The Influence of Images of Climate Change Causes, Consequences, and Solutions on the Relationships between Pro-Environmental Motivation and Change in the Intentions to Engage in Pro-Environmental Behaviors: A Comparison of Motivational Frameworks

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Thesis submitted to the University of Ottawa in partial fulfillment of the requirements for the Ph.D. degree in Psychology.

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Abstract

Some human actions are linked to the decline of the environment on a planetary scale. In order to motivate individuals to adopt pro-environmental behaviors (PEBs), it is important to understand how individuals react when exposed to persuasive messages. The goal of this program of research was to examine the influence of images of climate change causes, consequences, and solutions on the relationships between environmental motivation, psychological discomfort, discomfort compensation strategies, as well as changes in pro-environmental attitude and PEBs. In *Study 1* (N = 199), I identified visual stimuli (pictures) depicting causes, consequences or solutions to global warming to be used in *Study 2*. Also, I examined the relationship between environmental motivation and competency on the perception of these pictures. The results indicated that the pictures depicting causes or consequences were perceived more negatively than pictures depicting solutions. In addition, findings showed that regardless of the individual's perceived level of environmental competence and their type of motivation towards PEBs, individuals had a negative perception of pictures depicting causes and consequences to global warming as well as a positive perception of pictures related to solutions to global warming. In *Study 2* (N = 312), I examined the relationships between environmental motivation, psychological discomfort, discomfort compensation strategies, as well as changes in pro-environmental attitude and PEBs following the exposition to images identified in Study 1. Three models based on Self-Determination Theory (SDT), Action-Based Model, and the Hierarchical Action-Based model of Inconsistency Compensation in the Environment (HABICE) domain were examined. The results indicated that exposure to pictures alone is not enough to generate a significant change in pro-environmental attitude or PEBs. The findings showed that the SDT model was best suited to explain the process leading to PEBs changes when exposed to

pictures depicting causes of global warming. Finally, the results indicated that the HABICE model was best suited to explain changes in pro-environmental attitude when individuals are exposed to pictures depicting consequences. The HABICE was also a good model to explain the relationships among the different variables when individuals are exposed to pictures depicting solutions to global warming. Overall, this program of research contributed to both SDT and the HABICE models by supporting their conceptual framework.

Acknowledgement

This project would not have been possible without of the support of various important individuals. I would like to thank my thesis supervisor, Dr. Luc Pelletier. Luc, thank you for keeping me on my toes, encouraging me to further my reflections, supporting me in my career goals and helping me to develop confidence as a researcher. I am honored to have been supervised by such an experienced researcher.

To my thesis committee, I would like to thank all my committee members for their support and comments. Your advice allowed be to better myself as a researcher.

I would like to thank Dr. Simon Beaudry. My graduate experience would not have been as positive and fun without you. Thank you for encouraging me, believing in me, giving me advice, and making me laugh.

I would like to thank Dr. Philippe Desmarais, Dr. Daniel Baxter, Dr. Meredith Rocchi, Dr. Camille Guertin, and Kheana Barbeau for being awesome lab mates. Thank you all for your support, your advice and your encouragement. Phil, Dan, Meredith, Kheana, and Camille, thank you for taking the time to help me understand “complex” statistical analyses, to have philosophical conversations and to share funny stories. You’re the best.

I would like to thank the staff of the School of Psychology for being extraordinarily kind and sincerely having my success at heart.

I would like thank the Dorville, Pombert and Abbott families. Maman, Papa, Majo, je n’aurais pas pu me rendre aussi loin sans votre support. Merci d’avoir fait de moi une personne curieuse et résiliente.

Finally, I would like to thank all my friends. All of you allowed me to keep my spirit up.

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Chapter 1

Introduction

The decline of the environment, at a planetary scale, is a source of concern (Vlek & Steg, 2007). Some human actions are linked to a variety of environmental problems including global warming and biodiversity loss (Winter & Koger, 2014). Despite awareness of environmental conditions and efforts to motivate people to adapt environmentally responsible behaviors, the prevalence of pro-environmental behaviors (PEBs) remains relatively low in Canada. More specifically, while the majority of citizens (63.8%) report that the environment should receive more attention from the government (Institute for Social Research, 2013), only low proportions actually engage in important PEBs such as composting (23%), the installation of reduced volume toilets (27%) or of compact fluorescent light bulbs (53%) (Babooram, 2008). Furthermore, they also show an increase in harmful-environmental behaviors (HEBs) including an increase in the consumption of different types of fossil fuels (11% from 2008 to 2018) and an increase in residential waste creation (9% from 2008 to 2016) (Statistics Canada, 2015, 2018). Recent research suggests that communicating information related to environmental conditions can influence individuals' awareness and their level of activity (e.g., recycling) (Baek et al., 2015; Nebel et al., 2017). However, when we consider the frequency of PEBs over the last decades (e.g., Babooram, 2008; Statistics Canada, 2015, 2018), it is not clear whether media should emphasize portrayal of negative or positive messages to motivate individuals to change their behaviors.

The purpose of this research was thus to examine the extent to which the communication of information on climate change causes, consequences, and solutions are equally effective to motivate people to change their PEBs. In concurrence with Self-Determination Theory (SDT;

Deci & Ryan, 1985), I also examined the extent to which individuals' motivational orientation influences the level of psychological discomfort that people experience when they are exposed to different images and its relationship with PEBs. In the sections that follow, I first introduced Self-Determination Theory and examined how this theory could help us understand how different motivational orientations related to PEB. Then, I reviewed the information on the motivational influence of specific types of messages on PEBs.

Self-Determination Theory

Researchers have proposed that motivation could explain the differences in people's level of activity or inactivity towards the environment (Gifford, 2011; Osbaldiston & Sheldon, 2003; Pelletier, 2002; Pelletier et al., 1998). Over the last 30 years, SDT has emerged as a very useful theory of motivation to explain why people may be more or less motivated to do different activities (Ryan & Deci, 2017). SDT presents an organismic approach to human motivation with a focus on human's evolved inner ability for growth, personality development and behavior regulation (Deci & Ryan, 2000; Ryan & Deci, 2000). In this framework, the self can be defined as "both the psychological organization that integrates and the structure to which new functions, narratives, values, regulations, and preferences are integrated" (Ryan & Deci, 2017, p. 52). According to SDT, motivation varies in function of its quality and its origin rather than by its quantity (Ryan & Deci, 2017). SDT proposes different forms of motivation that can be situated on a self-determination continuum with self-determined types of motivation at one end and non-self-determined types of motivation at the other. When behaviors are undertaken in congruence with the self (internalization), then the behaviors are said to be self-determined (Desmarais, 2019; Ryan & Deci, 2017). The more the motives behind the behaviors are exterior to the self (partially internalized or non-internalized), the more these are non-self-determined. Based on

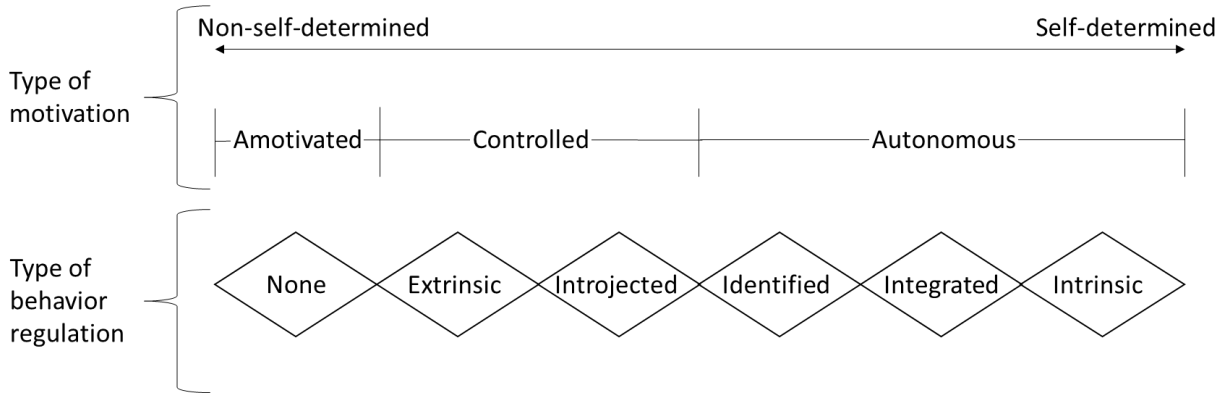
research looking at SDT and environmental behaviors, self-determined motives are related to more desirable cognitive, affective and behavioral outcomes (Desmarais, 2019; Lavergne & Pelletier, 2015). Furthermore, research indicated that different types of motivation are associated with different levels of PEBs (Desmarais, 2019; Green-Demers et al., 1997; Lavergne & Pelletier, 2015). Thus, since the concepts presented in SDT have different implications towards the integration and maintenance of behaviors in addition to being related to environmental behaviors (Pelletier et al., 2011; Ryan & Deci, 2000), I described a more in-depth look into the theory below.

Types of Motivation and Regulation

SDT proposes to distinguish between different types of motivation which are autonomous, controlled, and amotivation. These motivation types are associated to different behavioral regulation types (see Figure 1). Both motivation and regulation types can be situated on the self-determined continuum. The most self-determined motivation (SDM) type is autonomous, followed by controlled, and amotivation which represents the most non-self-determined motivation (NSDM) type (Ryan & Deci, 2000).

Figure 1

SDT Motivation Nomenclature



Autonomous motivation is present when individuals willingly engage in behaviors that are in accord with their true self including their values and core beliefs (Ryan & Deci, 2004). Furthermore, individuals engaging in behaviors with autonomous motivation perceive their behaviors to originate from within themselves (i.e., internal locus of causality) because their behaviors are driven and congruent with their sense of self, and authentic self-structures (e.g., values, beliefs) (Lavergne & Pelletier, 2015; Ryan & Deci, 2000, 2004). In the SDT framework, autonomous motivation is associated with three behavioral regulation types (Lavergne & Pelletier, 2015; Ryan & Deci, 2002, 2017). The most autonomous form of regulation, intrinsic motivation, occurs when people undertake behaviors out of interest, pleasure and satisfaction while doing a behavior (Deci & Ryan, 2000; Vallerand, 1997). The second regulation style, integrated regulation, is present when individuals participate in behaviors because it is valued and integrated harmoniously with other aspects of the self (e.g., goals, needs) (Deci & Ryan, 2000; Ryan & Deci, 2002). The least autonomous form of regulation of the three, identified regulation, is observed when individuals engage in behaviors because they value and endorse the behavior as personally important (Ryan & Deci, 2002). As an example, in an environmental behavioral context, individuals who recycle because they feel that it is important to them to mitigate pollution (identified regulation), because they value the environment and it is in congruence with their goals of not harming others (integrated regulation), or simply because they experience pleasure and satisfaction for engaging in the behavior (intrinsic regulation) all represent situations that reflect autonomous motivation. In short, these three forms of autonomous behavioral regulation are contingent on the implication of the self and the relative congruence of the behavior with the different dimensions of the self. For these reasons,

autonomous behaviors are defined as determined by the self (i.e., self-determined) (Ryan & Deci, 2002).

By comparison with autonomous motivation, controlled motivation is present when individuals engage in behaviors for motives incoherent with their authentic self-structures. Instead, they rely on their social environment and their ego-invested self-structures (e.g., prestige, self-worth) to regulate their behavior (Ryan & Deci, 2002; Vallerand, 1997). With this type of motivation, individuals are often concerned with external factors such as conformity, social norms, and instrumental gains contingent on a particular behavior (Lavergne & Pelletier, 2015; Ryan & Deci, 2000, 2017). Since the origin of the motivation does not emanate from the authentic self but rather from external factors, the perceived locus of causality of the behaviors is considered external (Lavergne & Pelletier, 2015; Ryan & Deci, 2000, 2004). Controlled motivation is associated with two regulation types, introjected and external. Introjected regulation is observed when individuals do behaviors to avoid feelings of guilt, shame or to obtain feelings of worth and reconnaissance (i.e., prestige) (Ryan & Deci, 2002). External regulation is present when people engage in behaviors to satisfy external demands often complemented by rewards or punishments (Ryan & Deci, 2000). As an example, individuals who engage in composting to avoid feeling guilty, to appear respectable in the eyes of neighbours (introjected regulation), to avoid fines, or to obtain free dirt for their garden (extrinsic regulation) represent situations where controlled motivation is present. In sum, since external factors such as rewards and punishments, and introjected demands such as a desire for prestige drive behavior, this type of motivation is considered not self-determined.

Amotivation is the least self-determined motivation type. Amotivation is characterised by the absence of intentional behavioral regulation (i.e., non-regulation) and internalization (Ryan &

Deci, 2017). This is often associated to a lack of understanding of the source or purpose of behavioral regulations (Desmarais, 2019; Pelletier et al, 1999). Amotivation is present when individuals don't feel competent engaging and maintaining a particular behavior, when they are not expecting the behavior to produce a desired outcome, or when they do not value the behavior (Pelletier et al, 1999; Ryan & Deci, 2000, 2002). Thus, amotivated individuals do not act or do so passively without having a clear understanding of the reasons for doing what they are doing (Ryan & Deci, 2000, 2002). For example, an individual could use their bicycle to commute to work but they would do so not out of concern for the environment and they may not be aware of the reasons behind engaging in such behavior. Since individuals that are amotivated do not act according to authentic self-structures, to ego-invested self-structure or to external demands, this motivation is the most non-self-determined.

SDT and Pro-Environmental Behaviors

Over the last decades, several researchers (e.g., Pelletier et al., 1998; Van der Werff et al., 2013; Webb et al., 2013) have examined how the different motivational orientations proposed by SDT could explain the variations in the frequency and the maintenance of PEBs (Pelletier, 2002; Pelletier et al., 2011).

Pelletier et al. (1998) were the first researchers to explore the relationships between SDT and PEBs. These researchers, through their studies, developed and validated a scale to measure motivation towards PEBs in relation to the six types of regulations proposed by SDT (i.e., amotivation, external, introjected, identified, integrated, and intrinsic). Their studies contributed to the understanding of motivation and its relationship to PEBs by showing that intrinsic, integrated, identified regulations and to some extent, introjected regulation, were positively related to perceived competence for PEBs and environmental attitudes towards topics including

environmental responsibility, rights, and governmental involvement, and were negatively related to environmental satisfaction. Pelletier et al. (1998) have also shown that external regulation was negatively related to environmental attitudes, and that amotivation was negatively related to perceived competence for PEBs and positively related to environmental attitudes. Furthermore, the results indicated that SDM (i.e., intrinsic, integrated, and identified regulations) was positively related to different PEBs including recycling, reusing, and purchasing behaviors, while introjected regulation was somewhat related to some of the same PEBs, and external regulation was negatively related to very few PEBs. Amotivation was negatively related to most of the PEBs (Pelletier et al., 1998) and was positively related to negative feelings towards the environment (Pelletier et al., 1999).

Another study conducted by Green-Demers et al. (1997) investigated the influence of behavioral difficulty (i.e., level of effort and resources needed in order to complete a behavior) on the association between SDM and PEBs. The results indicated that SDM was positively related to the frequency of difficult PEBs. This relationship was present when difficult PEBs were compared to moderately difficult PEBs and when moderately difficult PEBs were compared to easy PEBs. This association was also observed in a more recent study (Aitken et al., 2016) on transportation behaviors, where the authors observed that SDM was positively related to the frequency of difficult PEBs. In short, research did show that SDM towards the environment was related to a higher frequency of PEBs in comparison to NSDM even when PEBs were difficult (Green-Demers et al., 1997; Pelletier, 2002; Pelletier et al., 2011). Furthermore, high levels of SDM were also related to engaging in multiple PEBs as well as to their maintenance over time (Pelletier & Sharp, 2008). Finally, research has also shown that NSDM toward the environment was associated with relatively infrequent pro-environmental

behaviors especially if they are difficult (Green-Demers et al., 1997; Lavergne et al., 2010; Pelletier, 2002; Pelletier & Aitken, 2014). In conclusion, SDT and environmental behaviors have been studied in a variety of contexts throughout the last decades including recycling (Villacorta et al., 2003), purchasing behaviors (Pelletier et al., 1998), residential energy-saving behaviors (Webb et al., 2013), employee environmental behaviors (Graves et al., 2013), environmental activism (Séguin et al., 1998). These took place in different countries (e.g., Canada, United States, China, France, Spain, Japan, and Australia) and in different settings (e.g., workplace, classroom, and household).

Correlates of motivation towards the environment

Several studies have also examined how various factors or variables typically associated with the environment were correlated to motivation towards the environment. Of specific interest to the current research, Lavergne and Pelletier (2015, 2016) reported that autonomous environmental motivation was more strongly positively related to a favorable attitude towards the protection of the environment (pro-environmental attitude) than controlled environmental motivation. In addition, Lavergne and Pelletier (2015) reported that both autonomous and controlled environmental motivation were related to use of compensation (coping) strategies in order to deal with the psychological discomfort generated by a dissonance between an individual's pro-environmental attitude and their environmental behaviors. More specifically, autonomous environmental motivation was positively related to behavioral modifications (behavior compensation) strategies and negatively related to cognitive restructuring (cognitive compensation) strategies. Controlled environmental motivation was positively related to cognitive compensation strategies. Aitken et al. (2016) reported that autonomous environmental motivation was related to the individual's perception of their affective and cognitive competency

in regard to environmental behaviors (environmental competency). Taken together, these results suggested that pro-environmental attitude, environmental competency and dissonance compensation strategies were related to environmental motivation in different ways depending on the type of motivation. Outside the scope of this research, other variables, not directly of the environmental context, were also correlated to motivation towards the environment including social identity (Assis et al., 2017), self-integrity and ego-protection (Lavergne & Pelletier, 2015), and value orientation (de Groot & Steg, 2010). Knowing that diverse elements were related to motivation towards the environment and that messages can be used in an attempt to incite or modify individuals' behaviors and attitudes (Tannenbaum et al., 2015), further attention should be given on the potential influence of messages on motivation in an environmental context.

