently fewer numbers of bus trips, lower scores on the habit strength scale, and low behaviour interference and was labelled the Weak Habit group. The second group had

³ In all studies it was decided to not use any data imputation of missing values due to the potential to bias the cluster analysis. Multicollinearity was assessed with tolerance and variance inflation factor (VIF) values for all models in the article. No serious violations of multicollinearity were observed for any of the models in the article.

moderate scores on the habit strength scale and number of bus trips but scored high on the behaviour interference item and was labelled the Repeated Behaviour with Interference group. The third group had consistently high number of bus trips, high scores on the habit strength scale, and low behaviour interference and was labelled the Strong Habit group.

The silhouette measure of cohesion and separation is a measure of goodness of fit of cluster membership. The 3-cluster solution had a silhouette measure of cohesion and separation of .50, which is considered a good fit⁴ (Norušis, 2011). Based on the phase one analysis, the 3-cluster solution was retained as the best solution.

Phase two. A second cluster analysis was performed based on the results of the phase one Ward's method analysis. A k-means cluster analysis starts out with an initial set of means and classifies cases based on their distance to the cluster centers (Burns & Burns, 2009). Phase one of analysis was performed to establish the optimal number of groups (i.e., 3) and to obtain initial mean values.

The means of the three indicator variables (i.e., behaviour frequency, habit strength, behaviour interference) from the Ward's method cluster analysis were entered as the starting values for the 3-cluster k-means cluster analysis. Once the reclassification was completed the analysis once again produced 3-clusters with a pattern of means representing a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for the public transportation behaviour. Post-hoc analysis of the public transportation behaviour shows that each of the final three cluster groups were statistically significantly different on each of the three indicator variables⁵ $F_{Frequency}(2, 209) = 69.92, p < .001$, $F_{Habit Strength}(2, 209) = 88.20, p < .001$,

⁴ The 2 cluster and the 4 cluster solution had silhouette measures of cohesion and separation of 0.40 and 0.50 respectively.

⁵ In all three studies, the F tests should be used only for descriptive purposes because the clusters were chosen to maximize the differences among cases in different clusters. The observed statistical significance levels are not corrected for this and thus cannot be interpreted as tests of a hypothesis that the cluster means are equal.

$F_{Interference}(2, 209) = 361.91, p < .001$. Results, including post-hoc analyses, are displayed in the lower part of Table 2. There were very few changes made to the original classification (Weak Habit = 7%, Repeated Behaviour with Interference = 9%, Strong Habit = 1%).

Validation of Groups

In order to further validate the 3-cluster solution, the cluster groups were compared to other variables to show that the different groups would be related to other constructs in a predictable way. Since the validation variables are related to pro-environmental behaviour antecedents and consequences, it was expected the strong habit and the interfered repeated behaviour groups for pro-environmental recycling behaviour would be associated with higher scores on the pro-environmental related validation variables; whereas, the weak habit group would be less related to these pro-environmental validation variables. Results of the ANOVAs and subsequent post-hoc analyses assessing group differences between the clusters and the variables are displayed in Table 3.

Public transportation clusters. With respect to the antecedent variables, the three public transportation behaviour cluster groups differed on autonomous motivation toward the environment ($F(2, 188) = 4.02, p = .020$) but did not differ on controlled motivation toward the environment ($F(2, 195) = 2.67, p = .071$) and did not differ on nature relatedness ($F(2, 175) = 0.29, p = .745$). Tukey post hoc analysis indicated that the Weak Habit group had lower autonomous motivation than the other two groups. The Repeated Behaviour with Interference group had higher autonomous motivation than the Weak Habit group but lower autonomous motivation than the Strong Habit group.

The intention and behaviours variables did not differ between the three public transportation behaviour cluster groups on the intention to increase public transportation

behaviours ($F(2, 204) = 1.18, p = .310$), did differ on the intention to increase motor vehicle driving behaviours ($F(2, 207) = 4.27, p = .015$), and did not differ on the frequency of performing other pro-environmental behaviours ($F(2, 205) = 1.34, p = .263$). The Repeated Behaviour with Interference group reported a higher intention to increase motor vehicle use compared to the other two groups.

Study 1 Discussion

The results from Study 1 support the existence of the three proposed types of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit) for the public transportation behaviour and provides support for a distinction between behaviours that people have a habit for and those that are only repeated. The pattern across the habit indicators for the weak habit group was characterized by low behaviour frequency, a low habit strength score, and a low interference with the opposite competing behaviour. The repeated behaviour with interference group was characterized by a moderate behaviour frequency, a moderate habit strength score, but a high interference with the competing behaviour. The strong habit group was characterized by a moderate behaviour frequency, a high habit strength score, and a low interference with the competing behaviour. The interference indicator helped differentiate the interfered repeated behaviour from the strong habitual behaviour because it showed that repeated behaviour was less congruent.

The validation of the public transportation cluster groups found that autonomous motivation was positively associated with the strong habit group for the target pro-environmental public transportation behaviour but that controlled motivation was not a statistically significant factor as was predicted. Interestingly, the repeated behaviour with interference group had a statistically significantly higher intention to increase motor vehicle use. This could be viewed as

another indication that this group is lacking congruence, since they have some intention to do the non-environmental behaviour even though they are already doing the pro-environmental behaviour with some level of frequency and automaticity.

This study was limited in that it cannot be known if the habit indicators can be generalized to other samples or other pro-environmental behaviours. This study explored the possibility of differentiating groups of repeated behaviours, particularly between people who have a strong habit and those who have behaviour repetition, something that has not been explored in the literature previously. However, the statistically non-significant results across these validation variables may reflect people's preference to use other types of sustainable transportation other than taking the bus (e.g., walking, riding a bike), or may be due to the fact that transportation behaviours are often perceived to be more difficult to perform (Aitken & Pelletier, 2011; Green-Demers et al., 1997), leading to less consistent results. Subsequent studies need to determine if these results are consistent or a sample specific phenomenon (Kline, 2013). The indicators need to be assessed with a new sample and using a different pro-environmental behaviour, one that is more frequently performed by people.

Study 2

The goal of the second study was to replicate the results from the first study (Kline, 2013). A new target behaviour was used to show that the results were generalizable to other behaviours beyond transportation behaviours. A general population sample was used to show that the results were generalizable beyond a university student sample. A cross-sectional online survey study design was used with a convenient adult sample. Consistent with Study 1, it was hypothesized that the 3-cluster solution with a weak habit group, a repeated behaviour with interference group, and a strong habit group would be the best solution.

Target behaviour. Paper disposal was the new target pro-environmental behaviour. Disposal of paper at school or work is a behaviour repeated by people on a relatively daily basis (Wood et al., 2002). It is a common behaviour that can have an impact on natural resources, energy consumption, greenhouse gas emissions, and landfill space, all of which can be reduced through recycling disposal methods instead of disposing paper into the garbage (Čabalová, Kačík, Geffert, & Kačíková, 2011). Recycling is often perceived to be relatively easy to perform (Aitken & Pelletier, 2011; Green-Demers et al., 1997; Pelletier et al., 1998) and may result in greater reported variance across participants. Recycling disposal behaviours were the target behaviour, while garbage disposal behaviours were the opposite competing behaviour for this study.

Results

Participants for this study were recruited using the public online recruitment application Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011; Mason & Suri, 2012; Rand, 2012). They voluntarily completed an online survey in exchange for cash credit as per the rules and regulations of Mechanical Turk. Since this study targeted the general population, the participants were much older than Study 1, ages ranged from 18 to 68 years ($M = 31.55$, $SD = 11.10$). All measures were completed in English and 97% spoke English as their first language ($N = 375$; 53% females and 47% males).

Descriptive statistics can be seen in Table 4. Overall people reported fairly high recycling behaviour, as seen by the means for the recycling indicators. Consistent with Study 1 there was a high positive correlation between behaviour frequency and habit strength. As expected there was a negative correlation with the measure of interference and the other two habit indicators.

Cluster Analysis

Phase one. The Ward's method two-step hierarchical cluster analysis was performed on the recycling behaviour using the cases from the same three variables proposed to indicate habit as in Study 1 (e.g., frequency, habit strength, and behaviour interference). In the current sample, nine cases were removed as outliers, two were removed for being under 18 years of age and 79 cases were removed due to incomplete responses, resulting in a usable sample size of 293.

Ward's method produced a spontaneous 3-cluster solution. Compared to the 2-cluster and 4-cluster solution, the 3-cluster solution had the most theoretical and parsimonious cluster results with a good fit. It had a silhouette measure of cohesion and separation of .60, which is considered a good fit⁶. Results supported the hypothesized three distinct groups of repeated behaviours (see Table 5). Once again there was a group with consistently lower scores on the habit strength scale, number of disposals, and low behaviour interference, which was labelled the Weak Habit group. There was a group with similarly high scores on the habit strength scale and number of disposals but also scored high on the behaviour interference item and was labelled the Repeated Behaviour with Interference group. The final group had consistently high scores on the habit strength scale, number of disposals, and low behaviour interference, which was labelled the Strong Habit group. These results are consistent with the results from Study 1. The 3-cluster solution was retained as the best solution.

Phase two. The 3-cluster k-means cluster solution validated the three groups produced with the Ward's cluster method. Once the reclassification was completed, the analysis once again produced a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for the recycling behaviour based on the means of the three habit indicator variables. Post-hoc analysis of the recycling behaviour shows that each of the three cluster groups were

⁶ The 2 cluster and the 4 cluster solution both had silhouette measures of cohesion and separation of 0.60.

statistically significantly different on each of the three indicator variables $F_{Frequency}(2, 290) = 719.79, p < .001, F_{Habit\ Strength}(2, 290) = 206.39, p < .001, F_{Interference}(2, 290) = 163.23, p < .001$.

Results, including post-hoc analyses, are displayed in Table 5. There were some changes made to the original classification (Weak Habit = 38%, Repeated Behaviour with Interference = 32%, Strong Habit = 0%) and results were similar to Study 1.

Validation of Groups

To further validate the 3-cluster solution, the cluster groups were compared to other constructs to identify predicted differences. The same validation variables as Study 1 were selected to showcase differences between the groups (i.e., motivation toward the environment, nature relatedness, intention to increase the behaviour, and frequency of performing other pro-environmental behaviours). Results of the ANOVAs and subsequent Tukey post-hoc analyses assessing group differences between the clusters and the variables are displayed in Table 6.

Recycling clusters. The three recycling behaviour cluster groups differed on controlled motivation toward the environment ($F(2, 256) = 23.43, p < .001$), autonomous motivation toward the environment ($F(2, 258) = 30.04, p < .001$), and nature relatedness ($F(2, 246) = 8.03, p < .001$). Tukey post hoc analysis indicated that the Weak Habit group had lower motivation, both controlled and autonomous, and lower nature relatedness. The Repeated Behaviour with Interference group had the highest controlled motivation. The Strong Habit group had higher motivation than the Weak Habit group for both controlled and autonomous motivation but lower controlled motivation than the Repeated Behaviour with Interference group. The Strong Habit group and the Repeated Behaviour with Interference group had higher nature relatedness than the Weak Habit group.

The three recycling behaviour cluster groups differed on the intention to increase recycling behaviours ($F(2, 286) = 16.96, p < .001$), the intention to increase garbage behaviours ($F(2, 286) = 18.53, p < .001$), and frequency of performing other pro-environmental behaviours ($F(2, 267) = 21.86, p < .001$). The Weak Habit group had the lowest intention to increase recycling, and the lowest frequency of performing other pro-environmental behaviours. The Repeated Behaviour with Interference group had a higher intention to recycle and a higher frequency of performing other pro-environmental behaviours than the Weak Habit group. The Repeated Behaviour with Interference group had the highest intention to increase throwing paper in the garbage. The Strong Habit group had a higher intention to recycle and a higher frequency of performing other pro-environmental behaviours than the Weak Habit group.

Study 2 Discussion

Consistent with Study 1, these results support the existence of the three proposed classifications of repeated behaviour (i.e., weak habit, repeated behaviour with interference, and strong habit) and provides support for a distinction between behaviours that people have a habit for and those that are only repeated based on the level of interference or congruence between behaviours. Study 2 showed the same pattern as Study 1 among the three indicator variables and produced the same 3-cluster solutions. The weak habit group was characterized by a low behaviour frequency, low habit strength, and low interference with the opposite competing behaviour. The repeated behaviour with interference group was characterized by high behaviour frequency, high habit strength, but high interference with the competing behaviour. The strong habit group was characterized by high behaviour frequency, high habit strength, and low interference with the competing behaviour. The level of interference was an interesting indicator for differentiating the interfered repeated behaviour from the strong habitual behaviour because it

showed that the behaviour was less congruent and potentially less integrated. The repeated behaviour with interference group still did the target behaviour at an increased rate, but have not integrated it into their lifestyle and sense of self. This interference of the behaviour might be causing this group to consider options when deciding to perform or not perform the behaviour. The increased cognition prevents the behaviour from becoming fully automatic and habitual.

Compared to Study 1, the validation variables were more effective at detecting differences between the cluster groups in this study. The pro-environmental validation variables were generally positively associated with the strong habit and repeated behaviour with interference groups for the target pro-environmental recycling behaviour. The repeated behaviour with interference group had the highest level of controlled motivation, which is consistent with what would be expected according to SDT for a behaviour that has not become fully internalized (Deci & Ryan, 1985; 2000). However, autonomous motivation was not able to differentiate between the strong habit group and the repeated behaviour with interference group. Once again the opposite competing behaviour intention (i.e., intention to increase garbage use) was highest for the interfered repeated behaviour recycling group compared to the other two groups.

Study 1 and 2 showed fairly consistent results across different and diverse samples for different pro-environmental behaviours. The habit indicators need to be assessed with a new sample using the same pro-environmental behaviour to show consistency (Kline, 2013). Study 1 and 2 were also limited in that they only measured the habit indicators for the target pro-environmental behaviours but not the opposite competing non-environmental behaviours. When attempting to establish a new habit (i.e., target habit), people are confronted with the challenge to also change existing habits (i.e., current habit; Dahlstrand & Biel, 1997; Jager, 2003). Current habits may be obstacles to behaviour change and the ability to develop new habits, which is why

it is important to collect information on both behaviours; the target pro-environmental behaviour and the opposite non-environmental behaviour.

Study 3

The goal of the third study was to replicate the results from the first and second study using the same target behaviour (i.e., recycling) to show that the results were consistent across different samples for the same behaviour (Kline, 2013). Data was also collected about the habit indicators for the opposite competing behaviour (i.e., garbage use) to explore differences in repeated behaviours across both the target pro-environmental behaviour and the opposite competing non-environmental behaviour. A cross-sectional online survey study design was used with a convenient university sample. It was hypothesized that the 3-cluster solution, with a weak habit group, a repeated behaviour with interference group and a strong habit group, would be the best solution consistent with the previous two studies. It was expected that both recycling and garbage disposal behaviours would produce these three clusters.

Target behaviour. Disposal of paper is a behaviour repeated by people on a relatively daily basis and should not matter if the person is a student or from the general public. Recycling disposal behaviours were the target pro-environmental behaviour, while garbage disposal behaviours are the competing non-environmental behaviour for this study.

Results

Participants for this study were undergraduate students not living in residence ($N = 327$; 78% females and 22% males) enrolled in a psychology course at a Canadian university. They voluntarily completed an online survey in exchange for partial credit as per the rules and regulations of the participant pool. Demographics were very similar to the university sample

from the first study. Participants' ages ranged from 16 to 36 years ($M = 19.47$, $SD = 2.46$). All measures were completed in English and 74% spoke English as their first language.

Descriptive statistics for the habit indicators can be seen in Table 7. Overall people reported fairly high recycling behaviour, which were very similar to those from Study 2. Consistent with Study 2, there was a high positive correlation between behaviour frequency and habit strength, and a negative correlation with the measure of interference. As expected, there was a negative correlation between the indicators for the target pro-environmental behaviour recycling and the opposite competing non-environmental behaviour using the garbage, indicating that those who recycle were less likely to use the garbage and vice-versa.

Cluster Analysis

Two separate cluster analyses were performed in two phases (i.e., Ward's method and then k-means) using the data from the three variables proposed to identify habits (i.e., behaviour frequency, habit strength, and behaviour interference). One set of analyses was performed on the target pro-environmental behaviour (i.e. recycling disposal) and a second set of analyses on the opposite competing non-environmental behaviour (i.e., disposing in the garbage).

Phase one. The Ward's method two-step hierarchical cluster analysis was performed using the cases from the same three variables proposed to indicate habit (i.e., frequency, habit strength, and behaviour interference) on both the recycling disposal behaviour and garbage disposal behaviour. In the current sample, 12 cases were removed as outliers, 71 cases were removed due to incomplete responses for the recycling items resulting in a usable sample size of 256, and 66 cases were removed due to incomplete responses for the garbage items resulting in a usable sample size of 261.

The recycling and garbage disposal behaviours spontaneously created a 2-cluster solution. Compared to the 2-cluster and 4-cluster solution, the 3-cluster solution had the most theoretical and parsimonious cluster results with a good fit for both behaviours. Results supported the hypothesized three distinct groups of repeated behaviours. See Table 8 for the means. For both behaviours, there was a group with consistently lower scores on behaviour frequency, the habit strength scale, and behaviour interference, which was labelled the Weak Habit group. There was a group with a high number of disposals, high habit strength, but scored high on the behaviour interference item and was labelled the Repeated Behaviour with Interference group. The final group had consistently high scores on behaviour frequency, the habit strength scale, and a low behaviour interference, which was labelled the Strong Habit group. These results are consistent with the results from Study 1 and 2. The recycling behaviour solutions were a good fit with a silhouette measure of cohesion and separation of .60 for the 2 and 3-clusters and .50 for the 4-cluster solution (Norušis, 2011). The garbage behaviour solutions had a silhouette measure of cohesion and separation of .60. Based on the Ward's method analysis, the 3-cluster solution was retained as the best solution for both behaviours.

Phase two. The 3-cluster k-means cluster solution validated the three groups produced with the Ward's cluster method. Once the reclassification was completed the analysis once again produced a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for both disposal behaviours based on the means of the three habit indicator variables. Post-hoc analysis of the recycling behaviour shows that each of the final three cluster groups were significantly different on each of the three indicator variables $F_{Frequency}(2, 253) = 484.48, p < .001$, $F_{Habit Strength}(2, 253) = 127.22, p < .001$, $F_{Interference}(2, 253) = 185.57, p < .001$. Post-hoc analysis of the garbage behaviour shows that each of the final three cluster groups are statistically

significantly different on each of the three indicator variables $F_{Frequency}(2, 258) = 481.35, p < .001$, $F_{Habit Strength}(2, 258) = 161.88, p < .001$, $F_{Interference}(2, 258) = 158.64, p < .001$. Results, including post-hoc analyses, are displayed in Table 8. There were few changes made to the original classification for recycling (Weak Habit = 5%, Repeated Behaviour with Interference = 14%, Strong Habit = 6%) and using the garbage (Weak Habit = 17%, Repeated Behaviour with Interference = 34%, Strong Habit = 7%).

Comparing behaviour frequencies. It was expected that people who had a strong habit for the pro-environmental behaviour recycling were not the people who were using the garbage, whereas, those with a weak habit for recycling were likely to be the people using the garbage. This was tested with two ANOVAs. First, the three recycling behaviour cluster groups were found to differ on the frequency to dispose of paper in the garbage ($F(2, 237) = 91.40, p < .001$). Post hoc results can be seen in Table 9. The Weak Habit group for recycling had the highest frequency of garbage use, while the Strong Habit group reported the lowest frequency of garbage use. Second, the three garbage behaviour cluster groups were found to differ on the frequency to recycle paper ($F(2, 237) = 76.24, p < .001$). Post hoc results showed the same pattern as the recycling clusters. The Repeated Behaviour with Interference group for both behaviour clusters showed some behaviour frequency for both behaviours.

Validation of Groups

In order to further validate the 3-cluster solution, the cluster groups were again compared to motivation toward the environment, nature relatedness, intention to increase the behaviour, and frequency of performing other pro-environmental behaviours. Since the validation variables were pro-environmental variables, it was expected the results would differ between the target pro-environmental recycling behaviour and the non-environmental garbage use behaviour. It was

expected the strong habit and the interfered repeated behaviour groups for pro-environmental recycling behaviours would be associated with higher scores on the pro-environmental related validation variables; whereas, the weak habit group would be less related to these pro-environmental validation variables. This pattern should be reversed in the results for the non-environmental garbage use behaviour. Results of the ANOVAs and subsequent Tukey post-hoc analyses assessing group differences between the clusters and the variables are displayed in Table 10.

Recycling clusters. The three recycling behaviour cluster groups differed on controlled motivation toward the environment ($F(2, 223) = 5.44, p = .005$), autonomous motivation toward the environment ($F(2, 227) = 19.67, p < .001$), and nature relatedness ($F(2, 201) = 8.01, p < .001$). As predicted the Weak Habit group had lower motivation, both controlled and autonomous, and lower nature relatedness than the other two groups. No statistically significant differences were found between the Repeated Behaviour with Interference and the Strong Habit groups on the motivation types or nature relatedness.

The three recycling behaviour cluster groups differed on the intention to increase recycling behaviours ($F(2, 253) = 27.34, p < .001$), the intention to increase garbage behaviours ($F(2, 252) = 16.55, p < .001$), and frequency of performing other pro-environmental behaviours ($F(2, 239) = 19.38, p < .001$). Similar to Study 2, the Weak Habit group had the lowest intention to increase recycling and the lowest frequency of performing other pro-environmental behaviours. The Repeated Behaviour with Interference group had more intention to recycle than the Weak Habit group but less than the Strong Habit group and more frequency of performing other pro-environmental behaviours than the Weak Habit group but less than the Strong Habit group. As expected the Strong Habit group had the highest intention to increase recycling, lowest

intention to throw paper in the garbage, and the highest frequency of performing other pro-environmental behaviours.

Garbage clusters. The three garbage disposal behaviour cluster groups differed on controlled motivation toward the environment ($F(2, 225) = 5.62, p = .004$), autonomous motivation toward the environment ($F(2, 231) = 10.40, p < .001$), and nature relatedness ($F(2, 203) = 5.92, p = .003$). As expected the Weak Habit group for the garbage behaviour (i.e., those who are more pro-environmental) had higher autonomous motivation toward the environment than the other two groups and higher nature relatedness than the Weak Habit group. The Repeated Behaviour with Interference group for the garbage behaviour had higher controlled motivation than the Strong Habit group and lower autonomous motivation than the Weak Habit group. As expected the Strong Habit group for the garbage behaviour (i.e., those who are less pro-environmental) had lower autonomous motivation toward the environment and nature relatedness than the Weak Habit group.

The three garbage behaviour cluster groups differed on the intention to increase recycling behaviours ($F(2, 257) = 14.16, p < .001$), the intention to increase garbage behaviours ($F(2, 257) = 11.86, p < .001$), and frequency of performing other pro-environmental behaviours ($F(2, 243) = 18.86, p < .001$). The Weak Habit group for the garbage behaviour (i.e., those who are more pro-environmental) had the lowest intention to throw paper in the garbage, the highest intention to recycle, and the highest frequency of performing other pro-environmental behaviours compared to the other two groups. There were no statistically significant differences between the Repeated Behaviour with Interference and Strong Habit groups on the intentions or frequency of performing other pro-environmental behaviours variables.

Study 3 Discussion

Once again, the results from Study 3 support the existence of the three proposed classifications of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit) and provides some support for a distinction between repeated behaviours and habitual behaviours, this time for both the target pro-environmental behaviour recycling and the opposite competing non-environmental behaviour garbage disposal. For both disposal behaviours, the weak habit groups were characterized by low behaviour frequency, low habit strength and low interference with the competing behaviour. The repeated behaviour with interference groups were characterized by high behaviour frequency, high habit strength, but a high interference with the competing behaviour. The strong habit groups were characterized by high behaviour frequency, high habit strength, and a low interference with the competing behaviour. The three cluster groups of repeated behaviours were consistent across two different types of disposal behaviours (i.e., recycling and garbage). Both disposal behaviours showed a similar pattern among the three indicator variables and produced the same 3-cluster solutions.

The validation of the clusters for both the recycling behaviour and the garbage use behaviour produced results fairly consistent with expectations and the previous studies. When the behaviour was the target pro-environmental recycling behaviour, the pro-environmental validation variables were generally positively associated with the *more* internalized groups compared to the weak habit group. When the behaviour was the non-environmental garbage use behaviour, the pro-environmental validation variables were generally positively associated with the *less* internalized groups because the people who have a weak habit for using the garbage often have a strong habit for recycling.

General Discussion

Taken in their entirety, these three studies provide strong support for the existence of the three proposed classifications of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit) and provides some support for the distinction between behaviours that are only repeated and those which are habitual. These results were found to be very robust as a similar pattern was found across three studies, three different samples, and three different behaviours. Results supported the expectation that people who do not perform a behaviour very often, do not have much of a habit for the behaviour and that it has not been internalized (i.e., weak habit group). Alternatively, people who are highly habitual about a behaviour engage in the behaviour often, have a higher automaticity and efficiency for the behaviour, and have the behaviour integrated into their lifestyles (i.e., strong habit group). However, for the repeated behaviours with interference group, behaviours are often performed frequently and with some level of automaticity, but can be distinguished from the strong habits by the level of conflict or interference between opposite competing behaviours, the behaviour has not been completely internalized. This interference of the behaviour might be causing this group to consider options when deciding to perform or not perform the behaviour.

Difference Between Repeated Behaviours and Strong Habits

One of the main goals of this research was to identify differences between behaviours that are merely repeated and those that are integrated strong habits. Results showed differences between the repeated behaviour with interference groups and the strong habit groups across the three studies on both the habit indicator variables and the cluster validating variables. In all three studies the target pro-environmental behaviours had statistically significantly higher habit strength for the strong habit groups compared to the repeated behaviour with interference groups. Behaviour frequency was only statistically significantly higher for the strong habit group

compared to the repeated behaviour with interference group in Study 1. Interestingly, it was the level of interference between opposite competing behaviours that helped distinguish an interfered repeated behaviour from a strong habit. Across all three studies and every single behaviour, the level of interference was always statistically significantly higher for the repeated behaviour with interference groups compared to the strong habit groups. Experiencing interference between two potential behaviours in the same context forces some deliberation about the behaviour and suggests the behaviour is not fully internalized or fully habitual (Bargh, 1994; Verplanken, 2006). Habit conflict can interfere with habit integration (Dahlstrand & Biel, 1997) and this becomes a unique indicator in this research for differentiating repeated behaviours from strong habits.

Generally, the repeated behaviour with interference groups and strong habit groups were not statistically significantly different on the validation variables. However, compared to the weak habit groups the other two groups often had statistically significantly higher scores on the pro-environmental variables when the target behaviour was pro-environmental and statistically significantly lower scores when the behaviour was the non-environmental behaviour. This trend partially supports the idea that the more internalized repeated behaviour with interference groups and strong habit groups were related to pro-environmental factors more so than the weak habit groups.

The only antecedent variable that was fairly consistently successful in differentiating between the repeated behaviour with interference groups and strong habit groups was motivation toward the environment. Controlled motivation toward the environment was found to be statistically significantly higher for the repeated behaviour with interference groups for the recycling behaviour (Study 2) and the garbage behaviour (Study 3) compared to the strong habit

groups. This supports the internalization process proposed by SDT (Deci & Ryan, 2000; Ryan, 1995; Weinstein et al., 2013), which explains how controlled motivation leads to an internalization of a behaviour through a non-integrated process (i.e., introjection and identification) rather than the integration process. When behaviours are internalized through a non-integrated process, the regulatory process is accepted by the individual but it is not fully accepted as one's own or congruent with the self potentially preventing it from becoming a fully integrated strong habit. Autonomous motivation was found to only show statistically significant differences between the weak habit groups and the other two groups. Although this result was expected, a difference between the repeated behaviour with interference groups and strong habit groups on autonomous motivation was also expected. This does not support the internalization process proposed by SDT, which explains how autonomous motivation leads to an internalization of a behaviour through the integrated process potentially leading to a strong habit (Ryan, 1995).

The intention variables were successful in differentiating between the repeated behaviour with interference groups and strong habit groups. It was predicted that the more internalized the behaviour, the higher the desire to increase the target behaviour since people like to report positive intentions for behaviours they are already doing (Bem, 1972; Festinger, 1957; Ouellette & Wood, 1998). Overall, when the target behaviour and the intention were the same (e.g., recycling clusters x recycling intention) the more internalized groups (i.e., repeated behaviour with interference groups and strong habit groups), compared to the weak habit groups, showed a higher intention to increase the behaviour in the future.

The results for the repeated behaviour with interference groups and the intention to increase the competing behaviour were very interesting (e.g., recycling clusters x garbage

intention). Generally, the repeated behaviour with interference groups showed a higher intention to increase the opposite behaviour in the future compared to the strong habit group. The higher intention for the competing behaviour highlights the behaviour interference for the repeated behaviour with interference group. For example, those with an interfered repeated behaviour for recycling had a higher intention to use the garbage *and* use recycling because they are not sure which behaviour to do, it may depend on the context whether or not they recycle or use the garbage. Performing incongruent behaviours indicates internalization through a non-integrated process (Deci & Ryan, 2000; Sheldon & Schöler, 2011) and provides some support for the idea that repeated behaviours and habitual behaviours are the result of different internalization processes. Future models of pro-environmental behaviour change should take into account the difference between repeated behaviours and strong habitual behaviours.

Limitations and Future Research

How do habits develop: Results as part of the behaviour change process. Viewed in the context of the behaviour change process, the three identified groups of repeated behaviours can be seen as moments along a continuum of change. People with no habit or weak habit for doing a behaviour are at an earlier point and have not committed to doing the new behaviour (and may never want to). Once a person has begun to perform the new target behaviour, the increased frequency will help increase the automaticity of the behaviour (Bargh, 1994; Verplanken, 2006; Verplanken & Orbell, 2003) but the interference between the old behaviour and the new behaviour is a barrier to a complete behaviour change (Emmons & King, 1988; Jager, 2003; Verplanken, 2010a). The person may be repeating the behaviour but it has not been fully internalized through the integration process (Weinstein et al., 2013). Finally, once the conflict has been resolved, the behaviour has the potential to become fully integrated into the person's

lifestyle and sense of self (Deci & Ryan, 1985; 2000; Ryan, 1995), leading to a behaviour that is fully incorporated and automatic; to become a strong habit with a stable and sustained behaviour change. This research suggests there might be a development of behaviours along a continuum from no habit, to weak habit, to a repeated behaviour with interference, to an integrated strong habit and these different types of repeated behaviours might be the result of different internalization processes. However, due to the cross-sectional nature of this research there is no way to test the process and evolution of habit formation. Future longitudinal research is necessary to better understand the internalization process of habits.

How do habits develop: Results as part of predicting internalization types. In the current research there is no indication of what influences pro-environmental habits, only that they exist. According to SDT (Deci & Ryan, 1985; 2000) people can be motivated to internalize even uninteresting behaviours if believed to be important. The internalization process can occur through different processes resulting in different styles of self-regulation (Deci et al., 1994). By facilitating the internalization of pro-environmental behaviours through the integration process, it might be possible to develop stable and sustainable pro-environmental behaviours. The current research does not explore factors that would be important for facilitating this process and how they are related to the different types of repeated behaviours.

According to SDT, the support for basic needs (i.e., autonomy, competency, and relatedness) will help facilitate complete integration and a reduction of interference, as the behaviour is assimilated with one's core sense of self (Deci et al., 1994) leading to the development of a strong habit. Further studies need to explore factors that would facilitate the different internalization processes posited by SDT, specifically identifying differences between the cluster groups of repeated behaviours found in this research. Some variables of interest would

be types of motivation toward the environment, nature relatedness, perceived importance of the environment, frequency of pro-environmental behaviours, and life satisfaction.

Limitation in the method. For some, the use of cluster analysis for this research could be viewed as a methodological limitation since this type of analysis is a non-parametric analysis based on subjective interpretation, with different methods and criterion potentially producing different results (Field, 2013). Thus, it is important to base cluster interpretation on theory and use strong selection criteria. These results are interpreted using the past research on habits (Bargh, 1994; Verplanken, 2006) within the context of SDT (Deci & Ryan, 1985; 2000) and used strong selection criteria established a priori. Using different methods of clustering can produce different results because of the different criteria used to merge clusters (Burns & Burns, 2009; Mooi & Sarstedt, 2011). This research used two different cluster methods (i.e., Ward's and k-means) and both methods produced similar clusters across all three studies and three behaviours. Thus, despite the potential limitations of using cluster analysis, the results are very robust, plus they were able to harness the benefits of this method. The main benefit of using cluster analysis is that it allows similar data to group together, letting patterns emerge that might not have been evident using a variable-centred analysis (Asendorpf, 2013; Gore, 2000). Using this method it was possible to identify the three groups of repeated behaviours based on occurrences of the habit indicators for each individual participant.

Future research. The current research took a preliminary look at differences between the cluster groups on various antecedents and consequences of habitual pro-environmental behaviours but future research should replicate and expand on this analysis. There needs to be further exploration of how intentions for the target and competing behaviours are interacting with what is prompting behaviours (Gardner, 2009). It is possible the reasons for differences in

intention between the people with an interfered repeated behaviour and people with a strong habit are related to how the behaviour cues have been internalized. The repeated behaviour with interference group could have high intention because the regulation of the behaviour is associated to external cues, whereas the strong habit group has an internalized cue for the behaviour. Finally, longitudinal data is needed to explore the evolution of habit development. The current study hints at a process of internalizing behaviours as they become integrated strong habits but this needs to be confirmed by collecting data as individuals successfully develop strong habits. Learning how to increase the integration of targeted pro-environmental behaviours will facilitate the creation of specific effective interventions that are positive for the planet.

It is important to investigate the nature of habitual pro-environmental behaviours. Environmental sustainability is a complicated process but integrating pro-environmental habits into the daily lives of people is one way toward a sustained improvement to the environment. The next step will be to discover what determinants separate the different types of repeated behaviours to help design the most effective interventions. By targeting the what and how of internalization of behaviours and support self-regulation interventions, then behaviour change can become even more successful. Environmental problems are complex; while pro-environmental habits are a useful construct, they are only one avenue toward a sustainable future. However, they can provide insight into making individual changes and that is an important step.

References

- Aarts, H., & Dijksterhuis, A. (2000a). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology*, 78(1), 53–63.
doi:10.1037/0022-3514.78.1.53
- Aarts, H., Verplanken, B., & Knippenberg, A. (1998). Predicting behavior from actions in the past: Repeated decision making or a matter of habit? *Journal of Applied Social Psychology*, 28(15), 1355–1374. doi:10.1111/j.1559-1816.1998.tb01681.x
- Aitken, N. M. & Pelletier, L. G. (2011). The importance of self-determined motivation toward the environment for doing difficult pro-environmental behaviours. Paper presented, *State of Nature the 14th GSAED Interdisciplinary Conference*, March 2, 9, 16, 23, Ottawa, Ontario. Manuscript in preparation.
- Ajzen, I., & Fishbein, M. (2000). Attitudes and the attitude-behavior relation: Reasoned and automatic processes. *European Review of Social Psychology*, 11(1), 1–33.
doi:10.1080/14792779943000116
- Aldenderfer, M. S., & Blashfield, R. K. (1984). *Cluster Analysis*. Beverly Hills: Sage Publications.
- Arbuthnott, K. D. (2009). Education for sustainable development beyond attitude change. *International Journal of Sustainability in Higher Education*, 10(2), 152–163.
doi:10.1108/14676370910945954
- Arbuthnott, K. D., Sutter, G. C., & Heidt, C. T. (2014). Natural history museums, parks, and connection with nature. *Museum Management and Curatorship*, 29(2), 102–121.
doi:10.1080/09647775.2014.888818

- Asendorpf, J. B. (2013). Person-centered approaches. In M. L. Cooper & R. Larsen (Eds.), *Handbook of Personality Processes and Individual Differences*. Washington, DC: American Psychological Association. Retrieved from http://www.psychologie.hu-berlin.de/prof/per/pdf/2222/Person-centered_fin.pdf
- Bamberg, S. (2013). Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change. *Journal of Environmental Psychology*, 34, 151-159. doi:10.1016/j.jenvp.2013.01.002
- Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, 25, 175-188. doi:10.1207/S15324834BASP2503_01
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, 27, 14-25. doi:10.1016/j.jenvp.2006.12.002
- Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In Wyer, Robert S., Jr. (Ed); Srull, Thomas K. (Ed), *Handbook of Social Cognition* (2nd ed., pp. 1-40). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc. doi:10.1007/s00572-005-0022-9
- Bem, D. J. (1972). Self-perception theory. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 6, pp.1-62). New York: Academic Press, ISBN 978-0-12-015206-3
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, 6(1), 3-5. doi:10.1177/1745691610393980

- Burns, R., & Burns, R. (2009). Cluster analysis. *Business Research Methods and Statistics Using SPSS* (pp. 522–567). London: SAGE Publications Ltd.
- Čabalová, I., Kačík, F., Geffert, A., & Kačíková, D. (2011). The effects of paper recycling and its environmental impact. In Elzbieta Broniewicz (Ed.), *Environmental Management in Practice*. Rijeka, Croatia: InTech. doi: 10.5772/23110. Retrieved from <http://www.intechopen.com/books/environmental-management-in-practice/the-effects-of-paper-recycling-and-its-environmental-impact>
- Dahlstrand, U., & Biel, A. (1997). Pro-environmental habits: propensity levels in behavioral change. *Journal of Applied Social Psychology*, 27(7), 588–601. doi:10.1111/j.1559-1816.1997.tb00650.x
- de Groot, J. I. M., & Steg, L. (2010). Relationships between value orientations, self-determined motivational types and pro-environmental behavioural intentions. *Journal of Environmental Psychology*, 30(4), 368–378. doi:10.1016/j.jenvp.2010.04.002
- De Young, R. (1993). Changing behavior and making it stick: The conceptualization and management of conservation behavior. *Environment and Behavior*, 25(3), 485–505. doi:10.1177/0013916593253003
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-determination in Human Behavior*. New York: Plenum.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. doi:10.1207/S15327965PLI1104_01

- Deci, E L, Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality*, 62(1), 119–142.
doi:10.1111/j.1467-6494.1994.tb00797.x
- Dwyer, W. O., Leeming, F.C., Cobern, M.K., Porter, B.E., & Jackson, J. M. (1993). Critical review of behavioral interventions to preserve the environment: Research since 1980. *Environment and Behavior*, 25, 485-505. doi:10.1177/0013916593255001
- Emmons, R. A., & King, L. A. (1988). Conflict among personal strivings: Immediate and long-term implications for psychological and physical well-being. *Journal of Personality and Social Psychology*, 54(6), 1040–1048. doi:10.1037/0022-3514.54.6.1040
- Festinger, L. (1962). Cognitive dissonance. *Scientific American*, 207(4), 93–107.
doi:10.1038/scientificamerican1062-93
- Field, A. (2013). *Discovering Statistics using IBM SPSS Statistics* (4 edition.). London: Sage Publications. (<http://www.statisticshell.com/docs/cluster.pdf>).
- Fujii, S., Gärling, T., & Kitamura, R. (2001). Changes in drivers' perceptions and use of public transport during a freeway closure effects of temporary structural change on cooperation in a real-life social dilemma. *Environment and Behavior*, 33(6), 796–808.
doi:10.1177/00139160121973241
- Fujii, S., & Kitamura, R. (2003). What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. *Transportation*, 30(1), 81–95.
doi:10.1023/A:1021234607980
- Gardner, B. (2009). Modelling motivation and habit in stable travel mode contexts. *Transportation Research Part F: Traffic Psychology and Behaviour*, 12(1), 68–76.
doi:10.1016/j.trf.2008.08.001

- Gardner, B., de Bruijn, G. J., & Lally, P. (2011). A systematic review and meta-analysis of applications of the self-report habit index to nutrition and physical activity behaviours. *Annals of Behavioral Medicine*, 42(2), 174–187. doi:10.1007/s12160-011-9282-0
- Garvill, J., Marell, A., & Nordlund, A. (2003). Effects of increased awareness on choice of travel mode. *Transportation*, 30(1), 63–79. doi:10.1023/A:1021286608889
- Gifford, R. (2008). Psychology's essential role in alleviating the impacts of climate change. *Canadian Psychology/Psychologie canadienne*, 49(4), 273–280. doi:10.1037/a0013234
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66, 290-302. doi:10.1037/a0023566
- Gifford, R. (2014). Environmental psychology matters. *Annual Review of Psychology*, 65, 541-580. doi:10.1146/annurev-psych-010213-115048
- Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins & R. M. Sorrentino (Eds.), *The Handbook of Motivation and Cognition: Foundations of Social Behavior* (Vol. 2), 53-92. New York: Guilford Press.
- Gore, P. (2000). Cluster analysis. In H. E. A. Tinsley & S. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical Modeling* (pp. 297–321). New York: Academic Press.
- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 29(3), 157–166. doi:10.1037/0008-400X.29.3.157
- Gregory, G. D., & Leo, M. D. (2003). Repeated behavior and environmental psychology: The role of personal involvement and habit formation in explaining water consumption.

- Journal of Applied Social Psychology*, 33(6), 1261–1296. doi:10.1111/j.1559-1816.2003.tb01949.x
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education*, 18(2), 1–8. doi:10.1080/00958964.1987.9943482
- Hofer, M. (2007). Goal conflicts and self-regulation: A new look at pupils' off-task behaviour in the classroom. *Educational Research Review*, 2(1), 28–38. doi:10.1016/j.edurev.2007.02.002
- International Energy Agency (IEA) (2009). *CO2 Emissions from Fuel Combustion*, Paris, France: International Energy Agency.
- Jager, W. (2003). Breaking bad habits: a dynamical perspective on habit formation and change. In Hendrickx, L. C. W. P. (Ed.), *Human Decision Making and Environmental Perception: Understanding and Assisting Human Decision Making in Real-life Settings*. Groningen: University of Groningen.
- Kahle, L. R., & Beatty, S. E. (1987). Cognitive consequences of legislating postpurchase behavior: Growing up with the bottle bill. *Journal of Applied Social Psychology*, 17(9), 828–843. doi:10.1111/j.1559-1816.1987.tb00342.x
- Karl, T. R., Melillo, J. M., & Peterson, T. C. (2009). *Global Climate Change Impacts in the United States*. Cambridge University Press. Retrieved from <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>
- Katzev, R. D., & Johnson, T. R. (1983). A social-psychological analysis of residential electricity consumption: The impact of minimal justification techniques. *Journal of Economic Psychology*, 3(3-4), 267-284. doi:10.1111/j.1559-1816.1984.tb02217.x

- Kline, R. B. (2013). *Beyond Significance Testing: Statistics Reform in the Behavioral Sciences* (2nd ed.). Washington, DC: American Psychological Assoc.
- Klößner, C. A., & Matthies, E. (2004). How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *Journal of Environmental Psychology*, 24(3), 319–327. doi:10.1016/j.jenvp.2004.08.004
- Klößner, C. A., Matthies, E., & Hunecke, M. (2006). Problems of operationalizing habits and integrating habits in normative decision-making models. *Journal of Applied Social Psychology*, 33(2), 396–417. doi:10.1111/j.1559-1816.2003.tb01902.x
- Knussen, C., & Yule, F. (2008). “I’m not in the habit of recycling” The role of habitual behavior in the disposal of household waste. *Environment and Behavior*, 40(5), 683–702. doi:10.1177/0013916507307527
- Koestner, R., Losier, G. F., Vallerand, R. J., & Carducci, D. (1996). Identified and introjected forms of political internalization: Extending self-determination theory. *Journal of Personality and Social Psychology*, 70(5), 1025–1036. doi:10.1037/0022-3514.70.5.1025
- Lally, P., van Jaarsveld, C. H. M., Potts, H. W. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, 40(6), 998–1009. doi:10.1002/ejsp.674
- Lehman, P. K., & Geller, E. S. (2004). Behavioral analysis and environmental protection: Accomplishments and potential for more. *Behavior and Social Issues*, 13(1), 13–32. doi:10.5210/bsi.v13i1.33
- Levesque, C., Copeland, K. J., & Sutcliffe, R. A. (2008). Conscious and nonconscious processes: Implications for self-determination theory. *Canadian Psychology/Psychologie canadienne*, 49(3), 218–224. doi:10.1037/a0012756

- Maréchal, K. (2010). Not irrational but habitual: The importance of “behavioural lock-in” in energy consumption. *Ecological Economics*, 69(5), 1104–1114.
doi:10.1016/j.ecolecon.2009.12.004
- Martinent, G., Nicolas, M., Gaudreau, P., & Campo, M. (2013). A cluster analysis of affective states before and during competition. *Journal of Sport & Exercise Psychology*, 35(6), 600–611.
- Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon’s Mechanical Turk. *Behavior Research Methods*, 44(1), 1–23. doi:10.3758/s13428-011-0124-6
- Mooi, E., & Sarstedt, M. (2011). *A Concise Guide to Market Research: The Process, Data, and Methods Using IBM SPSS Statistics*. Berlin: Springer.
- Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. *Frontiers in Psychology*, 4(813), 1–11. doi: 10.3389/fpsyg.2013.00813
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale. *Environment and Behavior*, 41(5), 715 –740. doi:10.1177/0013916508318748
- Norušis, M. (2011). Cluster analysis. *IBM SPSS Statistics 19 Statistical Procedures Companion*. Upper Saddle River, New Jersey: Prentice Hall. Retrieved from
http://www.norusis.com/book_SPC_v19.php
- Orbell, S., & Verplanken, B. (2010). The automatic component of habit in health behavior: Habit as cue-contingent automaticity. *Health Psychology*, 29(4), 374–383.
doi:10.1037/a0019596
- Osbaldiston, R., & Schott, J. P. (2012). Environmental sustainability and behavioral science meta-analysis of proenvironmental behavior experiments. *Environment and Behavior*, 44(2), 257–299. doi:10.1177/0013916511402673

- Osbaldiston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals. *Journal of Environmental Psychology*, 23(4), 349–357. doi:10.1016/S0272-4944(03)00035-5
- Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin*, 124(1), 54–74. doi:10.1037/0033-2909.124.1.54
- Pelletier, L. G., & Aitken, N. M. (2014). Encouraging environmental actions in employees and in the working environment: A self-determination theory perspective. In M. Gagné (Ed.), *Oxford Handbook of Work Motivation, Engagement and Self-Determination Theory*. New York: Oxford University Press.
- Pelletier, L. G., Legault, L. R., & Tuson, K. M. (1996). The environmental satisfaction scale a measure of satisfaction with local environmental conditions and government environmental policies. *Environment and Behavior*, 28(1), 5–26. doi:10.1177/0013916596281001
- Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The motivation toward the environment scale (MTES). *Journal of Applied Social Psychology*, 28(5), 437–468. doi:10.1111/j.1559-1816.1998.tb01714.x
- Prochaska, J. O. and C. C. DiClemente (1986). The transtheoretical approach. In *Handbook of Eclectic Psychotherapy*. J. Norcross. New York, Brunner/Mazel: 163-200.

- Rand, D. G. (2012). The promise of Mechanical Turk: How online labor markets can help theorists run behavioral experiments. *Journal of Theoretical Biology*, 299, 172–179. doi:10.1016/j.jtbi.2011.03.004
- Ratelle, C. F., Guay, F., Vallerand, R. J., Larose, S., & Senécal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of Educational Psychology*, 99(4), 734–746. doi:2007-17712-004
- Rogers, C. (1963). The actualizing tendency in relation to “motives” and to consciousness. In M. R. Jones (Ed.), *Nebraska Symposium on Motivation* (Vol. 11, pp. 1–24). Lincoln, NE: University of Nebraska Press.
- Rothman, A., Sheeran, P., & Wood, W. (2009). Reflective and automatic processes in the initiation and maintenance of dietary change. *Annals of Behavioral Medicine*, 38(0), 4–17. doi:10.1007/s12160-009-9118-3
- Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality*, 63(3), 397–427. doi:10.1111/j.1467-6494.1995.tb00501.x
- Ryan, R. M., Weinstein, N., Bernstein, J. H., Brown, K. W., Mistretta, L., & Gagné, M. (2010). Vitalizing effects of being outdoors and in nature. *Journal of Environmental Psychology*, 30, 159–168. doi:10.1016/j.jenvp.2009.10.009
- Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: Detection, search, and attention. *Psychological Review*, 84(1), 1–66. doi:10.1037/0033-295X.84.1.1
- Schwarz, N. (1999). Self-reports: How the questions shape the answers. *American Psychologist*, 54(2), 93–105. doi:10.1037/0003-066X.54.2.93

- Schwarzer, R. (2008). Some burning issues in research on health behavior change. *Applied Psychology*, 57(1), 84–93. doi:10.1111/j.1464-0597.2007.00324.x
- Scott, J. F. (1972). *Internalization of Norms: A Sociological Theory of Moral Commitment*. Englewood Cliffs, N.J: Prentice Hall.
- Sheldon, K. M., & Elliot, A. J. (1998). Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology Bulletin*, 24(5), 546–557. doi:10.1177/0146167298245010
- Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need-satisfaction, and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology*, 76, 482-497. doi:10.1037/0022-3514.76.3.482
- Sheldon, K. M., & Schöler, J. (2011). Wanting, having, and needing: Integrating motive disposition theory and self-determination theory. *Journal of Personality and Social Psychology*, 101(5), 1106–1123. doi:10.1037/a0024952
- Sparks, P., Hinds, J., Curnock, S. & Pavey, L. (2014). Connectedness and its consequences: A study of relationships with the natural environment. *Journal of Applied Social Psychology*, 44 (3), 166-174. doi:10.1111/jasp.12206
- Statistics Canada (2011). *Households and the Environment Survey (HES)*.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29, 309-317. doi:10.1016/j.jenvp.2008.10.004

- Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407–424. doi:10.1111/0022-4537.00175
- Tabachnick, B. G., & Fidell, L. S. (2006). *Using Multivariate Statistics (5th Edition)*. Needham Heights, MA, USA: Allyn & Bacon, Inc.
- Verplanken, B. (2006). Beyond frequency: Habit as mental construct. *British Journal of Social Psychology*, 45(3), 639–656. doi:10.1348/014466605X49122
- Verplanken, B. (2010a). Old habits and new routes to sustainable behaviour. In L. Whitmarsh, S. O'Neill, & I. Lorenzoni (Eds.), *Engaging the Public with Climate Change: Behaviour Change and Communication* (pp. 17–30). London: Earthscan. Retrieved from <http://www.aps.org/units/fps/newsletters/201201/schroeder.cfm>
- Verplanken, B. (2010b). By force of habit. In A. Steptoe, K. Freedland, J. Jennings, M. Llabre, S. Manuck, & E. Susman (Eds.), *Handbook of Behavioral Medicine: Methods and Ratelle Applications* (pp. 73–82). New York: Springer.
- Verplanken, B., & Aarts, H. (1999). Habit, attitude, and planned behaviour: Is habit an empty construct or an interesting case of goal-directed automaticity? *European Review of Social Psychology*, 10, 101–134. doi:10.1080/14792779943000035
- Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A Self-report Index of Habit Strength. *Journal of Applied Social Psychology*, 33(6), 1313–1330. doi:10.1111/j.1559-1816.2003.tb01951.x
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the motivation toward the environment scale. *Environment and Behavior*, 35(4), 486–505. doi:10.1177/0013916503035004003

- Vygotsky, L. S., Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1980). *Mind in Society: Development of Higher Psychological Processes*. Cambridge: Harvard University Press.
- Wallis, K. C. & Poulton, J., L. (2001). *Internalization: The Origin and Construction of Internal Reality*. Buckingham, UK: Open University Press. Retrieved from <http://www.mcgrawhill.co.uk/openup/chapters/0335203051.pdf>
- Webb, O. J., & Eves, F. F. (2007a). Promoting stair climbing: Effects of message specificity and validation. *Health Education Research*, 22(1), 49–57. doi:10.1093/her/cyl045
- Webb, O. J., & Eves, F. F. (2007b). Effects of environmental changes in a stair climbing intervention: Generalization to stair descent. *American Journal of Health Promotion*, 22(1), 38–44. doi:10.4278/0890-1171-22.1.38
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2013). The integrative process: New research and future directions. *Current Directions in Psychological Science*, 22, 69-74. doi: 10.1177/0963721412468001
- Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology*, 70(4), 767–779. doi:10.1037/0022-3514.70.4.767
- Wittenbraker, J., Gibbs, B. L., & Kahle, L. R. (2006). Seat belt attitudes, habits, and behaviors: An adaptive amendment to the Fishbein model. *Journal of Applied Social Psychology*, 13(5), 406–421. doi:10.1111/j.1559-1816.1983.tb01748.x
- Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of Personality and Social Psychology*, 83(6), 1281–1297. doi:10.1037/0022-3514.83.6.1281

- Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology*, 88(6), 918–933. doi:10.1037/0022-3514.88.6.918
- Zelenski, J. M., & Nisbet, E. K. (2014). Happiness and feeling connected: The distinct role of nature relatedness. *Environment and Behavior*, 46(1), 3–23.
doi:10.1177/0013916512451901

Table 1

Descriptive Statistics for Study 1 Habit Indicators for Public Transportation (N = 254)

Variable	M	SD	Range	α	2	3
1. Behaviour Frequency	3.22	1.77	0-9	-	.51***	.03
2. Habit Strength	3.57	1.50	1-7	.92	-	.22**
3. Behaviour Interference	2.71	1.96	1-7	-	-	-

Note. *p < .05, **p < .01, ***p < .001

Table 2

Study 1 Clusters of the Public Transportation Target Behaviour (N = 212)

	Weak Habit Means (SD)	Repeated Behaviour Means (SD)	Strong Habit Means (SD)
Phase 1 Ward's Two-Step Hierarchical Clusters			
	32% (n = 71)	32% (n = 68)	34% (n = 73)
Behaviour Frequency	2.00	3.69	4.00
Habit Strength	2.32	3.63	4.71
Behaviour Interference	1.59	5.27	1.62
Phase 2 k-Means Cluster - Final Clusters*			
	36% (n = 76)	29% (n = 62)	35% (n = 74)
Behaviour Frequency	1.74 (0.62) _a	3.85 (1.74) _b	4.22 (1.58) _b
Habit Strength	2.32 (0.99) _a	3.73 (1.34) _b	4.71 (1.00) _c
Behaviour Interference	1.59 (0.95) _a	5.40 (1.03) _b	1.62 (0.82) _a

Note. Means with different subscripts differ at $p < .05$ according to Attribute Importance (AIM) post-hoc analyses.

* *Bus clusters achieved convergence due to no or small change in cluster centers at 5 iterations. The minimum distance between initial centers is 3.47.*

Table 3

Descriptive Statistics and ANOVA Results for the Three Retained Public Transportation Clusters and the Validation Measures for Study 1

	Weak Habit		Repeated Behaviour		Strong Habit		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>
<i>Antecedents</i>							
Controlled Motivation	2.64	1.02	3.08	1.23	2.94	1.10	2.67 ^t
Autonomous Motivation	3.45 _a	1.24	3.55 _{ab}	1.25	4.04 _b	1.32	4.02*
Nature Relatedness	4.67	2.03	4.66	2.30	4.91	1.82	0.29
<i>Consequences</i>							
Bus Intention	4.05	1.94	3.53	2.05	3.99	2.25	1.18
Car Intention	2.07 _a	1.55	2.71 _b	1.60	2.00 _a	1.40	4.27*
PEB frequency	3.52	0.77	3.36	1.01	3.62	0.89	1.34

Note. Means with different subscripts differ at $p < .05$ according Tukey HSD post-hoc analyses.

^t $< .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Descriptive Statistics for Study 2 Paper Recycling Habit Indicators (N = 375)

Variable	M	SD	Range	α	2	3
1. Behaviour Frequency	5.95	3.60	0-10	-	.80***	-.23***
2. Habit Strength	4.43	1.68	1-7	.96	-	-.28***
3. Behaviour Interference	2.36	1.85	1-7	-		-

Note. *p < .05, **p < .01, ***p < .001

Table 5

Study 2 Clusters of the Paper Recycling Target Behaviour (N = 293)

	Weak Habit Means (SD)	Repeated Behaviour Means (SD)	Strong Habit Means (SD)
Phase 1 Ward's Two-Step Hierarchical Clusters			
	22% (n = 64)	26% (n = 75)	52% (n = 154)
Behaviour Frequency	1.59	4.46	8.59
Habit Strength	2.37	4.00	5.50
Behaviour Interference	1.42	5.21	1.32
Phase 2 k-Means Cluster - Final Clusters*			
	31% (n = 89)	18% (n = 51)	52% (n = 153)
Behaviour Frequency	1.22 (1.30) _a	6.53 (1.98) _b	8.61 (1.35) _c
Habit Strength	2.55 (1.18) _a	4.59 (0.97) _b	5.48 (1.06) _c
Behaviour Interference	2.67 (1.99) _a	4.92 (1.22) _b	1.28 (0.51) _c

Note. Means with different subscripts differ at $p < .05$ according to Attribute Importance (AIM) post-hoc analyses.

* Recycle clusters achieved convergence due to no or small change in cluster centers at 13 iterations. The minimum distance between initial centers is 5.03.

Table 6

Descriptive Statistics and ANOVA Results for the Three Retained Recycling Clusters and the Validation Measures for Study 2

	Weak Habit		Repeated Behaviour		Strong Habit		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>
<i>Antecedents</i>							
Controlled Motivation	2.64 _a	1.24	4.15 _b	1.23	3.29 _c	1.27	23.43***
Autonomous Motivation	3.71 _a	1.57	5.04 _b	1.19	5.24 _b	1.37	30.04***
Nature Relatedness	5.23 _a	1.95	6.28 _b	1.63	6.27 _b	1.91	8.03***
<i>Consequences</i>							
Recycling Intention	2.99 _a	1.91	4.48 _b	1.61	4.50 _b	2.21	16.96***
Garbage Intention	1.60 _a	1.27	2.86 _b	1.72	1.52 _a	1.29	18.53***
PEB frequency	3.47 _a	1.21	4.54 _b	1.22	4.54 _b	1.22	21.86***

Note. Means with different subscripts differ at $p < .05$ according Tukey HSD post-hoc analyses.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 7

Descriptive Statistics for Study 3 Paper Disposal Habit Indicators (N = 327)

Variable	M	SD	Range	α	2	3	4	5
1. Recycle Frequency	6.82	2.93	0-10	-	.79***	-.69***	-.56***	-.24***
2. Habit Strength Recycle	4.48	1.56	1-7	.96	-	-.70***	-.53***	-.31***
3. Garbage Frequency	3.76	2.90	0-10	-		-	.77***	.39***
4. Habit Strength Garbage	3.05	1.66	1-7	.97			-	.42***
5. Behaviour Interference	2.28	1.77	1-7	-				-

Note. *p < .05, **p < .01, ***p < .001

Table 8

Study 3 Clusters of the Recycling and Garbage Target Behaviours

	Weak Habit Means (SD)	Repeated Behaviour Means (SD)	Strong Habit Means (SD)
Phase 1 Ward's Two-Step Hierarchical Clusters			
Recycling (N= 256)	21% (n = 54)	16% (n = 42)	63% (n = 160)
Recycling Frequency	2.15	7.63	8.40
Recycling Habit Strength	2.43	4.36	5.36
Behaviour Interference	2.84	5.03	1.29
Garbage (N= 261)	56% (n = 145)	23% (n = 61)	21% (n = 55)
Garbage Frequency	1.72	5.71	6.62
Garbage Habit Strength	1.85	4.17	4.38
Behaviour Interference	1.32	5.10	1.46
Phase 2 k-Means Cluster - Final Clusters*			
Recycling (N= 256)	22% (n = 57)	19% (n = 48)	59% (n = 151)
Recycling Frequency	2.18 (1.41) _a	7.68 (1.35) _b	8.53 (1.28) _b
Recycling Habit Strength	2.61 (1.18) _a	4.39 (1.24) _b	5.38 (1.06) _c
Behaviour Interference	2.89 (2.01) _a	4.65 (1.13) _a	1.21 (0.45) _c
Garbage (N= 261)	65% (n = 170)	15% (n = 40)	20% (n = 51)
Garbage Frequency	1.78 (1.17) _a	7.42 (1.51) _b	7.09 (1.74) _b
Garbage Habit Strength	2.04 (0.98) _a	4.96 (1.24) _b	4.26 (1.31) _b
Behaviour Interference	1.74 (1.35) _a	5.28 (0.73) _b	1.50 (0.77) _a

Note. Means with different subscripts differ at $p < .05$ according to Attribute Importance (AIM) post-hoc analyses.

* Recycling clusters achieved convergence due to no or small change in cluster centers at 5 iterations. The minimum distance between initial centers is 3.97.

* Garbage clusters achieved convergence due to no or small change in cluster centers at 6 iterations. The minimum distance between initial centers is 3.76.

Table 9

Mean Differences on Competing Behaviour Frequency Between the Cluster Groups

	Weak Habit		Repeated Behaviour		Strong Habit	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Recycling clusters						
Garbage Frequency	6.91 _a	2.38	4.51 _b	2.79	2.15 _c	1.90
Garbage clusters						
Recycling Frequency	8.33 _a	1.74	5.15 _b	2.77	4.19 _b	3.16

Note. Means with different subscripts differ at $p < .05$ according Tukey HSD post-hoc analyses.

Table 10

Descriptive Statistics and ANOVA Results for the Three Retained Recycling Clusters and the Validation Measures for Study 3

	Weak Habit		Repeated Behaviour		Strong Habit		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>
Recycling Behaviour							
Antecedents							
Controlled Motivation	2.87 _a	1.45	3.60 _b	1.17	3.46 _b	1.15	5.44**
Autonomous Motivation	3.40 _a	1.41	4.44 _b	1.25	4.83 _b	1.28	19.67***
Nature Relatedness	4.14 _a	1.85	5.41 _b	1.81	5.68 _b	2.38	8.01***
Consequences							
Recycling Intention	0.00	1.12	4.98 _b	1.12	5.41 _c	1.05	27.34***
Garbage Intention	2.95 _a	1.19	2.51 _a	1.13	1.97 _b	1.00	16.55***
PEB frequency	0.00	1.25	4.72 _b	0.99	5.09 _c	0.82	19.38***
Garbage Behaviour							
Antecedents							
Controlled Motivation	3.45 _a	1.23	3.74 _a	1.21	2.88 _b	1.17	5.62**
Autonomous Motivation	4.74 _a	1.33	4.06 _b	1.42	3.78 _b	1.40	10.40***
Nature Relatedness	5.61 _a	2.24	4.66 _{ab}	1.99	4.44 _b	1.84	5.92**
Consequences							
Recycling Intention	5.33 _a	1.08	4.49 _b	1.17	4.63 _b	1.15	14.16***
Garbage Intention	2.06 _a	1.00	2.84 _b	1.47	2.70 _b	1.15	11.86***
PEB frequency	5.08 _a	0.85	4.25 _b	1.24	4.26 _b	1.22	18.86***

Note. Means with different subscripts differ at $p < .05$ according Tukey HSD post-hoc analyses.

* $p < .05$, ** $p < .01$, *** $p < .001$

**What Predicts Habits for Pro-Environmental Behaviours?
An Analysis of the Determinants and Consequences of Pro-Environmental Behaviours**

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Abstract

Habits offer a potential mechanism for long-term maintenance of pro-environmental behaviours. The theoretical frameworks of habits (Bargh, 1994; Verplanken, 2006) and self-determination theory (Deci & Ryan, 2000) were combined to predict types of repeated behaviours using habit indicators and propose factors related to integrated pro-environmental habits. Three cross-sectional survey studies provided support for the three proposed types of repeated behaviours: weak habit, repeated behaviour with interference, and strong habit. Results were robust across three samples, two different target pro-environmental behaviours, and replicated previous research (Aitken & Pelletier, 2014). Autonomous motivation toward the environment, perceived importance of the environment, and frequency of other pro-environmental behaviours were fairly effective at distinguishing between behaviours that were not habitual, behaviours merely repeated, and behaviours fully internalized and habitual. The implications of these findings are discussed in relation to self-determination theory and the study of habits.

Keywords: Habits, pro-environmental behaviours, internalization, self-determination theory, determinants

What Predicts Habits for Pro-Environmental Behaviours:

An Analysis of the Determinants and Consequences of Pro-Environmental Behaviours

Climate change is having visible effects. According to the latest report by the Intergovernmental Panel on Climate Change (2014), the ice caps are melting, world water supplies are stressed, and weather patterns are intensifying. The report leaves little doubt that there is a scientific consensus on the negative impact climate change is having on the planet. Despite this consensus and an overwhelming public opinion that protecting the environment is important (Government of Canada, 2007), greenhouse emissions in Canada are increasing (Environment Canada, 2014). Part of the reason for the gap between people's concern for the environment and action on climate change is that climate change is a complex problem requiring human intervention now to combat future consequences. Individual behaviour change is an important tool for mitigating climate change, which is why it is an important topic for psychological research (Gifford, 2008; 2014; Karl, Melillo, & Peterson, 2009).

Pro-environmental behaviours (e.g., recycling) are individual behaviours that help mitigate human impact on the planet. Ensuring environmental sustainability requires that people need to do more than just *start* doing pro-environmental behaviours; they need to *keep* doing those pro-environmental behaviours by integrating the behaviours into their daily lives. Research into maintainable, targeted, pro-environmental behaviours should facilitate the creation of a lasting, positive impact for the planet. Habits offer a potential mechanism for long-term maintenance of pro-environmental behaviours (Rothman, Sheeran, & Wood, 2009). This is why habit formation is such an important element to target in the model of pro-environmental behaviour change.

Pro-Environmental Habits

There is a small but growing body of literature exploring pro-environmental habits (e.g., Dahlstrand & Biel, 1997; Klöckner & Matthies, 2004; Klöckner, Matthies, & Hunecke, 2006; Maréchal, 2010; Verplanken, 2010a). Habits are behaviours that a person repeats frequently. Many studies use behaviour frequency as an indicator of current and future habitual behaviour (e.g., Fujii & Kitamura, 2003; Gardner, 2009; Kahle & Beatty, 1987; Klöckner & Matthies, 2004; Webb & Eves, 2007a; 2007b). Based on their meta-analysis, Ouellette and Wood (1998) concluded the frequency of past behaviour reflects the strength of a habit, and past behaviour is the best indicator of future habitual behaviour. However, Verplanken and others (Verplanken, 2006; Verplanken & Aarts, 1999) contend that the frequency of past behaviour is confounded with unmeasured stable factors inflating the relationship between past and future habitual behaviour (Aarts, Verplanken & Knippenberg, 1998; Bamberg & Schmidt, 2003).

Frequent behaviour repetition is a necessary condition for habitual behaviour, but it is not the only condition. One essential condition is the strength of the habit. For a behaviour to be considered a habit the performance of the behaviour must show four characteristics related to its strength: a lack of awareness while performing the behaviour, difficulty in controlling the behaviour, performing the behaviour without intention, and few attentional resources when performing the behaviour (Bargh, 1994; Schneider & Shiffrin, 1977; Verplanken, 2006; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). From this perspective, a measure of frequency is an important indicator of a habit but an indicator of the habit strength provides a more direct measure of the automaticity of the behaviour (Ajzen & Fishbein, 2000; Wood, Tam & Witt, 2005).

Habitual Behaviour vs. Repeated Behaviour

Behaviour that is habitual is different from behaviour that is repeated. The difference comes from whether a new behaviour interferes with established behaviours. The notion of interference with other behaviours is important because when attempting to develop a new *target* habit people are confronted with the challenge of changing their *current* habits (Emmons & King, 1988; Jager, 2003; Verplanken, 2010a; 2010b) that may be in conflict with the target habit. The behaviour change process includes a reduction in the perceived interference between the current behaviour and the target behaviour as the target behaviour becomes internalized and habitual. Eventually, if a person is successful in integrating the target habit she may be able to work with her emotions, maintain the repeated behaviour, and integrate the new behaviour into a habit.