Communication and Threatening Messages

SDT's Perspective on the Communication of Messages

Some research in the SDT framework also looked at the influence of situational or contextual factors, such as the perceived government styles (Lavergne et al., 2010), the types of goals or aspirations (Osbaldiston & Sheldon, 2003), or the type of information (e.g.,, health risks, environmental education programs) that could directly affect motivation and indirectly affect the level of PEBs (see Pelletier et al., 2011). One line of research had more precisely proposed to examine the influence of information on environmental issues on the PEBs of individuals (Pelletier & Aitken, 2014; Pelletier & Sharp, 2008) for the purpose of explaining why some people may be more or less motivated to do PEBs. An unavoidable reality of people living in different parts of the world is that they have been exposed to potentially hundreds of messages related to environmental issues on a daily basis. Behind the onslaught of messages, was a substantial amount of resources that had been committed to the design and dissemination of this

information. People were constantly reminded with commercials, billboards, posters, tweets, and other forms of advertisements, to engage in pro-environmental behaviors, while also refraining from engaging in behaviors that could have a negative impact on the environment.

It was widely recognized that the vast majority of the population, and more specifically the Canadian population, was aware of the importance of adopting a PEBs (Statistics Canada, 2015, 2018). Despite the considerable resources invested in environmental awareness campaigns, a large proportion of the population still failed to initiate and/or sustain engagement in a number of PEBs, and, as suggested earlier, people continued to engage in behaviors that were harmful to the environment. This failure suggests that the motivation for successful behavior change may not simply result from the communication of information that makes people aware of the current conditions. We must also question the extent to which the content of the messages was effective.

More specifically, this line of research was questioning not only the type of strategies that were used to foster motivation in people but also their level of efficiency (Pelletier & Sharp, 2008) for the purpose of motivating people to act. For instance, Pelletier and Sharp (2008) suggested that the transmitted messages should be strategically tailored to the process of behavior change (i.e., detection phase, decision phase, implementation phase) and framed to present autonomous goals (e.g., well-being) instead of controlled goals (e.g., prestige) to promote self-determined pro-environmental behavioral change and maintenance. Based on their model, any messages that contain information that generates fear or discomfort are suitable for the detection of an issue but they were not sufficient to initiate the desired behavioral change which should be done by transmitting information on the different possible alternate efficient behaviors and how to do them (Pelletier & Sharp, 2008). However, in today's media, most of the

communication strategies on the environment consist in communicating information on the risk associated to the environmental conditions if nothing is done (e.g., climate change, pollution of air and water) to encourage people to act (Pelletier & Aitken, 2014; Pelletier & Sharp, 2008). Since the information that is typically communicated focused on the causes of the current environmental conditions and its consequences, at the expense of information on solutions to the issue, it appeals mainly to risk and fear. For this reason, it was important to understand the influence of fear appeals on motivation, whether fear appeals were effective, and what could be their possible limitations.

Fear Appeal

Fear appeal is a communication technique where an entity (e.g., individual, group, organization) uses messages in an attempt to persuade other entities through the threat of harmful or unpleasant consequences that will affect them if they fail to follow the recommendations (i.e., solutions) of those messages (Dillard et al., 1996; Maddux & Rogers, 1983). In other words, threats were used in the hope of motivating individuals to adopt a prescribed behavior. The fear appeal theories had mainly focused on three components: the content of the messages, the nature of the messages' recommended behavior, and the characteristics of the audience (Tannenbaum et al., 2015). The results on message content presented by the meta-analysis of Tannenbaum et al. (2015) suggested that fear appeals were effective at influencing individuals' attitudes, behaviors, and intentions although there was no significant difference between a moderate and a high level of depicted fear. In other words, once a moderate level of depicted fear was present, any further increase in fear level didn't seem to affect fear appeal effectiveness. The results of the meta-analysis (Tannenbaum et al., 2015) also indicated that the effectiveness of fear appeals increased when efficacy statements presented to the targeted audience contained the idea that engaging in

the recommended behavior would have positive outcomes (response-efficacy; e.g., focusing on physical activity to prevent heart attacks; Wurtele & Maddux, 1987). Results were similar with efficacy statements that promoted the idea that the targeted individuals were able to perform the recommended behaviors (self-efficacy; e.g., focusing on physical activity as an energizer for other behaviors while highlighting the individual's cognitive ability to commit to exercise; Wurtele & Maddux, 1987). Furthermore, Tannenbaum et al. (2015) reported that fear appeals had a greater impact when the recommended behaviors only had to be experienced once (e.g., immunization).

In short, fear appeals rely on threat to motivate individuals to adopt a prescribed behavior and its effectiveness was increased by different elements such as the message content (i.e., level of depicted fear, presence of efficacy statements, level of susceptibility and severity), and the recommended behavior and characteristic of the targeted audience. In other words, fear appeals seemed to create a source of motivation to act but it appeared effective when a sense of efficacy (i.e., the person perceives that they can deal with the issue) or solutions were also present. The fear appeal framework and the findings of the meta-analysis appeared to support the idea brought forward by Pelletier and Sharp (2008) that the integration of solutions in messages where the goal was to modify individuals' behaviors increased the efficiency of such messages when compared to messages that didn't contain solution related elements. However, although some studies included causal elements of the presented issue in their study design (e.g., Janis & Feshback, 1953), most fear appeal studies focused on the negative consequences as the instigator of fear without clearly monitoring the impact of those causal elements on fear arousal. Finally, although some elements linked to the characteristics of the audience were noted in the meta-analysis (i.e., gender), research (e.g., Hodgins & Knee, 2002) suggested that other individual

characteristics, specifically motivational orientation, had an impact on how some people cope with threatening elements.

Fear Appeal and PEBs

In a recent study conducted, Chen (2016) looked at the impact of fear appeal on individual's intention to engage in PEBs. Participants were assigned to one of three conditions: low, moderate, and high fear appeal. For each condition, participants were asked to read articles on climate change. Based on the presented results, the individuals in the condition with the highest reported evoked fear reported a higher intent to engage in PEBs when compared to the condition with the lowest reported evoked fear. This supports the idea that fear appeal can increase individuals' intention to engage in PEBs. Another study conducted by Hartmann et al. (2014) observed similar results. In that study, participants were assigned to one of three groups: moderate threat, strong threat or control. The participants in the moderate and strong threat groups were asked to view pictures related to the consequences of climate change (e.g., air pollution, droughts, floods). Each picture had a caption relevant to it (e.g., Climate change causes flooding). The results indicated that, for the strong threat condition, higher perceived threat level and higher fear response were associated with higher intention of engaging in PEBs. The data related to the moderate threat condition were excluded in most of the analyses due to the lack of significant differences when compared to the other two conditions.

In sum, environmental threats and fear responses had a significant role in the intention to engage in pro-environmental behaviors including adopting green energy or adopting a carbon tax. More specifically, fear appeal studies conducted specifically on PEBs appeared to be coherent with the information presented in the meta-analysis by Tannenbaum et al., (2015), that is, fear appeal can modify intentions to engage in PEBs. Interestingly, in both studies, the authors

mentioned the implication of coping strategies when individuals were confronted with threatening information. Chen (2016) mentioned that some individuals might cope with the presented threat in ways that decreases the intention of engaging in PEBs. Based on this information, a more in-depth look into individuals' reaction to threatening messages was important.

Responses to Threatening Information

As mentioned previously, in the SDT framework, humans possess evolved inner ability for growth, personality development, and behavior regulation (Ryan & Deci, 2000; Deci & Ryan, 2000) that could potentially affect their behavior when confronted with threatening information (Ryan & Deci, 2002). However, threatening information could be perceived differently by individuals with different motivational orientation. If individuals perceived the information as a threat, it will likely be accompanied with a defense response (i.e., behavioral, physiological, or cognitive reaction to a perceived threat) once the individuals' threat threshold (i.e., the point at which individuals would perceive a stimulus as a threat and respond accordingly) was reached (Hodgins et al., 2010). Some researchers have shown that motivational orientation was an important predictor of threat perception and defense response (Hodgins, 2008; Hodgins & Knee, 2002). Based on their findings, autonomous motivation was associated with a higher threat threshold than controlled motivation (Hodgins et al., 2010). This was congruent with the idea that autonomous motivation based on secure self-structures would allow, through lower defense, the integration of discrepant information to encourage growth (Hodgins et al., 2010). On the other hand, controlled motivation, with ego-invested self-structures (e.g., prestige), illustrated a more vulnerable self which encouraged hypervigilance (i.e., perception and readiness of defensive response) (Hodgins et al., 2010). In other words, individuals with an

autonomous motivational orientation had a tendency to respond to threatening information in an adaptive way (i.e., willingly and openly) to encourage organismic growth, whereas individuals with a controlled motivational orientation had a tendency to react defensively to avoid or minimize negative consequences with the purpose of protecting the ego-invested self. Researchers observed these findings in face-threatening contexts (i.e., ego-threatening or socially-defined worth threatening) (Hodgins & Liebeskind, 2003) where high self-determined individuals were less defensive when faced with mild and moderate reproach. Similar observations were made in a study evaluating performance in a social context (i.e., interview) where individuals primed for autonomous motivation depicted less threat response than individuals primed for controlled motivation (Hodgins et al., 2010). Furthermore, some researchers (Hodgins, 2008; Hodgins & Knee, 2002) mentioned that amotivation should be associated with the greatest experiential defensiveness when compared to the two other motivational orientations. However, recent research indicated that amotivation towards the environment failed to facilitate the dissonance arousal processes which was also illustrated by frequent harmful-environmental actions including but not limited to disposing of compostable or recyclable in the garbage bin, using plastic bags, and using a bus or a car to travel short distances (Lavergne, 2015). This was coherent with the idea that amotivation didn't foster motives for effective and nonconflicting action since the individuals were not concerned with that topic. In other words, defensive responses were influenced by the individual's motivational orientation.

Following this research by Hodgins and colleagues, Lavergne and Pelletier (2015) conducted research to better understand the influence of motivational orientation on defensive response. They included elements of the cognitive dissonance framework to examine the influence of individuals' motivational orientation on the reactions to aversive affect (i.e.,

psychological discomfort) that was generated in a pro-environmental context. Before reviewing some of their key findings, cognitive dissonance theory was briefly described.

Cognitive Dissonance Theory

According to Cognitive Dissonance Theory (Festinger, 1957), cognitive dissonance arises when individuals experience a minimum of two dissonant cognitions (i.e., any element of knowledge) simultaneously, which create an aversive affective state of psychological discomfort (Cooper, 2007; Festinger, 1957). Different dissonant elements could create psychological discomfort. For instance, fear appeals could create discomfort because images related to climate change were dissonant with the ideal images that people had of their desired or ideal environment. In other words, fear appeals create a discrepancy between the ideal positive state expected by individuals and the negative state presented in a message. The two cognitions (e.g., perceptions, sensations, notions) were dissonant because they were not expected to be associated with each other (Cooper, 2007). Furthermore, researchers proposed that the conditions that create dissonance through its arousal and discomfort motivated individuals to act in ways to reduce the discomfort they were experiencing (Elliot & Devine, 1994; Fazio & Cooper, 1983). In the research on fear appeals, researchers proposed that the psychological discomfort that results from fear should be aversive (i.e., fear of the consequences) and that it should motivate individuals to adopt certain behaviors (Tannenbaum et al., 2015) to avoid the consequences or to eliminate the source of the fear. In the Cognitive Dissonance Theory framework, researchers had proposed different approaches to explain how individuals compensate for aversive cognitive dissonance in their attempts to reduce psychological discomfort (Cooper, 2007; Leippe & Eisenstadt, 1999). We could categorize these approaches into two categories: direct and indirect (Lavergne & Pelletier, 2015). Direct approaches to the reduction of dissonance and discomfort are composed

of strategies including a categorical attitude change (e.g., modifying original attitude) and behavior change (e.g., removing the "physical trace" of the behavior) (Festinger, 1957). As an example, someone for whom the environment was important could directly mitigate the dissonance brought on by throwing a recyclable cup in a garbage can by believing that the environmental condition was not as important as he thought (i.e., attitude change) or by removing the can from the garbage can (i.e., behavior change). Indirect approaches were composed of strategies that can mitigate the dissonance by restructuring cognitions not directly responsible for the dissonance such as adding related cognitions to maximize the importance of the consonant cognitions as well as minimizing dissonant cognition (Leippe & Eiseistadt, 1999). As an example, someone for whom the environment was important could indirectly mitigate the dissonance brought on by throwing a recyclable cup in a garbage can by remembering that he often recycled diverse products and that he seldom adopts harmful-environmental behaviors. However, this theoretical approach had some limitations. More specifically, due to the repeated use of dissonance induction paradigms that offered a limited number of compensation strategies to the participants, it was difficult to fully understand what strategies individuals might use to address spontaneous dissonance in a normal day-to-day setting (Lavergne & Pelletier, 2015). In response to this limitation, a more contemporary theory on cognitive dissonance, the action-based model (Harmon-Jones et al., 2009), proposed a different perspective on the motivation linked to cognitive dissonance.

Action-Based Model

The action-based model proposed that the dissonance generates a negative affective state because the dissonant cognitions have the potential to undermine effective and unconflicted action (Harmon-Jones et al., 2009). In other words, dissonant cognitions became problematic

when they had conflicting action tendencies (e.g., saving money versus giving money to those in need) (Harmon-Jones et al., 2009). In addition, the model proposed two types of motivation behind the dissonance process: a proximal motivation and a distal motivation (Harmon-Jones et al., 2009). The proximal motivation refers to the motivation associated with the goal of reducing or eliminating the negative emotion linked to dissonance. The distal motivation is related to dominant behavioral commitments or goals implicated in the cognitive dissonance, that is the motivation that encourages individuals to adopt compensatory actions to reach, maintain or restore behavioral commitments and goals (Lavergne & Pelletier, 2015, Harmon-Jones et al., 2009). The findings of Harmon-Jones et al. (2009) also suggested that individual differences in dominant behavioral tendencies were better at predicting choices in compensation strategies in comparison to differences in the perceived importance of the dissonant domains suggested in the Cognitive Dissonance Theory framework (Lavergne & Pelletier, 2015). Although individiual differences in behavioral tendencies were important, the action-based model was lacking information on the source of individual differences in the the type of motivation that could lead to the use of different compensation strategies which led Lavergne and Pelletier (2015) to develop the Hierarchical Action-Based model of Inconsistency Compensation in the Environment (HABICE) domain to acquire more information in that particular area.

Hierarchical Action-Based Model of Inconsistency Compensation in the Environment Domain Model

The HABICE model brought together elements from the action-based model (Harmon-Jones, 2009) and self-determination theory (Deci & Ryan, 2000) to propose that individual differences in the choices of dissonance compensation strategies in the environmental domain were related to the type of motivation towards the environment (Lavergne & Pelletier, 2015).

Through their effort to understand the discrepancy between pro-environmental attitudes and behaviors, Lavergne and Pelletier (2015) observed that individuals' motivational orientation (i.e., autonomous motivation compared to controlled motivation) towards the environment influences their reactions to psychological discomfort. Their results suggested that individuals with authentic values and beliefs towards the environment (i.e., autonomous motivation) relied on the use of behavior modifications (e.g., stop using water bottle, compost vegetables instead of putting them in the garbage can) and avoided using cognitive restructuring (e.g., trivializing pro-environmental attitudes) as dissonance reducing strategies, to compensate for harmful-environmental actions. On the other hand, individuals who engaged in PEBs for controlled reasons (i.e., reasons other than authentic values and beliefs toward the environment), had a tendency to use cognitive restructuring to deal with psychological discomfort or to use behavioral modifications to reduce dissonance only when the inconsistencies were non-threatening. It was also observed that individuals with controlled motivation had lower motivation due to perceived incompetence and indifference (Lavergne & Pelletier, 2015) suggesting that, in some contexts, they might not act at all. In other words, individuals who genuinely believed in the welfare of the environment modified their behavior when faced with dissonance in that domain while individuals who were more concerned about ego-invested self-structure (e.g., prestige) or external regulations (e.g., rewards or punishments) modified their behavior only when those ego-invested structures were threatened (e.g., by observers such as friends or bylaw officers) or when external regulations were present. In the absence of threats or external regulation, individuals with controlled motivation reported using cognitive restructuring strategies to manage pro-environmental attitude-behavior inconsistencies. Although the study by Lavergne and Pelletier (2015) reported interesting findings, the researchers didn't control for the

type of situations recalled by the participants that led to the level of discomfort. Therefore, it was not clear if the recall of information leading to psychological discomfort was related to the causes of environmental conditions, the consequences of the environmental deterioration, or the solutions to deal with environmental situations.

Fear Appeal and Cognitive Dissonance Framework Comparison and Limitations

When compared, the concepts of cognitive dissonance, in relation to motivation, were similar to the concepts of fear appeal where threats (i.e., aversive affect versus psychological discomfort resulting from threat) were used to motivate individuals to adopt a prescribed behavior. In both of these frameworks, the affective state of individuals (i.e., discomfort) was presented as an important element in the motivational processes leading to the adoption of specific behavior or behavioral change. However, the two frameworks did not lead to the same predictions once the discomfort was experienced. First, research related to fear appeals suggested that the overall discomfort resulting from the appeal to fear represents a strong source of motivation for behavioral change. However, the research on cognitive dissonance and SDT suggested that people use different strategies to deal with the discomfort that results from dissonance. In some instances, people could reduce the discomfort by changing their behavior and, in other instances, they could change their perception of the situation to reduce the discomfort. Second, neither framework always clearly controlled for the factors that led to the discomfort, that is, the distinctions between the causes of a problem compared to the consequences related to a problem. Third, although both frameworks typically compare aversive conditions that induce discomfort to a control condition where no discomfort was induced, they do not include a comparison to a condition where solutions were proposed. One might hypothesise that solutions could also be a source of some discomfort if they make individuals

aware of the behaviors that they could be doing to improve environmental conditions. However, persuasive messages focusing on solutions might not generate the same level of discomfort than persuasive messages focusing on causes or consequences to a problem. Since the level of discomfort might be different, it was important to consider that the level of proximal motivation to change might be different as well (Harmon-Jones, 2009).