The habit literature is not conclusive about what a habit is, how to measure a habit properly, how behaviours are internalized, or what is a successful internalization of a habitual behaviour. As a consequence, what happens during the internalization process and what happens if the internalization process is not completed is not well understood. By applying self-determination theory (SDT; Deci & Ryan, 1985; 2000) to the identification of habits, recent research (Aitken & Pelletier, 2014) suggest that it could be possible to address many of these limitations.

Self-Determination Theory and Internalization

According to self-determination theory (SDT), people have an innate propensity to pursue challenges, novelty, and learning opportunities; that is, people tend toward psychological growth and development (Deci & Ryan, 1985; 2000). Successful development requires specific supports and supplements from the social environment. Through the internalization process, important pro-environmental behaviours are connected with other facets of the self-concept. Some contexts

facilitate the internalization of a behaviour. These contexts foster need satisfaction and autonomous motivation, and thus promote internalization and integration. If basic psychological needs are fulfilled, individuals are more likely to experience a sense of autonomous motivation, ultimately optimizing well-being and progress (Church et al., 2013; Ryan, 1995; Ryan & Deci, 2000; Vansteenkiste & Ryan, 2013).

From a SDT perspective, internalization is the active process of changing uninteresting but important activities into personally accepted activities. The internalization process is how people regulate behaviours that were originally externally motivated into integrated regulations (Deci & Ryan, 2000; Ryan, 1995). SDT suggests a distinction between different levels of internalization; introjection, identification and integration (Deci & Ryan, 1985). Introjection occurs when the internalization process is incomplete. The importance of doing the behaviour is understood but the behaviour is not accepted as one's own; it is not self-determined.

Identification is when a behaviour is internalized and the value of the behaviour is adopted as one's own but it is not congruent with all aspects of the self or other behaviours. Integration happens when the internalization process is complete and the importance of the behaviour is recognized, the regulation of the behaviour is incorporated into one's sense of self, and the behaviour is accepted as one's own. It is completely self-determined. There is a harmony between thoughts, feelings, and actions. People are more likely to perform a behaviour well and maintain it over the long-term when the behaviour is fully internalized and integrated (e.g., Deci, Eghrari, Patrick & Leone, 1994).

When the internalization process is complete, integration of a behaviour allows more autonomous behaviour regulation. When the internalization process is incomplete, such as is the case with introjected regulation and to some extent identified regulation, behaviour regulation

remains more external to the person and may lead to interference with other behaviours (Deci & Ryan, 2000).

Given internalization's importance to differentiating types of repeated behaviours, research needs to measure internalization. One way to determine the level of internalization of a behaviour is by measuring how congruent the target behaviour is with current behaviours. Current behaviour may impede one's ability to develop new habits (Dahlstrand & Biel, 1997; Verplanken, 2010b). Interference results from existing habits conflicting with developing habits. Many pro-environmental behaviours conflict with current habitual non-environmental behaviours (e.g., leaving the computer on instead of turning it off at the end of the day). Thus, in addition to behaviour frequency and habit strength, a third indicator of habit is the level of interference or congruence with other behaviours.

Based on SDT, three types of repeated pro-environmental behaviour should be detectable. The first type would be behaviours not yet internalized but regulated by external forces resulting in behaviours with no habit or a weak habit. Those with a weak habit for the target pro-environmental behaviour will be characterized by low behaviour frequency, a low habit strength score, and a low interference with the opposite competing non-environmental behaviour. The second type would be behaviours partially internalized through a non-integrated process resulting in behaviours that may be repeated but will not be fully internalized because of a continuing extrinsic influence and will have a lack of congruence. They are repeated behaviours with interference and will be characterized by a moderate behaviour frequency, a moderate habit strength score, but a high interference with the opposite competing non-environmental behaviour. The third type would be behaviours completely internalized and fully integrated resulting in a strong habit. Those with a strong habit for the target pro-environmental behaviour will be

characterized by a high behaviour frequency, a high habit strength score, and a low interference with the competing non-environmental behaviour.

Previous research supports the three proposed types of repeated behaviours: weak habit, repeated behaviour with interference, and strong habit (Aitken & Pelletier, 2014). Results from multiple cluster analyses identified the three types of repeated behaviours across three studies, three different samples, and three different target behaviours (i.e., using public transportation, recycling paper, putting paper in the garbage). The level of interference between competing behaviours was a unique habit indicator between a repeated behaviour and a strong habit. Full internalization of the behaviour is not possible while there is interference between behaviours. Our research aims to replicate this previous research with new cluster analyses to help identify the different types of repeated behaviour, and to build on this previous research by exploring how determinants and consequences of pro-environmental behaviours can help differentiate between the types of repeated behaviours.

Factors Associated with Pro-Environment Behaviours

SDT not only provides a theoretical explanation of how pro-environmental behaviours are internalized; it also posits the factors necessary for successful internalization. People with more perceived environmental importance, nature relatedness, and autonomous motivation will likely have a successful internalization process and develop strong habits.

Perceived environmental importance. Consistent with SDT (Deci & Ryan, 2000) and the theory of planned behaviour (Ajzen, 1991), if an individual believes that protecting the environment is important and values the natural environment, then she will take actions that correspond with these beliefs (Christensen, Rothberger, Wood, & Matz, 2004; Sparks & Shepherd, 1992; Whitmarsh & O'Neill, 2010).

Nature relatedness. According to SDT (Deci & Ryan, 1985; 2000), basic psychological needs (i.e., autonomy, competence and relatedness) are essential and necessary to support psychological growth, integrity, and well-being. In fact, relatedness has been identified as *absolutely essential* to the internalization process of behaviours (Ryan & Deci, 2000).

Relatedness need satisfaction promotes internalization and autonomous regulation for behaviours (e.g., Markland & Tobin, 2010; Grolnick & Ryan, 1989). Nature relatedness is how connected an individual feels to the natural environment (Nisbet, Zelenski, & Murphy, 2009). Nature relatedness is associated with pro-environmental attitudes, behaviours, intrinsic aspirations, autonomy, and well-being (Arbuthnott, Sutter, & Heidt, 2014; Brown & Kasser, 2005; Nisbet et al., 2009; Ryan et al., 2010; Sparks, Hinds, Curnock, & Pavey, 2014; Weinstein, Przybylski, & Ryan, 2009; Zelenski & Nisbet, 2014). However, little work has been done using the concept of nature relatedness within the SDT framework to predict habits for pro-environmental behaviours.

Motivational orientation. Motivational orientations govern people's ongoing activities and are characterized by the extent to which the person feels actions are determined by external (i.e., controlling motivational orientation) and internal (i.e., autonomous motivational orientation) factors. Autonomous motivation is based on valuing the behaviour and/or is based on deliberate reasoning and reflection to accommodate the behaviour (Deci & Ryan, 1985, 2000; Ratelle, Guay, Vallerand, Larose, & Senécal, 2007). Compared to controlled motivation, autonomous motivation has been reliably associated with more frequent and more persistent pro-environmental behaviours, and stronger behavioural intentions (de Groot & Steg, 2010; Deci & Ryan, 2000; Green-Demers, Pelletier, & Ménard, 1997; Osbaldiston & Sheldon, 2003; Pelletier, 2002; Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998).

Participation in other pro-environmental behaviours. More self-determined individuals report stable, pro-environmental attitudes over time and participate in a greater diversity of pro-environmental behaviours (Green-Demers et al., 1997; Pelletier et al., 1998; Villacorta, Koestner, & Lokes, 2003). The harmonious alignment of pro-environmental identities, autonomous motivations, values, and actions can lead to environmental activism where people are more actively committed to improving the quality of the environment (Séguin, Pelletier, & Hunsley, 1998).

Life satisfaction. Integration of behaviours can lead to more vitality, self-motivation, and well-being (Deci & Ryan, 2000; Johnston & Finney, 2010). In contrast, non-integration of behaviours can lead to lower motivation, impaired performance, and less well-being (Batholomew, Ntoumanis, Ryan, Thøgersen-Ntoumani, & Bosch, 2011; Deci & Ryan, 2000; Ryan, Deci, Grolnick, & La Guardia, 2006). Autonomous motivation and more internalized behaviours are related more strongly to eudaimonic types of well-being rather than hedonic conceptions of happiness (Deci & Ryan, 2000; Ryan, Huta & Deci, 2008). Thus, the eudaimonic well-being element of general life satisfaction is an important consequence of pro-environmental behaviour.

General Method

Three studies were conducted to address three research goals: (1) explore and verify the three types of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit) based on the proposed indicators of habits (i.e., behaviour frequency, habit strength, and interference with opposing behaviours), (2) identify differences between strong habits and behaviours that are merely repeated, and (3) explore potential determinants and consequences of strong habits.

Hypotheses

In agreement with Aitken and Pelletier (2014), it was hypothesized that three types of repeated behaviour would be identified. One type of repeated behaviour would be *weak habit* for the target behaviour. People with a weak habit for the target behaviour do not perform the behaviour frequently, have low habit strength, and report low interference with the opposing behaviour. A second type of repeated behaviour would be *repeated behaviour with interference*. People with interfered repeated behaviours have a moderate frequency and habit strength but high levels of interference. A third type of repeated behaviour would be *strong habit*. People with strong habits have high frequency, high habit strength, and low interference.

It was hypothesized that in regards to determinants and consequences, autonomous motivation would be associated with a higher prevalence of strong habits. Controlled motivation was expected to relate to incomplete, non-integrated internalization, and repeated behaviours with interference. It was expected that people with more perceived environmental importance and nature relatedness would have an internalized strong habit for the pro-environmental behaviour. It was expected that people with a strong habit would be more likely to participate in other pro-environmental behaviours and to report greater life satisfaction.

Overview of the Procedure

The same procedure was used for all three studies to promote replication of the research (Kline, 2013). All data were collected through an online survey system (i.e., limesurvey) that could be accessed by participants from any computer with Internet access and completed at the convenience of the participants. Participants voluntarily signed up for the survey titled “How are habits made? What's your motivation?” in exchange for partial class credit. The survey included measures presented in the following order; demographics, behaviour frequency, habit strength,

behaviour interference, motivation toward the environment, nature relatedness, environmental importance, frequency of other pro-environmental behaviours, and life satisfaction. Scale items were presented in random order and all surveys were completed in English. The average time participants took to complete all the measures was 33.25 minutes.

Participants were told the purpose of the study was to explore habits¹. After completing the demographic section, a cover story was provided to participants to hide the pro-environmental purpose of the study and help prevent self-selection bias. Participants were told they would be answering questions about their intentions and habits for three everyday office behaviours that had been randomly selected from a pool of 25 possible behaviours. In fact, the behaviours were not randomly selected but were the same for all participants in each study. Target pro-environmental behaviours had to also be office behaviours in order to preserve the cover story of the study. The three studies targeted different office pro-environmental behaviours (i.e., double-sided printing or paper recycling) to assess the level of repeated behaviour for the target pro-environmental behaviour using the three habit indicators (i.e., behaviour frequency, habit strength, and behaviour interference). Study 1 asked participants about their double-sided printing frequency (i.e., In an average WEEK, when you use a printer to print documents, how often do you print papers on both side of the paper?), double-sided printing habit strength, and behaviour interference between single and double-sided printing. Study 2 replicated Study 1 with a new behaviour (i.e., paper recycling) and a new sample to ensure the results could generalize to other behaviours and other people. The habit indicator wording was adapted to the new behaviour, while all other measures remained the same. Study 2 asked participants about their

¹ Recruitment blurb. “The purpose of this study is to explore how habits are made. This study is composed of one 30-minute online survey. During the online survey session you will be asked to complete a questionnaire about your intentions, level of habit, feelings about behaviours, motivation, your well-being, and basic demographic information. “

paper recycling frequency (i.e., In an average WEEK, how often do you recycle your paper products?), paper recycling habit strength, and behaviour interference between putting paper in the garbage and recycling paper. Study 3 replicated Study 2 with a new sample but targeted the same recycling behaviour to test for consistency (Kline, 2013).

Overview of the Analysis

Cluster analysis. In each study, cluster analyses were used to identify different types of repeated behaviour based on the proposed theoretical habit indicators. Cluster analysis is a person-centred statistical method that classifies individuals into groups, called clusters, based on the similarity within groups and the difference between groups identified using variables selected by the researcher (Aldenderfer & Blashfield, 1984; Burns & Burns, 2009). The ability to identify person specific, intra-individual organization of psychological processes and behaviours is the major benefit of using a person-centred approach over a variable-centred approach, which makes this analysis apt for identifying different types of repeated behaviours (Gore, 2000). For a comparison of person-centred and variable-centred approaches, see Asendorpf (2013). Variables selected for use in this research included the three identified indicators of habitual behaviour: behaviour frequency, habit strength, and interference with opposing behaviours. Clusters in all three studies were selected based on three criteria: (a) the most theoretically interpretable/meaningful, (b) the most parsimonious, and (c) the highest measure of cohesion and separation without compromising the first two criteria (Burns & Burns, 2009; Mooi & Sarstedt, 2011).

In each sample, repeated behaviour groups were established using the two stage cluster analysis method consistent with previous research (Aitken & Pelletier, 2014; Gore, 2000; Martinent, Nicolas, Gaudreau, & Campo, 2013). Phase one included a Ward's method two-step

hierarchical cluster analysis to identify the optimal number of clusters to retain based on the distances between cases. Phase two involved a k-means cluster analysis which sets the cluster centers generated in phase one as the initial seed points for the k-means clusters. Cluster analysis is a collection of algorithms for exploratory analysis and does not involve hypothesis testing; as such it does not have assumptions, per se, but it is sensitive to outliers and multicollinearity (Gore, 2000; Tabachnick & Fidell, 2001). No issues of multicollinearity were present in the three studies. For a more detailed discussion on using cluster analysis for identifying repeated behaviours using the indicators of habits, see the article by Aitken and Pelletier (2014).

Multinomial logistic regression. Once groups were identified using the cluster analysis, a series of multinomial logistic regressions were performed to assess likelihood of membership in the created groups. Predictors of interest were broken down into three groups; motivation toward the environment, potential determinants of pro-environmental habits (i.e., connection to nature and environmental importance), and potential consequences of having pro-environmental habits (i.e., frequency of pro-environmental behaviours and life satisfaction).

When a dependent variable has three or more categories, it cannot be analyzed with standard logistic regression (Hosmer, Lemeshow, & Sturdivant, 2013; Pampel, 2000). Multinomial logistic regression was necessary since it was anticipated more than two groups would be identified using the cluster analysis. Multinomial analysis sets one of the dependent variable groups to be a reference group and then breaks the analysis into a series of binary logistic regressions comparing each dependent variable group to the reference group (Hosmer, Lemeshow, & Sturdivant, 2013). It then estimates the odds of membership (i.e., logit) in the comparison group and estimates the odds ratio of predictor variables on the dependent variable (Field, 2013). For the current studies, the strong habit group was set as the reference group for all

analyses. Each multinomial logistic regression assesses the odds of membership in the strong habit group compared to the weak habit group, and the odds of membership in the strong habit group compared to the repeated behaviour with interference group.

Measures

A variety of scales were used to measure pro-environmental habits and validate the outcomes across the three studies in addition to a set of basic demographic questions about the individual (e.g., age, sex). This section describes all the measures that were used in this research.

Habit. Habits are operationalized as behaviours that are integrated within the person, an integral part of one's life, and congruent with the self. Habits were measured using the identified habit indicators: behaviour frequency, habit strength, and level of interference between opposing behaviours. Each of these indicators is adapted for the target pro-environmental behaviour in each study (i.e., double-sided printing or paper recycling).

Behaviour frequency. The frequency of performing the target behaviour was measured for each study. For example, the frequency of recycling paper asked “In an average WEEK, how often do you recycle your paper products?” on a scale from 0 (*Never*) to 10 (*Always*).

Habit strength. The 12-item Self-Report Habit Index (Verplanken & Orbell, 2003) measures the strength of a behavioural habit based on features of difficulty controlling the behaviour, lack of awareness, efficiency, and identification with the behaviour. Items complete the statement “Behaviour XXX is something...”. An example item is “I do automatically”. The items are measured on a 7-item response scale anchored by 1 (*Disagree*) to 7 (*Agree*). A higher score on the habit index indicates a stronger habit for the target behaviour. Construct validity of the scale has been demonstrated by exploratory factor analysis. Reliability was shown using a 3-

week test-retest method, and the scale exhibited high levels of internal consistency in the Verplanken and Orbell (2003) study.

Behaviour interference. Interference with opposing behaviours is an indicator of habitual behaviour when there is low interference between behaviours (i.e., congruence), whereas a high interference indicates the behaviour has not been fully integrated. A question related to the target behaviour's interference was developed for this research (e.g., “To what extent does your current form of paper disposal XX² interfere or conflict with your preferred form of paper disposal XX?”) using a 7-point scale ranging from 1 (*No conflict*) to 7 (*Strong conflict*).

Determinants

Motivation toward the environment. The Motivation Toward the Environment Scale (Pelletier et al., 1998) includes 24-items that rate reasons for engaging in environmentally friendly behaviours and reflect the motivational constructs specified by SDT. Example items include “for the pleasure I get from contributing to the environment” and “for the recognition I get from others”. On a 7-point scale ranging from 1 (*Does not correspond at all*) to 7 (*Corresponds exactly*), participants indicate the extent to which each item corresponded to their reasons for engaging in pro-environmental behaviours. Higher scores indicate a higher level of motivation toward the environment. For ease of interpretation, two sub-scales were created to reflect participants' level of controlled motivation toward the environment (i.e., external and introjected) and their autonomous motivation toward the environment (i.e, identified, integrated, and intrinsic) as per previous SDT research (Ratelle et al., 2007). Validity of the scale has been demonstrated by exploratory and confirmatory factor analyses. The scale exhibited high levels of

² The current and preferred disposal behaviours were self-identified earlier in the survey.

internal consistency using a 5-week test-retest method (Pelletier et al., 1998; Villacorta et al., 2003).

Nature relatedness. The Brief Nature Relatedness Scale (Nisbet & Zelenski, 2013) has 6-items that measure individual differences in how connected emotionally and physically a person is to the natural environment. An example item is “I take notice of wildlife wherever I am”. Higher scores indicate a stronger connection to nature. The validity and reliability of the Brief Nature Relatedness Scale was tested over four studies (Nisbet & Zelenski, 2013). Validity of the scale has been demonstrated by factor analysis. Concurrent validity was shown by correlations with established environmental and personality measures. Reliability was shown using a 4-week test-retest method on a diverse sample.

Environmental importance. The Environmental Importance Scale (Pelletier et al., 1998) includes 4-items that reflect participants' impressions about the importance of the environment. An example item is “I feel we must make changes in the way we treat the environment as quickly as possible”. Participants were asked to indicate the extent to which each item corresponded to their thoughts about the environment on a 10-point scale ranging from 1 (*Does not correspond at all*) to 10 (*Corresponds exactly*). Two of the four items are reverse scored. Higher scores indicate a higher level of importance to the environment.

Consequences

Pro-environmental behaviours. A scale was developed based on items from previous studies (Pelletier, Legault, & Tuson, 1996; Pelletier et al., 1998; Statistics Canada, 2011). There were 12 items in Study 1 and 28 items in Study 2 and Study 3. The items were rated on a 7-point scale ranging from 1 (*Not very often*) to 7 (*Very often*). Example items include “turn off lights

when you leave a room” and “participate in events organized by ecological groups”. Higher ratings are associated with participating more often in pro-environmental behaviours.

Life satisfaction. A global appraisal of one’s life and the extent to which one’s life measures up to expectations is measured with the Satisfaction with Life Scale (Diener, Emmons, Larsen & Griffin, 1985). The five items are rated on a 7-point scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*) with higher scores related to more satisfaction with life.

Study 1

A cross-sectional online survey study design was used with a convenient university sample. Three types of repeated pro-environmental behaviours were expected from the cluster analysis: weak habit, repeated behaviour with interference, and strong habit. It was expected the multinomial logistic regression results would show that higher autonomous motivation toward the environment, nature relatedness, environmental importance, frequency of other pro-environmental behaviours, and life satisfaction would be related to more internalized forms of the target pro-environmental behaviour (i.e., repeated behaviour with interference and strong habit) compared to the weak habits. For this study, the target behaviour was double-sided printing behaviours, while single sided printing behaviours were the opposing behaviours.

Results

The participants for this study were undergraduate students with access to a personal printer ($N = 394$; 79% females and 21% males) enrolled in a psychology course at a Canadian university. Participants’ ages ranged from 17 to 29 years ($M = 19.13$, $SD = 1.64$). A majority of participants (72%) spoke English as their first language.

Descriptive statistics for the habit indicators and the predictor variables can be seen in Table 1. Overall, participants had low frequency and reported on average using double-sided

printing 35% of the time. As expected, there was a high statistically significant positive correlation between the behaviour frequency and habit strength for double sided-printing. The interference indicator was not correlated with frequency or habit strength. People had mid-range motivation toward the environment, nature relatedness, and frequency of participating in other pro-environmental behaviours. Perception of environmental importance and life satisfaction were fairly high for the sample. Life satisfaction was not correlated with any of the other predictors, and nature relatedness and environmental importance were not correlated to pro-environmental behaviour frequency. The two types of motivation (i.e., autonomous and controlled) were positively correlated. Nature relatedness and environmental importance were both more strongly related the autonomous motivation than controlled motivation for the environment.

Table 1

Descriptive Statistics for Study 1 Habit Indicators and Predictors (N= 394)

Variable	M	SD	Range	α	2	3
<i>Habit Indicators</i>						
1. Habit Strength	2.75	1.99	1-7	.98	.84***	-.02
2. Behaviour Frequency	3.62	3.93	0-10	-	-	-.01
3. Interference	2.24	1.89	1-7	-		-
<i>Predictors</i>						
Variable	1	2	3	4	5	6
1. Controlled Motivation	-	.60***	.25***	.17**	.30***	.04
2. Autonomous Motivation		-	.58***	.57***	.13*	.08

3. Nature Relatedness	-	.39***	.07	.06		
4. Environmental Importance		-	-.09	-.02		
5. Frequency PEB			-	-.01		
6. Life Satisfaction				-		
Mean (SD)	3.45 (1.16)	4.33 (1.29)	4.62 (1.80)	7.18 (1.77)	3.49 (.84)	4.93 (1.26)
Range	1-7	1-7	1-9	1-10	1-7	1-7
Alpha	.85	.94	.87	.75	.76	.89

Note. PEB = Pro-environmental behaviours
 $t < .1$, $*p < .05$, $**p < .01$, $***p < .001$

Cluster Analysis

A cluster analysis was performed in two phases to identify patterns of individuals in the sample that have different types of repeated behaviours (i.e., Ward's method and then k-means) using the data from the three habit indicator variables. In the current sample, five cases were removed as outliers, and 77 cases were removed due to incomplete responses for the printing habit indicator items resulting in a usable sample size of 310. It was decided to not use any data imputation of missing values due to the potential to bias the cluster analysis.

Phase one. A Ward's method two-step hierarchical cluster analysis was performed using behaviour frequency, habit strength, and behaviour interference. A 3-cluster solution produced the most theoretically meaningful and parsimonious solution based on the means of the three indicator variables. It had a silhouette measure of cohesion and separation of .70, which is considered good (Aldenderfer & Blashfield, 1984; Norušis, 2011).

The first group had consistently lower scores on the habit strength scale, number of double-sided printings, low behaviour interference, and was labelled the Weak Habit group. The second group had modest scores on the habit strength scale and number of double-sided printings but scored high on the behaviour interference item, and was labelled the Repeated Behaviour with Interference group. The third group had consistently high scores on the habit strength scale, number of double-sided printings, low behaviour interference, and was labelled the Strong Habit group.

Phase two. A second cluster analysis was performed using the cluster means from the Ward's method cluster analysis on the three indicator variables (i.e., behaviour frequency, habit strength, behaviour interference) as the starting values for the 3-cluster k-means cluster solution. Once the reclassification was completed, the analysis once again produced 3-clusters with a pattern of means representing a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group. Post-hoc analysis of the double-sided printing behaviour shows that each of the final three cluster groups were different on each of the three proposed indicator variables³, $F_{Habit\ Strength}(2, 307) = 275.54, p < .001$, $F_{Frequency}(2, 307) = 1111.81, p < .001$, , $F_{Interference}(2, 307) = 221.55, p < .001$. Results, including post-hoc analyses, are displayed in Table 2. Few changes were made to the original classification of cases.

Table 2

Phase 2 k-Means Cluster Analysis for Study 1- Final Clusters (N=310)

	Weak Habit Mean (SD)	Repeated Behaviour Mean (SD)	Strong Habit Mean (SD)
	48% (n = 150)	14% (n = 45)	37% (n = 115)

³ In all three studies, the F tests should be used only for descriptive purposes because the clusters were chosen to maximize the differences among cases in different clusters. The observed statistical significance levels are not corrected for this and thus cannot be interpreted as tests of a hypothesis that the cluster means are equal.

Habit Strength	1.37 (0.82) _a	1.76 (1.17) _a	4.75 (1.57) _b
Frequency	0.60 (1.03) _a	1.45 (1.90) _a	8.39 (1.51) _b
Behaviour Interference	1.26 (0.57) _a	5.66 (1.10) _b	2.11 (1.78) _c

Note. Means with different subscripts differ at $p < .05$ according to Attribute Importance (AIM) post-hoc analyses.

Having used the person-centred cluster analysis to create unique groups of repeated behaviour, it is now possible to explore how other variables are related to differences between these groups. In this study we identified a number of determinant and consequence variables expected to relate differently amongst the groups. The next three sections will report the multinomial logistic regression results of the proposed predictors; motivation toward the environment, nature relatedness, environmental importance, frequency of pro-environmental behaviour composite scale, and life satisfaction.

Multinomial Logistic Regressions

Motivation toward the environment orientations. Multinomial logistic regression ($N=310$) was used to predict the influence of controlled and autonomous motivation toward the environment on the likelihood that a person had a weak habit ($n = 150$), a repeated behaviour with interference ($n = 45$), or a strong habit ($n = 115$). To maximize the use of the data and prevent bias, missing data on only the predictor variables were imputed using the expectation-maximization technique (Allison, 2002; Schlomer, Bauman, & Card, 2010). There were 26 values imputed for controlled motivation toward the environment and 32 values for autonomous motivation toward the environment⁴. No serious violations of multicollinearity or linearity in the logit were observed⁵ (Field, 2013; Tabachnick & Fidell, 2007).

⁴ All analyses in the article were performed both with and without imputation and results were consistent.

⁵ Linearity of the logit was tested by examining the predictive capacity of interaction terms and multicollinearity was assessed with tolerance and variance inflation factor (VIF) values for all models in the article. No serious violations of multicollinearity or linearity in the logit were observed for any of the models in the article.

There was a good model fit (i.e., discrimination among groups; UCLA: Statistical Consulting Group, 2014) using a deviance criterion on the basis of the motivation predictors, $\chi^2(548) = 537.47, p = .618$. The likelihood ratio chi-square similarly demonstrated good model fit, $\chi^2(4, N=310) = 21.76, p < .001$, indicating that the model as a whole fits better than a model with no predictors, and that the two predictors reliably distinguish between the three internalized behaviour groups (Field, 2013; Tabachnick & Fidell, 2007). The model accounted for approximately 8% of variance (Nagelkerke $R^2 = .078$). Table 3 shows the regression coefficients, odds ratios and the 95% confidence intervals for all the models.

Table 3

Predicting Type of Repeated Behaviours for Study 1

<i>Predictor</i>	<i>B</i>	<i>S.E. B</i>	<i>Wald χ^2</i>	<i>OR</i>	<i>95% CI</i>
<i>Motivation Toward the Environment</i>					
Weak Habit (1) vs. Strong Habit (0)					
Controlled Motivation	-.11	.145	.58	.90	.67 to 1.19
Autonomous Motivation	-.37	.136	7.42**	.69	.53 to .90
Repeated Behaviour (1) vs. Strong Habit (0)					
Controlled Motivation	-.30	.19	2.43	.74	.50 to 1.08
Autonomous Motivation	.13	.18	.58	1.14	.81 to 1.61
<i>Determinants of PEB Habits</i>					
Weak Habit (1) vs. Strong Habit (0)					
Nature Relatedness	-.36	.09	16.64***	.70	.58 to .83
Environmental Importance	.09	.08	1.10	1.09	.93 to 1.29
Repeated Behaviour (1) vs. Strong Habit (0)					
Nature Relatedness	-.28	.12	5.48*	.75	.23 to .79
Environmental Importance	.41	.13	10.10**	1.51	.92 to 1.03
<i>Consequences of PEB Habits</i>					
Weak Habit (1) vs. Strong Habit (0)					
PEB Frequency	-.65	.17	13.97***	.52	.37 to .73

Life Satisfaction	.02	.02	.83	1.02	.98 to 1.06
Repeated Behaviour (1) vs. Strong Habit (0)					
PEB Frequency	-.76	.27	8.15**	.47	.23 to .79
Life Satisfaction	-.02	.03	.59	.98	.92 to 1.03

Note. B = Regression coefficients in log-odd units, SE = Standard error of the coefficients, Wald = Wald chi-square statistic, OR = Odds ratio, CI = Confidence interval, PEB = Pro-environmental behaviours.

The strong habit was the reference group coded as zero.

* $p < .05$, ** $p < .01$, *** $p < .001$

Autonomous motivation toward the environment was the only statistically significant predictor between the weak habit group and the strong habit group for double-sided printing, when controlling for all other variables in the model. The odds of being in the weak habit group as opposed to the strong habit group decreased by a factor of .69 per unit increase in autonomous motivation. People with more autonomous motivation toward the environment were more likely to have a strong habit than a weak habit for double-sided printing. There were no statistically significant differences between the repeated behaviour with interference group and the strong habit group.

Determinants of pro-environmental behaviours. It was hypothesized the likelihood that a person had a weak habit, a repeated behaviour with interference, or a strong habit was related to nature relatedness and perceived environmental importance. There were 54 values imputed using the expectation-maximization technique for nature relatedness and 34 values for environmental importance. The multinomial logistic regression analysis ($N = 310$) revealed a good model fit using a deviance criterion, $\chi^2(606) = 590.64$, $p = .665$. The likelihood ratio test also demonstrated good model fit, $\chi^2(4, N=310) = 28.91$, $p < .001$. The variance accounted for was small with a Nagelkerke $R^2 = .10$.

Nature relatedness was the only statistically significant predictor between the weak habit group and the strong habit group (see Table 3). The odds ratio indicates that when controlling for

other variables in the model, the greater the nature relatedness, the more likely participants had a strong habit rather than a weak habit for double-sided printing. Similarly, the greater the nature relatedness, the more likely participants had a strong habit rather than a repeated behaviour with interference for double-sided printing. Finally, a one-unit increase in perceived importance of the environment was associated with a 1.51 increase in the odds of being in the repeated behaviour with interference group versus the strong habit group. People who think protecting the environment is important were more likely to have a repeated behaviour with interference rather than a strong habit for double-sided printing.

Consequences of pro-environmental behaviours. It was hypothesized the likelihood that a person had a weak habit, a repeated behaviour with interference, or a strong habit was related to frequency of other pro-environmental behaviours and life satisfaction. There were 11 values imputed using the expectation-maximization technique for pro-environmental behaviour frequency and 20 values for life satisfaction. The multinomial logistic regression analysis ($N=310$) revealed a good model fit using a deviance criterion, $\chi^2(564)=562.37, p=.51$. The likelihood ratio test also demonstrated good model fit, $\chi^2(4, N=310)=21.81, p<.001$. The variance accounted for is small, Nagelkerke $R^2=.08$.

The frequency of engaging in other pro-environmental behaviours was the only statistically significant predictor between the weak habit group and the strong habit group, and between the repeated behaviour with interference group and the strong habit group (see Table 3). The odds ratios indicates that people engaging in more pro-environmental behaviours were more likely to have a strong habit rather than a weak habit or an interfered repeated behaviour for double-sided printing.

Study 1 Discussion

The cluster analysis results from Study 1 support the existence of the three proposed types of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit) for the double-sided printing behaviour. The weak habit was characterized by a low habit strength, low behaviour frequency, and low interference with the opposite competing behaviour. The repeated behaviour with interference was characterized by modest habit strength, modest behaviour frequency, but also a high interference with the opposite behaviour. The strong habit was characterized by high habit strength, high behaviour frequency, and low interference with the opposite behaviour. This is consistent with what has been found in previous research (Aitken & Pelletier, 2014).

Increased interference was found to be an interesting indicator for differentiating the interfered repeated behaviour from the strong habitual behaviour. The repeated behaviour group is still participating in the behaviour and has some level of automaticity but also shows signs of conflict between the target pro-environmental behaviour and the opposite non-environmental behaviour. This interference of the behaviour might be causing this group to consider options when deciding to perform or not perform the behaviour. The increased cognition prevents the behaviour from becoming fully automatic and habitual (Bargh, 1994; Verplanken, 2006). It also shows that the repeated behaviour group lacks the same level of congruence between behaviours as the other two groups.

After establishing the three groups of repeated behaviour with cluster analysis, subsequent analysis used multinomial logistic regression to predict the likelihood that a person had a weak habit, repeated behaviour with interference or a strong habit based on the five identified factors related to pro-environmental behaviours; type of motivation toward the environment, nature relatedness, perceived environmental importance, frequency of other pro-

environmental behaviours, and life satisfaction. Autonomous motivation toward the environment helped predict being in the strong habit group over the weak habit group but not the repeated behaviour with interference group. Those with greater autonomous motivation were more likely to have a strong habit for the pro-environmental behaviour double-sided printing than the weak habit group. Having a connection to nature helped predict being in the strong habit group over the both weak habit group and the repeated behaviour with interference group. Those with greater nature relatedness were more likely to have a strong habit for double-sided printing. Perceived importance of the environment was able to help predict being in the repeated behaviour with interference group over the strong habit group but not the weak habit group. Those with greater concern for the environment were more likely to have an interfered repeated behaviour for double-sided printing. Lastly, frequency of other pro-environmental behaviours helped predict being in the strong habit group over both the weak habit group and the repeated behaviour with interference group. Those who reported more frequent performance of a variety of pro-environmental behaviours were more likely to have a strong habit for double-sided printing.

These results are generally consistent with expectation and support previous findings in the research. Autonomous motivation has been found to be associated with more complete internalization (Ryan & Deci, 2000; Weinstein, Przybylski & Ryan, 2013). Surprisingly, autonomous motivation was not able to differentiate between the strong habit group and the repeated behaviour with interference group. This failure may be because both these groups are related to some form of internalization for double-sided printing. Nature relatedness and frequency of performing other pro-environmental behaviours were both able to differentiate between the strong habit group and the repeated behaviour with interference group suggesting

there are differences between people who have a strong habit and those who merely repeat the behaviour. One unexpected result was that perceived environmental importance was related to having an interfered repeated behaviour over a strong habit. It might be that the repeated behaviour with interference group is highly concerned about the environment and is motivated to try to learn how to double-sided print but have not fully succeeded in automatizing and internalizing the behaviour. This lack of complete internalization might be due to an inability to use the double-sided printing functions on their printer. Or this lack of complete internalization could be a sample specific effect. Further research will be needed to identify the source of this effect.

This study explored the possibility of differentiating groups and identifying what factors are predictive of having a strong habit for double-sided printing. Since double-sided printing is often perceived to be more difficult and complicated to perform (Aitken & Pelletier, 2011), the results may be less generalizable. Subsequent studies will need to test if these results are a consistent pattern or a sample specific phenomenon (Kline, 2013). For these reasons, the results need to be assessed with a new sample and using a different pro-environmental behaviour, one that is more frequently done by people.

Study 2

The goal of Study 2 was to replicate the results from Study 1 (Kline, 2013) to show results were consistent using a new pro-environmental behaviour. For this study, the target behaviour was paper recycling disposal behaviours, while garbage disposal behaviours were the opposing behaviours. A cross-sectional online survey study design was used with a new convenient university sample. Consistent with the first study, three types of repeated behaviours were expected from the cluster analysis: weak habit, repeated behaviour with interference, and

strong habit. It was expected the multinomial logistic regression results would show that higher autonomous motivation toward the environment, nature relatedness, environmental importance, frequency of other pro-environmental behaviours and life satisfaction would be related to the two more internalized forms of the target pro-environmental behaviour compared to the weak habit.

Results

The participants for this study were undergraduate students ($N = 235$; 75% females and 25% males) enrolled in a psychology course at a Canadian university. Demographics were very similar to Study 1. Participants' ages ranged from 17 to 27 years ($M = 19.17$, $SD = 1.59$). A majority of participants (70%) spoke English as their first language.

Descriptive statistics for the habit indicators and the predictor variables can be seen in Table 4. Overall, participants reported recycling their paper often, as seen by the higher means for the recycling habit indicators than the double-sided printing habit indicators in Study 1. Consistent with Study 1, there was a high statistically significant positive correlation between the habit strength and behaviour frequency. As expected, there was a negative correlation with the measure of interference and the other two habit indicators. People had mid-range motivation toward the environment, nature relatedness, and frequency of participating in other pro-environmental behaviours. Perception of environmental importance was fairly high for the sample. Nature relatedness and environmental importance were both more strongly related to autonomous motivation than controlled motivation for the environment. Different than Study 1, life satisfaction was lower and it was correlated with all of the other predictors. The two types of motivation were positively correlated.

Table 4

Descriptive Statistics for Study 2 Habit Indicators and Predictors ($N = 235$)

Variable	M	SD	Range	α	2	3
<i>Habit Indicators</i>						
1. Habit Strength	4.75	1.43	1-7	.96	.79***	-.29***
2. Behaviour Frequency	6.97	2.67	0-10	-	-	-.36***
3. Interference	2.22	1.68	1-7			-
<i>Predictors</i>						
Variable	1	2	3	4	5	6
1. Controlled Motivation	-	.48***	.39***	.34***	.22**	.12 ^t
2. Autonomous Motivation		-	.62***	.55***	.48***	.19**
3. Nature Relatedness			-	.44***	.36***	.19**
4. Environmental Importance				-	.36***	.23***
5. Frequency PEB					-	.11 ^t
6. Life Satisfaction						-
Mean (SD)	3.37 (1.09)	4.47 (1.29)	5.56 (1.97)	7.62 (1.67)	4.41 (0.91)	4.90 (1.22)
Range	1-7	1-7	1-10	1-10	1-7	1-7
Alpha	.83	.95	.87	.78	.85	.87

Note. PEB = Pro-environmental behaviours
 $t < .1$, $*p < .05$, $**p < .01$, $***p < .001$

Cluster Analysis

Phase one. Once again, the Ward's method two-step hierarchical cluster analysis was performed using cases from the three variables proposed to indicate habit (e.g., recycling frequency, recycling habit strength, and behaviour interference). In the current sample, four cases were removed as outliers and 65 cases were removed due to incomplete responses, resulting in a usable sample size of 166.

The 3-cluster solution was retained as the best solution. It had the most theoretical and parsimonious cluster results with a good fit; it had a silhouette measure of cohesion and separation of .60. Results supported the hypothesized three groups of repeated behaviour; a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for the paper recycling behaviour.

Phase two. The 3-cluster k-means cluster solution validated the three groups produced with the Ward's cluster method. Once the reclassification was completed, the analysis again produced a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for the recycling behaviour based on the means of the three habit indicator variables. Post-hoc analysis of the recycling behaviour showed that each of the three cluster groups were statistically significantly different on each of the three indicator variables, $F_{Habit\ sStrength}(2, 163) = 100.65, p < .001$, $F_{Frequency}(2, 163) = 320.37, p < .001$, $F_{Interference}(2, 163) = 113.69, p < .001$. Results, including post-hoc analyses, are displayed in Table 5. These results were mostly consistent with the results from Study 1.

Table 5

Phase 2 k-Means Cluster Analysis for Study 2- Final Clusters (N=166)

Weak Habit Mean (SD)	Repeated Behaviour Mean (SD)	Strong Habit Mean (SD)
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	26% (n = 44)	19% (n = 31)	55% (n = 91)
Habit Strength	3.03 (0.85) _a	4.69 (1.04) _b	5.54 (0.98) _c
Frequency	3.05 (1.49) _a	7.66 (1.26) _b	8.63 (1.04) _c
Behaviour Interference	3.23 (1.82) _a	4.43 (1.22) _b	1.20 (0.48) _c

Note. Means with different subscripts differ at $p < .05$ according to Attribute Importance (AIM) post-hoc analyses.

Multinomial Logistic Regression

Motivation toward the environment orientations. Multinomial logistic regression ($N=166$) was used to predict the influence of controlled and autonomous motivation toward the environment on the likelihood that a person had a weak habit ($n=44$), a repeated behaviour with interference ($n=31$), or a strong habit ($n=91$). There were 11 values imputed using the expectation-maximization technique for controlled motivation toward the environment and 14 values for autonomous motivation toward the environment. The analysis showed a good model fit (i.e., discrimination among groups) using a deviance criterion on the basis of the motivation predictors, $\chi^2(310) = 290.05$, $p = .786$. The likelihood ratio chi-square similarly demonstrated good model fit, $\chi^2(4, N=166) = 26.38$, $p < .001$, indicating the two predictors reliably distinguish between the three internalized behaviour groups. The model accounted for approximately 17% of variance (Nagelkerke $R^2 = .17$). Table 6 shows the regression coefficients, odds ratios and the 95% confidence intervals of all the models.

Table 6

Predicting Type of Repeated Behaviours for Study 2

<i>Predictor</i>	<i>B</i>	<i>S.E. B</i>	<i>Wald χ^2</i>	<i>OR</i>	<i>95% CI</i>
<i>Motivation Toward the Environment</i>					
Weak Habit (1) vs. Strong Habit (0)					

Controlled Motivation	-.27	.23	1.37	.76	.48 to 1.20
Autonomous Motivation	-.62	.19	10.44**	.54	.37 to .78
Repeated Behaviour (1) vs. Strong Habit (0)					
Controlled Motivation	.12	.24	.24	1.12	.70 to 1.80
Autonomous Motivation	-.47	.20	5.40*	.62	.42 to .93
<i>Determinants of PEB Habits</i>					
Weak Habit (1) vs. Strong Habit (0)					
Nature Relatedness	-.19	.11	2.80 ^t	.83	.67 to 1.03
Environmental Importance	-.43	.13	10.48**	.65	.50 to .84
Repeated Behaviour (1) vs. Strong Habit (0)					
Nature Relatedness	.03	.11	.05	1.03	.82 to 1.28
Environmental Importance	-.28	.14	3.95*	.75	.57 to .99
<i>Consequences of PEB Habits</i>					
Weak Habit (1) vs. Strong Habit (0)					
PEB Frequency	-1.62	.31	27.64***	.20	.11 to .36
Life Satisfaction	-.08	.04	4.10*	.92	.86 to .99
Repeated Behaviour (1) vs. Strong Habit (0)					
PEB Frequency	-.21	.26	.63	.81	.49 to 1.36
Life Satisfaction	-.06	.04	2.70 ^t	.94	.87 to 1.01

Note. B = Regression coefficients in log-odd units, SE = Standard error of the coefficients, Wald = Wald chi-square statistic, OR = Odds ratio, CI = Confidence interval, PEB = Pro-environmental behaviours.

The strong habit was the reference group coded as zero.

$t < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Autonomous motivation toward the environment was the only statistically significant predictor between the weak habit group and the strong habit group for recycling, and between the repeated behaviour with interference group and the strong habit group for recycling. The odd ratios indicated that people with more autonomous motivation toward the environment were more likely to have a strong habit compared to those with a weak habit or an interfered repeated behaviour for recycling, when controlling for all other variables in the models.

Determinants of pro-environmental behaviours. It was hypothesized the likelihood that a person had a weak habit, a repeated behaviour with interference, or a strong habit was

related to nature relatedness and perceived environmental importance. There were 17 values imputed using the expectation-maximization technique for nature relatedness and seven values for perceived importance of the environment. The multinomial logistic regression ($N=166$) showed a good model fit using a deviance criterion, $\chi^2(326) = 306.11, p = .779$. The likelihood ratio test also demonstrated good model fit, $\chi^2(4, N=166) = 24.18, p < .001$. The variance accounted for was approximately 16% (Nagelkerke $R^2 = .16$).

Perceived importance of the environment was the only statistically significant predictor between the weak habit group and the strong habit group, and between the repeated behaviour with interference group and the strong habit group for recycling, when controlling for all other variables in the models. The odd ratios indicated that people who think protecting the environment is important were more likely to have a strong habit compared to those with a weak habit or a repeated behaviour with interference for recycling.

Consequences of pro-environmental behaviours. It was hypothesized the likelihood that a person had a weak habit, a repeated behaviour with interference, or a strong habit was related to frequency of pro-environmental behaviours and life satisfaction. There were two values imputed using the expectation-maximization technique for frequency of other pro-environmental behaviours and nine values for life satisfaction. The multinomial logistic regression ($N=166$) showed a good model fit using a deviance criterion, $\chi^2(318) = 275.74, p = .958$. The likelihood ratio test also demonstrated good model fit, $\chi^2(4, N=166) = 49.00, p < .001$. The variance accounted for is approximately 30% (Nagelkerke $R^2 = .30$).

Both the frequency of engaging in other pro-environmental behaviours and life satisfaction were statistically significant predictors between the weak habit group and the strong habit group (see Table 6). A one point increase in pro-environmental behaviour frequency

decreased the odds of being in the weak habit group as opposed to the strong habit group by .20, when controlling for all other variables in the model. A one point increase in life satisfaction decreased the odds of being in the weak habit group as opposed to the strong habit group by .92, when controlling for all other variables in the model. In both cases people were more likely to have a strong habit for recycling. There were no statistically significant differences between the repeated behaviour with interference group and the strong habit group.

Study 2 Discussion

Consistent with Study 1, these results support the existence of the three proposed classifications of repeated behaviours for the target pro-environmental recycling behaviour. Study 2 showed a similar pattern as Study 1 among the three indicator variables and produced the same 3-cluster solution; weak habit, repeated behaviour with interference, and strong habit. Once again the interference indicator differentiated the interfered repeated behaviour from the strong habitual behaviour. The high interference present in the interfered repeated behaviour shows that it is less automatic, less congruent, and potentially less integrated (Lally, van Jaarsveld, Potts & Wardle, 2010; Levesque, Copeland & Sutcliffe, 2008; Sheldon & Elliot, 1998; 1999). The repeated behaviour with interference group still does the target behaviour at an increased rate, but has not integrated it into their lifestyle and sense of self.

The multinomial logistic regression results of the recycling behaviour groups produced results mostly consistent with expectations. The new paper recycling pro-environmental behaviour was expected to have more variance across participants than the double-sided printing behaviour from Study 1, since recycling is often perceived to be relatively easy to perform (Aitken & Pelletier, 2011; Green-Demers et al., 1997; Pelletier et al., 1998). The added variance produced slightly different results; compared to Study 1, autonomous motivation toward the

environment helped predict being in the strong habit group over the weak habit group. However this time autonomous motivation was also able to differentiate between the strong habit group and the repeated behaviour with interference group. Consistent with the double-sided printing results from Study 1, those with more autonomous motivation were more likely to have a strong habit for recycling. Once again controlled motivation was not able to differentiate between the types of repeated pro-environmental behaviours.

Perceived importance of the environment helped predicted being in the strong habit group over both the weak habit group and the repeated behaviour with interference group. These results are slightly different than the double-sided printing results from Study 1. In Study 1 environmental importance was only able to differentiate between the strong habit group and the repeated behaviour with interference group but not the weak habit group, whereas in Study 2 there were differences between both, but nature relatedness was not a statistically significant predictor in Study 2. It seems that perceived importance of the environment is having a bigger effect than nature relatedness for the recycling behaviour. These results should be replicated using the same behaviour to establish what results are consistent within the same behaviour and then compare results across different behaviours (Kline, 2013).

In partial agreement with the hypothesis, frequency of pro-environmental behaviours helped predict being in the strong habit group over the weak habit group but not the repeated behaviour with interference group. Those who reported performing pro-environmental behaviours more frequently were more likely to have a strong habit for the pro-environmental behaviour recycling. These results are mostly consistent with the double-sided printing results from Study 1. The lack of significance between the repeated behaviour with interference and

strong habit models might be due to the small sample size and lack of power. The results should be replicated with a larger sample.

Study 2 explored the possibility of differentiating groups based on level of internalization and what factors were important for predicting when people would have a strong habit for paper recycling. This study showed that fairly consistent results were obtained across different pro-environmental behaviours and different people. However, the results from Study 2 are limited in that it cannot be known if the habit indicators are stable across samples for the same pro-environmental behaviour and the analysis might have reduced power due to the smaller sample size. The results need to be assessed with a new sample using the same pro-environmental behaviour recycling using a larger sample (Kline, 2013).

Study 3

The goal of the third study was to replicate the results from the second study using the same target behaviour (i.e., recycling) with a larger sample to increase power and generalizability. A cross-sectional online survey study design was used with a new convenient university sample. It was hypothesized that the cluster analysis would produce a 3-cluster solution (i.e., a weak habit group, a repeated behaviour with interference group and a strong habit group). Consistent with Study 2, it was expected the multinomial logistic regression results would show that higher autonomous motivation toward the environment, nature relatedness, environmental importance, frequency of other pro-environmental behaviours, and life satisfaction would be related to the two more internalized forms of the target pro-environmental behaviour compared to the weak habit group. For this study, the target behaviour was paper recycling disposal behaviours, while garbage disposal behaviours were the opposing behaviours.

Results

Descriptive statistics for the habit indicators and the predictor variables can be seen in Table 7. Overall participants reported fairly high recycling behaviour, which were very similar to those from Study 2 (reported from Table 4, $M_{Habit\ Strength} = 4.75(1.43)$, $M_{Frequency} = 6.97(2.67)$, $M_{Interference} = 2.22(1.68)$). Consistent with Study 2, there was a high positive correlation between the habit strength and behaviour frequency and a negative correlation with the measure of interference. Consistent with the other two studies, people had mid-range motivation toward the environment, nature relatedness, frequency of participating on other pro-environmental behaviours and life satisfaction. Perception of environmental importance was fairly high for the sample. Most of the predictors were more strongly related the autonomous motivation than controlled motivation for the environment.

Descriptive Statistics for Study 3 Habit Indicators and Predictors (N= 338)

[illegible]

Variable	1	2	3	4	5	6
1. Controlled Motivation	-	.61***	.29***	.30***	.23***	.14*
2. Autonomous Motivation		-	.57***	.60***	.40***	.30***
3. Nature Relatedness			-	.42***	.37***	.25***
4. Environmental Importance				-	.22***	.13*
5. Frequency PEB					-	.12*
6. Life Satisfaction						-
Mean (SD)	3.47 (1.16)	4.51 (1.35)	5.36 (1.93)	7.15 (1.76)	4.77 (1.00)	4.98 (1.28)
Range	1-7	1-7	1-9	1-10	1-7	1-7
Alpha	.86	.95	.89	.82	.89	.89

Note. PEB = Pro-environmental behaviours
 $t < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Cluster Analysis

Phase one. The Ward's method two-step hierarchical cluster analysis was performed using cases from the three variables proposed to indicate habits (e.g., recycling frequency, recycling habit strength, and behaviour interference). In the current sample, 12 cases were removed as outliers and 74 cases were removed due to incomplete responses resulting in a usable sample size of 264.

The 3-cluster solution was retained as the best solution. It had the most theoretical and parsimonious cluster results with a good fit; it had a silhouette measure of cohesion and

separation of .50. Results supported the hypothesized three groups of repeated behaviour; a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for the recycling behaviour.

Phase two. The 3-cluster k-means cluster solution validated the three groups produced with the Ward's cluster method. Once the reclassification was completed, the analysis again produced a Weak Habit group, a Repeated Behaviour with Interference group, and a Strong Habit group for the recycling behaviour based on the means of the three habit indicator variables. Post-hoc analysis of the recycling behaviour showed that each of the three cluster groups were statistically significantly different on each of the three indicator variables, $F_{Habit\ Strength}(2, 262) = 184.62, p < .001$, $F_{Frequency}(2, 262) = 779.75, p < .001$, $F_{Interference}(2, 262) = 61.50, p < .001$. Results, including post-hoc analyses, are displayed in Table 8. These results were mostly consistent with the results from Study 1 and 2.

Table 8

Phase 2 k-Means Cluster Analysis for Study 3 - Final Clusters (N=264)

	Weak Habit Mean (SD)	Repeated Behaviour Mean (SD)	Strong Habit Mean (SD)
	21% (n = 55)	32% (n = 84)	47% (n = 125)
Habit Strength	2.55 (1.13) _a	4.28 (1.07) _b	5.69 (0.94) _c
Frequency	1.99 (1.24) _a	7.08 (1.31) _b	9.04 (0.86) _c
Behaviour Interference	2.92 (2.18) _a	3.33 (1.81) _a	1.20 (0.60) _b

Note. Means with different subscripts differ at $p < .05$ according to Attribute Importance (AIM) post-hoc analyses.

Multinomial Logistic Regression

Motivation toward the environment orientations. Multinomial logistic regression ($N=264$) was used to predict the influence of controlled and autonomous motivation toward the

environment on the likelihood that a person had a weak habit ($n=55$), a repeated behaviour with interference ($n=84$), or a strong habit ($n=125$). There were 30 values imputed with the expectation-maximization technique for controlled motivation toward the environment and 27 values for autonomous motivation toward the environment.

The analysis showed a good model fit (i.e., discrimination among groups) using a deviance criterion on the basis of the motivation predictors, $\chi^2(480) = 467.51, p = .650$. The likelihood ratio chi-square similarly demonstrated good model fit, $\chi^2(4, N=264) = 47.74, p < .001$, indicating the two predictors reliably distinguish between the three internalized behaviour groups. The model accounted for approximately 19% of variance (Nagelkerke $R^2 = .19$). Table 9 shows the regression coefficients, odds ratios and the 95% confidence intervals of all the models.

Table 9

Predicting Type of Repeated Behaviours for Study 3

<i>Predictor</i>	<i>B</i>	<i>S.E. B</i>	<i>Wald χ^2</i>	<i>OR</i>	<i>95% CI</i>
<i>Motivation Toward the Environment</i>					
Weak Habit (1) vs. Strong Habit (0)					
Controlled Motivation	.18	.19	0.87	1.19	.82 to 1.73
Autonomous Motivation	-.96	.18	26.96***	0.38	.27 to .55
Repeated Behaviour (1) vs. Strong Habit (0)					
Controlled Motivation	.35	.16	5.04*	1.42	1.05 to 1.93
Autonomous Motivation	-.44	.15	9.02**	0.65	.49 to .86
<i>Determinants of PEB Habits</i>					
Weak Habit (1) vs. Strong Habit (0)					
Nature Relatedness	-.17	.10	2.85 [†]	0.84	.69 to 1.03
Environmental Importance	-.51	.11	19.99***	0.60	.48 to .75
Repeated Behaviour (1) vs. Strong Habit (0)					
Nature Relatedness	.04	.08	0.28	1.04	.89 to 1.22
Environmental Importance	-.33	.10	11.64**	0.72	.59 to .87

<i>Consequences of PEB Habits</i>					
Weak Habit (1) vs. Strong Habit (0)					
PEB Frequency	-1.01	.20	25.70***	0.37	.25 to .54
Life Satisfaction	-.08	.03	7.28**	0.93	.88 to .98
Repeated Behaviour (1) vs. Strong Habit (0)					
PEB Frequency	-.40	.16	6.63**	0.67	.49 to .91
Life Satisfaction	-.03	.02	1.38	0.97	.93 to 1.02

Note. B = Regression coefficients in log-odd units, SE = Standard error of the coefficients, Wald = Wald chi-square statistic, OR = Odds ratio, CI = Confidence interval, PEB = Pro-environmental behaviours.

The strong habit was the reference group coded as zero.

$t < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Autonomous motivation toward the environment was the only statistically significant predictor between the weak habit group and the strong habit group for recycling, when controlling for all other variables in the model. The odds of being in the weak habit group, as opposed to the strong habit group, decreased by a factor of .38 per unit increase in autonomous motivation. Both motivation types were statistically significant predictors between the repeated behaviour with interference group and the strong habit group for recycling. A one-unit increase in controlled motivation toward the environment was associated with a 1.42 increase in the odds of being in the repeated behaviour with interference group versus the integrated group. Alternatively, the odds of being in the repeated behaviour with interference group, as opposed to the strong habit group, decreased by a factor of .64 per unit increase in autonomous motivation.

Determinants of pro-environmental behaviours. It was hypothesized the likelihood that a person had a weak habit, a repeated behaviour with interference, or a strong habit was related to nature relatedness and perceived environmental importance. There were 52 values imputed with the expectation-maximization technique for nature relatedness and 25 values for perceived importance of the environment. The multinomial logistic regression (N= 264) showed a good model fit (i.e., discrimination among groups) using a deviance criterion on the basis of the

motivation predictors, $\chi^2 (506) = 495.03, p = .628$. The likelihood ratio chi-square of 42.40 (4, $N=264$), $p < .001$ indicated the model as a whole fits statistically significantly better than an empty model. The variance accounted for was approximately 17% (Nagelkerke $R^2 = .17$).

Environmental importance was a statistically significant predictor between the weak habit group and the strong habit group, and between the repeated behaviour with interference group and the strong habit group (see Table 9), when controlling for all other variables in the model. The odds ratio suggests that people who think protecting the environment is important are more likely to have a strong habit rather than a weak habit or a interfered repeated behaviour for recycling. Nature relatedness was not able to differentiate between the strong habit group and the weak habit group or the repeated behaviour with interference group.

Consequences of pro-environmental behaviours. It was hypothesized the likelihood that a person had a weak habit, a repeated behaviour with interference, or a strong habit was related to frequency of pro-environmental behaviours and life satisfaction. There were 14 values imputed with the expectation-maximization technique for pro-environmental behaviour frequency and 23 values for life satisfaction. The multinomial logistic regression ($N= 264$) showed a good model fit using a deviance criterion, $\chi^2 (492)= 485.97, p = .568$. The likelihood ratio test also demonstrated good model fit, $\chi^2(4, N=624) = 43.15, p < .001$. The variance accounted for was approximately 17% (Nagelkerke $R^2 = .17$).

The frequency of engaging in other pro-environmental behaviours was a statistically significant predictor between the weak habit group and the strong habit group, and between the repeated behaviour with interference group and the strong habit group (see Table 9), when controlling for all other variables in the models. The odds ratios indicated that people engaging in pro-environmental behaviours more frequently were more likely to have a strong habit rather

than a weak habit or a interfered repeated behaviour for recycling. A one point increase in life satisfaction decreased the odds of being in the weak habit group, as opposed to the strong habit group, by .93.

Study 3 Discussion

The results from Study 3 once again support the existence of the three proposed groups of repeated behaviour (i.e., weak habit, repeated behaviour with interference, and strong habit) and provide partial support for a distinction between behaviours that people have a strong habit for and those that are merely repeated.

The multinomial logistic regression of the recycling behaviour produced results mostly consistent with expectations. Autonomous motivation toward the environment helped predict being in the strong habit group over the weak habit group and over the repeated behaviour with interference group. Those with greater autonomous motivation were more likely to have a strong habit for recycling. These results are consistent with both the double-sided printing behaviour and the recycling behaviour from the previous studies. Controlled motivation toward the environment helped predict being in the repeated behaviour with interference group over the strong habit group but no difference was found between the weak habit and strong habit groups. Those with greater controlled motivation were more likely to have an interfered repeated behaviour for recycling. It is interesting to note that the repeated behaviour with interference group was associated with controlled motivation. This result is predicted by SDT (Deci & Ryan, 1985; 2000). Motivation will vary in how much it is controlled versus autonomous, with higher internalization being associated with the more autonomous forms and incomplete internalization being associated with controlling forms of motivation (Ryan & Deci, 2000; Weinstein et al., 2013).

Perceived importance of the environment helped predict being in the strong habit group over the weak habit group and the repeated behaviour with interference group. Those with greater perceived importance of the environment were more likely to have a strong habit for recycling. These results are the same as the recycling behaviour results from Study 2 but slightly different from the double-sided printing results of Study 1, which found importance to better predict membership in the repeated behaviour with interference group. Once again nature relatedness was not a statistically significant predictor. Nature relatedness seems to be a behaviour specific predictor, whereas environment importance is a general predictor. Differences in the results between the double-sided printing and the recycling behaviours might be due to the perception of people that double-sided printing is difficult to perform, whereas paper recycling is something most people report as being fairly easy to perform.

Frequency of other pro-environmental behaviours helped predict being in the strong habit group over the weak habit group and over the repeated behaviour with interference group. Those who reported performing pro-environmental behaviours more frequently once again were more likely to have a strong habit for the pro-environmental recycling behaviour. Consistent with Study 2, life satisfaction helped predict being in the strong habit group over the weak habit group. Those with greater life satisfaction were more likely to have a strong habit for recycling. Within SDT the basic psychological needs (i.e., autonomy, competence and relatedness) are the necessary supports to produce psychological growth, successful internalization, and improved well-being. When the three needs are satisfied and supported within a given social context, people experience greater self-motivation, more frequently participate in congruent behaviours, and experience greater life satisfaction (Ryan, 1995; Sheldon & Elliot, 1999; Sheldon & Schöler, 2011). Thus, these results are in-line with expectations.

General Discussion

This research had three goals; (1) explore and verify the three proposed different types of repeated pro-environmental behaviours based on the proposed theoretical habit indicators (i.e., behaviour frequency, habit strength, and interference with opposing behaviours), (2) highlight differences between strong habits and behaviours that are merely repeated, and (3) explore potential factors related to integrated strong habits. Taken in their entirety, these three studies provide stable support for the existence of the three proposed types of repeated behaviours (i.e., weak habit, repeated behaviour with interference, and strong habit), and for behavioural interference as a unique habit indicator between repeated behaviours with interference and strong habits. These results were found to be very robust, since the same pattern was found across three studies, three different samples, two different behaviours, and they corroborate previous research (Aitken & Pelletier, 2014).

Previously researchers have often relied on a simplified measurement of habits (i.e. past behaviour frequency) and a simplified distinction between habitual and non-habitual behaviours. Our studies show the importance of using an expanded measurement of habits, which allowed for detecting a difference between habitual behaviours and those that are merely repeated.

Difference Between Repeated Pro-Environmental Behaviours

This article not only replicated previous findings (Aitken & Pelletier, 2014) but built upon them. In all three studies autonomous motivation toward the environment, perceived importance of the environment, and frequency of other pro-environmental behaviours were found to be statistically significant predictors of some repeated behaviour group differences. The association of autonomous motivation to increased likelihood of people having a strong habit across all three studies is predicted by SDT. Motivational regulations are what govern people's

ongoing activities and are part of the internalization process. Controlled motivation (i.e., introjected and external regulation - pressured and directed by forces external to one's self) for behaviour are extrinsic motivations that come from outside the self and reflect low levels of integration within the self. Autonomous motivations (i.e., intrinsic, integrated, and identification regulation - voluntary, freely pursued, and fully endorsed by the self) for behaviour are more internalized motivations that come from within one's self and reflect greater integration within the self (Deci & Ryan, 2000). Autonomous type motivations are based on valuing the behaviour and/or deliberate reasoning and reflection to accommodate the behaviour (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000; Ratelle et al., 2007). Autonomous motivation for pro-environmental behaviour is associated with more complete internalization of the behaviour and thus, associated with strong habits compared to weak habits for the behaviours (Study 1, 2, and 3) and compared to repeated behaviours with interference (Study 2 and 3). According to SDT controlled motivation for pro-environment is associated with an incomplete internalization. This was supported in Study 1, which found controlled motivation to be more likely with the repeated behaviour with interference group compared to the strong habit group. However, this result was not replicated in Study 2 or 3.

There is a connection between environmental importance and predisposition toward pro-environmental behaviours and participation in behaviours (e.g., Bamberg Möser, 2007; Steg & Vlek, 2009; Stern 2000). Personal attitudes can be more or less consistent with values and behaviours, depending on whether they are based on self-endorsed and voluntary motives (autonomous) or on forces that are external to the self (controlled; Ryan & Deci, 2003; Soenens & Vansteenkiste, 2011). It can be seen from the current research (i.e., Study 2 and 3) that

perceived environmental importance was reliably related to people with a strong habit for recycling.

When a behaviour has been internalized and is motivated, that single behaviour is often done more frequently and over a longer period of time (Deci et al., 1994). It will align with the values and identity of the person and the behaviour will be in congruence with other behaviours that support the person's values and identity. The result of this congruence is the person will do a greater number of similar type behaviours (Renaud-Dube, Taylor, Lokes & Guay, 2010; Thøgersen & Ölander, 2003; Villacorta et al., 2003). People with a strong habit for recycling often recycle paper because it corresponds to their pro-environmental values and environmentalist identity, and they probably also recycle bottles and cans for the same reasons. The harmonious alignment of multiple pro-environmental identities, values, and actions potentially leads to a more engaged environmentalist.

Using SDT within the context of pro-environmental habits provided a fuller appreciation of the behavioural interference indicator of habits, the ability to predict types of repeated behaviours based on the internalization process outlined in SDT, and provided testable hypothesis about factors that promote or hinder people's participation in pro-environmental behaviours.

Applications, Future Research, and Limitations

One application of the present research is that interventions may be more effective when they target autonomous motivation toward the environment, perceived environmental importance and, to some extent, nature relatedness. By targeting these factors it might help develop a repeated behaviour with interference into a strong habit, since these factors were able to differentiate between these two types of repeated pro-environmental behaviours. Current results

support the idea that these factors are important for internalized integrated pro-environmental habits and could be more effective at creating integrated strong habits than external incentive interventions, although more research is needed.

People who are merely repeating a pro-environmental behaviour are still having a positive impact on the environment through their actions but they are more likely to stop the behaviour once the external motivator is removed, whereas people with internalized habits are committed and congruent in their beliefs and actions. Interventions based on external incentives are less likely to create integrated, strong habits (De Young, 1986; Katzev & Johnson, 1984).

Interventions, instead, should promote the full internalization of behaviours by seeking to develop and share knowledge about the behaviour, seeking out positive feedback, and connecting with others who support the behaviour (Deci & Ryan, 2008; Williams et al., 2006).

Our research was able to show a difference between repeated behaviours and strong habits but it could not show how habits develop over time as part of the behaviour change process. Although not tested, repeated behaviour is proposed to be part of the continuum of behaviour change toward a strong habit not as distinct stages as presented here. Future studies will need to compare the level of persistence for a behaviour between repeated behaviours and strong habits, explore longitudinal research to determine how habits are developed, and verify if the behaviour change process does in fact pass through a repeated behaviour with interference type on the way to becoming a strong habit or if repeated behaviours and strong habits are separate types, never to overlap.

Although the present program of research generated important findings on the distinctions between different forms of repeated pro-environmental behaviours, it has some limitations. The correlational and cross-sectional design does not allow testing of the causal directions the

relationships, although hypotheses were extrapolated from previous research providing a strong basis for the predictions. From an applied perspective, a better understanding of the causal sequence necessary for developing habits provided by experimental and longitudinal studies could help identify the essential factors to derive better results from interventions.

The concept of internalization is difficult to measure. In this research it was assumed to exist by the level of interference and congruence. In future research other tools should be used that potentially more directly assess internalization, integration, and automaticity with respect to identities, emotions, beliefs, and behaviours. For example, reaction-time measures, such as implicit association tasks (Keatley, Clarke, Ferguson, & Hagger, 2014; Levesque et al., 2008; Weinstein, Przybylski, & Ryan, 2012), and other indirect and projective assessments (e.g., Baumann, Kaschel, & Kuhl, 2010) could potentially represent useful tools to assess integration.