Current Research Program

Objectives

To date, little research has been done in the environmental context to examine whether different types of information on the environment could be a source of discomfort, if that discomfort could influence the motivation for PEB, and if this motivation could lead to change in PEB. The overarching goal of this research program was to further the investigation of the experience of dissonance or discomfort which might shine light on the efficiency of fear appeal strategies in an environmental context based on the characteristic of the targeted population. In order to achieve this goal, the first objective is to identify appropriate visual stimuli to be used in this research program. The second objective was to examine the potential relationships between motivational orientations towards the environment, the experience of psychological discomfort and the strategy to cope with it.

Studies Overview

In order to meet the stated objectives, this program of research was composed of two studies. The main purpose of *Study 1* was to identify the best pictures to be used as the experimental stimuli in *Study 2*. More specifically, in *Study 1*, the purpose was to identify three types of pictures that varied in terms of the causes, consequences of, or solutions to an environmental issue (i.e., global warming) and the valence (i.e., positive or negative) of the

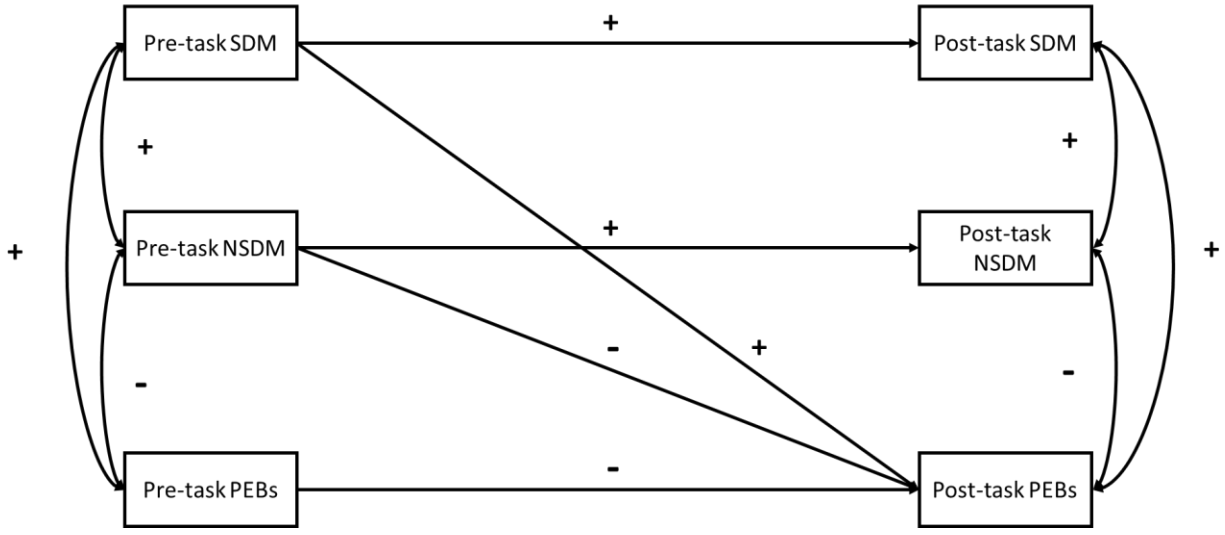
pictures related to global warming. The secondary goal for *Study 1* was to examine the relationships between motivational orientations towards the environment and the perception of the valence of pictures.

In *Study 2*, the main goal was to examine the potential relations between individuals' motivational orientation, the perception of the three types of images related to global warming, the report of compensation strategies, and the change in attitudes and behaviors related to the environment. More specifically, in agreement with the research reviewed so far, three models will be tested, one based on the effects of motivational orientations as defined by SDT (Figure 2), one based on the action-based model (Figure 3), and one based on the HABICE model (Figure 4). For all three models, in order to control for pre-task PEBs or pro-environmental attitude, these variables were integrated in the models. Looking at the different models, the model based on SDT reflects the concept that the quality of individuals' environmental motivation (self-determined or non-self-determined) could predict their intention in adopting PEBs. Specifically, self-determined individuals should have more intention to engage in PEBs, while non-self-determined individuals should have less intention to engage in PEBs. I controlled for the effect of post-task motivation (self-determined or non-self-determined) by including it in the model. The model based on the action-based model was coherent with the idea that, when faced with dissonance, individuals would either modify their attitude or their behavior. In more detail, the more an individual fosters pro-environmental attitude, the more they should experience discomfort when exposed to dissonance in the environmental domain. The individual could then choose to use cognitive strategies to cope with the dissonance, which should lead to a decrease in pro-environmental attitude, or they could choose behavioral strategies, which should lead to an increase in PEBs intention. I controlled for pre-task PEBs by adding the variable to the

model. Finally, the model based on the HABICE model illustrates the concepts that the quality of individuals' environmental motivation would influence the type of strategy used in order to cope with the discomfort of the dissonance which, in turn, would influence their environmental attitude and intention to engage in PEBs. More specifically, the more environmentally self-determined an individual was, the more they should have strong pro-environmental attitude and the more they should engage in PEBs. As discussed for the action-based model, pro-environmental attitude and PEBs should influence the amount of discomfort experienced when faced with dissonance. The environmentally self-determined individuals should use behavioral strategies to cope with the discomfort of the dissonance, which should lead to an increase in PEBs intention, while non-self-determined individuals, should use cognitive strategies to cope with the dissonance, which should lead to a decrease in pro-environmental attitude.

Figure 2

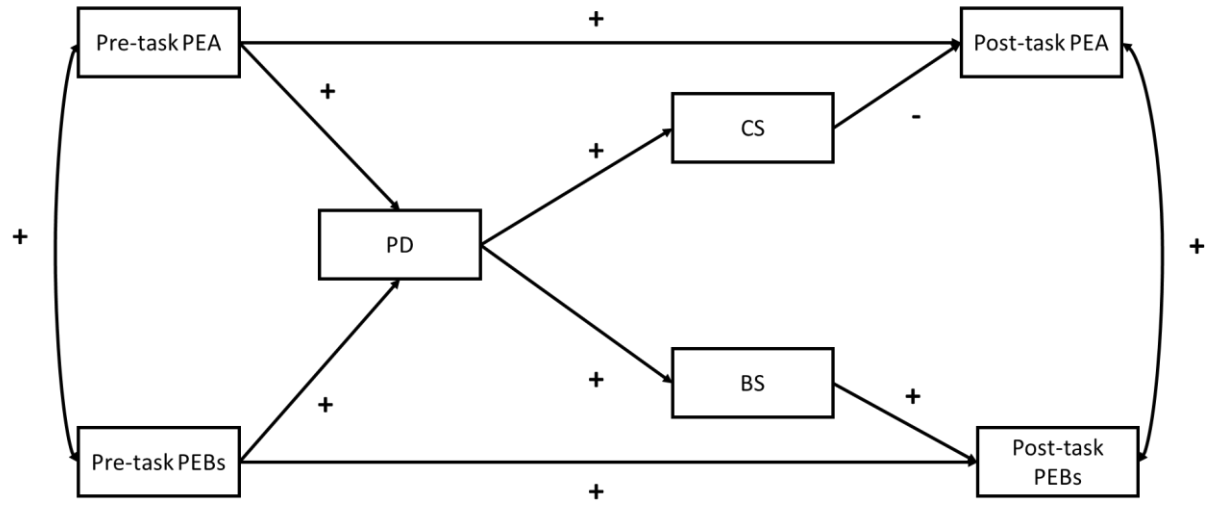
SDT Inspired Path Analysis Model



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEBs = pro-environmental behaviors.

Figure 3

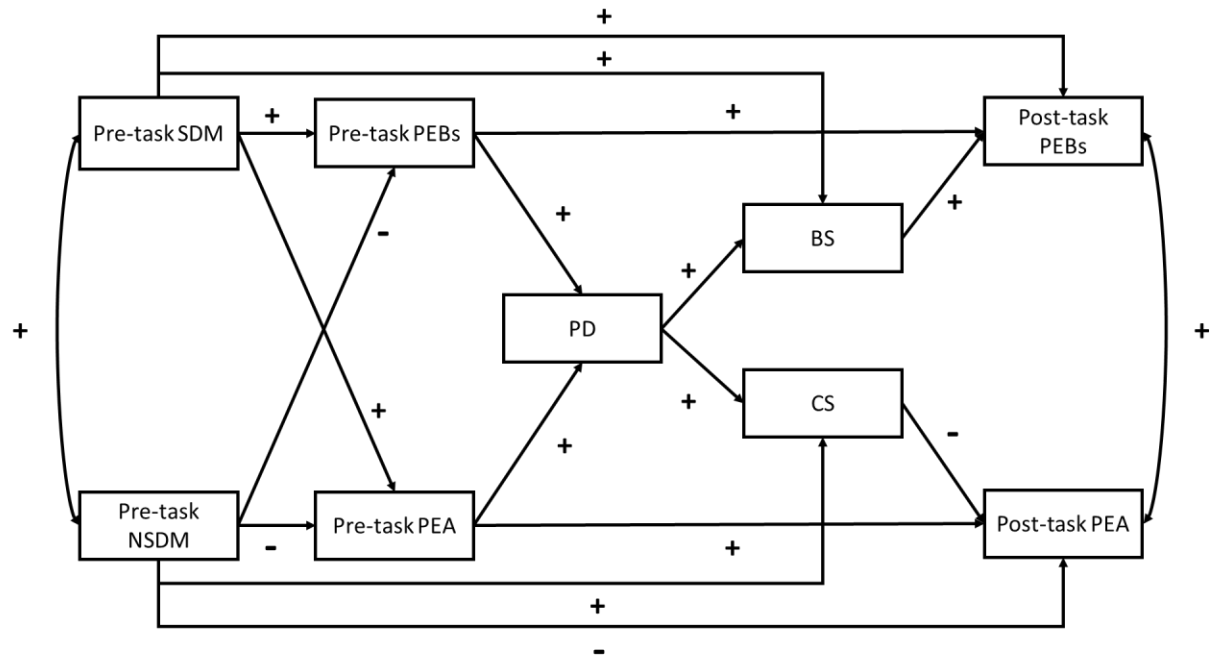
Action-Based Model Inspired Path Analysis Model



Note. PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = psychological discomfort, CS = cognitive coping strategies, BS = behavioral coping strategies.

Figure 4

Hierarchical Action-Based model of Inconsistency Compensation in the Environment Domain Model Inspired Path Analysis Model



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = psychological discomfort, CS = cognitive coping strategies, BS = behavioral coping strategies.

Anticipated Contributions

This program of research had the potential to make contributions in the study of motivation and communication as well as in the field of environmental psychology. One of the more modest contributions would be a database of valence attributed pictures illustrating causes, consequences and solutions to global warming that could be used in further studies on a similar topic. With regards to SDT, the findings could also further the understanding of the influence of

the motivational orientation on individuals' perceptive experience and compensation behaviors. This could be done by contributing new data related to the psychological discomfort directly experienced during the task instead of discomfort experienced on a past inconsistency. In addition, the observation of discomfort and compensation strategies in relation to threatening information linked to the environment could have implications resulting in the need to monitor the motivational characteristics of the targeted population when fear appeal strategies were used. This in turn, could have implication for message framing and tailoring when it comes to the creation of messages to encourage individuals to adopt PEBs. Finally, this research could be a steppingstone for further research on the elaboration of efficient behavioral altering messages by looking at the perception of motivational texts and the combination of picture and text towards the adoption of PEBs based on the individuals' motivation orientation.

Chapter 2

Study 1

The main objective for this study was to select appropriate stimuli to be used in subsequent studies looking at psychological discomfort towards PEBs and the strategies used to remediate to it. More specifically, the goal was to validate the valence (e.g., positive or negative) and the theme (i.e., causes, consequences or solutions) of pictures related to one of two topics (i.e., global warming or health issues). The best validated pictures related to global warming were to be used as experimental stimuli while the best validated pictures related to health issues were to be used as practice stimuli for *Study 2*. In addition, this study provided the opportunity to learn more on the potential relationship between motivation towards PEBs and the perception of pictures related to global warming. An online task was created in order to meet this goal. Overall, it was anticipated (*hypothesis 1)* that the images related to causes and consequences would be perceived as threatening (negative) while images linked to solutions would be perceived as less threatening (positive) by the participants. As a secondary goal, I was also interested to examine whether the key variables that would be used in the second study had an impact on the perceptions of the pictures. More specifically, I examined if the participants' motivational orientation would influence their perception (i.e., valence) of the pictures (*hypothesis 2*).

Method

Material

Two online questionnaires (version 1 and version 2, in French and English) were developed for this study to decrease the task completion time and to avoid participant fatigue. Each version of the questionnaire contained 45 different pictures (size 800 x 600 pixels)

randomly assigned to each version: 30 pictures were related to global warming (i.e., 10 related to the causes, 10 related to the consequences and 10 related to the solutions to global warming) and 15 related to health issues (i.e., five related to the causes, five related to the consequences and five related to the solutions to health issues). The pictures were presented in a random order. A brief literature review was done to determine the causes, consequences and solutions to global warming identified by the scientific community. Once identified, the different causes, consequences and solutions were summarized into keywords which were afterwards entered in the internet search engine Google Images. If the scientific articles related to a particular theme didn't lead to 10 different related elements, the theme itself was used as a keyword (e.g., causes of global warming) (see Appendix A and Appendix B for the different scientific articles and keywords). The selected pictures had to be of a minimum size of 800x600 pixels and reflect the theme of the keywords (pictures of a size superior to 800x600 were resized to meet size requirement). Pictures that were altered, that contained excessive writing in French or English or that were unrelated to the theme were excluded.

Participants

A total of 199 participants, undergraduate students of the University of Ottawa, participated in this study. They were recruited from the Integrated System of Participation in Research participant pool and were compensated with course credits. Four participants (2%) were excluded due to equipment failure during the completion of the study which led to a total sample size of 195 participants. The mean age of the sample was 19.22 years (SD = 3.67) with a range of 16 to 56 years. Three participants (2.1%) declined to report their age, while three participants (1.54%) declined to report their gender. The majority of the sample identified as female (n = 169; 86.7%). Since we used two versions of a questionnaire to assess the

participants' perceptions of the pictures, we wanted to ensure that there were no significant differences between the samples demographic and observed variables in order to combine the data in one database. A total of 95 participants (48.7%) completed version 1 of the questionnaire; 46 (48.4%) of them completed the questionnaire in English. From the 100 participants who completed version 2 of the questionnaire, 50 (50%) of them completed it in English. There were no significant differences in the age of the participants for the first questionnaire (*Mdn* = 18 years) and the second questionnaire (*Mdn* = 18 years) participants, U = 4149.5, z = -1.15, p = .25. Furthermore, there were no significant differences in gender proportions between questionnaire 1 (male: 10.8%, female: 89.2%) and questionnaire 2 (male: 13.1%, female: 86.9%) participants, $\chi 2$ (1, N = 192) = 0.26, p = .61. The same can be said of ethnicity proportions (see Table 1) between questionnaire 1 (Caucasian: 65.9%, non-Caucasian (non-White): 34.1%) and questionnaire 2 (Caucasian (White): 57.3%, non-Caucasian (non-White): 42.7%) participants, which indicated that there were no significant differences, $\chi 2$ (1, N = 184) = 1.44, p = .23. 11 participants declined to share their ethnicity. The participants who completed Version 1, 31 (32.6%) reported English as their first language, 50 (52.6%) reported that French was their first language, 12 (12.6%) reported another language as their first language learned, and 2 (2.1%) declined to report their first language. From the participants who completed version 2 of the questionnaire, 27 (27%) reported English as their first language, 50 (50%) reported that French was their first language, 22 (22%) reported another language as their first language learned, and 1 (1%) declined to report their first language. Once again, no significant difference in first spoken language proportions is observed between questionnaire 1 (English: 33.3%, French: 53.8%, other: 12.9%) and questionnaire 2 (English: 27.3%, French: 50.5%, other: 22.2%) participants, $\chi 2$ (2, N = 192) = 3.03, p = .22.

Table 1

Study 1 Ethnicity Frequency

Ethnicity	Questionnaire Version 1	Questionnaire Version 2	Total
African-American	9	4	13
Arabic	4	8	12
Asian	5	14	19
Caucasian	58	55	113
Hispanic	3	2	5
Other	9	13	22

Procedure

The participants were informed that their participation was voluntary and that their responses would be confidential. The participants gave consent before they started the task. They completed one version of two online questionnaires in French or English based on their language of choice. I randomly assigned a version of the questionnaire to participants. They filled in the questionnaires (i.e. in their respective order: picture valence, picture theme, motivation towards PEBs, and pro-environmental competency) on site at the INSPIRE Lab in a standardized environment in order to limit potential distractors. Each participant was assigned a cubicle separated from the other participants which contained a computer and its accessories (i.e., screen, mouse and keyboard). The research assistant gave instructions to not use cellphones and to complete the task in silence. All the instructions regarding the task were presented at the beginning of the study. All data was collected with the use of an online survey system (i.e., Qualtrics).

Measures

Picture Theme and Valence

Five items were developed to assess the valence and theme of pictures related to global warming and health issues (see Appendices C and D). Specifically, participants responded to

images relative to their appraisal of each picture (1 item; e.g., “When thinking of the environment, what is your impression of the picture?”). Responses were provided on a 7-point Likert-type scale (1 very negative, 4 neutral, 7 very positive). This item, which allowed preliminary findings on the emotional valence of the stimuli, was developed following the fact that several researchers agree that the primary distinction between emotional events are the perception of the event as, among others, either good or bad (Arnold, 1960), positive or negative (Cacioppo & Berntson, 1994), appetitive or aversive (Dickinson & Dearing, 1979), and pleasant or unpleasant (Lang et al., 1990). Participants were then asked to express the level at which the picture illustrated a cause, consequence, or solution (3 items; e.g., “When thinking of the environment, to what degree do you find this to represent a cause?”) on a 7-point Likert scale (1 not at all, 4 moderately, 7 exactly). Finally, the participants indicated which of the three themes (i.e., cause, consequence, or solution) were mostly depicted by the picture (1 item; e.g., “When thinking of the environment, which of the three categories do you associate with this picture?”). Participants had to choose from four options (i.e., cause, consequence, solution, other/none of the above). The last item determines the perceived theme of the picture while the three items individually linked to the themes add quantitative data.