The broader literature on pro-environmental behaviour highlights the diversity of factors which influence different pro-environmental behaviours. Pro-environmental habits and determinants proposed by SDT are one useful avenue for working toward a sustainable future. Habits offer a potential mechanism for long-term maintenance of pro-environmental behaviours. This is why habit formation is such an important element to target in the model of pro-environmental behaviour change.

References

- Aarts, H., Verplanken, B., & Knippenberg, A. (1998). Predicting behavior from actions in the past: Repeated decision making or a matter of habit? *Journal of Applied Social Psychology*, 28(15), 1355–1374. doi:10.1111/j.1559-1816.1998.tb01681.x
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211. doi:10.1016/0749-5978(91)90020-t
- Ajzen, I., & Fishbein, M. (2000). Attitudes and the attitude-behavior relation: Reasoned and automatic processes. *European Review of Social Psychology*, 11(1), 1–33. doi:10.1080/14792779943000116
- Aitken, N. M. & Pelletier, L. G. (2014). Integration of habit indicators and self-determination theory: Differentiating types of repeated pro-environmental behaviours. Manuscript submitted for publication.
- Aitken, N. M. & Pelletier, L. G. (2011). The importance of self-determined motivation toward the environment for doing difficult pro-environmental behaviours. Paper presented, *State of Nature the 14th GSAED Interdisciplinary Conference*, March 2, 9, 16, 23, Ottawa, Ontario. Manuscript in preparation.
- Aldenderfer, M. S., & Blashfield, R. K. (1984). *Cluster Analysis*. Beverly Hills: Sage Publications.
- Allison, P. D. (2002). *Missing Data*. Thousand Oaks, Calif.: Sage Publications.
- Arbuthnott, K. D., Sutter, G. C., & Heidt, C. T. (2014). Natural history museums, parks, and connection with nature. *Museum Management and Curatorship*, 29(2), 102–121. doi:10.1080/09647775.2014.888818

- Asendorpf, J. B. (2013). Person-centered approaches. In M. L. Cooper & R. Larsen (Eds.), *Handbook of Personality Processes and Individual Differences*. Washington, DC: American Psychological Association. http://www.psychologie.hu-berlin.de/prof/per/pdf/2222/Person-centered_fin.pdf
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, 27, 14-25. doi:10.1016/j.jenvp.2006.12.002
- Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environment and Behavior*, 35(2), 264–285. doi:10.1177/0013916502250134
- Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In Wyer, Robert S., Jr. (Ed); Srull, Thomas K. (Ed), *Handbook of Social Cognition* (2nd ed., pp. 1-40). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.
- Batholomew, K.J., Ntoumanis, N., Ryan, R.L., Bosch, J.A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, 37, 1459-1473. doi:10.1177/0146167211413125
- Baumann, N., Kazén, M. & Kuhl, J. (2010). Implicit motives: A look from personality systems interaction theory. In O.C. Schultheiss & J.C. Brunstein (Hrsg.), *Implicit Motives* (pp. 375-403). New York, NY: Oxford University Press.

- Brown, K. W., & Kasser, T. (2005). Are psychological and ecological well-being compatible? The role of values, mindfulness, and lifestyle. *Social Indicators Research*, 74, 349-368. doi:10.1007/s11205-004-8207-8
- Burns, R., & Burns, R. (2009). Cluster analysis. In *Business Research Methods and Statistics Using SPSS* (pp. 522–567). London: SAGE Publications Ltd.
- Christensen, P. N., Rothgerber, H., Wood, W., & Matz, D. C. (2004). Social norms and the self: A motivational model of normative impact. *Personality and Social Psychology Bulletin*, 30, 1295-1309. doi:10.1037/0022-3514.73.3.523
- Church, A. T., Katigbak, M. S., Locke, K. D., Zhang, H., Shen, J., Vargas-Flores, J. de J., Ibáñez-Reyes, J., Tanaka-Matsumi, J., Curtis, G. J., Cabrera, H. F., Mastor, K. A., Alvarez, J. M., Ortiz, F. A., Simon, J. R. & Ching, C. M. (2013). Need satisfaction and well-being testing self-determination theory in eight cultures. *Journal of Cross-Cultural Psychology*, 44(4), 507–534. doi:10.1177/0022022112466590
- Dahlstrand, U., & Biel, A. (1997). Pro-environmental habits: propensity levels in behavioral change. *Journal of Applied Social Psychology*, 27(7), 588–601. doi:10.1111/j.1559-1816.1997.tb00650.x
- de Groot, J. I. M., & Steg, L. (2010). Relationships between value orientations, self-determined motivational types and pro-environmental behavioural intentions. *Journal of Environmental Psychology*, 30(4), 368–378. doi:10.1016/j.jenvp.2010.04.002
- De Young, R. (1986) Encouraging environmentally appropriate behavior: The role of intrinsic motivation. *Journal of Environmental Systems*, 15(4), 281-292. doi:10.2190/3fwv-4wm0-r6mc-2urb

- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-determination in Human Behavior*. New York: Plenum.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268.
doi:10.1207/S15327965PLI1104_01
- Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life’s domains. *Canadian Psychology/Psychologie Canadienne*, 49(1), 14–23.
doi:10.1037/0708-5591.49.1.14
- Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality*, 62(1), 119–142.
doi:10.1111/j.1467-6494.1994.tb00797.x
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment*, 49, 71-75. doi:10.1207/s15327752jpa4901_13
- Emmons, R. A., & King, L. A. (1988). Conflict among personal strivings: Immediate and long-term implications for psychological and physical well-being. *Journal of Personality and Social Psychology*, 54(6), 1040–1048. doi:10.1037/0022-3514.54.6.1040
- Environment Canada (2014, January 29). *Climate Change - National Inventory Report 1990-2012: Greenhouse Gas Sources and Sinks in Canada*. Retrieved June 9, 2014, from <https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=3808457C-1&offset=1&toc=show>
- Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4 edition.). London: Sage Publications. <http://www.statisticshell.com/docs/cluster.pdf>.

- Fujii, S., & Kitamura, R. (2003). What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. *Transportation*, 30(1), 81–95.
doi:10.1023/A:1021234607980
- Gardner, B. (2009). Modelling motivation and habit in stable travel mode contexts. *Transportation Research Part F: Traffic Psychology and Behaviour*, 12(1), 68–76.
doi:10.1016/j.trf.2008.08.001
- Gifford, R. (2008). Psychology's essential role in alleviating the impacts of climate change. *Canadian Psychology/Psychologie canadienne*, 49(4), 273–280. doi:10.1037/a0013234
- Gifford, R. (2014). Environmental psychology matters. *Annual Review of Psychology*, 65, 541–580. doi:10.1146/annurev-psych-010213-115048
- Gore, P. (2000). Cluster analysis. In H. E. A. Tinsley & S. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical Modeling* (pp. 297–321). New York: Academic Press.
- Government of Canada, (2007). *Canadian Environmental Sustainability Indicators 2007*. Catalogue no. 16-251-XIE, Ottawa, ON.
- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 29(3), 157–166. doi:10.1037/0008-400X.29.3.157
- Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology*, 81(2), 143–154.
doi:10.1037/0022-0663.81.2.143

- Hosmer, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied Logistic Regression* (3rd edition). Hoboken, New Jersey: Wiley.
- Intergovernmental Panel on Climate Change (IPCC) (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Retrieved from <http://www.realclimate.org/index.php/archives/2014/03/ipcc-wg2-report-now-out/>
- Jager, W. (2003). Breaking bad habits: A dynamical perspective on habit formation and change. In Hendrickx, L. C. W. P. (Ed.), *Human Decision Making and Environmental Perception: Understanding and Assisting Human Decision Making in Real-life Settings*. Groningen: University of Groningen.
- Johnston, M. M., & Finney, S. J. (2010). Measuring basic needs satisfaction: Evaluating previous research and conducting new psychometric evaluations of the Basic Needs Satisfaction in General Scale. *Contemporary Educational Psychology*, 35, 280-296.
doi:10.1016/j.cedpsych.2010.04.003
- Kahle, L. R., & Beatty, S. E. (1987). Cognitive consequences of legislating postpurchase behavior: Growing up with the bottle bill. *Journal of Applied Social Psychology*, 17(9), 828–843. doi:10.1111/j.1559-1816.1987.tb00342.x
- Karl, T. R., Melillo, J. M., & Peterson, T. C. (2009). *Global Climate Change Impacts in the United States*. Cambridge University Press. Retrieved from <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>
- Katzev, R. D. & Johnson, T. (1984). Comparing the effects of monetary incentives and foot-in-the-door strategies in promoting residential electricity conservation. *Journal of Applied Social Psychology*, 14, 12-27. doi:10.1111/j.1559-1816.1984.tb02217.x

- Keatley, D. A., Clarke, D. D., Ferguson, E., & Hagger, M. S. (2014). Effects of pretesting implicit self-determined motivation on behavioral engagement: Evidence for the mere measurement effect at the implicit level. *Frontiers in Psychology*, 5. doi:10.3389/fpsyg.2014.00125
- Kline, R. B. (2013). *Beyond Significance Testing: Statistics Reform in the Behavioral Sciences* (2nd ed.). Washington, DC: American Psychological Assoc.
- Klößner, C. A., & Matthies, E. (2004). How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *Journal of Environmental Psychology*, 24(3), 319–327. doi:10.1016/j.jenvp.2004.08.004
- Klößner, C. A., Matthies, E., & Hunecke, M. (2006). Problems of operationalizing habits and integrating habits in normative decision-making models. *Journal of Applied Social Psychology*, 33(2), 396–417. doi:10.1111/j.1559-1816.2003.tb01902.x
- Lally, P., van Jaarsveld, C. H. M., Potts, H. W. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, 40(6), 998–1009. doi:10.1002/ejsp.674
- Levesque, C., Copeland, K. J., & Sutcliffe, R. A. (2008). Conscious and nonconscious processes: Implications for self-determination theory. *Canadian Psychology/Psychologie canadienne*, 49(3), 218–224. doi:10.1037/a0012756
- Maréchal, K. (2010). Not irrational but habitual: The importance of “behavioural lock-in” in energy consumption. *Ecological Economics*, 69(5), 1104–1114. doi:10.1016/j.ecolecon.2009.12.004
- Markland, D., & Tobin, V. J. (2010). Need support and behavioural regulations for exercise among exercise referral scheme clients: The mediating role of psychological need

- satisfaction. *Psychology of Sport and Exercise*, 11(2), 91–99.
doi:10.1016/j.psychsport.2009.07.001
- Martinent, G., Nicolas, M., Gaudreau, P., & Campo, M. (2013). A cluster analysis of affective states before and during competition. *Journal of Sport & Exercise Psychology*, 35(6), 600–611.
- Mooi, E., & Sarstedt, M. (2011). *A Concise Guide to Market Research: The Process, Data, and Methods Using IBM SPSS Statistics* (2011 edition). Berlin: Springer.
- Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. *Frontiers in Psychology*, 4:813. doi: 10.3389/fpsyg.2013.00813
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale. *Environment and Behavior*, 41(5), 715–740. doi:10.1177/0013916508318748
- Norušis, M. (2011). Cluster analysis. *IBM SPSS Statistics 19 Statistical Procedures Companion*. Upper Saddle River, New Jersey: Prentice Hall. Retrieved from http://www.norusis.com/book_SPC_v19.php
- Osbaldeston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals. *Journal of Environmental Psychology*, 23(4), 349–357. doi:10.1016/S0272-4944(03)00035-5
- Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin*, 124(1), 54–74. doi:10.1037/0033-2909.124.1.54
- Pampel, F. C. (2000). *Logistic Regression: A Primer*. SAGE.

- Pelletier, L. G. (2002). A motivational analysis of self-determination for pro-environmental behaviors. In E. L. Deci, & R. M. Ryan (Eds.), *The Handbook of Self-Determination Research* (pp. 205-232). Rochester, N. Y.: University of Rochester Press.
- Pelletier, L. G., Legault, L. R., & Tuson, K. M. (1996). The Environmental Satisfaction Scale a measure of satisfaction with local environmental conditions and government environmental policies. *Environment and Behavior*, 28(1), 5–26.
doi:10.1177/0013916596281001
- Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The Motivation Toward the Environment Scale (MTES). *Journal of Applied Social Psychology*, 28(5), 437–468. doi:10.1111/j.1559-1816.1998.tb01714.x
- Ratelle, C. F., Guay, F., Vallerand, R. J., Larose, S., & Senécal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of Educational Psychology*, 99(4), 734–746. doi:2007-17712-004
- Renaud-Dubé, A., Taylor, G., Lekes, N., Koestner, R. et Guay, F. (2010). Adolescents' motivation toward the environment: Age-related trends and correlates. *Canadian Journal of Behavioural Science*, 42, 194-199. doi:2010-14875-007
- Rothman, A., Sheeran, P., & Wood, W. (2009). Reflective and automatic processes in the initiation and maintenance of dietary change. *Annals of Behavioral Medicine*, 38(0), 4–17. doi:10.1007/s12160-009-9118-3
- Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality*, 63(3), 397–427. doi:10.1111/j.1467-6494.1995.tb00501.x

- Ryan, R. M., & Deci, E. L. (2000). The darker and brighter sides of human existence: Basic psychological needs as a unifying concept. *Psychological Inquiry*, 11(4), 319–338.
doi:10.1207/S15327965PLI1104_03
- Ryan, R. M., & Deci, E. L. (2003). On assimilating identities to the self: A self-determination theory perspective on internalization and integrity within cultures. In M. R. Leary & J. P. Tangney (Eds.), *Handbook on Self & Identity* (pp. 253-274). New York: The Guilford Press.
- Ryan, R. M., Deci, E. L., Grolnick, W. S., & La Guardia, J. G. (2006). The significance of autonomy and autonomy support in psychological development and psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental Psychopathology: Theory and Method* (Vol 1, pp. 795-849). New Jersey: John Wiley & Sons, Inc.
- Ryan, R. M., Huta, V., & Deci, E. L. (2008). Living well: A self-determination theory perspective on eudaimonia. *Journal of Happiness Studies*, 9, 139-170.
doi:10.1007/s10902-006-9023-4
- Ryan R. M., Weinstein N., Bernstein J., Brown K. W., Mistretta L., & Gagné M. (2010). Vitalizing effects of being outdoors and in nature. *Journal of Environmental Psychology*, 30, 159–168. doi:10.1016/j.jenvp.2009.10.009
- Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology*, 57(1), 1–10.
doi:10.1037/a0018082

- Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: Detection, search, and attention. *Psychological Review*, 84(1), 1–66.
doi:10.1037/0033-295X.84.1.1
- Séguin, C., Pelletier, L. G., & Hunsley, J. (1998). Toward a model of environmental activism. *Environment and Behavior*, 30, 628–652. doi:10.1177/001391659803000503
- Sheldon, K. M., & Elliot, A. J. (1998). Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology Bulletin*, 24(5), 546–557.
doi:10.1177/0146167298245010
- Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need-satisfaction, and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology*, 76, 482–497. doi:10.1037/0022-3514.76.3.482
- Sheldon, K. M., & Schöler, J. (2011). Wanting, having, and needing: Integrating motive disposition theory and self-determination theory. *Journal of Personality and Social Psychology*, 101(5), 1106–1123. doi:10.1037/a0024952
- Soenens, B., & Vansteenkiste, M. (2011). When is identity congruent with the self? A self-determination theory perspective. In S. J. Schwartz, K. Luyckx, & V. L. Vignoles (Eds.), *Handbook of Identity Theory and Research* (pp. 381–402). New York: Springer.
- Sparks, P., Hinds, J., Curnock, S. & Pavey, L. (2014). Connectedness and its consequences: A study of relationships with the natural environment. *Journal of Applied Social Psychology*, 44(3), 166–174. doi:10.1111/jasp.12206

- Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with “green consumerism.” *Social Psychology Quarterly*, 55(4), 388. doi:10.2307/2786955
- Statistics Canada (2011). *Households and the Environment Survey (HES)*.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. doi:10.1016/j.jenvp.2008.10.004
- Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407-424. doi:10.1111/0022-4537.00175
- Tabachnick, B. G., & Fidell, L. S. (2006). *Using Multivariate Statistics (5th Edition)*. Needham Heights, MA, USA: Allyn & Bacon, Inc.
- Thøgersen, J., & Ölander, F. (2003). Spillover of environment-friendly consumer behaviour. *Journal of Environmental Psychology*, 23(3), 225–236. doi:10.1016/S0272-4944(03)00018-5
- UCLA: Statistical Consulting Group (n.d.). *Annotated SPSS Output; Multinomial Logistic Regression*. Retrieved from <http://www.ats.ucla.edu/stat/spss/output/mlogit.htm>
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23, 263–280. doi: 10.1037/a0032359
- Verplanken, B. (2006). Beyond frequency: Habit as mental construct. *British Journal of Social Psychology*, 45(3), 639–656. doi:10.1348/014466605X49122
- Verplanken, B. (2010a). Old habits and new routes to sustainable behaviour. In L. Whitmarsh, S. O'Neill, & I. Lorenzoni (Eds.), *Engaging the Public with Climate Change: Behaviour*

- Change and Communication* (pp. 17–30). London: Earthscan. Retrieved from <http://www.aps.org/units/fps/newsletters/201201/schroeder.cfm>
- Verplanken, B. (2010b). By force of habit. In A. Steptoe, K. Freedland, J. Jennings, M. Llabre, S. Manuck, & E. Susman (Eds.), *Handbook of Behavioral Medicine: Methods and Applications* (pp. 73–82). New York: Springer.
- Verplanken, B., & Aarts, H. (1999). Habit, attitude, and planned behaviour: Is habit an empty construct or an interesting case of goal-directed automaticity? *European Review of Social Psychology*, 10, 101-134. doi:10.1080/14792779943000035
- Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A Self-report Index of Habit Strength. *Journal of Applied Social Psychology*, 33(6), 1313–1330. doi:10.1111/j.1559-1816.2003.tb01951.x
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the Motivation Toward the Environment Scale. *Environment and Behavior*, 35(4), 486–505. doi:10.1177/0013916503035004003
- Webb, O. J., & Eves, F. F. (2007a). Promoting stair climbing: Effects of message specificity and validation. *Health Education Research*, 22(1), 49–57. doi:10.1093/her/cyl045
- Webb, O. J., & Eves, F. F. (2007b). Effects of environmental changes in a stair climbing intervention: Generalization to stair descent. *American Journal of Health Promotion*, 22(1), 38–44. doi:10.4278/0890-1171-22.1.38
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin*, 35(10), 1315–1329. doi:10.1177/0146167209341649

- Weinstein N., Przybylski A. K., & Ryan R. M. (2012). The index of autonomous functioning: Development of a scale of human autonomy. *Journal of Research in Personality*, 46, 397–413. doi:10.1016/j.jrp.2012.03.007
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2013). The integrative process: New research and future directions. *Current Directions in Psychological Science*, 22, 69-74. doi: 10.1177/0963721412468001
- Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30(3), 305–314. doi:10.1016/j.jenvp.2010.01.003
- Williams, G. C., McGregor, H. A., Sharp, D., Levesque, C. S., Kouides, R. W., Ryan, R. M., & Deci, E. L. (2006). Testing a self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychology*, 25, 91-101. doi:10.1037/0278-6133.25.1.91
- Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology*, 88(6), 918–933. doi:10.1037/0022-3514.88.6.918
- Zelenski, J. M., & Nisbet, E. K. (2014). Happiness and feeling connected: The distinct role of nature relatedness. *Environment and Behavior*, 46(1), 3–23. doi:10.1177/0013916512451901

General Discussion

General Discussion

Summary and Recap of Thesis Objectives

There is a scientific consensus on the detrimental impact of climate change on the planet (Intergovernmental Panel on Climate Change, 2014) and Canadian public opinion supports protecting the environment (Government of Canada, 2007), yet greenhouse emissions in Canada are still increasing (Environment Canada, 2014). To improve the environmental situation people need to change current non-environmental behaviours into more sustainable behaviours. One factor that could have implications for the development of sustainable behaviour is the formation of pro-environmental habits.

Pro-environmental habits have been the subject of research recently (e.g., Dahlstrand & Biel, 1997; Klöckner & Matthies, 2004; Klöckner, Matthies, & Hunecke, 2006; Maréchal, 2010; Verplanken, 2010a). However, past research considered simple repetition of behaviour a sufficient operational definition of a habitual pro-environmental behaviour (Verplanken, 2010b). In the present thesis we outlined the limitations of that approach and proposed to measure pro-environmental habits with the conventional behaviour frequency and improve the quality of the measurement by including indicators of habit strength and behaviour interference. Measuring the level of automaticity in the current research provided a sense of the strength of the habit, over and above the frequency of performing the behaviour (Ajzen & Fishbein, 2000; Bargh, 1994; Verplanken & Orbell, 2003). The measure of behavioural interference was used to capture the level of conflict between competing pro-environmental and non-environmental behaviours (i.e., a habit theory concept; Dahlstrand & Biel, 1997; Emmons & King, 1988; Jager, 2003; Verplanken, 2010a), and the level of congruence of the pro-environmental behaviour (i.e., an SDT concept; Deci & Ryan, 1985; 2000; Sheldon & Elliott, 1999). By combining a self-determination theory

(SDT) framework to the theories of habit, this research has been able to better measure and explain habits for pro-environmental behaviours than either framework by itself.

The current program of research had three goals to further elaborate on the measurement and explanation of pro-environmental habits. The first goal was to determine if the indicators identified in the literature (i.e., behaviour frequency, habit strength, behaviour interference) could be used to identify three different types of repeated pro-environmental behaviours; weak habit, repeated behaviour with interference, and strong habit. The second goal was to find support for differences between strong habits and behaviours that are merely repeated. The third goal was to explore potential factors of pro-environmental behaviours with the aim to identify ways to predict and facilitate integrated strong habits for pro-environmental behaviours.

Overview of the studies. The current thesis included six studies to address the three research goals. The purpose of the first three studies, presented in the article “Integration of habit indicators and self-determination theory: Differentiating types of repeated pro-environmental behaviours”, was to determine if the three habit indicators could be used to identify different types of repeated pro-environmental behaviours. These studies identified the three proposed types of repeated behaviours: weak habit, repeated behaviour with interference, and strong habit. They provided support for an important distinction between behaviours that people have a strong habit for and those that are merely repeated. These results were found to be very robust, since the same pattern was found across three studies, three different samples and three different behaviours.

The purpose of the next three studies, presented in the article “What predicts habits for pro-environmental behaviours: An analysis of the determinants and consequences of pro-environmental behaviours”, was to use the identified types of repeated pro-environmental

behaviours in an exploratory analysis of various factors expected to be able to distinguish differences between the groups. Once again the same three types of repeated pro-environmental behaviours were found (i.e., weak habit, repeated behaviour with interference, and strong habit) across the three studies, using three independent samples and two different pro-environmental behaviours (i.e., double-sided printing and paper recycling). Three predictors were found, in some of the studies, to fairly consistently identify difference between some of the groups: autonomous motivation toward the environment, perceived importance of the environment, and frequency of other pro-environmental behaviours. Key findings from these six studies, as well as implications for the study of habits in general and the study of pro-environmental habits specifically, limitations of the current studies, and suggestions for future research are discussed in detail below.

Key Findings and Implications

Habits are More than Behaviour Frequency

The power of past behaviours to consistently predict future behaviour has been shown in many studies of habits (e.g., Fujii & Kitamura, 2003; Kahle, & Beatty, 1987; Klöckner & Matthies, 2004; Webb & Eves, 2007a; 2007b; Wittenbraker, Gibbs, & Kahle, 2006), suggesting that measures of past behaviour frequency are a useful measure of habits but they were limited by the simplistic definition of a habit. Recently, the habit research has begun moving beyond simple behaviour frequency as a measurement of habits to better capture additional elements of habitual behaviour. For example, a longitudinal study that directly compared past behaviour as a measure of habits and a cue-response based measure of habits found that only the cue-response measure of habits was able to predict stability of behaviour over time (Friedrichsmeier, Matthies & Klöckner, 2013). The literature on habits is evolving to include more advanced measures of

habits, such as those that include an independent measure of the strength of the habit (Gardner, de Bruijn, & Lally, 2011; Verplanken & Orbell, 2003).

Habit strength is assessed by evaluating various characteristics of automatic behaviour. These characteristics include a lack of awareness while performing the behaviour, difficulty in controlling the behaviour once the behaviour is set in motion, unintentionality, and mental efficiency (Bargh, 1994; Schneider & Shiffrin, 1977; Verplanken, 2006; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). The automaticity of behaviour appears to be the essential quality of a habit (Verplanken, 2006; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). Unfortunately, this quality is not captured with a simple measure of past behaviour frequency.

Building on these advancements in the measurement of habits, the current research included the Self-report Habit Index to measure the strength of the habits for the target pro-environmental behaviours. The Self-reported Habit Index (Verplanken & Orbell, 2003) is a validated multi-item measure that is able to accurately measure the latent construct of habit strength (i.e., automaticity). It has been used in environmental psychology research (Klöckner & Friedrichsmeier, 2011; Webb, Benn, & Chang, 2014) and in research from other domains; particularly in health research (De Bruijn, Kremers, Singh, van den Putte, & van Mechelen, 2009; Gardner et al., 2011), another ripe area for behaviour change and habit research. This scale provided a more direct measure of the participants' perceived automaticity for the pro-environmental behaviours than possible with a measure of behaviour frequency alone.

This thesis argued that habits are more than just often repeated behaviours; they are a complex construct and thus need to be measured with multiple indicators. By including both a measure of behaviour frequency and habit strength, the current research was able to notice differences between participants. The reported behaviour frequency and habit strength often

exhibited a similar pattern (e.g., both low or both high), reflecting a fairly consistent measurement of the level of habit for the targeted pro-environmental behaviour. However, sometimes there were deviations between the measurements and this was seen most often within the repeated behaviour with interference groups. As the research on habits for pro-environmental behaviours moves forward, more advanced measures of habits need to be used. The current research has provided an effective, meaningful and fruitful method for identifying pro-environmental habits and more importantly for identifying differences between types of repeated pro-environmental behaviours.

Habits Represent Integrated Behaviours

The current research also included a third indicator of habits, in addition to behaviour frequency and habit strength. The third indicator was a measure of behavioural interference. It was included to address limitations in the habit literature related to the internalization process of habits. To overcome this limitation, aspects of SDT were used to provide a more complete understanding of what habits are and how they might have been internalized by a person. Using SDT within the context of pro-environmental habits provided two important improvements to this thesis; a fuller appreciation of the behavioural interference indicator of habits and the ability to predict types of repeated behaviours based on the internalization process outlined in SDT.

Habit theory interference. In the habit literature behavioural interference represents the conflict that happens when current non-environmental habits or habitual behaviours related to other life domains impede people's behaviour change and people's ability to develop new pro-environmental habits (Dahlstrand & Biel, 1997; Emmons & King, 1988; Jager, 2003; Verplanken, 2010a). As a behaviour is changing there will be some interference between the competing behaviours. Full habituation of the behaviour becomes difficult to achieve when there

is interference because of a cognitive conflict about which behaviour to perform under what context (i.e., the current non-environmental behaviour or the target pro-environmental behaviour); whereas a fully integrated, strong pro-environmental habit shows a reduced level of interference between competing behaviours; the target behaviour is just performed, without much thought. Unfortunately this understanding of interference from the habit literature is incomplete, since it does not explain how the behaviour becomes internalized into a habitual behaviour, it only seems to specify that there will be interference between behaviours during the behaviour change process and this interference will not be present for a habitual behaviour. The internalization process in SDT is capable of filling some of these gaps.

Self-determination theory interference. The level of reported interference in the SDT literature represents an indicator of how harmonious a pro-environmental behaviour is with a person's thoughts, feelings, and actions (Deci & Ryan, 1985; 2000; Sheldon & Elliott, 1999). As a behaviour begins to change, it will have an incomplete internalization, identified by interference between the competing non-environmental and pro-environmental behaviours. A fully integrated pro-environmental behaviour will have a complete internalization, identified by a lack of interference between the competing behaviours and congruence with similar behaviours.

As a complement to habit theory, SDT provides the conditions that will create incomplete internalization with measurable interference between competing behaviours and complete internalization with measurable congruence between similar behaviours and a lack of interference between competing behaviours. Thus, the third habit indicator used in the current thesis captured the interference concept highlighted in both the habit and the SDT literature and was able to provide a fuller understanding of types pro-environmental habits than either field could have provided independently. Since the concept of interference is present in both the habit

literature and in the SDT literature (i.e., congruence and incongruence), it is not surprising that this habit indicator was an important part of the identification of the different types of repeated pro-environmental behaviours in this thesis.

Types of repeated pro-environmental behaviours. Using the indicators identified in habit theory and the internalization process described in SDT (Deci, Eghrari, Patrick, & Leone, 1994; Deci & Ryan, 1985; Ryan, 1995; Weinstein, Przybylski, & Ryan, 2013) we predicted the three types of repeated pro-environmental behaviours found in the current research. The first type was the weak habit group, which are behaviours not yet internalized but regulated by external forces (i.e., external regulation). Those with a weak habit for the target pro-environmental behaviour were characterized by low behaviour frequency, low habit strength, and low interference with the opposite competing non-environmental behaviour.

The second type was the repeated behaviour with interference group, which are behaviours partially internalized through a non-integrated process (i.e., introjected or identified). These behaviours may be repeated but will not be fully internalized because of a continuing extrinsic influence or lack of congruence (Deci & Ryan, 1985; 2000; Sheldon & Elliott, 1999). Those with an interfered repeated behaviour for the target pro-environmental behaviour were characterized by a moderate to high behaviour frequency, moderate to high habit strength, and high interference with the opposite competing non-environmental behaviour.

The third type was the strong habit group, which are behaviours completely internalized and fully integrated (i.e., integration). Integrated behaviours would be self-determined, personally endorsed, repeated over the long-term, congruent with the self, and congruent with other behaviours (Deci & Ryan, 1985; 2000; Ryan, 1995). Those with a strong habit for the target pro-environmental behaviour were characterized by a high behaviour frequency, high habit strength,

and low interference with the competing non-environmental behaviour. In sum the proposed method of identifying habits using the three indicators of behaviour frequency, habit strength, and behaviour interference represents an important contribution to distinguishing types of repeated pro-environmental behaviours as predicted by habit theory and SDT.

Differences Between Repeated Behaviours and Habits

One exciting contribution¹ of the current research was the identification of factors to discriminate between strong pro-environmental habits and behaviours merely repeated. By applying the internalization process proposed by SDT as a framework, it was possible to predict differences between strong habits and interfered repeated behaviours using the three indicators of habits, as well as the factors related to pro-environmental behaviours included in this thesis.

Differences between the indicators. The level of behavioural interference between opposing behaviours was an important habit indicator for distinguishing a repeated behaviour from a strong habit. Across all six studies and every measured pro-environmental behaviour, the level of interference was always higher for the repeated behaviour with interference groups compared to the strong habit groups. As mentioned above, this research used a measure of interference to capture both the habit theory and the SDT concepts' of behavioural interference and congruence, thus is not surprising that this indicator was related to the differences between these two types of repeated behaviours. Habit conflict can interfere with habit integration (Dahlstrand & Biel, 1997) and this interference becomes a unique indicator for differentiating repeated behaviours from strong habits.

Differences between the factors related to pro-environmental behaviours. Current habit research has been limited in scope about the factors that influence pro-environmental habits

1 It was this very question that spurred this program of research in the first place. It was very exciting for me to identify differences.

since many of the theories within environmental psychology focus on intentional pro-environmental behaviours (e.g., theory of planned behavior; Azjen, 1991). Thus, our research drew from SDT to propose additional factors to further explore factors related to pro-environmental behaviours. A number of factors of pro-environmental behaviours were able to differentiate between the repeated behaviour with interference groups and strong habit groups. Motivation toward the environment, environmental importance, frequency of other pro-environmental behaviours, and intention to increase behaviours were found to be able to predict group differences across many of the studies.

Motivation toward the environment. Overall, both controlled and autonomous motivations toward the environment were found to be statistically significant predictors for some of the different types of repeated pro-environmental behaviours. Controlled motivation toward the environment was somewhat effective at differentiating between the repeated behaviour with interference groups and strong habit groups. It was found to be statistically significantly higher for the repeated behaviour with interference groups compared to the strong habit groups for the recycling behaviour (Study 2 and 6) and the garbage behaviour (Study 3). This partially supports the internalization process proposed by SDT, which explains how controlled motivation leads to an internalization of a behaviour through a non-integrated process (i.e., introjection and identification) rather than the integration process (Deci & Ryan, 2000; Koestner, Losier, Vallerand, & Carducci, 1996). When behaviours are internalized through a non-integrated process, the regulatory process is accepted by the individual but it is not fully accepted as one's own or congruent with the self (Ryan, 1995) potentially preventing it from becoming a fully integrated strong habit.

Autonomous motivation toward the environment was somewhat effective at differentiating between the repeated behaviour with interference groups and strong habit groups. It was found to be statistically significantly higher for the strong habit groups compared to the repeated behaviour with interference groups for the recycling behaviour in Study 5 and Study 6. This also partially supports the internalization process proposed by SDT, which explains how autonomous motivation leads to an internalization of a behaviour through the integrated process (Ryan, 1995). When behaviours are internalized through an integrated process, the regulatory process is accepted by the individual, it is fully accepted as one's own and is congruent with the self (Weinstein et al., 2013), which facilitates the development of an integrated strong habit.

In this research autonomous motivation toward the environment was not always able to differentiate between the repeated behaviour with interference groups and strong habit groups but it was effective at differentiating the weak habit groups from the other two groups. In both article one and two, autonomous motivation toward the environment was always higher for the more internalized groups (i.e., repeated behaviour with interference group or strong habit group) compared to the weak habit group. Taken together these results indicate that motivation toward the environment is necessary for participating in pro-environmental behaviours with some level of repetition or habituation.