Motivation towards Pro-Environmental Behaviors

An adaptation of the scale used by Guertin et al. (2015) to assess motivation related to the regulation of eating was used to assess motivation towards pro-environmental behaviors. Beside the difference in thematic (i.e., eating regulation), the original scale by Guertin et al. (2015) and the current scale are similar since they are both based on the same SDT motivational concepts. In this study, participants reported their motivation towards pro-environmental behaviors (i.e., amotivation, extrinsic, introjected, identified, integrated, and intrinsic) by indicating their

agreement with six statements illustrating different reasons to engage in such behaviors, reflecting the different forms of motivation (e.g., "I do pro-environmental behaviors on a regular basis…" "Purely for the interest and enjoyment I get out of it") (see Appendix E). Responses were provided on a 7-point Likert-type scale (1 do not agree at all, 4 moderately agree, 7 completely agree). Some studies looking at general level of self-determination have shown the usefulness of combining the score of each subscale, which were representing a position on the self-determination continuum, into a self-determination index (Pelletier & Dion, 2007). Following the literature, the index score was calculated by weighting the score of each subscale based on their position on the self-determination continuum (Blais et al., 1990; Pelletier et al., 1999). Specifically, a self-determination index was calculated by tripling the amotivation and intrinsic scores (item 6 and item 1), by doubling the extrinsic and integrated scores (item 2 and item 5) and finally subtracting the sum of the amotivation, extrinsic, and introjected scores from the sum of the identified, integrated and intrinsic scores (i.e., (3(item 1) + 2(item 5) + (item 4)) – ((item 3) + 2(item 2)+ 3(item 6))). Higher scores refer to a more self-determined motivational orientation towards PEBs and lower scores refer to non-self-determined motivational orientation towards PEBs. Since this questionnaire contains more than one concept, it did not make sense to report the alpha related to internal consistency (Tavakol, & Dennick, 2011).

Perceived Pro-Environmental Competence

An adaptation of a scale developed by Pelletier et al. (1999) to evaluate perceived competence towards environmental behaviors was used to assess the participants' perceived competence towards pro-environmental behaviors. Participants indicated their level of agreement on a 7-point Likert scale (1 do not agree at all, 4 moderately agree, 7 completely agree) for three items (e.g., "If I wanted to, I could easily do various pro-environmental behaviors"). They also

indicated the difficulty level of pro-environmental behaviors (i.e., "Doing various pro-environmental behaviors is, for me…") on a 7-point Likert scale (1 not at all easy, 4 somewhat easy, 7 extremely easy) (see Appendix F). Internal consistency is acceptable ($\alpha = .83$) (Tavakol, & Dennick, 2011). The four items were averaged together to yield a composite score of competence. This would serve as a control variable since it had been observed to be related to motivation (Pelletier et al., 1999)

Results

In order to verify the hypotheses related to this study, I conducted the vast majority of the statistical analyses in IBM SPSS 23 (2015). In order to determine differences in the valence of the picture themes, repeated measures GLMs (general linear model) with and without a covariate were performed. In regards to sample size, a priori power analyses were conducted with G*Power version 3.1 (Faul et al., 2009) and GLIMMPSE version 2 (Kreidler et al., 2013). In order to have a power of .80, among the different planned analyses, the highest minimum number of participants for the total sample was 122. Current sample size exceeded that amount. Furthermore, although regressions were initially considered, I conducted a repeated measure GLM with a covariate to examine the potential relationships between pro-environmental motivation and perceived valence. The results of these analyses (see Table 4) will be presented in the following section as well as various information including data preparation and the stimulus selection process.

Data Preparation

Missing data

An examination of the missing data indicated that the vast majority of the variables (99.6%) had no more than 2.1% of missing data. One variable, participant ethnicity, had 4% and

7.4% missing data in the version 1 and 2 of the questionnaires respectively. Looking at potential missing data patterns, analyses indicated that the missing data were missing completely at random whether looking at the data separately (questionnaire 1 Little's MCAR: $\chi^2_{(1923)} = 0$, $p = 1.00$; questionnaire 2 Little's MCAR: $\chi^2_{(3348)} = 0$, $p = 1.00$) or as a whole (Little's MCAR: $\chi^2_{(5271)} = 1964.52$, $p = 1.00$). Since the amount of missing data was low and there was no specific missing data assumptions for the planned analysis, I did not impute the missing data.

Versions of the Questionnaire

Looking at the motivation towards pro-environmental behavior index, there was no significant group difference between questionnaire 1 ($M = 10.34$) and questionnaire 2 ($M = 10.21$), t (193) = 0.10, $p = .92$. Finally, looking at pro-environmental competence, there was no significant difference between questionnaire 1 ($Mdn = 4.75$) and questionnaire 2 ($Mdn = 4.50$) participants, $U = 4149$, $z = -1.53$, $p = .13$. In short, there was no significant difference between the groups when looking at age, gender, ethnicity, first spoken languages, or environmental motivation and environmental competency scores.

Selection of pictures

I conducted chi-square goodness-of-fit analyses on all pictures in order to determine which ones had predominant themes (i.e., cause, consequence, solution, none of the above). The analyses indicated that, for all 90 pictures, the four themes were not equally represented by the participants recruited in the study. Standardized residuals (see Appendix G) were calculated to identify the source of the significant results (Sharpe, 2015). Each picture was then assigned a specific theme based on the highest standardized residuals (i.e., if the highest residual score is associated to the cause theme, the picture was classified as such). Afterwards, I ranked them based on their standardized residual scores. Thus, for each theme related to global warming, five

pictures were selected from the seven highest standardized residual scores to become our experimental stimulus in the second study (see Table 2). For each theme related to health issues, three pictures were selected from the four highest standardized residual scores to become the practice items in the second study (see Table 2). This left us with 24 pictures (see Appendices H and I) representing one of the three themes which would be used as stimuli in study 2 (see Table 2).

Table 2

Study 1 Standardized Residuals and Assigned Theme of the Selected Pictures

Stimuli Type	Theme	Questionnaire Version	Selected Pictures ID	Standardized Residual
Practice	Causes	2	CG	7.80
		2	CC	7.20
		2	CD	6.89
	Consequences	1	CI	13.00
		2	AQ	10.11
		2	CH	10.11
	Solutions	1	AE	12.36
		1	CB	12.20
		2	AH	11.95
Experimental	Causes	2	AT	7.60
		2	AX	7.40
		2	AV	7.09
		2	BJ	7.00
		1	E	6.01
	Consequences	2	L	12.78
		2	BA	11.20
		2	BE	10.10
		1	AY	9.70
		1	I	9.70
	Solutions	1	BP	13.40
		1	BT	13.32
		2	BR	12.71
		2	AB	11.86
		2	AA	11.34

Creation of composite variables

To conduct the various analyses in order to test our hypotheses, I created a total of six composite variables representing valence (see Table 3) related to each theme (i.e., cause, consequence, solution) for each group of pictures (i.e., experimental stimuli, practice stimuli). Each composite variable related to the experimental stimuli was the average of the valence of the five pictures selected to represent their specific theme. Each of the composite variables related

to the practice stimuli was the average of the valence of the three pictures selected to represent their specific theme. Please note that the valence variable related to the pictures depicting causes of health problems has a size of 100 data points because all the pictures that compose the variable are from questionnaire 2 ($N = 100$).

Outliers

I screened the data for univariate outliers on all six composite valence variables as well as the motivation towards pro-environmental behaviors and the perceived competency towards pro-environmental behaviors. First, to examine if there was the presence of univariate outliers, I transformed all data for each mentioned variable into *z*-scores and compared them to an extreme score of $z = \pm 3.29$ (Tabachnick & Fidell, 2007). I detected a total of 11 outliers and winsorized them to the closest value within the acceptable range of $z = \pm 3.29$.

Table 3

Study 1 Descriptive Statistics and Winsorized Outliers Frequency

Composite Variable	Sample Size (Missing Data)	*M*	*SD*	Range	Number of Outliers Winsorized
Valence of pictures related to causes of health problems	100 (95)	2.63	.69	1.00-4.33	0
Valence of pictures related to consequences of health problems	194 (1)	1.66	.68	1.00-3.60	2
Valence of pictures related to solutions to health problems	195 (0)	6.55	.60	4.80-7.00	2
Valence of pictures related to causes of global warming	194 (1)	1.80	.80	1.00-4.30	4
Valence of pictures related to consequences of global warming	195 (0)	2.02	.78	1.00-4.50	2
Valence of pictures related to solutions to of global warming	195 (0)	6.05	.82	3.30-700	1
MPEB	195 (0)	10.27	8.61	-9.00-36.00	0
PCPEB	195 (0)	4.60	1.00	1.75-7.00	0

Note. MPEB = motivation towards pro-environmental behaviors, PCPEB = perceived competency towards pro-environmental behaviors

Determining the Valence of the Themed Pictures

Perceived Competency towards Pro-Environmental Behaviors as a Covariate

In order to determine if perceived competency towards pro-environmental behaviors is related to the valence of all three experimental picture themes, I conducted a Spearman's Rho correlation. I verified the assumption of normality through visual and quantitative evaluations (Field, 2009). It was not respected for all picture valence variables. Visual inspections of scatter plots supported a monotonic but nonlinear relationship between perceived competency towards pro-environmental behaviors and the valence of the three picture themes. The result of the Spearman's Pho correlations indicated that there was a significant but weak relationship (Akoglu, 2018) between perceived competency towards pro-environmental behaviors and the valence of pictures related to causes of global warming (ρ = -.12, p = .03) but not with the valence of pictures related to consequences (ρ = -.10, p = .08) or the solution to global warming (ρ = .06, p = .23). Although the relationship between perceived competency towards pro-environmental behaviors and the valence of one the themes (i.e., cause) of the pictures was weak, I decided to consider perceived competency towards pro-environmental behaviors a covariate in the relevant statistical analysis.

Main Analyses

Environmental Global Warming Related Pictures. I conducted a repeated measures GLM with perceived competency towards pro-environmental behaviors as a covariate in order to observe potential differences in valence across picture themes of global warming. In coherence with the suggestion by Schneider et al. (2015), I centered perceived competency towards pro-environmental behaviors before integrating it in the analysis. Following the central limit theorem, due to the size of the sample or more specifically due to an error degree of freedom

(error *df* = 349.61) superior to 20, I assumed that the dependent variable was normally distributed for each level of the within-subjects factor (Tabachnick & Fidell, 2007). However, the assumption of sphericity was violated ($\chi^2(2) = 23.09$, $p < .001$) and therefore the degrees of freedom were corrected using the Huynh-Feldt correction since the Greenhouse–Geisser estimate ($\varepsilon = .90$) was greater than .75 (Field, 2009). In addition to visual inspection, I conducted a univariate analysis of variance (ANOVA) with perceived competency towards pro-environmental behaviors and picture themes as independent variables in order to assess the homogeneity of the regression slopes through an assessment of the interaction between these variables (Leech, Barrett, & Morgan, 2008). The interaction between picture themes and perceived competency towards pro-environmental behaviors was not significant ($F(2, 578) = 1.95$, $p = .14$) suggesting that the homogeneity of regression slopes was respected (Leech et al., 2008). Looking at the repeated measures GLM with perceived competency towards pro-environmental behaviors as a covariate, the interaction between the valence of the different picture themes and perceived competency towards pro-environmental behaviors was not significant ($F(1.82, 349.61) = 1.93$, $p = .15$), indicating that perceived competency towards pro-environmental behaviors had no significant influence on the relationship between the theme and valence of the pictures. Further analysis indicated that there was a significant difference in valence depending on the picture theme, $F(1.82, 349.61) = 1824.44$, $p < 0.001$, $\eta_p^2 = .91$ (Ferguson, 2009). Planned contrasts revealed a significant difference between the valence associated with causes ($M = 1.80$, $SD = .80$) and consequences ($M = 2.02$, $SD = .78$), $F(1, 192) = 11.38$, $p = 0.001$, $\eta_p^2 = .06$. The contrasts also indicated that the valence associated with solutions ($M = 6.04$, $SD = .82$) was significantly different from the valence associated to both causes and consequences, $F(1, 192) = 2739.13$, $p < 0.001$, $\eta_p^2 = .93$. Once again, following the

recommendations of Schneider et al. (2015), I conducted a repeated measures ANOVA in order to examine the remaining effects other than the interaction of the covariate and the themes. The results were quite similar to those of the repeated measures GLM with perceived competency towards pro-environmental behaviors as a covariate. Of course, the assumptions related to GLMs mentioned previously were met the same way for this analysis. Huynh-Feldt correction was applied in this analysis as well. Here again, there was a significant difference in valence depending on the picture theme, $F(1.81, 348.58) = 1815.34$, $p < 0.001$, $\eta_p^2 = .90$. Planned contrasts revealed a significant difference between the valence associated with causes ($M = 1.80$, $SD = .80$) and consequences ($M = 2.02$, $SD = .78$), $F(1, 193) = 11.43$, $p = 0.001$, $\eta_p^2 = .06$. The contrasts also indicated that the valence associated with solutions ($M = 6.04$, $SD = .82$) was significantly different from the valence associated to both causes and consequences, $F(1, 193) = 2713.62$, $p < 0.001$, $\eta_p^2 = .93$. In short, the analyses provided support for *hypothesis 1* that viewers perceived pictures depicting solutions to global warming more positively than pictures depicting causes or consequences to global warming. In addition, viewers perceived pictures depicting causes more negatively than pictures depicting consequences. However, this difference had a smaller effect size.

Health Issues Related Pictures. I conducted a repeated measures ANOVA in order to examine the potential differences in valence across picture themes of health issues related pictures. Following the central limit theorem, due to the size of the sample or more specifically due to an error degree of freedom (error $df = 173.47$) superior to 20, I assumed that the dependent variable was normally distributed for each level of the within-subjects factor (Tabachnick & Fidell, 2007). However, the assumption of sphericity was violated ($\chi^2(2) = 17.06$, $p < .001$) and therefore the degrees of freedom were corrected using the Huynh-Feldt correction

since the Greenhouse–Geisser estimate (ε = .86) is greater than .75 (Field, 2009). Furthermore, it is important to state that, due to unequal groups (causes: $N = 100$, consequences: $N = 194$, solutions $N = 195$), the statistical software omitted unpaired data in the analysis resulting in equal group size ($N = 100$). The analysis showed that there was a significant difference in valence depending on the picture theme, $F(1.75, 173.47) = 1322.49$, $p < 0.001$, $\eta_p^2 = .93$. Planned contrasts revealed a significant difference between the valence associated with causes ($M = 2.63$, $SD = .69$) and consequences ($M = 1.86$, $SD = .68$), $F(1, 99) = 98.42$, $p < 0.001$, $\eta_p^2 = .50$. The contrasts also indicated that the valence associated with solutions ($M = 6.57$, $SD = .66$) was significantly different from the valence associated to both causes and consequences, $F(1, 99) = 1875.03$, $p < 0.001$, $\eta_p^2 = .95$. In short, similarly to the pictures related to the different theme of global warming, the analyses confirmed *hypothesis 1* that viewers perceived pictures depicting solutions to health issues more positively (i.e., very positive) than pictures depicting causes (i.e., slightly negative) or consequences (i.e., negative) to health issues. In addition, results also showed that pictures depicting consequences are perceived more negatively than pictures depicting causes.

Determining Relationship between Motivation towards Pro-Environmental Behaviors and Perceived Picture Valence

Main Analyses

Based on our hypotheses, a quadratic relationship should exist between motivation towards pro-environmental behaviors and perceived picture valence. Initially, in order to test these hypotheses, I considered curvilinear regressions analyses for all three picture themes related to global warming. A verification of the assumptions revealed, through the inspection of the P-P plot of regression standardized residuals, that the errors were not distributed normally.

As suggested by Archontoulis and Miguez (2015), I instead conducted a generalized linear model.

More specifically, in order to determine if motivation towards pro-environmental behaviors influences the relationship between picture theme and valence, I conducted a repeated measures GLM with motivation towards pro-environmental behaviors as a covariate. Prior to the analysis, I centered the covariate, motivation towards pro-environmental behaviors (Schneider et al., 2015). In addition to visual inspection, I conducted a univariate ANOVA analysis with motivation towards pro-environmental behaviors and picture themes as independent variables in order assess the homogeneity of the regressions slopes through an assessment of the interaction between these variables (Leech et al., 2008). The interaction between picture themes and motivation towards pro-environmental behaviors was not significant ($F(2, 578) = 1.29$, $p = .28$) suggesting that the homogeneity of regression slopes was respected (Field, 2009; Leach et al., 2008). Following the central limit theorem, due to the size of the sample or more specifically due to an error degree of freedom (error $df = 349.57$) superior to 20, I assumed that the dependent variable was normally distributed for each level of the within-subject factor (Tabachnick & Fidell, 2007). However, the assumption of sphericity was violated ($\chi^2(2) = 23.11$, $p < .001$) and therefore the degrees of freedom were corrected using the Huynh-Feldt correction since the Greenhouse–Geisser estimate ($\varepsilon = .89$) is greater than .75 (Field, 2009). Looking at the repeated measure GLM with motivation towards pro-environmental behaviors as a covariate, the interaction between the valence of the different picture themes and motivation towards pro-environmental behaviors was not significant ($F(1.82, 349.57) = 1.33$, $p = .27$), indicating that motivation towards pro-environmental behaviors had no significant influence on the relationship between theme and the valence of the pictures. The gathered results do not provide enough

evidence to reject the null hypotheses in relation to *hypotheses 2*. In short, this suggests that all participants, whatever their level of motivation, perceived the different pictures in their respective theme as having the same valence.

Table 4

Study 1 Results Summary

Focus of analyses	Planned analyses	Failed assumptions (Resolution)	Analyses conducted	Results	Hypotheses and status
Valence group difference based on picture themes (global warming)	Repeated measure GLM with PCPEB as covariate	Sphericity (Applied Huynh-Feldt corrections to analyses)	Repeated measure GLM with PCPEB as covariate	No interaction Ca, Cs < Sol** Ca < Cs < Sol**	Hypothesis 1 : H_0 is rejected
			Repeated measure GLM	Ca, Cs < Sol** Ca < Cs < Sol**	Hypothesis 1: H_0 is rejected
Valence group difference based on picture themes (health issues)	Repeated measure GLM	Spericity (Applied Huynh-Feldt corrections to analysis)	Repeated measure GLM	Ca, Cs < Sol** Ca > Cs < Sol**	Hypothesis 1: H_0 is rejected
Prediction of the valence of global warming pictures associated to each theme by MPEB	Nonlinear regressions	Normally distributed errors (Conduct Repeated measure GLM with MPEB as covariate and Huynh-Feldt corrections)	Repeated measure GLM with MPEB as covariate	No interaction	Hypothesis 2: H_0 is retained

Note. GLM = general linear model, PCPEB = perceived competency towards pro-environmental behaviors, MPEB = motivation towards pro-environmental behaviors.

** $p < .01$.

Discussion

The main goal of this study was to identify the best pictures that represented causes, consequences and solutions to the environmental conditions, which would be used as stimuli in *Study 2*. Concurrently, I identified some of the best pictures illustrating causes, consequences and solutions to health problems which would be used as practice items in the second study. In addition, I was also interested in potential relationships between the different themes as well as between individuals' motivational style towards pro-environmental behaviors and their perception of images depicting theme linked to global warming.

First, the results showed that pictures depicting causes or consequences were perceived more negatively than pictures depicting solutions regardless if the topic was global warming or health issues. This supported the hypothesis that the images related to causes and consequences would be perceived as more threatening (negative) while images linked to solutions would be perceived as less threatening (positive). In regards to the pictures related to the topic of global warming, the results indicated that the individual's perceived level of competence towards PEBs did not influence the differences in valence between the picture themes. Secondly, the outcome of the analyses suggested that the individual's motivation towards PEBs did not influence the perception of the images related to global warming. These results did not support the hypothesis that individuals with a high level of self-determination towards PEBs would perceive images linked to causes and consequences of climate change as less threatening than individuals with a low level of self-determination. Here again, the results did not support the hypothesis that individuals with a high level of self-determination and amotivated individuals would perceive less positively images depicting solutions than individuals with a low level of self-determination. In short, as a whole, the findings suggested that regardless of the individual's perceived level of

competence in partaking in PEBs and their type of motivation towards PEBs, individuals would have a negative perception of pictures depicting causes and consequences to global warming and a positive perception of pictures related to solutions to global warming.

This study was not only instrumental in successfully identifying pictures to be used as experimental stimuli and practice items; it also contributed in gaining knowledge on the relationships (or lack thereof) between individual perceived competency or motivation toward PEBs and the perception of pictures depicting causes, consequences or solutions to global warming. In turn, this knowledge promotes reflection and further questioning. As an example, when the findings are combined with previous research on motivation and PEBs, one might suggest that individuals can perceive the negativity of causes and consequences of global warming regardless of their motivation towards PEBs but that it might influence the coping strategy used in order to rectify the potential discomfort generated by these themes.

Chapter 3

Study 2

The main goal of this study was to examine the potential relationships between individuals' motivational orientation, the perception of images related to global warming, the report of compensation strategies, and the change in attitudes and behaviors related to the environment following the exposition to pictures showing either causes of, consequences of or solutions to global warming. The hypothesized relationships were based on concepts derived from different theoretical frameworks including fear appeal, cognitive dissonance theory and self-determination theory. Specifically, I hypothesized that the three types of images should all create some discomfort (*hypothesis 1*). I anticipated that individuals who viewed pictures related to causes or consequences of global warming would experience more psychological discomfort than individuals who viewed pictures related to solutions to global warming (*hypothesis 2*). I expected that individuals who viewed pictures depicting solutions to global warming would use less behavioral modification (*hypothesis 3a*) or cognitive coping strategies (*hypothesis 3b*) than the individuals who viewed pictures related to causes and consequences of global warming. However, I anticipated that individuals who viewed pictures depicting solutions to global warming would have the same level of intent to engage in PEBs in the future as the individuals who viewed pictures related to causes or consequences of global warming (*hypothesis 4*). Self-determined individuals should experience more psychological discomfort when viewing images linked to causes (*hypothesis 5a*) and consequences (*hypothesis 5b*) of global warming than non-self-determined individuals. I also expected self-determined individuals to experience less discomfort when viewing pictures depicting solutions to global warming when compared to non-self-determined individuals (*hypothesis 6*). Self-determined individuals should have the intention

to use behavioral coping strategies to address the discomfort across all conditions (*hypothesis 7a*) which should be associated with an increase in their intention of engaging in more pro-environmental behavior in the future (*hypothesis 7b*). Finally, non-self-determined individuals should have the intention to use cognitive modification strategies to address the discomfort across all conditions (*hypothesis 8a*) which should be associated with a decrease in pro-environmental attitude (*hypothesis 8b*).

In additions to the hypotheses related to the main goals, I had some general expectations in regards to the different relationship models based on different presented theoretical frameworks. First, the SDT based model should contribute information on how the different images could affect environmental motivation and lead to changes in PEBs. However, it should not contribute to the knowledge of the influence of psychological discomfort on pro-environmental attitude changes. The action-based model should contribute information on how the images can affect the experience of psychological discomfort which, in turn, would affect changes in pro-environmental attitude and PEBs. However, this model does not include environmental motivation limiting the knowledge on its role and effects on which coping strategies people use and, therefore, whether people are likely to change their pro-environmental attitude or their PEB. Finally, the Hierarchical Action-Based model of Inconsistency Compensation in the Environment domain (HABICE) model should represent a more effective model than the SDT model and the action-based model because it includes both environmental motivation and psychological discomfort in order to explain the impact of images on changes in PEBs and pro-environmental attitude. Overall, although I expected to find support for the 3 models that are proposed, the HABICE model should be especially useful to explain the conditions that lead to change in PEB and change in environmental attitudes. The HABICE

model should also be especially useful to explain why images that create more discomfort (causes and consequences compared to solutions) are more likely to lead to changes in PEB for individuals who were self-determined toward the environment, and changes in pro-environmental attitude for individuals who were non-self-determined toward the environment.

Method

Participants

A total of 381 participants, undergraduate students of the University of Ottawa, were initially recruited to participate in this two-part study. They were recruited from the Integrated System of Participation in Research participant pool and were compensated with course credits. A total of 69 participants were excluded due to equipment failure (n = 5), to multiple incomplete questionnaires administered in part 1 (n = 2) or to not participating in the second part of the study (n = 62). With these participants excluded, the sample was composed of 312 individuals. The mean age of the sample was 19.10 years (*SD* = 2.05) with a range of 17 to 34 years. Seven participants (2.2%) declined to report their age. While four participants (1.3%) declined to report their gender, the majority of the sample identified as female (n =260; 83.3%). Since there were three experimental conditions, I wanted to ensure that there was no significant difference between the conditions' demographic variables. A total of 100 participants (32.1%) were part of the *causes* condition; 59 of them completed the task in English. From the 106 participants (34%) who were part of the *consequences* condition of the questionnaire, 74 (69.8%) of them completed the task in English. From the 106 participants (34%) who were part of the *solutions* condition, 77 (72.6%) of them completed the task in English. There was no significant difference in the age of the participants of the *causes* (*M* = 19.01), *consequences* (*M* = 19.53), and *solutions* (*M* = 18.73) conditions, χ^2 (2) = 3.65, *p* = .16. Furthermore, there was no significant difference in gender

proportions between the *causes* 1 (male: 18.4%, female: 81.6%), the *consequences* (male: 16%, female: 84 %), and the *solutions* (male: 12.5%, female: 87.5%) conditions, $\chi 2$ (2) = 1.35, p = .51. The same can be said of ethnicity proportions (see Table 5) between *causes* (Caucasian (White): 49%, non-Caucasian (non-White): 51%), *consequences* (Caucasian (White): 58.1%, non-Caucasian (non-White): 41.9%), and *solutions* (Caucasian (White): 46.2%, non-Caucasian (non-White): 53.8%) conditions, $\chi 2$ (2) = 3.25, p = .20. Seven participants declined to share their ethnicity. Finally, no significant difference in first spoken language proportions was observed between *causes* (English: 38.8%, French: 40.8%, other: 20.4%), *consequences* (English: 42.9%, French: 40%, other: 17.1%), and *solutions* (English: 40.4%, French: 32.7%, other: 26.9%) conditions, $\chi 2$ (4) = 3.70, p = .45. A total of five participants did not share their first language.

Table 5

Study 2 Ethnicity Frequency

Ethnicity	Causes Condition	Consequences Condition	Solutions Condition	Total
Aboriginal	1		1	2
African-American	3	9	6	18
Arabic	13	8	11	32
Asian	12	11	23	46
Caucasian	47	61	48	156
Hispanic	3	6	1	10
Other	17	10	14	41

Material

The current study was a two-part experiment. For the first part of this study, an online task composed of multiple self-report questionnaires, available in French or English, was created through Qualtrics, an online survey system. This first task assessed the participants' motivation and attitude towards the environment as well as the frequency of pro-environmental behaviors. Participants completed the first part three to five days prior to the second part of the experiment.

For the second part, I created three versions of an online task composed of picture viewings and multiple self-report questionnaires, available in French or English, through Qualtrics. The versions of the task differed from each other only by the theme of the pictures presented in the viewing part of the experiment: pictures related to causes, consequences and solutions to global warming. The viewing section of each version was composed of eight pictures selected from the first study presented in Chapter 2. The viewings started with three practice pictures related to health so that the participants could familiarize themselves with the procedures. These practice pictures were followed by five experimental pictures related to global warming. The specific theme (i.e., cause, consequence and solution) of the pictures was exclusive to each version (i.e., experimental condition) of the task. The pictures were presented for six seconds, in a random order. Once all the viewings completed, multiple self-report questionnaires were presented to the participants. These questionnaires assessed various elements including overall psychological discomfort, discomfort compensation strategies, environmental motivation, attitude towards the environment, and intended future behaviors towards the environment.

Procedure

In order for the participants to complete the first part of the study, an email (see Appendix J) was sent to them five days before their scheduled participation in the second part of the study. Being conscientious of students' busy schedule, the participants had 48 hours after the reception of the email to complete the online questionnaires. At the beginning of the survey, the consent form informed participants that their participation was voluntary and that their responses would be confidential. The participants gave consent in order to be able to fill the various questionnaires. Participants completed questionnaires that measured their motivation, attitude,

and behaviors towards the environments in their respective order. All data was collected with the use of an online survey system (i.e., Qualtrics).

In the second part of the experiment, the participants presented themselves at the INSPIRE Lab to complete an experimental task created on Qualtrics. They completed the task at the INSPIRE Lab in a standardized environment in order to limit potential distractors. Participants were randomly assigned to one of three experimental conditions (i.e., cause, consequence, solution). Each participant was assigned a cubicle separated from the other participants which contained a computer and its accessories (i.e., screen, mouse and keyboard). Here again, the consent form informed the participants that their participation was voluntary and that their responses would be confidential. The participants gave consent before completing the task. The research assistants gave instructions to not use cellphones and to complete the task in silence. All other instructions (see Appendix K) regarding the task were presented at the beginning of the study. Participants were first presented with three practice images related to health and were asked to report their discomfort. Afterwards, participants were exposed to five images related to global warming. Each picture, regardless if they were practice or experimental stimuli, were presented for six seconds. Once all the images related to global warming were presented, participants were asked to fill questionnaires in regards to the psychological discomfort experienced, the compensation strategies used as well as their environmental motivation, pro-environmental attitude, and their intention to engage in PEBs respectively.

Measures

Motivation towards the Environment Scale

This scale developed by Pelletier et al. (1998) assessed motivation for pro-environmental behavior and consists of 24 items (see Appendix L). The items formed six subscales of four

items that correspond to the regulatory types identified by SDT (Deci & Ryan, 2000). They included intrinsic regulation (e.g., “For the pleasure I experience when I find new ways to improve the quality of the environment.”), integrated regulation (e.g., “Because taking care of the environment is an integral part of my life.”), identified regulation (e.g., “Because it is a reasonable thing to do to help the environment.”), introjected regulation (e.g., “Because I would feel guilty if I didn't.”), external regulation (e.g., “For the recognition I get from others.”), and amotivation (e.g., “I don't really know; I can't see what I'm getting out of it.”). Participants were asked to indicate to what extent each item corresponds to their reasons for doing things for the environment using a 7-point Likert scale (1 Does not correspond at all, 4 Corresponds moderately, 7 Corresponds exactly). Published validation studies have demonstrated that the English (Pelletier et al., 1998; Villacorta et al., 2003) and French (Pelletier et al., 1997) versions of the scale possesses adequate construct validity and internal reliability. Composite scores of self-determined motivation and non-self-determined motivation were calculated. The self-determined motivation scores were calculated by averaging the scores of the intrinsic, integrated, and identified regulation subscales. The non-self-determined motivation scores were calculated the same way using the scores of the introjected and the external regulation subscales as well as the four non-regulation items. The composite scores for environmental SDM and NSDM were both internally consistant at the pre-task (respectively α = .92, α = .79) and post-task (respectively α = .93, α = .79). The higher the composite score the more likely that the motivational type was present.

Pro-Environmental Attitude Strength Scale

The Pro-Environmental Attitude Strength scale (see Appendix M) developed by Lavergne & Pelletier (2015) assessed favourable attitudes toward environmental protection in

French or English. It was similar to other attitude measurement scales (Brannon et al., 2007; Pomerantz et al., 1995). Additionally, the scale measured attitude importance and resistance to change which were observed to increase resistance to persuasion (i.e., attitude change; Brannon et al., 2007; Pomerantz et al., 1995). Participants indicated their agreement with two items presenting pro-environmental statements (i.e., "human activities have a harmful impact on the environment" and "humans need to take action to reduce their harmful impact on the environment") on a 7-point Likert scale (1 Do not agree, 4 Somewhat agree, 7 Completely agree). Participants indicated on a 7-point Likert scale (1 not at all, 4 Somewhat, 7 very much) their response to six items that measures different dimensions of attitude strength including the personal importance of environmental issues ("How important to you personally are environmental issues?"), the attitude's centrality relative to the self-concept ("How central is your attitude toward the environment to your self-image/self-concept?"), the attitude's representativeness of personal values ("How representative of your values is your attitude toward the environment?"), the amount of knowledge about environmental issues ("How knowledgeable are you about environmental issues?"), the likelihood of changing the attitude ("How likely are you to change your opinion about the environment?"; reverse scored item) and attitude certainty ("How sure are you that your opinion about the environment is right?"). A composite score of pro-environmental attitude strength was calculated from the mean of the 8 items which were internally consistent both before and after the experimental task (respectively $\alpha = .77$, $\alpha = .76$). Higher scores reflected higher attitude strength toward protecting the environment.

Frequency of Recent Pro-Environmentally Relevant Actions Scale

This scale was adapted from the Frequency of Recent Environmentally Relevant Actions scale created by Lavergne & Pelletier (2015). The Frequency of Recent Pro-Environmentally

Relevant Actions scale differs from the original scale by only including the items related to the pro-environmental relevant actions' subscale (see Appendix N). The French and English versions of the Frequency of Recent Pro-Environmentally Relevant Actions scale are composed of 9 items each representing pro-environmental relevant actions (e.g., "Purchased local foods") The participants indicated the frequency (i.e., 0 to 20) of the different actions over the last 7 days (i.e., "Thinking about all of your activities and actions over the past week/7 days, please estimate how many times you've performed the following actions."). The actions are related to greenhouse gas emissions (e.g., "Opted to walk, cycle, skate, etc. instead of riding in a bus/car over a short distance (< 3km)"), water conservation (6 items; e.g., "Washed dishes under running water (instead of in a plugged sink)"), and waste reduction (6 items; e.g., "Tossed compostable or recyclable waste in the garbage bin"). The items of the scale were internally consistent (α = .70). A score of frequency of pro-environmental actions was calculated with the sum of the 9 pro-environmental items. The higher the scores, the more PEBs took place over the previous week.

General Current Psychological Discomfort Scale

General psychological discomfort was assessed using an adapted version of the Psychological Discomfort scale developed by Lavergne (2015). I modified the questionnaire following information obtained in the confirmatory factor analysis (CFA) conducted by Lavergne (2015). The number of items was reduced to decrease the length of the questionnaire while maintaining key items. Similar to the original measure, the participants indicated their level of psychological discomfort (i.e., "Thinking of all the pictures that were presented, to what extent are you feeling discouraged?") (see Appendix O). Three items presented affective states described as "uneasy", "uncomfortable" and "bothered"; adjectives that were associated to the

motivational state of psychological discomfort presented in Cognitive Dissonance Theory based on the research of Elliot & Devine (1994). Three other items were linked to self-conscious negative emotions (i.e., guilty, ashamed) and dejection-related emotions (i.e., discouraged). Despite the theoretical distinction among the negative emotion subgroups, the CFA conducted by the Lavergne (2015) supported the uni-dimensionality of the scale. Similar to the original scale, three items from the original scale associated to positive emotions (i.e., proud, hopeful, content) were integrated to decrease demand characteristics. The participants responded using a 7-point Likert scale (1 Not at all, 4 Somewhat, 7 Very much). A composite score was calculated using the average of the six items related to psychological discomfort. Items related to positive emotions were not included in the composite score. These items were internally consistent (α = .95).