Environmental importance. Consistent with SDT and the theory of planned behaviour (Ajzen, 1991; Deci & Ryan, 1985; 2000), an individual with strong pro-environmental attitudes, who identifies as an environmentalist, considers taking care of the environment important, and who values the natural environment will participate in behaviours that correspond to these identities and values (Christensen, Rothberger, Wood, & Matz, 2004; Sparks & Shepherd, 1992; Whitmarsh & O'Neill, 2010). Supporting this, perceived environmental importance was an

interesting predictor of strong pro-environmental habits in the second article². In Study 5 and 6, perceived environmental importance was a statistically significant predictor associated with higher strong pro-environmental habits compared to the repeated behaviour with interference groups.

Past research reveals that the more strongly people accept values beyond their immediate self-interests, the more likely they are to engage in pro-environmental behaviour (e.g., Nordlund & Garvill, 2002; Schultz & Zelezny, 1999; Steg, & Vlek, 2009; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). This research showed that people with a greater sense of environmental importance were often associated with the group who had the greatest frequency of performing the pro-environmental behaviour, the highest reported habit strength for the target behaviour, and a low behavioural interference (i.e. the strong habit group).

Perceived environmental importance was not only effective at differentiating between strong habits and repeated behaviours with interference, it was also fairly effective at differentiating the strong habits from the weak habits (Study 4 and 5). It was higher for the strong pro-environmental habit groups compared to the weak habit groups in these studies.

It seems as if perceived environmental importance continues to increase in people who have more internalized pro-environmental behaviours. These results indicate that perceived environmental importance was usually associated with the the strong habit and repeated behaviour with interference groups. However, this being correlational research, it is not possible to know if the greater reported environmental importance assists in the internalization of the target pro-environmental behaviour or if the internalization process produces a greater sense of environmental importance. Previous research suggests that values and attitudes might have a

2 Environmental importance was not included in the first three studies.

stronger impact on the internalization process as the new behaviour becomes entwined with a person's wider beliefs, rather than the other way around. Future studies should look at how environmental attitudes, values, and norms relate to habits; and in particular how these concepts relate to the internalization process of different types of repeated behaviours.

Nature relatedness. In only one of the six studies (Study 4) was nature relatedness able to differentiate between the repeated behaviour with interference and the strong habit groups. Nature relatedness was included in the current research as an expanded measure of need satisfaction, since pro-environmental behaviours require individuals to have a relationship with the environment as a whole rather than individual people. This suggests that there might be limitations due to the nature relatedness measure used (discussed in the limitations section) or an indirect relation in how nature relatedness is connected to pro-environmental habits. SDT predicts that need satisfaction has an indirect effect on behaviour by influencing the quality of motivation for the behaviour (Vallerand, 1997). Relatedness need satisfaction should then promote autonomous regulation for behaviours leading to more complete internalization (Grolnick & Ryan, 1989; Ryan, Stiller, and Lynch, 1994).

Previous research has shown a statistically significant indirect effect of nature relatedness through motivation on pro-environmental behaviours. Aitken, Pelletier, and Nisbet (2012) tested a bootstrapped multiple mediation model of nature relatedness through both autonomous and controlled motivation toward the environment on frequency of pro-environmental behaviours. They found a statistically significant positive mediation of nature relatedness through autonomous but not controlled motivation. Increasing nature connections were positively associated with a higher frequency of pro-environmental behaviours through autonomous motivation toward the environment only. This research supports an indirect relation between

nature relatedness and motivation toward the environment but did not look at habits for pro-environmental behaviours, only frequency of pro-environmental behaviours measured with a composite score from a range of different behaviours that many or may not have been habitual for the participants. Future research should look at the mediation relation of nature relatedness on pro-environmental habits through types of motivation toward the environment.

Although nature relatedness was not statistically significantly different between the repeated behaviour with interference and the strong habit groups, it was more generally found to be a statistically significant predictor of the three different groups of repeated pro-environmental behaviours in articles one and two. In article one, nature relatedness was generally higher for the more internalized groups (i.e., repeated behaviour with interference groups and the strong habit groups) compared to the weak habit groups for the recycling behaviour (Study 2 and 3).

However, there were no statistically significant differences in nature relatedness between the three groups for the transportation behaviour in Study 1. Having a strong connection to nature seems to encourage or instigate the development of internalized pro-environmental behaviours but then seems to levels off, reflected in the lack of difference in nature relatedness between the repeated behaviour with interference groups and the strong habit groups.

In article two, nature relatedness was generally higher for the strong habit groups compared to the weak habit groups for all three studies, although it was only marginally statistically significant for the recycling behaviours. It seems that when both nature relatedness and perceived environmental importance are included together, the underlying environmental attitude is explaining more variance than the connection to nature. Thus, future research needs to investigate in more detail how nature relatedness interacts with other determinants to increase participation in pro-environmental behaviours and better facilitate the internalization to help

create more integrated strong pro-environmental habits. It will also be important to explore how the other basic needs of competence and autonomy, in addition to the need for relatedness, interact with the formation of integrated strong habits for pro-environmental behaviours.

Taken together the current studies highlight one final implication of this research, that it is important to use a wider concept of relatedness when researching pro-environmental behaviours. Pro-environmental behaviours require people to have a relationship with the planet. This wider sphere of influence is why it may be important to expand the concept of need for relatedness in future research to include a connection to the natural environment (e.g., nature relatedness). The next section will look at the major consequences of pro-environmental behaviours explored in this thesis: frequency of doing other pro-environmental behaviours, intention to increase the target pro-environmental behaviour, and satisfaction with life as an indicator of well-being. Only frequency of pro-environmental behaviours and intention to increase behaviours were sometimes able to differentiate between strong habits and behaviours merely repeated.

Frequency of other pro-environmental behaviours. Frequency of other pro-environmental behaviours (i.e., other than the target pro-environmental behaviour) was sometimes able to differentiate between the repeated behaviour with interference groups and strong habit groups in articles one and two. It was found to be statistically significantly higher for the strong habit groups compared to the repeated behaviour with interference groups for the recycling behaviour in Study 3, 4, and 6.

When a behaviour has been internalized and is motivated, that single behaviour is often done more frequently and over a longer period of time (de Groot & Steg, 2010; Deci et al., 1994; Green-Demers, Pelletier, & Ménard, 1997; Osbaldiston & Sheldon, 2003; Pelletier, Tuson,

Green-Demers, Noels, & Beaton, 1998). When a behaviour has been internalized through integration and is autonomously motivated, the single behaviour will become entwined with the individual's wider beliefs, align with the values of the person, and the behaviour will be in congruence with other behaviours that support the person's values and identity. The person will do a greater number of similar type behaviours as a result of this congruence (Renaud-Dube, Taylor, Lokes & Guay, 2010; Stern, et al., 1999; Thøgersen & Ölander, 2001).

Frequency of other pro-environmental behaviours was not just effective at differentiating between the strong habits and the repeated behaviours with interference, it was also generally effective at differentiating between all three types of repeated behaviours in article one and two. Only in Study 1 (i.e. transportation behaviour) was frequency of other pro-environmental behaviours not able to show a difference between the weak habit groups and the repeated behaviour with interference groups and strong habit groups. Generally, more participation in other pro-environmental behaviours was found to be a statistically significant predictor of the repeated behaviour with interference groups and strong habit groups compared to the weak habit group.

Taken together these results seem to suggest that people who have more internalized integrated pro-environmental habits participate in additional pro-environmental behaviours, more than those with a weak habit and even more than those who merely repeat the pro-environmental behaviour. These results provide some support for the idea that people with internalized pro-environmental habits might be contributing more toward a sustainable future.

Intentions to increase behaviours. Intentions to increase the target pro-environmental behaviour were able to differentiate between the repeated behaviour with interference groups and

the strong habits in the first article³. When the target behaviour and the intention to increase the behaviour were the same (e.g., recycling clusters x recycling intention) the more internalized integrated strong habit group showed a higher intention to increase recycling in the future than the repeated behaviour with interference group in Study 3. Although this result was not replicated with the recycling behaviour in Study 2. Study 2 found no statistically significant difference between the strong habit group and the repeated behaviour with interference group for the recycling behaviour. The differences between the two studies might be due to the different composition of the samples; Study 2 was an adult sample with participants across the USA and Canada, while Study 3 was a university sample where all participants were exposed to the same recycling infrastructure. The more homogeneous sample in Study 3 might have an easier time detecting differences between the two internalized groups.

The results for the repeated behaviour with interference groups and the intention to increase the opposite behaviour are very interesting. When the target behaviour and the intention to increase the behaviour were the not the same (e.g., recycling clusters x garbage intention) the repeated behaviour with interference groups showed a higher intention to increase the opposite behaviour, compared to the strong habit group. The higher intention for increasing the opposite behaviour in the future really highlights the behaviour interference for the repeated behaviour with interference group. For example, those with an interfered repeated behaviour for recycling would have a higher intention to use the garbage *and* use recycling because they are not sure which behaviour to do; it may depend on the context whether or not they recycle or use the garbage. The strong habit group does not have this same behavioural interference between the competing behaviours. The strong habit group reports low intentions to increase the opposite

3 Intention to increase the target behaviour was not included in the second three studies.

behaviour in the future because participating in the competing behaviour would be incongruent with the internalized integrated target behaviour.

Intentions to increase the behaviour in the future was also generally effective at differentiating between all three types of repeated behaviours in article one. Generally, results across the three studies in the first article show that when the intention corresponds to the target behaviour (e.g., recycling clusters x recycling intention), weak habit people are not interested in increasing the behaviour in the future. In contrast, the interfered repeated behaviour and strong habit groups have a higher intention to increase behaviour because they are interested in doing the behaviour.

When the intention did not correspond to the target behaviour (e.g., recycling clusters x garbage intention), the overall level of intention was low for all the groups, in all the studies. It makes sense that most people are not interested in increasing these non-environmental behaviours due to a social desirability of pro-environmental behaviours and the undesirability of the competing non-environmental behaviours (e.g., recycling is good, while putting paper in the garbage is bad). The weak habit people (i.e., those likely to have a high habit for the contrary intention) usually reported a low intention to increase the opposite behaviour because they are likely already doing the behaviour⁴. For example, those with a weak habit for recycling would have a low intention for increasing garbage use in the future because they are probably already putting paper in the garbage. The strong habit groups also had a low intention for increasing the opposite behaviour because it would be contrary to their pro-environmental values and be an incongruent behaviour for them. For example, those with a strong habit for recycling would have

4 In the case of the garbage clusters, the intention to increase recycling was high for the weak habit group, which might be due to the social pressure to do the “right thing” for this group that is not recycling.

a low intention for increasing garbage use in the future because it would go against their environmentalist identity and values.

Life satisfaction. A person's satisfaction with life was not able to differentiate between the repeated behaviour with interference and the strong habit groups in any of the studies in article two⁵ but was found to be a statistically significant predictor of differences between the weak habit groups and the strong habit groups in Studies 5 and 6. Life satisfaction was greater for the more internalized strong habit groups compared to the weak habit groups.

After establishing in article one that the level of behavioural interference was an important indicator for differentiating types of repeated pro-environmental behaviours, article two investigated factors related to the successful internalization process of pro-environmental behaviours. One of the best known outcomes related to a successful internalization process across the SDT literature is increases in well-being. According to SDT, when people have more autonomous types of motivation compared to controlled motivations, this is associated with more well-being (Deci & Ryan, 2008; Chirkov, Ryan & Sheldon, 2010; Kasser, 2009; Villacorta, Koestner & Lekes, 2003). This was observed in the present research, given that greater life satisfaction was associated with the strong habit groups compared to the weak habit groups in the current research.

Why a Difference Between Repeated Behaviours and Habits is Important

Both repeated behaviours with interference and strong habits for pro-environmental behaviours produce improvements to the environment but strong habits have additional benefits. Repeated pro-environmental behaviours may be undertaken for non-environmental reasons, such as to save money or to impress significant people. Important environmental benefits are realized

5 Life satisfaction was not included in the first three studies.

in spite of the intended non-environmental, self-interested goals (Gifford, 2011). An interfered repeated pro-environmental behaviour will produce a similar positive outcome to a strong habit but having a habit for the behaviour will result in the behaviour being done more frequently and more easily, as the studies in this thesis have shown. For all six studies, the frequency of the target behaviour was highest for those in the strong habit group.

Theoretically, strong habitual behaviours should be done with more persistence, since the motivation for the behaviour comes from within, rather than from external sources, and the behaviour is done automatically with less effort; whereas, the motivation for interfered repeated behaviour comes from less internal and congruent sources. Even though interfered repeated pro-environmental behaviours will have a positive impact on the environment, they are more dependent on external motivators. Habits have the benefit of being integrated into a person's identity and lifestyle, thus are less susceptible to being disrupted by external motivators.

Combining the fact that people with a strong habit were more likely to do the target behaviour more frequently, with the fact that this group, in five of the six studies, also more frequently participated in other pro-environmental behaviours, this suggests people with strong habits are having a bigger positive impact on the planet than people with low pro-environmental habits. The harmonious alignment of multiple pro-environmental identities, values and actions potentially leads to an environmental activist. By being positive role models and leaders, environmentalists may be the ones to motivate others toward sustainable behaviours. People who repeat pro-environmental behaviours will help the planet with their protective behaviours, but those with strong pro-environmental habits could inspire others to be more sustainable. Future models of pro-environmental behaviour change should take into account the difference between repeated behaviours and strong habitual behaviours.

Implications for Self-Determination Theory

There are several reasons that SDT has the potential to make a significant contribution to environmental psychology and specifically to the study of pro-environmental habits. Generally, SDT provides testable hypothesis about the social, contextual, and interpersonal conditions that can promote or hinder people's motivation to perform pro-environmental behaviours. Also, SDT outlines various consequences (e.g., cognitive, affective, behavioural) that are associated with the different motivation orientations (i.e., autonomous and controlled). As seen in this thesis, SDT is able to distinguish between different motivation orientations that can have a distinct impact on the maintenance and integration of pro-environmental behaviours.

In addition, SDT addresses the process of internalization by which behaviours that were initially reinforced by external sources (e.g., incentives or a significant other) become integrated within an individual to form a permanent part of one's character (i.e., self). The internalization process provides hope for the creation of environmentally active people who participate in multiple pro-environmental behaviours, who have pro-environmental habits for these behaviours, and who promote sustainability which could help create a more sustainable future. Finally, this thesis has shown that pro-environmental habits are a new fruitful area for SDT research. Future research suggestions are discussed in a following section.

Limitations

Differences Between the Articles

There were a few small differences between the results of the first and second article. One difference worth noting was the relation between the types of repeated pro-environmental behaviours and motivation toward the environment. In the first article controlled motivation toward the environment was a statistically significant variable in Study 2 and 3, while

autonomous motivation was found to only show statistically significant differences between the weak habit groups and the other two groups also in Study 2 and 3. In the second article autonomous motivation toward the environment was a statistically significant variable in all three studies, while controlled motivation was generally not found to show statistically significant differences between any of the types of repeated behaviours. Only in Study 6 was controlled motivation a significant predictor.

The reason for this difference in which type of motivation toward the environment was statistically significant is likely the result of the different statistical analyses chosen for the articles. In article one, determinants of pro-environmental behaviours (including motivation toward the environment) were included in separate ANOVAs used to validate the clusters. This analysis was chosen to be consistent with previous cluster analysis research (Gore, 2000; Martinent, Nicolas, Gaudreau, & Campo, 2013). In article two, the purpose of testing motivation toward the environment was different; it was included to help identify the determinants and consequences variables that had the best odds for predicting group membership in the already established types of repeated pro-environmental behaviours, rather than attempting to validate the clusters. Thus, article one looked at each variable in isolation, whereas in article two various variables were evaluated in combination. It is likely that the more sophisticated analysis in the second article allowed for a more realistic evaluation of the relations between variables.

Measurement and Design Issues

Although the present program of research generated important findings on the distinctions between different forms of repeated pro-environmental behaviours, it has some limitations. One limitation of the current research is that all the studies were correlational and cross-sectional. Due to the exploratory nature of this research this study design was advantageous. This thesis

combined two research fields never before united (i.e., habits and SDT) thus the flexibility and variety afforded from a correlational and cross-sectional design allowed us to test multiple variables at the same time and tease out the relationships between the habit indicators and patterns across the selected determinants and consequences included in the studies.

Unfortunately this type of study design restricts the types of conclusions that can be made from the analysis. For example, the current research was only able to focus on identifying habits using the correlational and cross-sectional design, whereas longitudinal research will be necessary to define the process involved in developing habits. This process is expected to be continuum of change and not a set of stages as it is presented here. Establishing types of repeated behaviours was a necessary restriction due to the cross-sectional design and statistical analyses used in this thesis.

The correlational and cross-sectional design does not allow testing of the causal directions the relationships identified, although hypotheses were extrapolated from previous research which provided a strong basis for the predictions made in this thesis. From an applied perspective, a better understanding of the causal sequence necessary for developing habits could help identify the factors to focus on to derive better results from interventions.

Experimental studies are also needed to test the correlational relations found in this thesis. However, designing effective laboratory studies to test habits is particularly challenging. Habits are most effective when being done within a familiar setting; the environment cues the behaviour and the person automatically responds with the behaviour. Disrupting these cues can disrupt the activation of the habit (Wood, Tam, & Witt, 2005). This is because the brain likes efficiency, and automatic habits are efficient. They require significantly less cognitive effort (Bargh, 1994). But in a psychology research laboratory participants know their behaviour is being

evaluated, they are often hyper-aware of their actions; all of their actions, even the ones not related to the posted study description. This cognitive appraisal of behaviours in the laboratory can interfere with the expression of habitual behaviours. Even the most ingrained and automatic habits can become conscious behaviours (Bamberg, 2006; Verplanken & Wood, 2006; Wood et al., 2005), all that is needed is for the person to become mindful of the behaviour and this is what can happen in a highly artificial laboratory setting.

Some research has attempted to model habit development in the laboratory by having participants create a habit for a simple task (e.g., identifying the presence of a memorized consonant from a set of presented letters) and then test how much the learned response interferes with performance on a new but similar task (e.g., Webb, Sheeran & Luszczynska, 2009). However, this is an artificial habit that likely does not persist much beyond the testing session. It is hard to equate such a simple task to the complicated behaviours being targeted in models of pro-environmental behaviour change. This simplified experimental design will be able to provide some information about the structures of habits, but like the correlational design of the current research neither of these designs are optimal for providing a complete picture of habits.

Future research needs to find creative ways of observing habitual behaviour within natural settings, not only to observe “real life” habits but also to measure the habit indicators to see if they are applicable beyond an online survey research design. Workplaces would be an ideal location for this type of research, since employees generally have the same routine to their workday. The context of the behaviours would be consistent and the cues for workplace habits would be naturally derived. Within a work setting multiple research methodologies could be implemented. For example, employees could fill out online surveys that include measures of the habit indicators and various determinants and consequences, much as what was done in the

current research. In addition, observational data could be collected about various pro-environmental behaviours of the employees. Did they use a sustainable transportation mode to get to work, did they turn off the computer at the end of the day, how much waste is in the trash compared to the recycling bins near workstations, did they use disposable coffee cups, how much did they print, and was it single or double sided? Finally, even quasi-experimental methods could be implemented with the introduction of various interventions. After obtaining base-line measures, new employees could be exposed to an intervention designed to increase pro-environmental habits. By targeting new employees, old habits will be easier to change into new pro-environmental habits. Intervention results can then be compared to results for the established employees. Overall, workplaces are an opportune environment for research on pro-environmental behaviours and habitual behaviours.

All this data from studies in a workplace could be collected over the long-term, if the organization was motivated and saw a benefit to collecting this type of information about their employees. For example, Google is two years into a century long study of their employees to learn which are the best work environments, how to enhance the happiness of employees, how to facilitate high performance teams, and maximize productivity (Brock, 2014). Imagine what they will know in a decade from now, or 10 decades from now. Other organizations can easily accomplish the same thing. However, it is our job as environmental psychologists to make the case to the businesses that environmental constructs are important for the health, happiness, and productivity of the workplace.

A second limitation of the current research was the findings were based primarily on data collected through self-report measures obtained through online surveys. Self-report measures have been found to both overestimate *and* underestimate constructs being measured (Prince et al.,

2008). Inaccurate self-reporting can be caused by recall bias, social desirability bias, and errors in self-observation (Field, 2013). Although the use of validated scales (e.g., Self-report Habit Index and Motivation Toward the Environment Scale) provides increased reliability and validity of the measures and should be used whenever possible, the addition of observed measures would greatly increase the validity of the results.

Although some items used in the current thesis were created and not validated measures, preliminary testing provided additional support for the use of the habit indicators by including additional measures in surveys to corroborate data collected from the indicators. For example, single item questions about the habit of the behaviour (e.g., Are you currently habitual about taking public transportation?), other proposed measures of habits from the literature (e.g., Response Frequency Measure; Verplanken et al., 1994), and open ended questions about habitual behaviour (e.g., How do you know when a behaviour has become a habit for you?) were all included. Participants completed these questions in addition to the three habit indicators and comparisons showed agreement across measures providing assurances of the appropriateness of the habit indicators as measures of habitual behaviour.

Using online surveys have advantages and disadvantages. One benefit of this methodology is that it can provide access to interesting research to people who might not otherwise be able to participate due to time, financial, geographical, or physical restrictions, which prevent them from doing on campus laboratory experiments. However, the online format may have inadvertently attracted people who prefer being inside and on the computer, which definitely limits the generalizability of these findings but could also bias results about pro-environmental concepts. Future studies should expand beyond the online self-report surveys and

would benefit from replication with alternate behavioural assessments of key variables (Kline, 2013), including habits, determinants, and consequences.

Across studies listwise deletion was used for the cluster analysis without the use of data imputation of the missing data on the three habit indicators. Listwise deletion is known to potentially bias parameter estimations and reduce power when there is more than 5% of data missing (Allison, 2002). Usually data imputation is recommended to address missing data. However, the goal of the exploratory cluster analysis procedure is to group cases that are similar and the assumptions of imputation can create artificial similarities, potentially leading to creating less reliable clusters. Thus, performing the cluster analysis on samples with missing data was determined to be the more conservative approach. Once the cluster membership was set, data imputation was used for missing data on the validation variables in article one and the multinomial logistic regression predictors in article two. Imputing the missing data helped protect against bias and reduction of the sample size before the parametric analyses were performed.

Among others, the concept of internalization is difficult to measure. In this thesis it was assumed to exist by using a proxy indicator of interference and congruence. Future research should look at alternative tools that have the potential to be used to either directly or indirectly assess internalization, integration and automaticity with respect to identities, emotions, beliefs, and behaviours. For example, reaction-time measures, such as implicit association tasks (Greenwald & Farnham, 2000; Legault, Green-Demers, Grant, & Chung, 2007; Weinstein et al., 2013), and other indirect and projective assessments (e.g., Baumann, Kaschel, & Kuhl, 2010) are starting to be used in the field. There is growing evidence that behaviours and perceptions can be caused by unconscious motivators (Levesque, Copeland, & Sutcliffe, 2008; Ryan & Deci, 2006).

Autonomous and controlled forms of motivation orientations have been activated non-consciously due to people having mental representations of motivational orientations related to intrinsic and extrinsic motivations. Priming these motivation orientations has been shown to impact behaviour performance (Levesque & Pelletier, 2003; Radel, Sarrazin, & Pelletier, 2009). Based on recent research (Levesque & Pelletier, 2003; Radel et al., 2009; Ryan & Deci, 2006), it is expected that the non-conscious activation of motivation should also occur for pro-environmental behaviours and could be related to prompting habitual pro-environmental behaviours in those people with intrinsic motivation representations, although this has not been researched yet.

The failure of nature relatedness to identify differences between the repeated behaviour with interference groups and the strong habit groups in five of the six studies is a bit surprising and warrants some attention here. One explanation for this was the possible indirect effect of nature relatedness on pro-environmental behaviours through people's motivation toward the environment described in the key finding section. A second explanation could be related to a ceiling effect of the Brief Nature Relatedness Scale (Nisbet & Zelenski, 2013) used to measure nature relatedness in this thesis. The current results showed that having a strong connection to nature seemed to encourage or instigate the development of pro-environmental behaviours but then levels off, since it was associated with the two more internalized types of repeated pro-environmental behaviours compared to the weak habit groups but did not statistically significantly differ between the repeated behaviour with interference groups and the strong habit groups. The Brief Nature Relatedness Scale (Nisbet & Zelenski, 2013) is thought to capture the people's trait level of connection to nature. This measure was selected because it was thought that trait level nature relatedness would be a better predictor of a stable behaviour, like a habit, than

other connection to nature measures (e.g., Mayer & Frantz, 2004; Schultz, 2004). However, the brief 6-item measure of the Brief Nature Relatedness Scale might not be sensitive enough to identify differences at the upper end of internalized behaviours (e.g., repeated behaviour with interference and strong habit groups). Future research should use the full 21-item Nature Relatedness Scale (Nisbet, Zelenski, & Murphy, 2009) to see if its three sub-scales can provide more information about differences between the repeated behaviour with interference and the strong habit groups.

Future Research

Several additional areas for future research can be identified from a conceptual perspective. A few interesting areas for expansion are outlined here but this is not an exhaustive list. Topics covered here include exploring differences between sources of the cues which prompt behaviours, repercussions of performing incongruent behaviours, habits as part of the behaviour change process, and suggestions of other theories to include in future research.

Different Cues for Behaviours

Habits develop as a person consistently repeats the same behaviour in the same situation (Gardner et al., 2011; Verplanken, 2006; Wood et al., 2002). The repetition comes from the satisfactory results the repeated behaviour produces. As long as the situation remains similar to prompt the behaviour and the result continues to be satisfactory, then the behaviour gradually becomes habitual (Verplanken, 2006; Wood & Neal, 2009). Once a habit is formed, perception of the prompt or situational cue will initiate the habitual behaviour without the original goal or conscious intention (Lally, van Jaarsveld, Potts, & Wardle, 2010; Levesque et al., 2008; Orbell & Verplanken, 2010). A prompt or situational cue can be a location, a time of day, an object, a

sequence of actions, a particular mood, the presence of a specific person, or just about anything (Ji Song & Wood 2007; Ouellette & Wood 1998; Wood et al., 2005).

What is not clear from the current research are the reasons why people are interested in pursuing the behaviour, which behaviours become automatized, and what develops into the behavioural cue for prompting a pro-environmental habit. It is possible the reasons for performing the behaviour are different between the people with an interfered repeated behaviour and people with a strong habit. The repeated behaviour with interference group could have high intention to perform the behaviour because the regulation of the behaviour is associated with external cues. For example, the presence of a sign to turn off the lights acts as a cue while the extrinsic consequences of the behaviour (e.g., external pressure, guilt, rewards) are also present. In this case what is being internalized and automatized is the relationship between the external consequences that act as cue and the pro-environmental behaviour.

The strong habit group could also have also high intention to perform the behaviour but the regulation of the behaviour is associated with internal cues. Internal cues could be things like the values and identity of the individuals, which guide the behaviour regulation. For example, the light switching sign acts as a cue that automatically activates the internal values and identity prompting the behaviour. In this case what is being internalized and automatized is the relationship between the internal values and self-identity that act as cue and the pro-environmental behaviour. Future studies will need to explore the interactions between intentions, cue selection, and different types of repeated behaviours.

Performing Incongruent Behaviours

Theoretically, when people with a strong habit for a pro-environmental behaviour are not able to perform the habitual behaviour (i.e., forced to do the competing non-environmental

behaviour), they will find themselves temporarily in the repeated behaviour group. For example, a person with a habit for recycling paper is forced to place the paper in the garbage for a lack of recycling infrastructure. Being forced to do a behaviour contrary to the internalized habit will force the habitual behaviour to become conscious again. When forced to think about a habitual behaviour because it cannot be automatically performed creates a similar experience to those with an interfered repeated behaviour, due to the increased cognition and conflict between the behaviour the person wants to perform (e.g., the habitual pro-environmental behaviour) and the incongruent behaviour they have to perform (e.g., the non-environmental behaviour).

The repercussions of a situation where one is forced to perform an incongruent behaviour are not covered within the current research but would be a wonderful extension of the findings. One way to research this situation would be to study travellers or other people outside of their usual environment. Travellers on vacation are people outside of their usual context and away from the usual external cues for certain pro-environmental behaviours. How they behave at the hotel or around the new city would allow for the testing of differences between types of repeated behaviours and the consequences of performing incongruent behaviours. Internal and external behavioural cues could be compared with travellers, since the current situation would be out of context (i.e., away from home and work) but still a natural setting (e.g., compared to the artificial setting of a laboratory). This setting would also allow the researcher to observe the consequences of forcing a strong habitual person to not do the habitual behaviour. What does the person do and how does she feel if she is forced to throw recyclables in the garbage because the new location does not have the same recycling infrastructure? Much could be learned about the difference between repeated behaviours and strong habits from the population of travellers.

Part of the Behaviour Change Process

This thesis was able to show a difference between repeated behaviours and strong habits but it could not show how habits develop over time as part of the behaviour change process due to design limitations. A behaviour that is merely repeated is neither fully internalized nor fully automatic and can be identified by the residual interference between competing opposite behaviours. An internalized habitual behaviour is a behaviour that combines repeated performance with indicators of high habit strength (i.e., automaticity) and reduced interference with other behaviours. However, attempting to change an existing behaviour (i.e., target habit), confronts people with the challenge of also changing existing habits (i.e., current habit; Jager, 2003; Verplanken, 2010a). This process includes reducing the perceived interference between the current behaviour and the target behaviour, allowing the new target behaviour to become internalized and habitual.

Eventually, if a person maintains the repeated behaviour long enough, it is possible she will be able to relate the importance of the new behaviour to her wider beliefs, and with a better understanding of her own current behaviour she will be able to integrate the new behaviour, potentially developing a strong habit. Thus, repeated behaviour is proposed to be part of the continuum of behaviour change toward a strong habit, although this was not tested in the current research. Future studies will need to compare the level of persistence for a behaviour between repeated behaviours with interference and those with strong habits, explore longitudinal research to determine how habits are developed, and verify if the behaviour change process does in fact pass through an interfered repeated behaviour stage on the way to becoming habitual or if repeated behaviours and habits are separate processes, never to overlap.

Use of Other Theories

Lastly, additional theories should be explored to help expand our knowledge of pro-environmental habits. Past research has attempted to combine habits within the theory of planned behaviour (Bamberg & Schmidt, 2003; Godin, Valois, & Lepage, 1993) but other theories should also be tested. Some of the most relevant to expanding the current research would be theories related to behaviour change and motivation.

It is possible that weak habits and repeated behaviours with interference are part of the continuum of behaviour change toward a strong habit, thus theories related to behaviour change should be explored. For example, Lewin's 3-stage theory of behaviour change (1947) suggests that change usually happens in three steps; unfreezing, moving and refreezing. Unfreezing happens when a person's goals are not being met and this is proposed to initiate a change in behaviour. More detailed theories of change can be used to help extrapolate the gaps in the Lewin theory and predict what is happening along the continuum of change rather than focusing on stages. SDT has been used in this thesis but others hold promise as well. Recently Bamberg (2011; 2013a; 2013b) has proposed a comprehensive stage model of self-regulated behaviour change that includes four qualitatively different stages: predecisional, preactional, actional, and postactional. He has incorporated research from a number of theories to develop the model, including habits, which are part of the postactional or maintenance stage, and is now publishing research in support of the model (e.g., 2013a).

This thesis focused on SDT as a theory of motivation to help explain differences between types of repeated pro-environmental behaviours but other theories of motivation could be explored in the future. The hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997) and goal systems theory (Kruglanski et al., 2002) are two such theories. Within the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997), self-determined

motivation operates and interacts at a global level (i.e., personality level), life domain level (i.e., contextual level), and situational level (i.e., when a target behaviour is assessed in a given situation). The current research explored motivation at the contextual level but more could be learned by incorporating information at the remaining two levels, particularly by exploring how pro-environmental habits may result from a more global self-determined orientation, or may result from situational self-determined experiences repeated on several occasions. Within goal systems theory (Kruglanski et al., 2002), goals and goal-means are associated with each other and arranged in an interconnected, hierarchical system which can be used to predict when and how people are motivated to perform behaviours. Exploring these determinants might provide additional insight into people's selection of behaviour cues or additional differences between repeated pro-environmental behaviours and strong habitual behaviours.

Conclusion

The actions of individuals are one important factor driving climate change. Changes to people's behaviours have the potential to reduce some of the negative impact of climate change on the planet. Psychological factors are strong determinants of these individual behaviours. Environmental psychology has made important contributions to the understanding of what drives behaviour change toward pro-environmental behaviours. The findings of this thesis highlight that habits are an important concept to include in models of behaviour change because not all behaviours are deliberate. Habits are behaviours that are done frequently, with a high level of automaticity, are congruent with other behaviours and the person's sense of self.

The difference between interfered repeated behaviours and strong habits discovered in this thesis is both theoretically and practically important. People with a strong habit experience congruence, whereas those who merely repeat the behaviour experience interference. This

difference has implications for explaining how behaviours are internalized and how behaviour change is modelled. It also has implications for creating more effective behaviour change interventions.

SDT has also made important contributions to the understanding of what drives behaviour change toward pro-environmental behaviours. Having strong pro-environmental habits was generally associated with greater autonomous motivation toward the environment, life satisfaction, a desire to increase the pro-environmental behaviour, and more participation in a variety of other pro-environmental behaviours. However, the current research has only scratched the surface of the topic of pro-environmental habits, and much fertile ground remains for continued research. The benefit of creating pro-environmental habits is the potential for these behaviours to become part of a person's daily life and produce a larger positive impact on the planet.

A Last Word: Suggestions for Changing Habits

Changing behaviours and creating new habits are difficult but possible. One benefit of a thesis about habits is a familiarity with the literature on habits and behaviour change. This literature on the topic of behaviour change and habits is growing and can be used to help people make a successful behaviour change. The studies in this thesis have added to this growing literature. Although the current studies focus on habits for pro-environmental behaviours, the theory and findings identified in this thesis can be applied to any type of behaviour one might like to change (e.g., exercise, medication adherence, eating behaviours). In the interest of helping readers create their own habits, this section provides a few suggestions on how to create new positive habits based on the literature and the findings from this thesis.