Current Inconsistency Compensation Strategies Scale

An adaptation of the abbreviated Inconsistency Compensation Strategies scale composed of 9 items was used to assess the compensation strategies (behavioral or cognitive strategies) that participants used during the task. The original scale developed by Lavergne & Pelletier (2015) was worded in a way to assess the compensation strategies used to address the psychological discomfort linked to a recalled transgression at the time it occurred. In this adapted version, the items assessing compensation strategies were reworded to be task specific: “When I became aware of the discomfort brought forward by the viewing of all the presented pictures, I reacted by …” (see Appendix P). Participants responded using a 7-point Likert scale (1 Not at all, 4 Somewhat, 7 Very much). Being a bi-dimensional scale, composite scores were calculated for each subscale using the mean of items that composed them (i.e., behavior modification strategies: items 1, 2, 8, and 9; cognitive restructuring strategies: items 3 to 7). The items

composing the behavior modification strategy and cognitive restructuring strategies subscales were internally consistent (respectively α = .87, α = .66). Higher scores indicated higher use of subscale specific compensation strategy.

Pro-Environmentally Relevant Actions Intention Scale

This scale was adapted from the Frequency of Recent Pro-Environmentally Relevant Actions scale. It was composed of 9 items each representing pro-environmentally relevant actions to measure the relative frequency of intended future pro-environmental (e.g., "Purchasing local foods") (see Appendix Q). The participants were asked to indicate the intended frequency (i.e., 0 to 20) of the stated action over the next 7 days (i.e., "Please estimate how many times you are intending to perform the following actions over the next week/7 days."). The actions were related to greenhouse gas emissions water conservation, and waste reduction. The items were internally consistent (α = .73). A score of frequency of pro-environmental action intentions was calculated with the sum of the 9 pro-environmental items. The higher the score, the higher the intention to conduct PEBs over the next week.

Results

In order to test the hypotheses related to this study, I conducted the majority of the statistical analyses in IBM SPSS 23 (2015). In order to determine group differences, one-way ANOVAs and mixed ANOVAs were performed. I conducted multiple regressions and path analyses to examine the potential relationships between the variables. In regards to sample size, a priori power analyses were conducted with G*Power version 3.1 (Faul et al., 2009) for the ANOVAs and multiple regression. In order to have a power of .80, among the different planned analyses, the highest minimum number of participants for the total sample was 159. Concerning path analyses, a rule of thumb of 10 participant per observed parameter was followed (Barbeau et al.,

2019). In short, current sample size was satisfactory for all analysis. The descriptive statistics can be found in Table 6 and inter-variable correlations for all the measured variables per condition in Appendix R. The results of the different analyses were presented in the following sections.

Data Preparation

Missing Data

An examination of the missing data indicated that the vast majority of the variables (97.36%) had no more than 3% of missing data. The highest value of missing data was 5%. Looking at potential missing data patterns, analyses indicated that the missing data was missing completely at random within all experimental conditions (causes Little's MCAR: $\chi^2(9063) = 0$, $p = 1.00$; consequences Little's MCAR: $\chi^2(7956) = 0$, $p = 1.00$; solutions Little's MCAR: $\chi^2(8397) = 0$, $p = 1.00$). Since the planned path analyses have a specific assumption related to the absence of missing data, I imputed the missing data, at the exception of the categorical demographic variables (i.e., ethnicity, language, gender), with the expectation maximization (EM) algorithm.

Outliers

In order to avoid biased results, I screened the data for univariate outliers on all dependent and covariate variables as well as the motivation towards pro-environmental measure. First, to examine if there was the presence of univariate outliers, I transformed all data for each mentioned variable into *z*-scores and compared them to an extreme score of $z = \pm 3.29$ (Tabachnick & Fidell, 2007). I detected a total of nine outliers and transformed (winsorized) the scores to the closest value within the acceptable range of $z = \pm 3.29$ (see Table 6).

Table 6

Study 2 Descriptive Statistics and Frequency of Winsorized Outliers

Variable	Moment Collected	Condition	Sample Size	*M*	*SD*	Range	NOW
SDM	Pre-task	Ca	100	4.69	1.13	1.08 – 7.00	1
		Cs	106	4.84	1.13	1.33 – 7.00	0
		Sol	106	4.92	0.98	2.33 –7.00	0
	Post-task	Ca	100	4.52	1.29	1.17 – 7.00	0
		Cs	106	4.78	1.20	1.58 – 6.92	0
		Sol	106	4.70	1.02	2.08 – 6.67	0
NSDM	Pre-task	Ca	100	2.87	.73	1.17 – 4.92	0
		Cs	106	2.95	.83	1.17 – 5.33	0
		Sol	106	2.95	.83	1.00 – 5.58	0
	Post-task	Ca	100	2.82	.71	1.17 – 4.33	1
		Cs	106	2.87	.81	1.08 – 4.83	1
		Sol	106	2.84	.80	1.00 – 4.67	0
PEA	Pre-task	Ca	100	4.88	0.85	3.13 – 7.00	0
		Cs	106	4.93	0.83	2.38 – 6.50	0
		Sol	106	5.03	0.73	3.50 – 6.75	0
	Post-task	Ca	100	4.95	0.81	3.38 – 6.88	0
		Cs	106	4.99	0.84	2.38 – 6.88	0
		Sol	106	4.97	0.75	3.00 – 6.63	0
GCPDS	Post-task	Ca	100	4.21	1.40	1.00 – 7.00	0
		Cs	106	4.66	1.31	1.00 – 6.67	0
		Sol	106	2.13	1.12	1.00 – 6.50	0
CCS	Post-task	Ca	100	2.43	0.88	1.00 – 4.60	1
		Cs	106	2.23	0.92	1.00 – 5.00	0
		Sol	106	2.19	0.88	1.00 – 4.40	1

BCS	Post-task	Ca	100	4.57	1.43	1.00 – 7.00	0
		Cs	106	4.75	1.34	1.00 – 7.00	0
		Sol	106	4.15	1.46	1.00 – 7.00	0
FRPERA	Pre-task	Ca	100	42.28	24.13	2.00 – 112.00	2
		Cs	106	40.18	21.74	0.00 – 106.00	1
		Sol	106	42.51	21.72	6.00 – 102.00	2
PERAI	Post-task	Ca	100	44.58	26.80	4.00 – 130.00	2
		Cs	106	40.30	21.03	5.00 – 106.00	0
		Sol	106	44.10	23.11	9.00 – 117.00	0

Note. BCS = behavioral compensation strategies, Ca = cause, CCS = cognitive compensation strategies, Cs = consequence, FRPERA = frequency of recent pro-environmentally relevant actions, GCPD = general current psychological discomfort, NOW = number of outliers winsorized, NSDM = environmental non-self-determined motivation, PEA = pro-environmental attitude strength, PERAI= pro-environmentally relevant actions intentions, SDM = environmental self-determined motivation, Sol = solution.

Group Comparisons

One-way ANOVAs

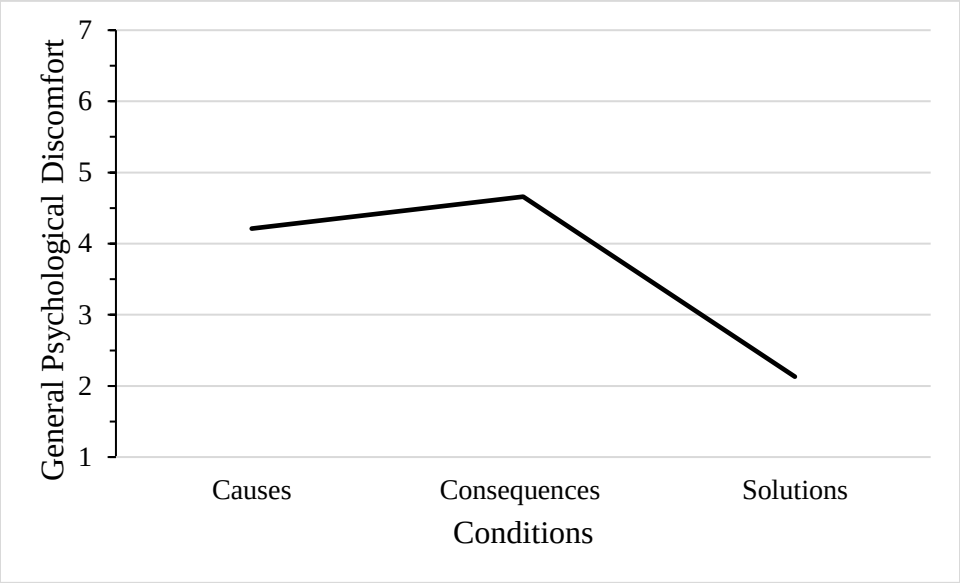
I conducted one-way ANOVAs in order to assess potential group differences across conditions in variables that were not measured before and after the experimental task.

Psychological Discomfort. First, following the central limit theorem, due to the size of the sample or more specifically due to an error degree of freedom (error *df* = 309) superior to 20, I assumed that the dependent variable was normally distributed for each level of the between-subjects factor (Tabachnick & Fidell, 2007). The assumption of homogeneity of variance was respected ($F(2, 309) = 1.498$, $p = .22$).

The analysis indicated that there was a significant difference in psychological discomfort depending on the experimental condition, $F(2, 309) = 117.17$, $p < .001$, $\eta_p^2 = .43$ following a quadratic trend $F(1, 309) = 95.08$, $p < .001$, $\eta_p^2 = .43$ (see Figure 5). Planned contrasts revealed a significant difference between the discomfort reported by participants of the causes ($M = 4.21$, $SD = 1.40$) and consequences ($M = 4.66$, $SD = 1.31$) conditions, $t(309) = 2.55$, $p = .01$, $d_s = 1.71$. The contrasts also indicated that the valence associated with solutions ($M = 2.13$, $SD = 1.12$) was significantly different from the valence associated with both causes and consequences, $t(309) = -15.05$, $p < .001$, $d_s = 10.10$. In short, the results of the analyses supported most of the hypotheses. More specifically, as expected, the reported means of psychological discomfort support the hypothesis that the task generated discomfort for all conditions (*hypothesis 1*). Furthermore, the results support the hypothesis that the individuals who viewed pictures related to causes and consequences of global warming reported experiencing more discomfort than the individuals who viewed pictures related to solutions to global warming (*hypothesis 2*). In addition, the analyses suggested that individuals who viewed pictures related to consequences reported experiencing more discomfort than the individuals who viewed pictures related to causes of global warming.

Figure 5

Study 2 General Psychological Discomfort Means among Experimental Conditions



Behavioral Compensation Strategies. Once again, normality was assumed. The assumption of homogeneity of variance was respected ($F(2, 309) = 1.00$, $p = 0.37$). The analysis indicated that there was a significant difference in behavioral strategies across experimental conditions, $F(2, 309) = 5.06$, $p = .01$, $\eta_p^2 = .03$. However, the effect size was fairly small. Post-hoc analysis using the Ryan, Einot, Gabriel and Welsch Q procedure (Field, 2009) indicated that the usage of behavioral strategies by the participants in the *solutions* condition ($M = 4.15$, $SD = 1.46$) was significantly lower than the usage of the participants in the *causes* ($M = 4.57$, $SD = 1.43$) and *consequences* conditions ($M = 4.75$, $SD = 1.34$), $p < 0.05$. There was no significant difference between the *causes* and *consequences* conditions, $p = .34$. In other words, participants who viewed pictures related to solutions used less behavioral compensation strategies that participant who viewed pictures related to causes or consequences. These findings support our *hypothesis 3a*.

Cognitive Compensation Strategies. Here again, I assumed that the dependent variable was normally distributed (error *df* = 309) for each level of the between-subjects factor (Tabachnick & Fidell, 2007). The assumption of homogeneity of variance was respected ($F(2, 309) = 0.12$, $p = .89$). The analysis indicated that there was no significant difference in cognitive strategies across experimental conditions, $F(2, 309) = 2.08$, $p = .13$. In other words, the reported use of cognitive compensation (i.e., coping) strategies were similar across experimental conditions. These findings do not support the hypothesis that individuals who viewed pictures related to solution would report using less cognitive compensation strategies than the other conditions (*hypothesis 3b*)

Two-way Mixed ANOVAs

I conducted 2 (pre-post) x 3 (experimental conditions) mixed ANOVAs on the variables that were measured both before and after the experimental task in order to observe potential differences across the task and experimental conditions.

Pro-environmental Behaviors. I assumed that the dependent variable was normally distributed (error *df* = 309) for each level of the factors (Tabachnick & Fidell, 2007). The assumption of homogeneity of variance was respected for both recent, $F(2, 309) = .43$, $p = .79$), and intended, $F(2, 309) = 1.12$, $p = .33$, PEBs. Since the within-subject factor has two levels, Mauchly's sphericity was not assessed. Since Box's M test of equality of covariance matrices probability value was superior to 0.001 for PEBs ($p = .003$), I assumed that the homogeneity of the variance-covariance matrices was respected (Frey, 2018). The results of the between-group analysis indicated that there was no significant main effect related to the experimental conditions for PEBs, $F(2, 309) = .70$, $p = .50$. The within group analyses indicated that no significant main effect related to the task existed, $F(1, 309) = 2.92$, $p = .09$. No interaction was present, $F(2, 309)$

= .67, p = .51. In short, there was no significant difference in PEBs between the conditions. The results supported the hypothesis that individuals who viewed pictures related to solutions to global warming would have a similar frequency of intended PEBs when compared to the other conditions (*hypothesis 4*). In addition, the result indicated that the task did not create any significant difference between the frequencies of recent PEBs before the task and the intended frequency of PEBs after the task.

Pro-environmental Attitude. I assumed that the dependent variable was normally distributed (error df = 309) for each level of the factors (Tabachnick & Fidell, 2007). The assumption of homogeneity of variance was respected for both pre-task, $F(2, 309) = 1.35$, p = .26), and post-task, $F(2, 309) = .47$, p = .63, pro-environmental attitude. Since the within-subject factor has two levels, Mauchly's sphericity was not assessed. Since Box's M test of equality of covariance matrices probability value was superior to 0.001 for PEBs (p = .108), I assumed that the homogeneity of the variance-covariance matrices was respected (Frey, 2018). The results of the between-group analysis indicated that there was no significant main effect related to the experimental conditions, $F(2, 309) = .35$, p = .71. The within group analyses indicated that no significant main effect related to the task was present, $F(1, 309) = .61$, p = .44. No interaction was present, $F(2, 309) = 1.80$, p = .17. In short, there was no significant difference in pro-environmental attitude between or within the conditions. Neither the task nor the theme of the presented pictures appeared to significantly explain any difference in pro-environmental attitude.

Environmental Self-Determined Motivation. I assumed that the dependent variable was normally distributed (error df = 309) for each level of the factors (Tabachnick & Fidell, 2007). The assumption of homogeneity of variance was respected for both pre-task $F(2, 309) = 0.96$, p = .39) and post-task $F(2, 309) = 1.24$, p = 0.29) environmental SDM. Since the within-

subject factor has two levels, Mauchly's sphericity was not assessed. Since Box's M test of equality of covariance matrices probability value is superior to 0.001 (p = .13; Frey, 2018), I assumed that the homogeneity of the variance-covariance matrices was respected. The results indicated that there was no significant main effect related to the experimental conditions, F(2, 309) = 1.19, p = .31. Furthermore, the analysis indicated that a significant main effect related to the task was present, F(1, 309) = 15.64, p < .001, η_p^2 = .05. However, the effect size was fairly small. No interaction between the experimental conditions and the task was present, F(2, 309) = 1.65, p = .19. Looking at the descriptive statistics (see Table 6) in combination with the results of the analysis, it appears that environmental SDM was higher prior to the task than after regardless of the experimental condition. In other words, there was a significant decrease in environmental SDM after the task regardless of the theme of the pictures viewed.

Environmental Non-Self-Determined Motivation. I assumed that the dependent variable was normally distributed (error df = 309) for each level of the factors (Tabachnick & Fidell, 2007). The assumption of homogeneity of variance was respected for both pre-task F(2, 309) = 0.82, p = .44) and post-task F(2, 309) = .52, p = .60) environmental NSDM. Since the within-subject factor has two levels, Mauchly's sphericity was not assessed. Since Box's M test of equality of covariance matrices probability value was superior to 0.001 (p = .03; Frey, 2018), I assumed that the homogeneity of the variance-covariance matrices was respected. The results indicated that there was no significant main effect related to the experimental conditions, F(2, 309) = .23, p = .80. The analysis indicated that a significant main effect related to the task was present, F(1, 309) = 6.33, p = .01, η_p^2 = .02. However, the effect size was quite small. No interaction between the experimental conditions and the task was present, F(2, 309) = .31, p = .73. Looking at the descriptive statistics (see Table 6) in combination with the results of the

analysis, it appeared that NDSM was higher prior to task than after regardless of the experimental condition. In other words, there was a significant decrease in environmental NSDM after the task regardless of the theme of the pictures viewed.

Relationships

Multiple Regressions

Relationship between Motivation and Psychological Discomfort. I used multiple regressions to determine the potential relationship between pre-task motivation (i.e., environmental SDM and NSDM) and psychological discomfort. Assumptions were met. More specifically, normal distribution of the data was assessed by viewing the histograms of the residuals. No significant skewness or kurtosis was observed. For all conditions, the variance inflation factor (VIF) was below 10 for all predictors, and tolerance was superior to .2 indicating that there was no excessive multicollinearity (Field, 2009). Since the Durbin–Watson test value was superior to 1 and inferior to 3 for all conditions, the assumption of independence of error was met (Field, 2009). The assumptions of homoscedasticity and linearity were verified by viewing the residuals scatterplots. No obvious fan shaped scatters or curvilinear relationships were observed.

Both environmental SDM and NSDM were, as a set, associated with the variability in psychological discomfort related to the task for the *causes* ($F(2,97) = 8.615$, $p < .01$) and *consequences* ($F(2, 103) = 5.51$, $p = .01$) conditions, but not the *solutions* ($F(2,103) = 2.72$, $p = .07$) condition. The regressions coefficients and probability values are shown in Table 7.