First, identify a positive habit (i.e., target habit) that you want to develop and a negative habit (i.e., current habit) to be broken (e.g., biking to work versus driving a car to work). Figure out the context and the cue that triggers the negative habit (Lally et al., 2010; Levesque et al., 2008; Orbell & Verplanken, 2010; Ji Song & Wood 2007; Ouellette & Wood 1998; Wood et al., 2005). Then find a way to disrupt the context, forcing the negative habit to become more conscious (Bamberg, 2006; Verplanken & Wood, 2006; Wood et al., 2005). This may take some experimentation to determine what is prompting the negative behaviour. Give yourself time to explore different possibilities. Next, replace the negative habit with the new positive behaviour. By working on the behaviours in tandem, it will be easier to transition from the old habit to the new habit (Dahlstrand & Biel, 1997). The trick is to make the positive behaviour enjoyable and automatic, something done without thinking, while the negative habit becomes a reasoned response, something thought about carefully before doing (Jager, 2003).

Make sure to set specific, achievable goals, and commit to an action plan for avoiding the negative habit and performing the new positive behaviour (Gollwitzer, 1999; Lokhorst, Werner, Staats, van Dijk, & Gale, 2013; Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Implementation intention plans have been found to be effective in changing behaviours once the negative habit has been disrupted and unfrozen (Aarts & Dijksterhuis, 2000a; Gollwitzer, 1999).

Implementation intentions will help create goal-directed automatic behaviours that are fully internalized and should be targeted at interfered repeated behaviours; when the behaviours (i.e., current and target) are known to have behavioural interference and more cognition about the behaviours (Aitken & Pelletier, 2014a; 2014b). Focusing implementation intentions at this point can help you assimilate and internalize the new positive behaviour and work toward it becoming an integrated strong habit.

Extrinsic motivators may be needed initially to help motivate the behaviour change, such as rewarding participation in the new positive behaviour. Keep in mind that external motivators have only short-term effects (Aronson & Gonzales, 1990; De Young, 1986; Katzev & Johnson, 1984; Lehman & Geller, 2004) and do not lead to complete integrated internalization of the behaviour (Deci & Ryan, 1985; 2000). New habits are more likely to be established when they can be incorporated into your existing lifestyle and are an activity that is enjoyable or is thought to be important.

Promoting interventions that increase autonomous motivation toward the environment, nature relatedness, and perceived environmental importance will help to internalize pro-environmental behaviours into strong habits (Aitken & Pelletier, 2014a; 2014b). For example, one of the easiest interventions to implement is to spend more time outdoors. Being in nature, even nearby urban nature, has been found to have a restorative effect (e.g., Berman, Jonides, & Kaplan, 2008; Bowler, Buyung-Ali, Knight, & Pullin, 2010) and it is related to higher nature relatedness (e.g., Nisbet et al., 2009). Nature relatedness is related to autonomous motivation toward the environment (Aitken et al., 2012). By spend time in nature as part of your daily routine, you can nurture this important connection, facilitate internalization of pro-environmental behaviours, and increase well-being. Other interventions that can increase autonomous motivation and facilitate internalization of the behaviour include seeking to develop and share knowledge about the behaviour, seeking out positive feedback, and connecting with others who support the behaviour (Deci & Ryan, 2008; Williams et al., 2006).

Finally, make sure to repeat the behaviour, often. Behaviour frequency might not be the best way to measure habits but the literature is very clear that repeating the behaviour is

important to the process of a behaviour becoming habitual (e.g., Gardner et al., 2011; Verplanken, 2006; Wood et al., 2002). So do it often and do it well. Happy habit making.

References

- Aarts, H., & Dijksterhuis, A. (2000a). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology*, 78(1), 53–63.
doi:10.1037/0022-3514.78.1.53
- Aarts, H., & Dijksterhuis, A. (2000b). The automatic activation of goal-directed behaviour: the case of travel habit. *Journal of Environmental Psychology*, 20(1), 75–82.
doi:10.1006/jevp.1999.0156
- Aarts, H., Verplanken, B., & Knippenberg, A. (1998). Predicting behavior from actions in the past: Repeated decision making or a matter of habit? *Journal of Applied Social Psychology*, 28(15), 1355–1374. doi:10.1111/j.1559-1816.1998.tb01681.x
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211. doi:10.1016/0749-5978(91)90020-t
- Ajzen, I., & Fishbein, M. (2000). Attitudes and the attitude-behavior relation: Reasoned and automatic processes. *European Review of Social Psychology*, 11(1), 1–33.
doi:10.1080/14792779943000116
- Aitken, C. K., McMahon, T. A., Wearing, A. J., & Finlayson, B. L. (1994). Residential water use: Predicting and reducing consumption1. *Journal of Applied Social Psychology*, 24(2), 136–158. doi:10.1111/j.1559-1816.1994.tb00562.x
- Aitken, N. M. & Pelletier, L. G. (2014a). Integration of habit indicators and self-determination theory: Differentiating types of repeated pro-environmental behaviour. Manuscript submitted for publication.

- Aitken, N. M. & Pelletier, L. G. (2014b). What predicts habits for pro-environmental behaviours: An analysis of the determinants and consequences of pro-environmental behaviours. Manuscript submitted for publication.
- Aitken, N. M., Pelletier, L. G., & Nisbet, L.K. (2012). Connections help to motivate pro-environmental action. Paper presentation, *Canadian Psychological Association, 73rd Annual Convention*, June 14-16, Halifax, Nova Scotia.
- Allison, P. D. (2002). *Missing data*. Thousand Oaks, Calif.: Sage Publications.
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *The British Journal of Social Psychology / the British Psychological Society*, 40(4), 471–499. doi:10.1348/014466601164939
- Aronson, E., & Gonzales, M. H. (1990). Alternative social influence processes applied to energy conservation. In J. Edwards, R. S. Tindale, L. Health, & E.J. Posavas (Eds.), *Social influence processes and prevention* (pp. 301-325). New York, NY. Plenum Press.
- Bamberg, S. (2006). Is a residential relocation a good opportunity to change people's travel behavior? Results from a theory-driven intervention study. *Environment and Behavior*, 38(6), 820–840. doi:10.1177/0013916505285091
- Bamberg, S. (2011). Processes of change. In L. Steg, A. E. van den Berg, & J. I. M. de Groot (Eds.), *Environmental Psychology: An Introduction* (pp. 267-280). Chichester, UK: Wiley.
- Bamberg, S. (2013a). Applying the stage model of self-regulated behavioral change in a car use reduction intervention. *Journal of Environmental Psychology*, 33, 68–75. doi:10.1016/j.jenvp.2012.10.001

- Bamberg, S. (2013b). Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change. *Journal of Environmental Psychology*, 34, 151-159.
doi:10.1016/j.jenvp.2013.01.002
- Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and Applied Social Psychology*, 25(3), 175–187. doi:10.1207/S15324834BASP2503_01
- Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environment and Behavior*, 35(2), 264–285. doi:10.1177/0013916502250134
- Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In Wyer, Robert S., Jr. (Ed); Srull, Thomas K. (Ed), *Handbook of Social Cognition* (2nd ed., pp. 1-40). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.
- Batholomew, K.J., Ntoumanis, N., Ryan, R.L., Bosch, J.A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin*, 37, 1459-1473. doi:10.1177/0146167211413125
- Baumann, N., Kazén, M. & Kuhl, J. (2010). Implicit motives: A look from personality systems interaction theory. In O.C. Schultheiss & J.C. Brunstein (Hrsg.), *Implicit Motives* (pp. 375-403). New York, NY: Oxford University Press.
- Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological Science*, 19(12), 1207–1212. doi:10.1111/j.1467-9280.2008.02225.x

Bock, L. (2014, March 27). Google's scientific approach to work-life balance (and much more).

Harvard Business Review. Retrieved from <http://blogs.hbr.org/2014/03/googles-scientific-approach-to-work-life-balance-and-much-more/>

Brown, K. W., & Kasser, T. (2005). Are psychological and ecological well-being compatible?

The role of values, mindfulness, and lifestyle. *Social Indicators Research*, 74, 349-368.

doi:10.1007/s11205-004-8207-8

Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). A systematic review of

evidence for the added benefits to health of exposure to natural environments. *BMC*

Public Health, 10(1), 456. doi:10.1186/1471-2458-10-456

Christensen, P. N., Rothgerber, H., Wood, W., & Matz, D. C. (2004). Social norms and the self:

A motivational model of normative impact. *Personality and Social Psychology Bulletin*,

30, 1295-1309. doi:10.1037/0022-3514.73.3.523

Chirkov, V. I., Sheldon, K. M., & Ryan, R. M. (2010). The struggle for happiness and autonomy

in cultural and personal contexts: An overview. In V. I. Chirkov, R. M. Ryan & K. M.

Sheldon (Eds.), *Human Autonomy in Cultural Contexts: Perspectives on the Psychology of Agency, Freedom, and Well-being* (pp.1-30). Dordrecht, NL: Springer.

Dahlstrand, U., & Biel, A. (1997). Pro-environmental habits: propensity levels in behavioral

change. *Journal of Applied Social Psychology*, 27(7), 588-601. doi:10.1111/j.1559-

1816.1997.tb00650.x

de Bruijn, G.J., Kremers, S. P. J., Singh, A., van den Putte, B., & van Mechelen, W. (2009).

Adult active transportation: Adding habit strength to the theory of planned behavior.

American Journal of Preventive Medicine, 36(3), 189-194.

doi:10.1016/j.amepre.2008.10.019

- de Groot, J. I. M., & Steg, L. (2010). Relationships between value orientations, self-determined motivational types and pro-environmental behavioural intentions. *Journal of Environmental Psychology*, 30(4), 368–378. doi:10.1016/j.jenvp.2010.04.002
- De Young, R. (1986) Encouraging environmentally appropriate behavior: The role of intrinsic motivation. *Journal of Environmental Systems*, 15(4), 281-292. doi:10.2190/3fwv-4wm0-r6mc-2urb
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-determination in Human Behavior*. New York: Plenum.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268.
doi:10.1207/S15327965PLI1104_01
- Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life’s domains. *Canadian Psychology/Psychologie Canadienne*, 49(1), 14–23.
doi:10.1037/0708-5591.49.1.14
- Deci, E. L, Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality*, 62(1), 119–142.
doi:10.1111/j.1467-6494.1994.tb00797.x
- Emmons, R. A., & King, L. A. (1988). Conflict among personal strivings: Immediate and long-term implications for psychological and physical well-being. *Journal of Personality and Social Psychology*, 54(6), 1040–1048. doi:10.1037/0022-3514.54.6.1040
- Environment Canada (2014, January 29). *Climate Change - National Inventory Report 1990-2012: Greenhouse Gas Sources and Sinks in Canada*. Retrieved June 9, 2014, from <https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=3808457C-1&offset=1&toc=show>

- Field, A. (2013). *Discovering Statistics using IBM SPSS Statistics* (4 edition.). London: Sage Publications.
- Friedrichsmeier, T., Matthies, E., & Klöckner, C. A. (2013). Explaining stability in travel mode choice: An empirical comparison of two concepts of habit. *Transportation Research Part F: Traffic Psychology and Behaviour*, 16, 1–13. doi:10.1016/j.trf.2012.08.008
- Fujii, S., Gärling, T., & Kitamura, R. (2001). Changes in drivers' perceptions and use of public transport during a freeway closure effects of temporary structural change on cooperation in a real-life social dilemma. *Environment and Behavior*, 33(6), 796–808.
doi:10.1177/00139160121973241
- Fujii, S., & Kitamura, R. (2003). What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. *Transportation*, 30(1), 81–95.
doi:10.1023/A:1021234607980
- Gardner, B., de Bruijn, G. J., & Lally, P. (2011). A systematic review and meta-analysis of applications of the self-report habit index to nutrition and physical activity behaviours. *Annals of Behavioral Medicine*, 42(2), 174–187. doi:10.1007/s12160-011-9282-0
- Garvill, J., Marell, A., & Nordlund, A. (2003). Effects of increased awareness on choice of travel mode. *Transportation*, 30(1), 63–79. doi:10.1023/A:1021286608889
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66, 290–302. doi:10.1037/a0023566
- Godin, G., & Kok, G. (1996). The theory of planned behavior: A review of its applications in health-related behaviors. *American Journal of Health Promotion*, 11, 87–98.
doi:10.4278/0890-1171-11.2.87

- Godin, G., Valois, P., & Lepage, L. (1993). The pattern of influence of perceived behavioral control upon exercising behavior: An application of Ajzen's theory of planned behavior. *Journal of Behavioral Medicine*, 16(1), 81–102. doi:10.1007/bf00844756
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist*, 54(7), 493–503. doi:10.1037/0003-066X.54.7.493
- Gore, P. (2000). Cluster analysis. In H. E. A. Tinsley & S. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical Modeling* (pp. 297–321). New York: Academic Press.
- Government of Canada, (2007). *Canadian Environmental Sustainability Indicators 2007*. Catalogue no. 16-251-XIE, Ottawa, ON.
- Graybiel, A. M. (2008). Habits, rituals, and the evaluative brain. *Annual Review of Neuroscience*, 31, 359–387. doi:10.1146/annurev.neuro.29.051605.112851
- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 29(3), 157–166. doi:10.1037/0008-400X.29.3.157
- Greenwald, A. G., & Farnham, S. D. (2000). Using the Implicit Association Test to measure self-esteem and self-concept. *Journal of Personality and Social Psychology*, 79, 1022–1038. doi:10.1037/0022-3514.79.6.1022
- Gregory, G. D., & Leo, M. D. (2003). Repeated behavior and environmental psychology: The role of personal involvement and habit formation in explaining water consumption. *Journal of Applied Social Psychology*, 33(6), 1261–1296. doi:10.1111/j.1559-1816.2003.tb01949.x

- Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology*, 81(2), 143–154.
doi:10.1037/0022-0663.81.2.143
- Hofer, M. (2007). Goal conflicts and self-regulation: A new look at pupils' off-task behaviour in the classroom. *Educational Research Review*, 2(1), 28–38.
doi:10.1016/j.edurev.2007.02.002
- Intergovernmental Panel on Climate Change (IPCC) (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Retrieved from
<http://www.realclimate.org/index.php/archives/2014/03/ipcc-wg2-report-now-out/>
- Jager, W. (2003). Breaking bad habits: a dynamical perspective on habit formation and change. In Hendrickx, L. C. W. P. (Ed.), *Human Decision Making and Environmental Perception: Understanding and Assisting Human Decision Making in Real-life Settings*. Groningen: University of Groningen.
- Ji Song, M. F., & Wood, W. (2007). Purchase and consumption habits: Not necessarily what you intend. *Journal of Consumer Psychology*, 17(4), 261–276. doi:10.1016/S1057-7408(07)70037-2
- Jog, M. S., Kubota, Y., Connolly, C. I., Hillegart, V., & Graybiel, A. M. (1999). Building neural representations of habits. *Science*, 286(5445), 1745–1749.
doi:10.1126/science.286.5445.1745
- Johnston, M. M. & Finney, S. J. (2010). Measuring basic needs satisfaction: Evaluating previous research and conducting new psychometric evaluations of the Basic Needs Satisfaction in General Scale. *Contemporary Educational Psychology*, 35, 280-296.
doi:10.1016/j.cedpsych.2010.04.003

- Kahle, L. R., & Beatty, S. E. (1987). Cognitive consequences of legislating postpurchase behavior: Growing up with the bottle bill. *Journal of Applied Social Psychology, 17*(9), 828–843. doi:10.1111/j.1559-1816.1987.tb00342.x
- Kasser, T. (2009). Psychological need satisfaction, personal well-being, and ecological sustainability. *Ecopsychology, 1*, 175-180.
- Kasser, T., & Ahuvia, A. (2002). Materialistic values and well-being in business students. *European Journal of Social Psychology, 32*(1), 137–146. doi:10.1002/ejsp.85
- Katzev, R. D. & Johnson, T. (1984). Comparing the effects of monetary incentives and foot-in-the-door strategies in promoting residential electricity conservation. *Journal of Applied Social Psychology, 14*, 12-27. doi:10.1111/j.1559-1816.1984.tb02217.x
- Kline, R. B. (2013). *Beyond Significance Testing: Statistics Reform in the Behavioral Sciences* (2nd ed.). Washington, DC: American Psychological Assoc.
- Klöckner, C. A., & Friedrichsmeier, T. (2011). A multi-level approach to travel mode choice – How person characteristics and situation specific aspects determine car use in a student sample. *Transportation Research Part F: Traffic Psychology and Behaviour, 14*(4), 261–277. doi:10.1016/j.trf.2011.01.006
- Klöckner, C. A., & Matthies, E. (2004). How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *Journal of Environmental Psychology, 24*(3), 319–327. doi:10.1016/j.jenvp.2004.08.004
- Klöckner, C. A., Matthies, E., & Hunecke, M. (2006). Problems of operationalizing habits and integrating habits in normative decision-making models. *Journal of Applied Social Psychology, 33*(2), 396–417. doi:10.1111/j.1559-1816.2003.tb01902.x

- Koestner, R., Losier, G. F., Vallerand, R. J., & Carducci, D. (1996). Identified and introjected forms of political internalization: Extending self-determination theory. *Journal of Personality and Social Psychology*, 70(5), 1025–1036.
- Kruglanski, A. W., Shah, J. Y., Friedman, R., Fishbach, A., Friedman, R., Chun, W. Y., & Sleeth-Keppler, D. (2002). A theory of goal systems. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (pp. 331–378). San Diego, CA: Academic Press.
- Lally, P., van Jaarsveld, C. H. M., Potts, H. W. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European Journal of Social Psychology*, 40(6), 998–1009. doi:10.1002/ejsp.674
- Lehman, P. K., & Geller, E. S. (2004). Behavioural analysis and environmental protection: Accomplishments and potential for more. *Behavioural and Social Issues*, 13, 13–24.
- Legault, L., Green-Demers, I., Grant, P., & Chung, J. (2007). On the self-regulation of implicit and explicit prejudice: A self-determination theory perspective. *Personality & Social Psychology Bulletin*, 33(5), 732–749. doi:10.1177/0146167206298564
- Legault, L., & Inzlicht, M. (2013). Self-determination, self-regulation, and the brain: Autonomy improves performance by enhancing neuroaffective responsiveness to self-regulation failure. *Journal of Personality and Social Psychology*, 105(1), 123–138. doi:10.1037/a0030426
- Levesque, C., Copeland, K. J., & Sutcliffe, R. A. (2008). Conscious and nonconscious processes: Implications for self-determination theory. *Canadian Psychology/Psychologie Canadienne*, 49(3), 218–224. doi:10.1037/a0012756

- Levesque, C., & Pelletier, L. G. (2003). On the investigation of primed and chronic autonomous and heteronomous motivational orientations. *Personality & Social Psychology Bulletin*, 29(12), 1570–1584. doi:10.1177/0146167203256877
- Lewin, K. (1947). Frontiers in group dynamics. In Cartwright, D. (Ed.), *Field Theory in Social Science*. London: Social Science Paperbacks.
- Lokhorst, A. M., Werner, C., Staats, H., Dijk, E. van, & Gale, J. L. (2013). Commitment and behavior change: A meta-analysis and critical review of commitment-making strategies in environmental research. *Environment and Behavior*, 45(1), 3–34. doi:10.1177/0013916511411477
- Maréchal, K. (2010). Not irrational but habitual: The importance of “behavioural lock-in” in energy consumption. *Ecological Economics*, 69(5), 1104–1114. doi:10.1016/j.ecolecon.2009.12.004
- Martinent, G., Nicolas, M., Gaudreau, P., & Campo, M. (2013). A cluster analysis of affective states before and during competition. *Journal of Sport & Exercise Psychology*, 35(6), 600–611.
- Mayer, F. S., & Frantz, C. M. (2004). The nature connectedness scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, 24, 503–515. doi:10.1016/j.jenvp.2004.10.001
- Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. *Frontiers in Psychology*, 4:813. doi:10.3389/fpsyg.2013.00813
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature Relatedness Scale. *Environment and Behavior*, 41(5), 715–740. doi:10.1177/0013916508318748

Nordlund, A. M., & Garvill, J. (2002). Value structures behind pro-environmental behavior.

Environment and Behavior, 34, 740–756. doi:10.1177/001391602237244

Orbell, S., & Verplanken, B. (2010). The automatic component of habit in health behavior: Habit as cue-contingent automaticity. *Health Psychology*, 29(4), 374–383.

doi:10.1037/a0019596

Ortis, L. C., Maymi, J. N., Feliu, J. C., Vidal, J. M. L., Romero, E. P., Bassets, M. P., et al.

(2007). Exercise motivation in university community members: A behavioural intervention. *Psicothema*, 19, 250–255.

Osbaldiston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for

environmentally responsible behavior: A prospective study of environmental goals.

Journal of Environmental Psychology, 23(4), 349–357. doi:10.1016/S0272-4944(03)00035-5

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple

processes by which past behavior predicts future behavior. *Psychological Bulletin*, 124(1), 54–74. doi:10.1037/0033-2909.124.1.54

Pelletier, L. G. (2002). A motivational analysis of self-determination for pro-environmental

behaviors. In E. L. Deci, & R. M. Ryan (Eds.), *The Handbook of Self-Determination Research* (pp. 205-232). Rochester, N. Y.: University of Rochester Press.

Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are

you doing things for the environment? The Motivation Toward the Environment Scale (MTES). *Journal of Applied Social Psychology*, 28(5), 437–468. doi:10.1111/j.1559-

1816.1998.tb01714.x

- Prince, S. A., Adamo, K. B., Hamel, M. E., Hardt, J., Gorber, S. C., & Tremblay, M. (2008). A comparison of direct versus self-report measures for assessing physical activity in adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 5(1), 56. doi:10.1186/1479-5868-5-56
- Radel, R., Sarrazin, P., & Pelletier, L. (2009). Evidence of subliminally primed motivational orientations: The effects of unconscious motivational processes on the performance of a new motor task. *Journal of Sport & Exercise Psychology*, 31(5), 657–674.
- Ratelle, C. F., Guay, F., Vallerand, R. J., Larose, S., & Senécal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of Educational Psychology*, 99(4), 734–746. doi:2007-17712-004
- Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin*, 26(4), 419–435. doi:10.1177/0146167200266002
- Renaud-Dubé, A., Taylor, G., Lekes, N., Koestner, R. et Guay, F. (2010). Adolescents' motivation toward the environment: Age-related trends and correlates. *Canadian Journal of Behavioural Science*, 42, 194-199. doi:2010-14875-007
- Rogers, C. (1963). The actualizing tendency in relation to “motives” and to consciousness. In M. R. Jones (Ed.), *Nebraska Symposium on Motivation* (Vol. 11, pp. 1–24). Lincoln, NE: University of Nebraska Press.
- Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality*, 63(3), 397–427. doi:10.1111/j.1467-6494.1995.tb00501.x

- Ryan, R. M., & Deci, E. L. (2000). The darker and brighter sides of human existence: Basic psychological needs as a unifying concept. *Psychological Inquiry*, 11(4), 319–338.
doi:10.1207/S15327965PLI1104_03
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52, 141–166.
doi:10.1146/annurev.psych.52.1.141
- Ryan, R. M., & Deci, E. L. (2006). Self-regulation and the problem of human autonomy: Does psychology need choice, self-determination, and will?. *Journal of Personality*, 74, 1557-1586. doi:10.1111/j.1467-6494.2006.00420.x
- Ryan, R. M., Deci, E. L., Grolnick, W. S., & La Guardia, J. G. (2006). The significance of autonomy and autonomy support in psychological development and psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental Psychopathology: Theory and Method* (Vol 1, pp. 795-849). New Jersey: John Wiley & Sons, Inc.
- Ryan, R. M., Huta, V., & Deci, E. L. (2008). Living well: A self-determination theory perspective on eudaimonia. *Journal of Happiness Studies*, 9, 139-170.
doi:10.1007/s10902-006-9023-4
- Ryan, R. M., Stiller, J., & Lynch, J. H. (1994). Representations of relationships to teachers, parents, and friends as predictors of academic motivation and self-esteem. *Journal of Early Adolescence*, 14, 226–249. doi:10.1177/027243169401400207
- Ryan R. M., Weinstein N., Bernstein J., Brown K. W., Mistretta L., & Gagné M. (2010). Vitalizing effects of being outdoors and in nature. *Journal of Environmental Psychology*, 30, 159–168. doi:10.1016/j.jenvp.2009.10.009

- Schneider, W., & Shiffrin, R. M. (1977). Controlled and automatic human information processing: Detection, search, and attention. *Psychological Review*, 84(1), 1–66.
doi:10.1037/0033-295X.84.1.1
- Schultz, P. W. (2002). "Inclusion with nature: The psychology of human-nature relations". In P. W. Schmuck & W. P. Schultz (Eds.), *Psychology of Sustainable Development*. (pp. 62-78). Norwell, MA: Kluwer Academic.
- Schultz, P. W., & Zelezny, L. C. (1998). Values and proenvironmental behaviour. A five-country study. *Journal of Cross-Cultural Psychology*, 29, 540–558.
doi:10.1177/0022022198294003
- Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 10, pp. 221-279). San Diego: Academic Press.
- Scott, J. F. (1972). *Internalization of Norms: A Sociological Theory of Moral Commitment*. Englewood Cliffs, N.J: Prentice Hall.
- Séguin, C., Pelletier, L. G., & Hunsley, J. (1998). Toward a model of environmental activism. *Environment and Behavior*, 30, 628–652. doi:10.1177/001391659803000503
- Sheldon, K. M., & Elliot, A. J. (1998). Not all personal goals are personal: Comparing autonomous and controlled reasons for goals as predictors of effort and attainment. *Personality and Social Psychology Bulletin*, 24(5), 546–557.
doi:10.1177/0146167298245010
- Sheldon, K. M., & Elliot, A. J. (1999). Goal striving, need-satisfaction, and longitudinal well-being: The self-concordance model. *Journal of Personality and Social Psychology*, 76, 482-497. doi:10.1037/0022-3514.76.3.482

- Sheldon, K. M., & Houser-Marko, L. (2001). Self-concordance, goal attainment, and the pursuit of happiness: Can there be an upward spiral? *Journal of Personality and Social Psychology*, 80(1), 152–165. doi:10.1037/0022-3514.80.1.152
- Sheldon, K. M., & Schöler, J. (2011). Wanting, having, and needing: Integrating motive disposition theory and self-determination theory. *Journal of Personality and Social Psychology*, 101(5), 1106–1123. doi:10.1037/a0024952
- Sniehotta, F. F., Schwarzer, R., Scholz, U., & Schüz, B. (2005). Action planning and coping planning for long-term lifestyle change: Theory and assessment. *European Journal of Social Psychology*, 35(4), 565–576. doi:10.1002/ejsp.258
- Soenens, B., Berzonsky, M. D., Dunkel, C. S., Papini, D. R., & Vansteenkiste, M. (2011). Are all identity commitments created equally? The importance of motives for commitment for late adolescents' personal adjustment. *International Journal of Behavioral Development*, 35(4), 358–369. doi:10.1177/0165025411405954
- Sparks, P., Hinds, J., Curnock, S. & Pavey, L. (2014). Connectedness and its consequences: A study of relationships with the natural environment. *Journal of Applied Social Psychology*, 44 (3), 166-174. doi:10.1111/jasp.12206
- Sparks, P., & Shepherd, R. (1992). Self-identity and the theory of planned behavior: Assessing the role of identification with “green consumerism.” *Social Psychology Quarterly*, 55(4), 388. doi:10.2307/2786955
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. doi:10.1016/j.jenvp.2008.10.004

- Stern, P. C., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, 6, 81-95.
- Sutton, S. (1994). The past predicts the future: Interpreting behaviour-behaviour relationships in social psychological models of health behaviour. In D. R. Rutter & L. Quine, (Eds.), *Social Psychology and Health: European Perspectives* (pp. 71–88). Brookfield, VT, US: Avebury/Ashgate Publishing Co.
- Thøgersen, J., & Ölander, F. (2003). Spillover of environment-friendly consumer behaviour. *Journal of Environmental Psychology*, 23(3), 225–236. doi:10.1016/S0272-4944(03)00018-5
- Triandis, H. C. (1977). *Interpersonal Behavior*. Monterey, CA: Brooks/Cole.
- Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 29, pp. 271-360). San Diego, CA: Academic Press.
- Verplanken, B. (2006). Beyond frequency: Habit as mental construct. *British Journal of Social Psychology*, 45(3), 639–656. doi:10.1348/014466605X49122
- Verplanken, B. (2010a). Old habits and new routes to sustainable behaviour. In L. Whitmarsh, S. O'Neill, & I. Lorenzoni (Eds.), *Engaging the Public with Climate Change: Behaviour Change and Communication* (pp. 17–30). London: Earthscan. Retrieved from <http://www.aps.org/units/fps/newsletters/201201/schroeder.cfm>
- Verplanken, B. (2010b). By force of habit. In A. Steptoe, K. Freedland, J. Jennings, M. Llabre, S. Manuck, & E. Susman (Eds.), *Handbook of Behavioral Medicine: Methods and Applications* (pp. 73–82). New York: Springer.

- Verplanken, B., & Aarts, H. (1999). Habit, attitude, and planned behaviour: Is habit an empty construct or an interesting case of goal-directed automaticity? *European Review of Social Psychology*, 10, 101-134. doi:10.1080/14792779943000035
- Verplanken, B., Aarts, H., Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *British Journal of Social Psychology*, 37(1), 111–128. doi:10.1111/j.2044-8309.1998.tb01160.x
- Verplanken, B., Aarts, H., van Knippenberg, A., & van Knippenberg, C. (1994). Attitude versus general habit: Antecedents of travel mode choice. *Journal of Applied Social Psychology*, 24(4), 285–300. doi:10.1111/j.1559-1816.1994.tb00583.x
- Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-report index of habit strength. *Journal of Applied Social Psychology*, 33(6), 1313–1330. doi:10.1111/j.1559-1816.2003.tb01951.x
- Verplanken, B. & Wood, W. (2006). Interventions to break and create consumer habits. *Journal of Public Policy & Marketing*, 25(1), 90-103. doi:10.1509/jppm.25.1.90
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the motivation toward the environment scale. *Environment and Behavior*, 35(4), 486–505. doi:10.1177/0013916503035004003
- Vygotsky, L. S., Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1980). *Mind in Society: Development of Higher Psychological Processes*. Cambridge: Harvard University Press.
- Wallis, K. C. & Poulton, J., L. (2001). *Internalization: The Origin and Construction of Internal Reality*. Buckingham, UK: Open University Press. Retrieved from <http://www.mcgrawhill.co.uk/openup/chapters/0335203051.pdf>

- Webb, T. L., Benn, Y., & Chang, B. P. I. (2014). Antecedents and consequences of monitoring domestic electricity consumption. *Journal of Environmental Psychology, 40*, 228–238. doi:10.1016/j.jenvp.2014.07.001
- Webb, O. J., & Eves, F. F. (2007a). Promoting stair climbing: effects of message specificity and validation. *Health Education Research, 22*(1), 49–57. doi:10.1093/her/cyl045
- Webb, O. J., & Eves, F. F. (2007b). Effects of environmental changes in a stair climbing intervention: Generalization to stair descent. *American Journal of Health Promotion, 22*(1), 38–44. doi:10.4278/0890-1171-22.1.38
- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132*(2), 249–268. doi:10.1037/0033-2909.132.2.249
- Webb, T. L., Sheeran, P., & Luszczynska, A. (2009). Planning to break unwanted habits: Habit strength moderates implementation intention effects on behaviour change. *The British Journal of Social Psychology / the British Psychological Society, 48*(3), 507–523. doi:10.1348/014466608X370591
- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin, 35*(10), 1315–1329. doi:10.1177/0146167209341649
- Weinstein N., Przybylski A. K., & Ryan R. M. (2012). The index of autonomous functioning: Development of a scale of human autonomy. *Journal of Research in Personality, 46*, 397–413. doi:10.1016/j.jrp.2012.03.007

- Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2013). The integrative process: New research and future directions. *Current Directions in Psychological Science*, 22, 69-74. doi:10.1177/0963721412468001
- Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30(3), 305–314. doi:10.1016/j.jenvp.2010.01.003
- Williams, G. C., McGregor, H. A., Sharp, D., Levesque, C. S., Kouides, R. W., Ryan, R. M., & Deci, E. L. (2006). Testing a self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychology*, 25, 91-101. doi:10.1037/0278-6133.25.1.91
- Wittenbraker, J., Gibbs, B. L., & Kahle, L. R. (2006). Seat belt attitudes, habits, and behaviors: An adaptive amendment to the Fishbein model. *Journal of Applied Social Psychology*, 13(5), 406–421. doi:10.1111/j.1559-1816.1983.tb01748.x
- Wood, W., & Neal, D. T. (2009). The habitual consumer. *Journal of Consumer Psychology*, 19(4), 579–592. doi:10.1016/j.jcps.2009.08.003
- Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of Personality and Social Psychology*, 83(6), 1281–1297. doi:10.1037/0022-3514.83.6.1281
- Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology*, 88(6), 918–933. doi:10.1037/0022-3514.88.6.918
- Zelenski, J. M., & Nisbet, E. K. (2014). Happiness and feeling connected: The distinct role of nature relatedness. *Environment and Behavior*, 46(1), 3–23. doi:10.1177/0013916512451901

Appendix A Study Recruitment Description

Study 1 (Survey ID:96194)

Title: How do you get to school? A study of transportation habits

The purpose of this study is to explore how habits are made. This study is composed of one 30-minute online survey. During the online survey session you will be asked to complete a questionnaire about your transportation intentions, level of habit, feelings about the behaviour, motivation, your well-being, and basic demographic information.

Study 2 (Survey ID 19764)

Title: Survey: Tell us about your habits and motivation

Fill out a survey about your habits (~15 min).

The purpose of this study is to explore how office habits are made and is part of my PhD research. You will complete a questionnaire about your intentions, level of habit for a random office behaviour, motivation, well-being, and basic demographic information.

Open the link below in a new web page. Complete the online survey. Return to this page to enter the code found at the end of the survey. This random code will grant you your remuneration.

<http://www.pelletiermotlab.uottawa.ca/survey/index.php?sid=19764&lang=en>

Thank you very much

Study 3 and 6 (Survey ID 75582)

(Note Study 3 and 6 come from the same large sample that was randomly split into two smaller samples).

Title: How are habits made? What's your motivation?

The purpose of this study is to explore how habits are made. This study is composed of one 30-minute online survey. During the online survey session you will be asked to complete a questionnaire about your intentions, level of habit, feelings about the behaviour, motivation, your well-being, and basic demographic information.

Study 4 (Survey ID:62941)

Title: How are habits made? What's your motivation?

The purpose of this study is to explore how habits are made. This study is composed of one 30-minute online survey. During the online survey session you will be asked to complete a questionnaire about your intentions, level of habit, feelings about behaviours, motivation, your well-being, and basic demographic information.

Study 5 (Survey ID 61223 and 23798 combined)

Title: How are habits made? What's your motivation?

The purpose of this study is to explore your level of participation in daily behaviours and how it relates to your personality, motivation, and well-being. This study is composed of one 30-minute online survey. During the online survey session you will be asked to complete a questionnaire about your intentions, level of habit, and feelings about behaviours, plus your motivation, your well-being, and basic demographic information.

Appendix B Measures

Below includes the measures from all six studies of this thesis. Not all measures were included in all studies and some wordings were changed depending on the target behaviours included in the survey or the population. Thus, measures below are identified as being included in all studies (ALL) or are identified with the corresponding study number (Study 1).

DEMOGRAPHICS

Demographics (ALL)

Sex: Female / Male

Age: _____

First spoken language: English / French / Other

Where do you currently live? Ottawa / Gatineau / Other

Do you live in campus residence? ☐ yes ☐ no

Socioeconomic status

Think of this scale as representing people's social standing in Canada. At the RIGHT of the scale are the people who are the best off (those who have the most money, the most education and the most respected jobs). At the LEFT are the people who are the worst off (those who have the least money, the least education and the least respected jobs or no job). Where would you place yourself on this scale?

Sliding scale from Worst off (1) to Best off (10)

Demographics in Study 1 only

Do you have a valid drivers licence? ☐ yes ☐ no

How often do you have reliable use of a car? (0 = never to 7 = always)

Demographics in Study 2 only

In which country do you currently live?

Do you live in campus residence? ☐ yes ☐ no was not included

Think of this scale as representing people's social standing in your country. At the RIGHT of the scale are the people who are the best off (those who have the most money, the most education and the most respected jobs). At the LEFT are the people who are the worst off (those who have the least money, the least education and the least respected jobs or no job). Where would you place yourself on this scale?

Sliding scale from Worst off (1) to Best off (10)

In Study 3 and 6 only

Nothing different

Demographics in Study 4 only

Where did you live growing up? Ottawa / Gatineau / Other

Which situation best reflects your current computer use most of the time?

Use a personal computer

Use the school computers

Use a shared household computer

Other

Which situation best reflects your current printer use most of the time?

Use a personal printer

Use the school printers

Use a shared household printer

Other

Which situation best reflects your current printer availability? I can use ... (check all that apply)

the school printers

a personal printer

a shared household printer

Other

In Study 5 only

Nothing different

INSTRUCTIONS 1

Preceded by demographic questions. Followed by all remaining questions.

In Study 2, 3, 4, 5, and 6

In the next few pages you will be asked about your intentions and habits about 3 everyday office behaviours that have been randomly selected from a pool of 25 possible behaviours. Please answer as honestly as you can for the selected behaviours.

HABIT

Frequency Study 1

In an average WEEK, how many ONE WAY trips do you take on public transportation? Please check one.* (Target behaviour)

* A one way trip is defined as a trip from point A to point B. A trip from home to school would be one trip and from school back home would be counted as a second trip.

0	1-4	5-8	9-12	13-16	17-20	21-24	25-28	More than 28 trips

In an average WEEK, how many ONE WAY trips do you take in a car? Please check one. (Competing behaviour)

* A one way trip is defined as a trip from point A to point B. A trip from home to school would be one trip and from school back home would be counted as a second trip.

0	1-4	5-8	9-12	13-16	17-20	21-24	25-28	More than 28 trips

Frequency Study 2, 3, 5 and 6

In an average WEEK, how often do you recycle your paper products?

Never Some Always
1 2 3 4 5 6 7 8 9 10

Frequency Study 3 and 6

In an average WEEK, how often do you put paper products in the garbage?

Never Some Always
1 2 3 4 5 6 7 8 9 10

Frequency Study 4

In an average WEEK, when you use a printer to print documents how often do you print papers on both side of the paper?

Never Some Always
1 2 3 4 5 6 7 8 9 10

Habit Strength (All)

The Self-Report Habit Index

(Behaviour XXX) is something ...

1. ... I do frequently.
2. ... I do automatically.
3. ... I do without having to consciously remember.
4. ... that makes me feel weird if I do not do it.
5. ... I do without thinking.
6. ... would require effort not to do it.
7. ... that belongs to my (daily, weekly, monthly) routine.
8. ... I start doing before I realize I'm doing it.
9. ... I would find hard not to do.
10. ... I have no need to think about doing.
11. ... that's typically 'me'.
12. ... I have been doing for a long time.

Note: the items are accompanied by 7-item response scales that are anchored by agree – disagree

Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self-report index of habit strength. *Journal of Applied Social Psychology*, 33, 1313-1330.

Behavioural Interference Study 1

What is your current form of transportation?

Driving a motorized vehicle

Car pool

Walking

Public transportation

Bicycle

What is your preferred form of transportation?

Driving a motorized vehicle

Car pool

Walking

Public transportation

Bicycle

To what extent does your current form of transportation (XXX) conflict with your preferred form of transportation (XXX)?

No conflict

Some conflict

Strong conflict

1

2

3

4

5

6

7

To what extent are taking public transportation and driving a car are activities conflict for you personally?

No conflict

Some conflict

Strong conflict

1

2

3

4

5

6

7

Behavioural Interference Study 2, 3, 5 and 6

What is your current form of paper disposal (used most often)?

Recycle

Throw in the garbage

Compost

Re-use

What is your preferred form of paper disposal?

Recycle

Throw in the garbage

Compost

Re-use

To what extent does your current disposal method (XXX) conflict or interfere with your preferred disposal method (XXX)?

No conflict

Some conflict

Strong conflict

1

2

3

4

5

6

7

Behavioural Interference Study 4

What is your current form of document printing (used most often)?

One sided printing

Double sided printing

I do not print on paper

What is your preferred form of document printing?

One sided printing

Double sided printing

I do not print on paper

To what extent does your current printing method (XXX) conflict or interfere with your preferred printing method (XXX)?

No conflict

Some conflict

Strong conflict

1

2

3

4

5

6

7

Habit Study 1

How do you know when a behaviour has become a habit for you?

Are you currently habitual about taking public transportation?

No habit

Some habit

Strong habit

1

2

3

4

5

6

7

Are you currently habitual about driving a car?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Habit Study Study 2, 3, 5 and 6

Do you currently have a habit for recycling all your paper products?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Do you currently have a habit for recycling in general?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Habit Study 3 and 6

Are you currently habitual about putting all your paper products in the garbage?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Are you currently habitual about throwing things in the garbage in general?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Habit Study 4

Are you currently habitual about printing on both sides of all your papers?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Are you currently habitual about reducing printing in general?

No habit			Some habit			Strong habit
1	2	3	4	5	6	7

Response Frequency Measure of Habit (RFM) Study 1

Assume you want to do the following things. Which travel mode are you most likely to use?

Please answer spontaneously.

Visiting a friend in a nearby town.

1. Going to the city centre.
2. Visiting a pub in the evening.
3. Taking an excursion in nice weather.
4. Shopping for daily needs.
5. Going to school or work.

Select from:

Driving a car
 Car pool
 Walking
 Public transportation
 Bicycle
 Other

Response Frequency Measure of Habit (RFM) Study 2, 3, 4 and 6

Assume you want to dispose of the following things. Which disposal methods are you most likely to use? Please answer spontaneously.

1. Paper (when at work / school)
2. Paper towel
3. Old electronics
4. Glass jars
5. Plastic bottles
6. Paper (when at home)

Select from:

Recycle
 Put in the garbage
 Compost
 Re-use
 Other

INSTRUCTIONS 2

Preceded by demographics, habit, and conflict questions. Followed by all remaining questions.

In Study 2 and 4

Now you will be asked question about different things that influence habits. Some of these questions are at the personal or individual level, some are at the organizational level, and some are related to the environment around you. Please answer as honestly as you can for each of the questions. There are no right or wrong answers.

DETERMINANTS

Motivation Toward The Environment (All)

WHY ARE YOU DOING THINGS FOR THE ENVIRONMENT?

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

Does not Correspond at all - Corresponds Moderately - Corresponds Exactly (1 to 7)

1. For the pleasure I experience while I am mastering new ways of helping the environment.
2. Honestly, I don't know; I truly have the impression that I'm wasting my time doing things for the environment.
3. For the pleasure I experience when I find new ways to improve the quality of the environment.
4. Because it is a reasonable thing to do to help the environment.
5. Because I like the feeling I have when I do things for the environment.
6. I don't really know; I can't see what I'm getting out of it.
7. I think I'd regret not doing something for the environment.
8. I wonder why I'm doing things for the environment; the situation is simply not improving.
9. For the pleasure I get from contributing to the environment.
10. Because it's a sensible thing to do in order to improve the environment.
11. Because it's a way I've chosen to contribute to a better environment.
12. Because other people will be upset if I don't.
13. For the recognition I get from others.
14. Because I would feel bad if I didn't do anything for the environment.
15. Because taking care of the environment is an integral part of my life.
16. Because my friends insist that I do it.
17. Because it seems to me that taking care of myself and taking care of the environment are inseparable.
18. Because I would feel guilty if I didn't.
19. Because being environmentally-conscious has become a fundamental part of who I am.
20. Because it's part of the way I've chosen to live my life.
21. Because I would feel ashamed of myself if I was doing nothing to help the environment.
22. Because I think it's a good idea to do something about the environment.
23. To avoid being criticized.
24. I don't know; I can't see how my efforts to be environmentally-conscious are helping the environmental situation.

Pelletier, L.G., Tuson, K.M., Green-Demers, I., Noels, K. & Beaton, A.M. (1998). Why are you doing things for the environment? The Motivation Toward the Environment Scale (MTES). *Journal of Applied Social Psychology* 28 (5), 437–68.

Nature Relatedness (All)

For each of the following, please rate the extent to which you agree with each statement. Please respond as you really feel, rather than how you think “most people” feel.

1. My ideal vacation spot would be a remote, wilderness area
2. I always think about how my actions affect the environment
3. My connection to nature and the environment is a part of my spirituality
4. I take notice of wildlife wherever I am
5. My relationship to nature is an important part of who I am
6. I feel very connected to all living things and the earth

A 9-point Likert scale ranging from 1 (disagree strongly) to 9 (agree strongly).

Nisbet, E. K., & Zelenski, J. M. (2013). The NR-6: A new brief measure of nature relatedness. *Frontiers in Psychology*, 4(813), 1-11. doi: 10.3389/fpsyg.2013.00813

Environmental Importance (All)

YOUR IMPRESSIONS ABOUT THE ENVIRONMENT

Using the 1-10 scale below, please indicate the extent to which each of the following statements describe your thoughts about the environment.

1. I feel that the seriousness of the environmental situation has been blown out of proportion.
2. I am very concerned about the impact that the present environmental problems might have on future generations.
3. I feel that we must make changes in the way we treat the environment as quickly as possible.
4. Quite honestly, I'm not too concerned with the environment.

Does not correspond at all

Corresponds moderately

Corresponds exactly

1 2 3 4 5 6 7 8 9 10

CONSEQUENCES

Intentions Study 1

Think about your transportation behaviour over the last year and how you currently think about the way you choose to get around.

Do you intend to increase your use of public transportation?

No intention

Moderate intention

Definitely

1 2 3 4 5 6 7

Are you currently trying to increase the amount you travel by motorized vehicle?

No intention

Moderate intention

Definitely

1 2 3 4 5 6 7

Intentions Study 2, 3 and 6

Think about your paper recycling behaviour over the last year and how you currently choose to dispose of waste and answer the following questions.

Do you intend to increase how much you recycle paper?

No intention

Moderate intention

Definitely

1	2	3	4	5	6	7
Do you intend to increase the amount of paper you throw in the garbage?						
No intention			Moderate intention			Definitely
1	2	3	4	5	6	7

Intentions Study 4

Think about your printing behaviour over the last year and how you currently think about the way you choose to print documents.

Do you intend to increase the amount you print two sided?

No intention			Moderate intention			Definitely
1	2	3	4	5	6	7

Do you intend to increase how much you print one sided?

No intention			Moderate intention			Definitely
1	2	3	4	5	6	7

Pro-Environmental Behaviours¹ Study 1

We are interested in various everyday environmental behaviours. Please indicate, using the rating scales below, how often (frequency) you do the following activities during an average month and how challenging (difficulty) the activities are to do:

HOW OFTEN DID YOU DO THE FOLLOWING ACTIVITIES THIS MONTH?

Using the 1-7 scale below (Not very often) to (Very often), please indicate how frequently you engaged in the activities listed below this month.

HOW DIFFICULT DO YOU FIND THE FOLLOWING ACTIVITIES?

Using the 1-7 scale below (Extremely difficult) to (Extremely easy), please indicate how challenging you find in the activities listed below.

1. Recycle
2. Turn off lights when not home
3. Use environmentally friendly forms of transportation (e.g., bike, walk, car-pool, bus) to conserve gasoline consumption
4. Avoid buying products with excessive packaging
5. Pass along information to friends regarding how they can help the environment
6. Reuse lunch or grocery bags
7. Minimize amount of water used
8. Seek out information on what can be done to help the environment
9. Buy recycled products (e.g., recycled paper, paper towels)
10. Let others know when their behaviours are not environmentally friendly
11. Buy in bulk
12. Reuse plastic containers

1 Corresponding target pro-environmental behaviours were not included in the calculation of the composite scores of pro-environmental behaviours measures for any of the six studies.

13. Participate in events organized by ecological groups
14. Circulate a petition demanding an improvement of government policies regarding the environment
15. Participate in protests about actual environmental conditions
16. Buy less stuff

Pro-Environmental Behaviours Study 2

We are interested in various everyday environmental behaviours. Please indicate, using the rating scales below, how often (frequency) you do the following activities during an average WEEK and how challenging (difficulty) the activities are to do:

HOW OFTEN DID YOU DO THE FOLLOWING ACTIVITIES THIS WEEK?

Using the 1-7 scale below (Not very often) to (Very often), please indicate how frequently you engaged in the activities listed below this week.

Not applicable = 8

HOW DIFFICULT DO YOU FIND THE FOLLOWING ACTIVITIES?

Using the 1-7 scale below (Extremely difficult) to (Extremely easy), please indicate how challenging you find in the activities listed below.

1. Separate kitchen waste to be composted from the rest of garbage
2. Participate in events organized by ecological groups
3. Unplug electronics for extended absences
4. Turn off lights when you leave a room
5. Leave this question blank (validity question, is not included in the scale calculation.)
6. Buy less stuff
7. Write to a politician about an environmental concern
8. Used an environmental method of travel to work / school when it is nice outside (walk, bike, bus, car pool, ...)
9. Used an environmental method of travel to work / school when it is not nice outside (walk, bike, bus, car pool, ...)
10. Print double sided

Pro-Environmental Behaviours Study 3 and 6

We are interested in various everyday environmental behaviours. Please indicate, using the rating scales below, how often (frequency) you do the following activities during an average WEEK and how challenging (difficulty) the activities are to do:

HOW OFTEN DID YOU DO THE FOLLOWING ACTIVITIES THIS WEEK?

Using the 1-7 scale below (Not very often) to (Very often), please indicate how frequently you engaged in the activities listed below this week.

Not applicable = 8

HOW DIFFICULT DO YOU FIND THE FOLLOWING ACTIVITIES?

Using the 1-7 scale below (Extremely difficult) to (Extremely easy), please indicate how challenging you find in the activities listed below.

1. Recycle paper products

2. Use energy-saving lights
3. Recycle glass products
4. Use reusable grocery bags
5. Participate in protests about environmental conditions
6. Use green cleaning products
7. Participate in events organized by ecological groups
8. Purchase organic foods
9. Unplug electronics for extended absences
10. Reduce heating in certain rooms
11. Use a clothesline or drying rack
12. Use fans in the summer rather than air conditioning
13. Close the curtains on hot days
14. Turn off lights when you leave a room
15. Dress warmer instead of increasing the temperature
16. Turn off the tap when brushing teeth
17. Ensure that the washing machine is full before turning it on
18. Ensure that the dishwasher is full before turning it on
19. Separate kitchen waste to be composted from the rest of garbage
20. Purchase better-quality items even though they may be more expensive
21. Buy less stuff
22. Lower the temperature when asleep
23. Recycle plastic products
24. Write to a politician about an environmental concern
25. Circulate a petition demanding the improvement of government policies regarding the environment
26. Recycle metal products
27. Used an environmental method of travel to school during the colder months (walk, bike, bus, car pool, ...)
28. Used an environmental method of travel to school during the warmer months (walk, bike, bus, car pool, ...)

Pro-Environmental Behaviours Study 4

We are interested in various everyday environmental behaviours. Please indicate, using the rating scales below, how often (frequency) you do the following activities during an average WEEK and how challenging (difficulty) the activities are to do:

HOW OFTEN DID YOU DO THE FOLLOWING ACTIVITIES THIS WEEK?

Using the 1-7 scale below (Not very often) to (Very often), please indicate how frequently you engaged in the activities listed below this week.

Not applicable = 8

HOW DIFFICULT DO YOU FIND THE FOLLOWING ACTIVITIES?

Using the 1-7 scale below (Extremely difficult) to (Extremely easy), please indicate how challenging you find in the activities listed below.

Pro-Environmental Behaviours

1. Participate in events organized by ecological groups
2. Use a clothes line or drying rack (air dry clothes)
3. Turn off lights when you leave a room
4. Turn off computer at the end of the day
5. Recycle paper products
6. Use reusable grocery bags
7. Circulate a petition demanding the improvement of government policies regarding the environment
8. Used an environmental method of travel to school during the colder months (walk, bike, bus, car pool, ...)
9. Used an environmental method of travel to school during the warmer months (walk, bike, bus, car pool, ...)
10. Print double sided
11. Buy less stuff
12. Buy local products

Non-Environmental Behaviours

1. Drive to school
2. Throw unfinished food in the garbage
3. Have a full hot bath
4. Leave computer on standby
5. Wash clothes in hot water
6. Circulate a petition demanding the improvement of government policies regarding the economy
7. Write to a politician about an environmental concern
8. Use the dryer to get wrinkles out of your outfit
9. Run the tap when brushing your teeth
10. Double bag your groceries in plastic
11. Write a politician to improve roadways and / or increase parking
12. Litter
13. Buy bottled water

Pro-Environmental Behaviours Study 5

We are interested in various everyday environmental behaviours. Please indicate, using the rating scales below, how often (frequency) you do the following activities during an average WEEK and how challenging (difficulty) the activities are to do:

HOW OFTEN DID YOU DO THE FOLLOWING ACTIVITIES THIS WEEK?

Using the 1-7 scale below (Not very often) to (Very often), please indicate how frequently you engaged in the activities listed below this week.

Not applicable = 8

HOW DIFFICULT DO YOU FIND THE FOLLOWING ACTIVITIES?

Using the 1-7 scale below (Extremely difficult) to (Extremely easy), please indicate how challenging you find in the activities listed below.

1. Recycle paper products

2. Use energy-saving lights
3. Recycle glass products
4. Use reusable grocery bags
5. Participate in protests about environmental conditions
6. Use green cleaning products
7. Participate in events organized by ecological groups
8. Purchase organic foods
9. Unplug electronics for extended absences
10. Reduce heating in certain rooms
11. Use a clothesline or drying rack
12. Use fans in the summer rather than air conditioning
13. Close the curtains on hot days
14. Turn off lights when you leave a room
15. Dress warmer instead of increasing the temperature
16. Turn off the tap when brushing teeth
17. Ensure that the washing machine is full before turning it on
18. Ensure that the dishwasher is full before turning it on
19. Separate kitchen waste to be composted from the rest of garbage
20. Purchase better-quality items even though they may be more expensive
21. Buy less stuff
22. Lower the temperature when asleep
23. Recycle plastic products
24. Write to a politician about an environmental concern
25. Circulate a petition demanding the improvement of government policies regarding the environment
26. Recycle metal products
27. Used an environmental method of travel to school during the colder months (walk, bike, bus, car pool, ...)
28. Used an environmental method of travel to school during the warmer months (walk, bike, bus, car pool, ...)

Life Satisfaction (All)

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

7 - Strongly agree 6 - Agree 5 - Slightly agree 4 - Neither agree nor disagree 3 - Slightly disagree
2 - Disagree 1 - Strongly disagree

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

Diener, Emmons, Larsen & Griffin, 1985 The Satisfaction With Life Scale Journal of Personality Assessment Vol.49 No.1

William Pavot and Ed Diener Psychological Assessment Vol.5 No.2 164-172 1993 Review of the Satisfaction With Life Scale

Study 5 included additional measures of well-being not included in the current thesis.

Instructions

The next set of questions ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable choice.

Perceived Stress

1. In the last month, how often have you ...
2. been upset because of something that happened unexpectedly
3. felt that you were unable to control the important things in your life?
4. felt nervous and stressed?
5. dealt successfully with day-to-day problems and annoyances?
6. felt that you were effectively coping with important changes that were occurring in your life?
7. felt confident about your ability to handle your personal problems?
8. felt things were going your way?
9. found that you could not cope with all the things you had to do?
10. been able to control the irritations in your life?
11. felt that you were on top of things?
12. been angered because of things that happened that were outside of your control?
13. found yourself thinking about things that you have to accomplish?
14. been able to control the way you spend your time?
15. felt difficulties were piling up so high that you could not overcome them?

Never	Almost Never	Sometimes	Fairly often	Very often
0	1	2	3	4

Cohen, S., Kamarck, T., Mermelstein, R. (1983). A global measure of perceived stress. Journal of Health and Social Behavior, 24, 385-396.

Meaning

Please take a moment to think about what makes your life and existence feel important and significant to you. Please respond to the following statements as truthfully and accurately as you can, and also please remember that these are very subjective questions and that there are no right or wrong answers. Select how true or untrue each statement is for you.

1. I understand my life's meaning.
2. I am looking for something that makes my life feel meaningful.
3. I am always looking to find my life's purpose.
4. My life has a clear sense of purpose.
5. I have a good sense of what makes my life meaningful.
6. I have discovered a satisfying life purpose.
7. I am always searching for something that makes my life feel significant.
8. I am seeking a purpose or mission for my life.
9. My life has no clear purpose.
10. I am searching for meaning in my life.

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

Affect

Please indicate the degree to which you have experienced each of the following moods during the past year.

1. Happy
2. Joyful
3. Pleased
4. Enjoyment/Fun
5. Depressed/Blue
6. Unhappy
7. Frustrated
8. Angry/Hostile
9. Worried/Anxious

Not at all			Moderately			Extremely
1	2	3	4	5	6	7

Appendix C Consent Forms

Study 1

CONSENT FORM

The purpose of an informed consent form is to ensure that you understand the purpose of this study and the nature of your involvement. It must provide adequate information for you to decide whether or not you wish to participate.

PLEASE PRINT A COPY OF THIS FORM FOR YOUR RECORDS

I agree to participate in the present online study. This research project, from the Human Motivation research laboratory, is funded by the CIHR. The purpose of this study is to explore how habits are made. My participation in this study will provide the researchers, the academic community, decision-makers, and the general public with valuable information about the links between habits, motivation, and successful behaviour change.

My participation in this study will consist of one online session of approximately 30 minutes, in which I will complete a questionnaire about my transportation habits, my motivation, and my well-being. As it was explained to me at the beginning of the semester, my participation in this study will grant me .5 points in my class.

There are no foreseeable psychological, physical, social, or economic risks associated with my participation in this study. I understand my participation is voluntary and I may withdraw from the study at any time without any negative consequences. I may skip survey items that I do not feel comfortable answering. My information will be kept strictly confidential. My name will never be directly associated with the results. Only the researchers of this study will have access to the collected data. The researchers will use my information for research purposes only and will not disclose any personal information. Data will be securely stored in the human motivation lab for 5 years after the publication of results.

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154 or by email at ethics@uottawa.ca.

For more information about this research I can contact:
Nicole Aitken, principle investigator, University of Ottawa
Dr. Luc Pelletier, faculty supervisor, University of Ottawa

I have read the above description of the study and understand the conditions of my involvement.
Yes No

(This was the mandatory first question. Participants would not be directed to the survey unless they selected yes to the consent form. If they selected no, they were directed to the debriefing form).

Study 2**CONSENT FORM**

The purpose of an informed consent form is to ensure that you understand the purpose of this study and the nature of your involvement. It must provide adequate information for you to decide whether or not you wish to participate.

PLEASE PRINT A COPY OF THIS FORM FOR YOUR RECORDS

I agree to participate in the present online study. This research project, from the Human Motivation research laboratory at the University of Ottawa, is funded by the CIHR. The purpose of this study is to explore how habits are made. My participation in this study will provide the researchers, the academic community, decision-makers, and the general public with valuable information about the links between habits, motivation, and successful behaviour change. My participation in this study will consist of one online session of approximately 15 minutes, in which I will complete a questionnaire about my habits, my motivation, and my well-being. There are no foreseeable psychological, physical, social, or economic risks associated with my participation in this study. I understand my participation is voluntary. I may skip survey items that I do not feel comfortable answering and I can withdraw my participation at any time by ceasing to answer questions, without penalty or loss of remuneration.

To receive remuneration please proceed to the end of the survey, obtain the unique code for this HIT, return to Mechanical Turk, and enter the code.

My information will be kept strictly confidential. My name will never be directly associated with the results. Only the researchers of this study will have access to the collected data. The researchers will use my information for research purposes only and will not disclose any personal information. Data will be securely stored in the human motivation lab for 5 years after the publication of results.

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154 or by email at ethics@uottawa.ca.

For more information about this research I can contact:
Nicole Aitken, principle investigator, University of Ottawa
Dr. Luc Pelletier, faculty supervisor, University of Ottawa

I have read the above description of the study and understand the conditions of my involvement.
Yes No

(This was the mandatory first question. Participants would not be directed to the survey unless they selected yes to the consent form. If they selected no, they were directed to the debriefing form).

Study 3 to 6**CONSENT FORM**

The purpose of an informed consent form is to ensure that you understand the purpose of this study and the nature of your involvement. It must provide adequate information for you to decide whether or not you wish to participate.

PLEASE PRINT A COPY OF THIS FORM FOR YOUR RECORDS

I agree to participate in the present online study. This research project, from the Human Motivation research laboratory, is funded by the CIHR. The purpose of this study is to explore how habits are made. My participation in this study will provide the researchers, the academic community, decision-makers, and the general public with valuable information about the links between habits, motivation, and successful behaviour change.

My participation in this study will consist of one online session of approximately 30 minutes, in which I will complete a questionnaire about my habits, my motivation, and my well-being. As it was explained to me at the beginning of the semester, my participation in this study will grant me participation points in my class as per the rules of the ISPR.

There are no foreseeable psychological, physical, social, or economic risks associated with my participation in this study. I understand my participation is voluntary and I may withdraw from the study at any time without any negative consequences. I may skip survey items that I do not feel comfortable answering. My information will be kept strictly confidential. My name will never be directly associated with the results. Only the researchers of this study will have access to the collected data. The researchers will use my information for research purposes only and will not disclose any personal information. Data will be securely stored in the human motivation lab for 5 years after the publication of results.

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154 or by email at ethics@uottawa.ca.

For more information about this research I can contact:

Nicole Aitken, principle investigator, University of Ottawa

Dr. Luc Pelletier, faculty supervisor, University of Ottawa

I have read the above description of the study and understand the conditions of my involvement.

Yes No

(This was the mandatory first question. Participants would not be directed to the survey unless they selected yes to the consent form. If they selected no, they were directed to the debriefing form).

Appendix D Debriefing Forms

Study 1

DEBRIEFING FORM

Thank you for participating in this research study on habits, motivation, and successful behaviour change. We would like to tell you more about our research and why we are interested in this topic.

PLEASE PRINT A COPY OF THIS FORM FOR YOUR RECORDS

What are we trying to learn in this research?

The main goal of this study is to explore how motivation is related to habit formation. Specifically there are two aims of this research; 1) Test if we can measure transportation habits and detect a difference between behaviour maintenance (repeating behaviour) and integrated behaviour (habit formation). 2) Explore how a conflict between a current habit (car use) and new habit (taking the bus) impacts motivation and habit formation.

Why is this important to scientists or the general public?

There is a need to examine ways to increase pro-environmental behaviours to help lessen the impact humans have on the natural world. This research is important because it may highlight ways to increase pro-environmental habits by increasing motivation.

What are our hypotheses and predictions?

It is expected that people with higher self-determined motivation will have a more integrated habit formation and higher well-being. We are hoping to differentiate between behaviour maintenance and integrated habit formation by measuring not just the frequency of the behaviour but also the strength of the habit and how people feel about the behaviour. Finally, it is expected that a stronger conflict between habits will moderate the creation of a new habit.

What if I have questions later?

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154 or by email at ethics@uottawa.ca.

For more information about this research I can contact:

Nicole Aitken, principle investigator, University of Ottawa

Dr. Luc Pelletier, faculty supervisor, University of Ottawa

Is there anything that I can do if I have worries or concerns about my well-being or the environment?

Health Services, Family Health Team: 100 Marie Curie Street (300) Ottawa, Ontario K1N 6N5

<http://www.uottawa.ca/health/family-health/>

Suzuki Nature Challenge: <http://www.davidsuzuki.org/NatureChallenge/>

The Ecology of Ottawa: <http://ecologyofottawa.org/>

Thank you for your participation.

Study 2

Instructions included before the debriefing form.

Write this number down. This is your unique code that verifies the completion of this survey.

Please return to Mechanical Turk and enter this code to receive your payment. The number is = 492296 Write this number down and then submit the survey.

DEBRIEFING FORM

Thank you for participating in this research study on habits, motivation, and successful behaviour change. We would like to tell you more about our research and why we are interested in this topic.

Please return to Mechanical Turk and enter your code to receive your remuneration.

PLEASE PRINT A COPY OF THIS FORM FOR YOUR RECORDS

What are we trying to learn in this research?

The main goal of this study is to explore how motivation is related to habit formation. Specifically there are three aims of this research; 1) Look at what types of everyday behaviours can be considered a habit (behaviours you do every day, environmental behaviours, easy behaviours, behaviours that are difficult to do). 2) Test a new way to measure everyday habits and detect a difference between behaviour maintenance (repeating behaviour) and integrated behaviour (habit formation). 3) Explore how a conflict between a current habit and new habit impacts motivation and habit formation.

Why is this important to scientists or the general public?

There is a need to examine how habits develop because such a large part of everyday behaviour is habitual behaviour. This research is important because it may highlight ways to increase positive habits by increasing motivation.

What are our hypotheses and predictions?

It is expected that people with higher self-determined motivation will have a more integrated habit formation and higher well-being. We are hoping to differentiate between behaviour maintenance and integrated habit formation by measuring not just the frequency of the behaviour but also the strength of the habit and how people feel about the behaviour. Finally, it is expected that a stronger conflict between habits will moderate the creation of a new habit.

What if I have questions later?

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154 or by email at ethics@uottawa.ca.

For more information about this research I can contact:

Nicole Aitken, principle investigator, University of Ottawa

Dr. Luc Pelletier, faculty supervisor, University of Ottawa

Is there anything that I can do if I have worries or concerns about my well-being or behaviour change?

<http://www.cmha.ca/mental-health/your-mental-health/stress/>

<http://www.apa.org/research/action/health.aspx>

Thank you for your participation.

Study 3 to 6**DEBRIEFING FORM**

Thank you for participating in this research study on habits, motivation, and successful behaviour change. We would like to tell you more about our research and why we are interested in this topic. You will receive your participation point within 48 hours.

PLEASE PRINT A COPY OF THIS FORM FOR YOUR RECORDS

What are we trying to learn in this research?

The main goal of this study is to explore how motivation is related to habit formation. Specifically there are two aims of this research; 1) Test if we can measure everyday habits and detect a difference between behaviour maintenance (repeating behaviour) and integrated behaviour (habit formation). 2) Explore how a conflict between a current habit and new habit impacts motivation and habit formation.

Why is this important to scientists or the general public?

There is a need to examine how habits develop because such a large part of everyday behaviour is habitual behaviour. This research is important because it may highlight ways to increase positive habits by increasing motivation.

What are our hypotheses and predictions?

It is expected that people with higher self-determined motivation will have a more integrated habit formation and higher well-being. We are hoping to differentiate between behaviour maintenance and integrated habit formation by measuring not just the frequency of the behaviour but also the strength of the habit and how people feel about the behaviour. Finally, it is expected that a stronger conflict between habits will moderate the creation of a new habit.

What if I have questions later?

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154 or by email at ethics@uottawa.ca.

For more information about this research I can contact:

Nicole Aitken, principle investigator, University of Ottawa

Dr. Luc Pelletier, faculty supervisor, University of Ottawa

Is there anything that I can do if I have worries or concerns about my well-being or behaviour change?

Health Services, Family Health Team: 100 Marie Curie Street (300) Ottawa, Ontario K1N 6N5
<http://www.uottawa.ca/health/>

Thank you for your participation.