For the *causes* condition, environmental SDM was positively related to the reported psychological discomfort ($p < .01$). Environmental NSDM was not significantly related to

psychological discomfort (p = .23). This model accounted for 15% of the variability in psychological discomfort.

For the *consequences* condition, environmental SDM was not significantly related to psychological discomfort (p = .12). Environmental NSDM was positively related to psychological discomfort (p = .01). This model accounted for 10% of the variability of psychological discomfort.

For the *solutions* condition, both environmental SDM (p = .10) and environmental NSDM were not significantly related to psychological discomfort (p = .08). This model accounted for 5% of the variability of intended PEBs.

In short, the results partially supported some of the hypotheses. Specifically, for the *causes* condition, the more environmentally self-determined individuals were, the more they reported experiencing psychological discomfort. However, environmental NSDM was not significantly related to psychological discomfort. These results partially supported *hypothesis 5a.* For the *consequences* condition, environmental NSDM was positively related to psychological discomfort. However, environmental SDM was not significantly related to psychological discomfort. These results did not support *hypothesis 5b*. Finally, for the *solution* condition, environmental SDM and environmental NSDM were not significantly related to psychological discomfort. The results did not support *hypothesis* 6.

Table 7

Study 2 Multiple Regressions Coefficients of Relationships between Motivation and Psychological Discomfort

Conditions	Predictors	*B*	*SE B*	*β*
Causes	Constant	1.55	.70	
	Self-determined Motivation	.43	.12	.35**
	Non-self-determined Motivation	.22	.18	.11
Consequences	Constant	2.67	.65	
	Self-determined motivation	.17	.11	.15
	Non-self-determined motivation	.40	.15	.25*
Solutions	Constant	2.34	.65	
	Self-determined motivation	-.18	.11	-.16
	Non-self-determined motivation	.23	.13	.17

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

Path Analysis

I used path analyses to assess the presence of hypothesized relationships as well as to explore how models based on different theoretical frameworks could explain changes in PEBs and pro-environmental attitude. Not only did this statistical analysis produce relevant information concerning the relationships between multiple predictor and dependent variables simultaneously in a model (Barbeau, et al., 2018) but it was also used in research on the topic of environment with similar variables (Desmarais, 2019; Lavergne & Pelletier, 2016). The analyses were conducted in Mplus (version 8).

SDT Model: Relationships between Motivation and PEBs. I used path analysis to assess the relationship between motivation and PEBs following the theoretical framework of SDT. The assumptions related to path analysis were verified for all conditions. More specifically, the variables in the model were continuous and there were no missing data. Furthermore, univariate and multivariate normality were respected. In order to determine if the variables were respecting normality, their skewness value should be situated within ± 2 and their kurtosis value

within ±7 (Kim, 2013). There were no univariate or multivariate outliers. In order to be considered an outlier, univariate (*z*-score) and multivariate (χ^2) data point probability value needed to be inferior to .001. There was no excessive multicollinearity. As suggested by Tabachnick & Fidell (2007), correlation between variables should be under .90 to avoid multicollinearity. Finally, sample size was also assessed.

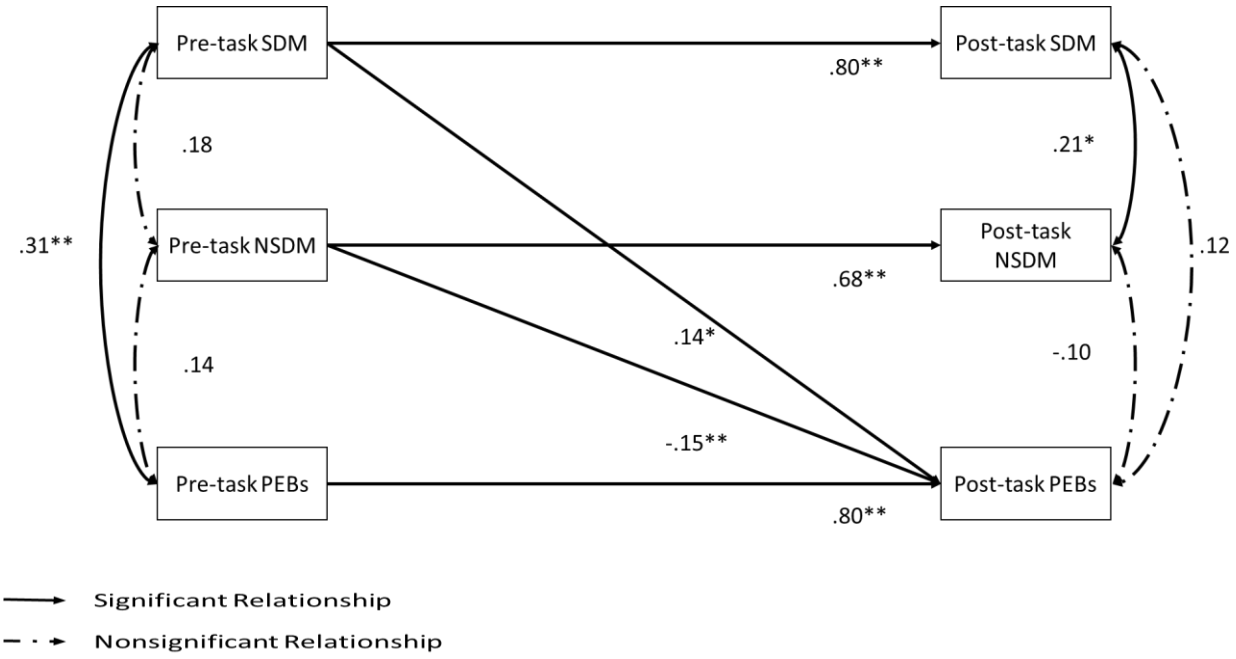
For all conditions, the model was a good fit for the data. The fit indices (i.e., chi-square (χ^2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR) index) all supported a good model fit. More specifically, for the chi-square, a non-significant value (i.e., $p \geq .05$) suggested a good model fit (Shah, 2012). For the CFI, a value equal or superior to .95 indicates that the model has acceptable fit (Bentler, 1990). In regards to the TLI, a value equal or superior to .95 signifies that the model has a good fit (Hu & Bentler, 1999). For the RMSEA, a value equal or inferior to 0.05 indicated a good model fit while a value between .06 and .08 suggests an acceptable model fit (Barbeau et al., 2019). Finally, for the SRMR, a value equal or inferior to .05 suggested an acceptable model fit (Barbeau et al., 2019).

For the *causes* condition, the indices indicated that the hypothesized model (see Figure 6) was a good fit: $\chi^2(4) = 5.03$, $p = .28$, CFI = 1, TLI = .99, RMSEA = .05 CI_{90}[.000, .166], SRMR =.03. Furthermore, all of the hypothesized unidirectional paths were significant. This model contained only direct effects. First, pre-task PEBs were significantly positively associated with post-task PEB intentions ($\beta = .80$, $p < .001$). As expected in a SDT framework, pre-task environmental SDM was significantly positively related to post-task environmental SDM ($\beta = .80$, $p < .001$). Pre-task environmental SDM was significantly positively associated with post-task PEB intentions ($\beta = .14$, $p = .02$). Pre-task environmental NSDM was significantly

positively related to post-task environmental NSDM (β = .68, p < .001). As expected in this theoretical framework, pre-task environmental NSDM was significantly negatively related to post-task PEBs intentions (β = -.15, p = .01). Looking at post-task relationships, post-task environmental SDM was not significantly related to post-task PEBs intentions (β = .12, p = .22). Post-task environmental NSDM was not significantly related to post-task PEBs intentions (β = -.10, p = .30). Looking at the variance explained, the current model explained 65% of the variance of post-task environmental SDM, 46% of the variance of post-task environmental NSDM, and 71% of the variance of the post-task PEBs intentions. In sum, the analyses suggested that both pre-task environmental SDM and NSDM were significant predictors of the change in PEBs following exposure to pictures that represented causes of global warming. More specifically, pre-task environmental SDM was positively associated with the change in PEBs while environmental NSDM was negatively associated with the change in PEBs.

Figure 6

SDT Path Analysis Model with Standardized Coefficient for the Causes Condition



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEBs = pro-environmental behaviors.

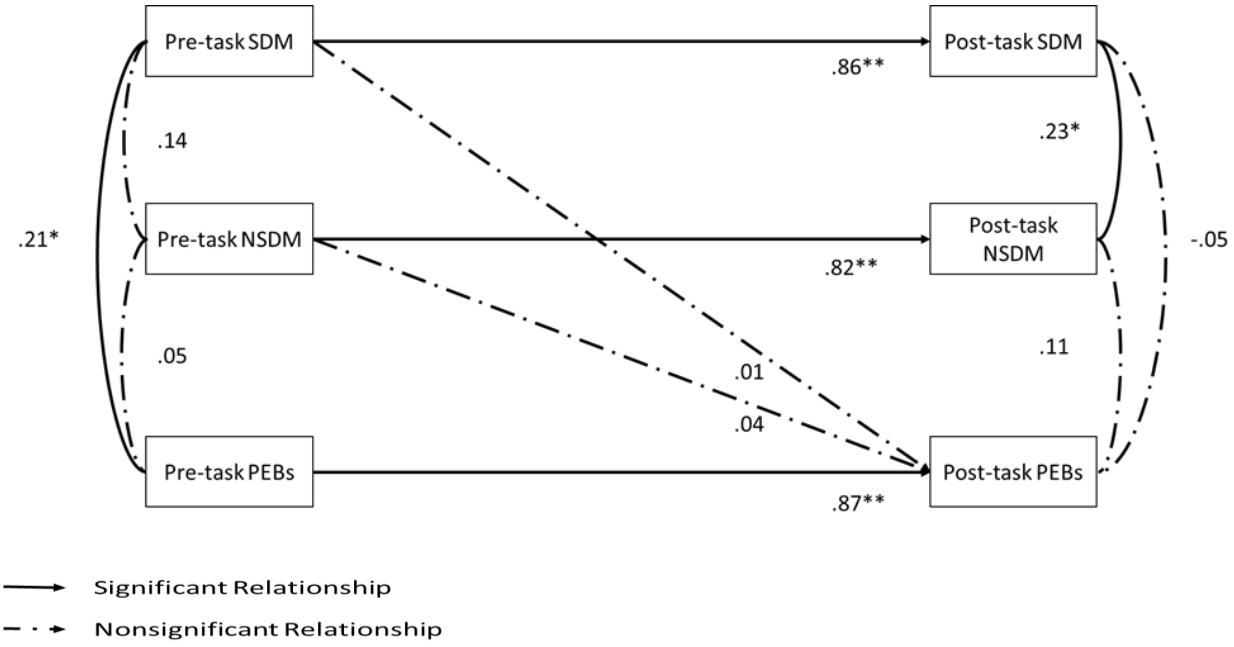
* $p < .05$, ** $p < .01$.

For the *consequences* condition, the indices indicated that the hypothesized model (see Figure 7) was a good fit: $\chi^2(4) = 4.98$, p= .29, CFI = 1, TLI = .99, RMSEA = .05 CI_{90}[.000, .161], SRMR =.03. First, pre-task PEBs was significantly positively associated with post-task PEBs intentions ($\beta = .87$, $p < .001$). As hypothesized, pre-task environmental SDM was significantly positively related to post-task environmental SDM ($\beta = .86$, $p < .001$). Pre-task environmental SDM was not associated with post-task PEBs intentions ($\beta = .01$, $p = .90$). Pre-task environmental NSDM was significantly positively related to post-task environmental NSDM ($\beta = .82$, $p < .001$). Pre-task environmental NSDM was not related to post-task PEBs intentions ($\beta = .04$, $p = .42$). Looking at post-task relationships, post-task environmental SDM post-task PEBs

intentions (β = -.05, p = .64). Post-task environmental NSDM was not significantly related to post-task PEBs intentions (β = .11, p = .27). Looking at the variance explained, the current model explained 74% of the variance of post-task environmental SDM, 67% of the variance of post-task environmental NSDM, and 77% of the variance of the post-task PEBs intentions intention. In sum, the analyses suggest that both pre-task environmental SDM and NSDM were not significant predictors of the change in PEBs following exposure to pictures that represented consequences of global warming.

Figure 7

SDT Path analysis model with standardized coefficient for the consequences condition



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEBs = pro-environmental behaviors.

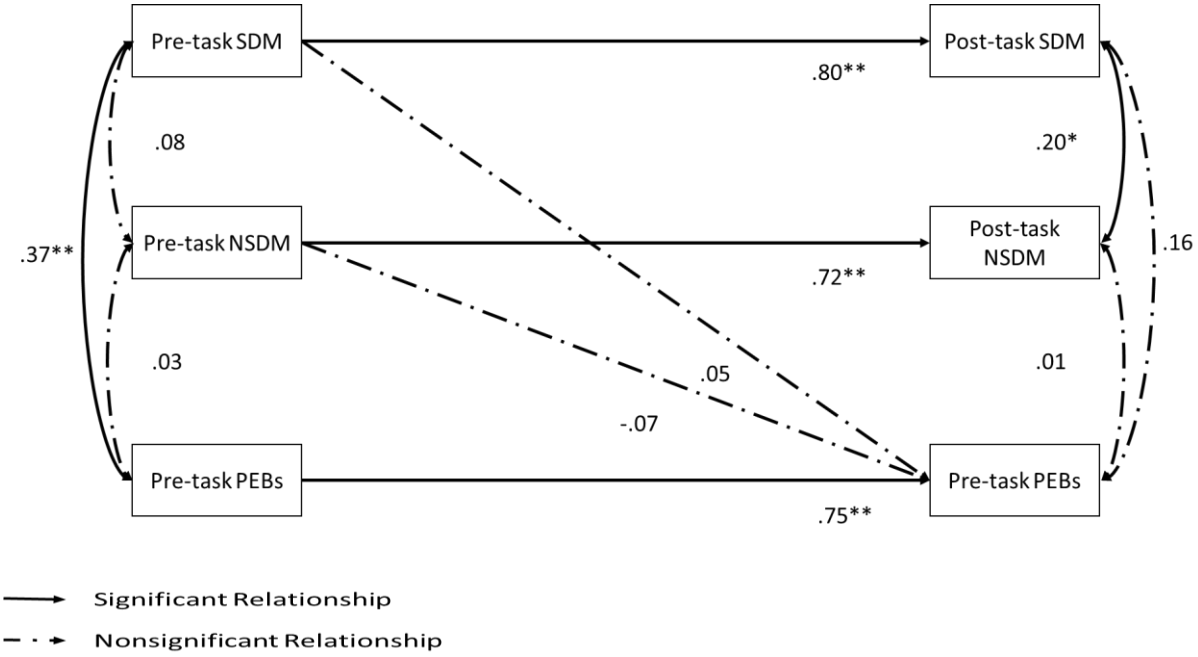
* p < .05, ** p < .01.

For the *solutions* condition, the indices indicated that the hypothesized model (see Figure 8) was a good fit: $\chi^2(4) = 2.98$, p = .56, CFI = 1, TLI = 1, RMSEA = .00 CI_{90}[.000, .128], SRMR

=.04. First, pre-task PEBs was significantly positively associated with post-task PEBs intentions (β = .75, p < .001). As hypothesized, pre-task environmental SDM was significantly positively related to post-task environmental SDM (β = .80, p < .001). Pre-task environmental SDM was not associated with post-task PEBs intentions (β = .05, p = .46). Pre-task environmental NSDM was significantly positively related to post-task environmental NSDM (β = .72, p < .001). Pre-task environmental NSDM was not related to post-task PEBs intentions (β = -.07, p = .28). Looking at post-task relationships, post-task environmental SDM was not significantly related to post-task PEBs intentions (β = .16, p = .10). Post-task environmental NSDM was not related to post-task PEBs intentions (β = .01, p = .91). Looking at the variance explained, the current model explained 64% of the variance of post-task environmental SDM, 51% of the variance of post-task environmental NSDM, and 60% of the variance of the post-task PEBs intentions. In sum, the analyses suggested that both pre-task environmental SDM and NSDM were not significant predictors of the change in PEBs following exposure to pictures that represented solutions to global warming.

Figure 8

SDT Path analysis model with standardized coefficient for the solutions condition



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEBs = pro-environmental behaviors.

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

In sum, it appears that the models were somewhat different from each other depending on the conditions. The *causes* condition, when compared to the other two, is the only condition for which pre-task environmental SDM and NSDM were significantly directly associated to post-task PEBs intentions. Despite this difference, the models also had similar relationships. Specifically, for all three conditions, pre-task variables were positively related to their post-task measures. In addition, pre-task environmental SDM was significantly positively associated to pre-task PEBs and post-task environmental SDM was significantly positively associated post-task environmental NSDM.

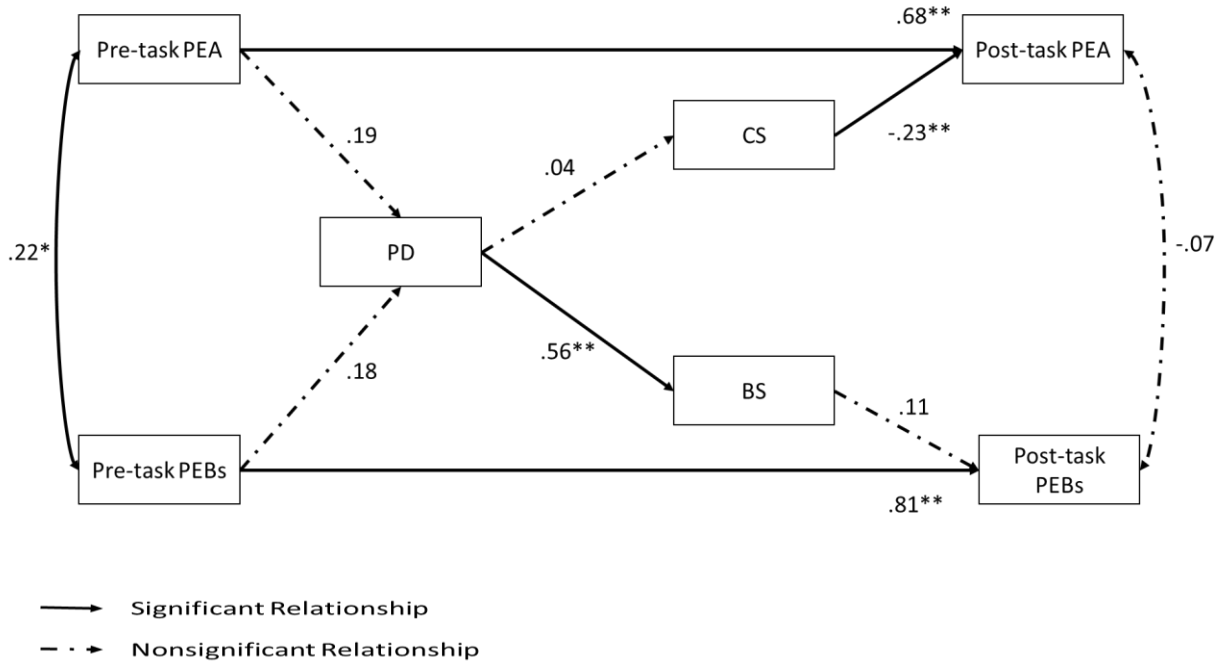
Action-Based Model: Relationship between Psychological Discomfort, Coping Strategies, Pro-Environmental Attitude and PEBs. I used path analysis to examine the potential effects of coping strategies related to psychological discomfort on both post-task pro-environmental attitude and PEB intentions. Similar to the previous models, pre-task pro-environmental attitude and PEBs were included in the models. Based on previous literature (Lavergne & Pelletier, 2015), pre-task pro-environmental attitude was included in the model as a predictor of psychological discomfort. In order to control for pre-task PEBs, that variable was included on the same level as pre-task pro-environmental attitude and considered a predictor. The analyses were conducted in Mplus (version 8). The assumptions related to path analysis were verified for all groups. More specifically, the variables in the model were continuous and there was no missing data. Furthermore, univariate and multivariate normality were respected. In order to determine if the variables were respecting normality, their skewness value should be situated within ± 2 and their kurtosis value within ±7 (Kim, 2013). There were no univariate or multivariate outliers. In order to be considered an outlier, univariate (*z*-score) and multivariate (χ^2) data point probability value needed to be inferior to .001. There was no excessive multicollinearity. As suggested by Tabachnick & Fidell (2007), correlation between variables should be under .90 to avoid multicollinearity.

The proposed model was not a good fit for the data. More specifically, the fit indices for the *causes* ($\chi^2(11) = 76.01$, $p < .001$, CFI = .79, TLI = .57, RMSEA = .26 CI_{90}[.21, .31], SRMR = .17), *consequences* ($\chi^2(11) = 46.18$, $p < .001$, CFI = .90, TLI = .81, RMSEA = .17 CI_{90}[.12, .23], SRMR =.14), and *solutions* conditions ($\chi^2(11) = 36.29$, $p < .001$, CFI = .89, TLI = .80, RMSEA = .15 CI_{90}[.10, .20], SRMR = .12) indicated that the proposed model was not an acceptable fit for the three experimental conditions. Despite this, some relationships were worth noting.

For the *causes* condition (see Figure 9), pre-task pro-environmental attitude was not significantly directly associated with psychological discomfort ($\beta = .19$, $p = .05$). Similarly, pre-task PEBs were not significantly directly associated with psychological discomfort ($\beta = .18$, $p = .06$). However, pre-task pro-environmental attitude was significantly directly associated with post-task pro-environmental attitude ($\beta = .68$, $p < .001$) and pre-task PEBs was significantly directly associated with post-task PEBs ($\beta = .81$, $p < .001$). No significant indirect effects were present between the predicting exogenous variables (i.e., pre-task pro-environmental attitude and PEBs) and the other endogenous variables of the model. Furthermore, the data suggested that a positive relationship between psychological discomfort and behavioral coping strategies was present ($\beta = .56$, $p < .001$). The data also suggested that a negative relationship between cognitive coping strategies and post-task pro-environmental attitude was present ($\beta = -.23$, $p = .003$).

Figure 9

Action-Based Model Path Analysis Model Including Pro-Environmental Attitude, PEBs, Psychological Discomfort, and Coping Strategies with Standardized Coefficients for the Causes Condition



Note. PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = non-self-determined motivation towards the environment, CS = cognitive coping strategies, BS = behavioral coping strategies.

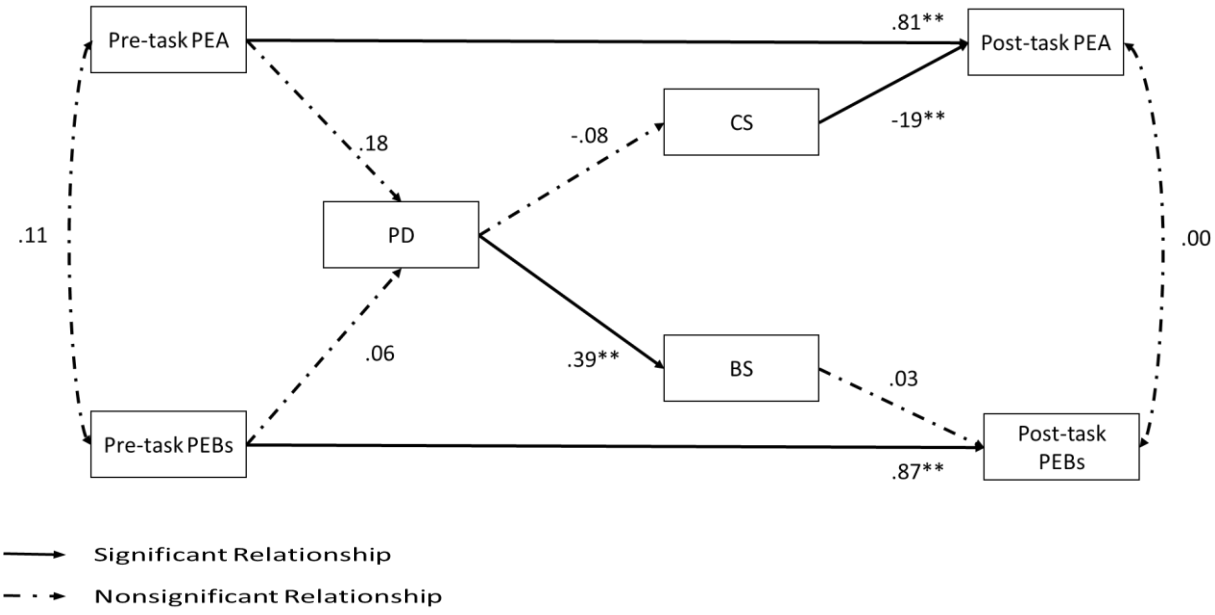
* $p < .05$, ** $p < .01$.

For the *consequences* condition (see Figure 10), here again, pre-task pro-environmental attitude was not significantly directly associated with psychological discomfort ($\beta = .18$, $p = .05$). Pre-task PEBs were not significantly directly associated with psychological discomfort ($\beta = .06$, $p = .50$). However, pre-task pro-environmental attitude was significantly directly associated with post-task pro-environmental attitude ($\beta = .81$, $p < .001$) and pre-task PEBs was significantly directly associated with post-task PEBs ($\beta = .87$, $p < .001$). No significant indirect effects were

present between the predicting exogenous variables and the other endogenous variables of the model. In addition, here again, the data suggested that a positive relationship between psychological discomfort and behavioral coping strategies was present ($\beta = .39$, $p < .001$). The data also suggested that a negative relationship between cognitive coping strategies and post-task pro-environmental attitude was present ($\beta = -.19$, $p = .002$)

Figure 10

Action Based Model Path Analysis Model Including Pro-Environmental Attitude, PEBs, Psychological Discomfort, and Coping Strategies with Standardized Coefficients for the Consequences Condition



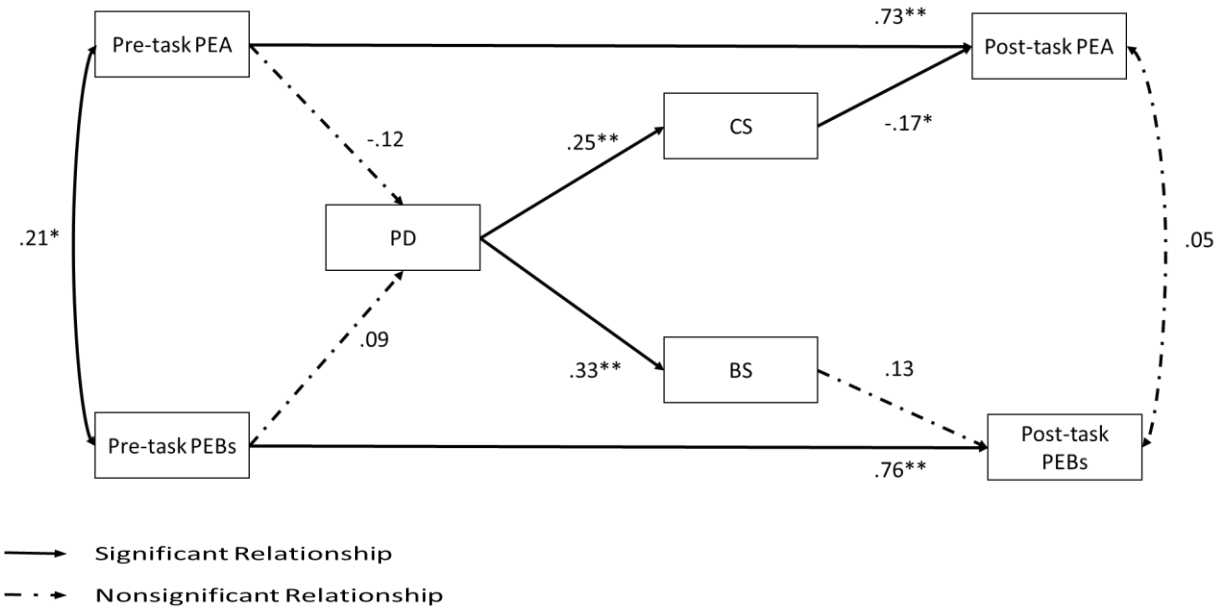
Note. PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = non-self-determined motivation towards the environment, CS = cognitive coping strategies, BS = behavioral coping strategies.

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

For the *solutions* condition (see Figure 11), pre-task pro-environmental attitude was not significantly directly associated with psychological discomfort (β = -.12, p = .21). Pre-task PEBs were not significantly directly associated psychological discomfort (β = .09, p = .34). However, pre-task pro-environmental attitude was significantly directly associated with post-task pro-environmental attitude (β = .73, p < .001) and pre-task PEBs was significantly directly associated with post-task PEBs (β = .76, p < .001). No significant indirect effects were present between the predicting exogenous variables and the other endogenous variables of the model. Furthermore, the data suggested that a positive relationship between psychological discomfort and cognitive coping strategies was present (β = .25, p = .01). The data also suggested that a positive relationship between psychological discomfort and behavioral coping strategies was present (β = .33, p < .001). Here again, data suggested that a negative relationship between cognitive coping strategies and post-task pro-environmental attitude was present (β = -.17, p = .01).

Figure 11

Action-Based Model Path Analysis Model Including Pro-Environmental Attitude, PEBs, Psychological Discomfort, and Coping Strategies with Standardized Coefficients for the Solutions Condition



Note. PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = non-self-determined motivation towards the environment, CS = cognitive coping strategies, BS = behavioral coping strategies.

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

In sum, the hypothesized model did not acceptably fit the data for any of the experimental conditions. This suggest that the changes in post-task pro-environmental attitude and PEBs could not be explained by the indirect effect of coping strategies used (i.e., behavioral or cognitive coping strategies) to cope for the psychological discomfort created by the images presented. However, some relationships in the model did suggest certain trends among the three different conditions. First, both pre-task pro-environmental attitude and PEBs were directly positively

associated to their post-task homologues. Second, psychological discomfort was positively associated with behavioral coping strategies. Finally, cognitive coping strategies were negatively associated with post-task pro-environmental attitude. These results indicated that for all three conditions, the use of cognitive strategies was negatively related to a change in pro-environmental attitude, suggesting that the more participants used these strategies, the less they believe that it was important to protect the environment. In other words, across conditions, the action-based model was especially useful to explain a negative change in pro-environmental attitude following the use of cognitive strategies.

In the next section, we examined whether a change in post-task pro-environmental attitude and PEBs could be explained by the motivation towards environment directly and indirectly through the coping strategies used (i.e., behavioral or cognitive coping strategies) to cope for the psychological discomfort created by the images presented.

Hierarchical Action-Based model of Inconsistency Compensation in the Environment Domain Model: Relationship between Motivation, Coping Strategies, Pro-Environmental Attitude and PEBs. I used path analysis to examine the potential effects of motivation on coping strategies related to psychological discomfort on both post-task pro-environmental attitude and PEBs intention. Similar to the previous models, pre-task pro-environmental attitude and PEBs were included in the models. The analyses were conducted in Mplus (version 8). The assumptions related to path analysis were verified for all groups. More specifically, the variables in the model were continuous and there was no missing data. Furthermore, univariate and multivariate normality were respected. In order to determine if the variables were respecting normality, their skewness value should be situated within ± 2 and their kurtosis value within ±7 (Kim, 2013). There were no univariate or multivariate outliers. In order

to be considered an outlier, univariate (*z*-score) and multivariate (χ^2) data point probability value needed to be inferior to .001. There was no excessive multicollinearity. As suggested by Tabachnick & Fidell (2007), correlation between variables should be under .90 to avoid multicollinearity.

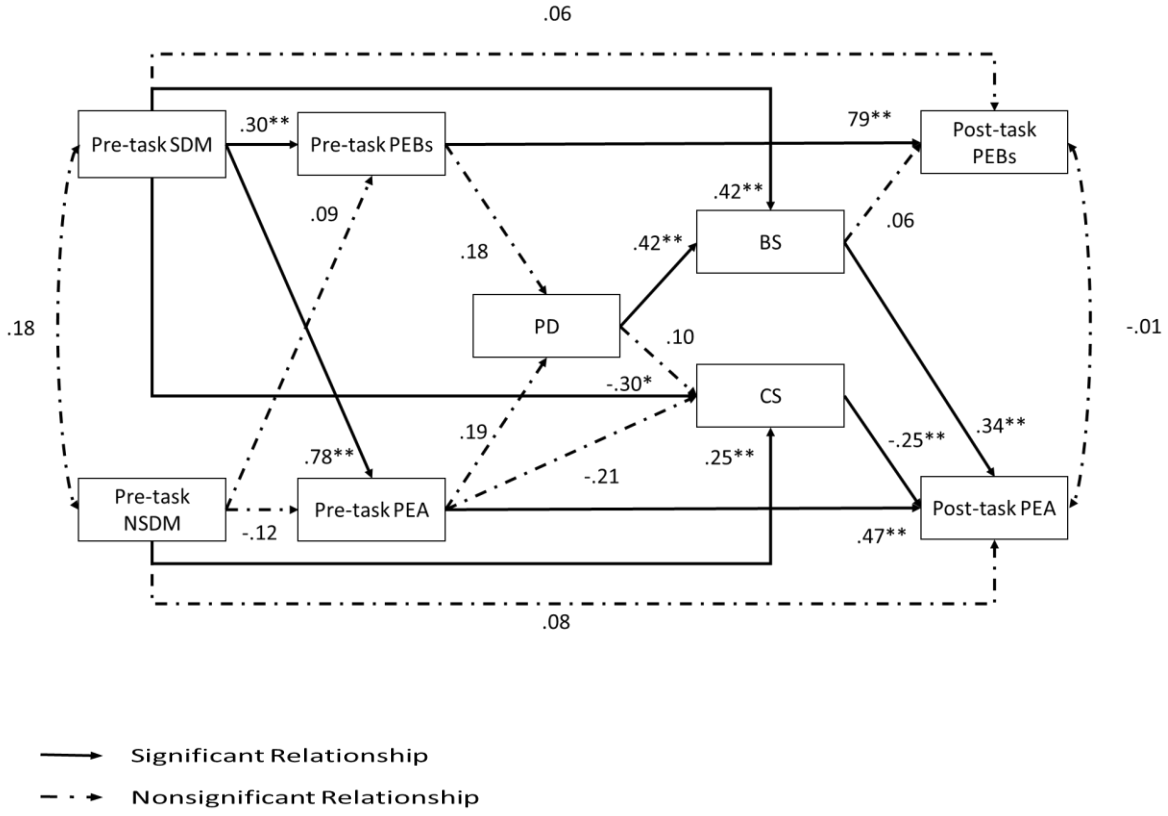
For the *causes* condition, the initial proposed model was not a good fit for the data ($\chi^2(18) = 78.64$, $p < .001$, CFI = .86, TLI = .72, RMSEA = .18 CI_{90}[.14, .23], SRMR =.13). In an attempt to reach acceptable model fit, associations that were not present in the hypothesized model but that are theoretically relevant were added to the model (Kline, 2010). Despite the addition of a relationship between pre-task motivation and cognitive coping strategies, a relationship between pre-task attitude and cognitive coping strategies, and a relationship between behavioral coping strategies and post-task attitude (see Figure 12), the fit of the model improved considerably ($\chi^2(15) = 30.47$, $p = .01$, CFI = .96, TLI = .92, RMSEA = .10 CI_{90}[.05, .15], SRMR =.06) although the value of the RMSEA remained relatively high. Despite this, some relationships were worth noting.

Pre-task environmental SDM was directly associated with pre-task PEBs ($\beta = .30$ $p = .001$), pre-task pro-environmental attitude ($\beta = .78$, $p < .001$), the use of behavioral coping strategies ($\beta = .42$, $p < .001$), and the use of cognitive coping strategies ($\beta = -.30$, $p = .04$). Pre-task environmental NSDM was directly associated with cognitive strategies ($\beta = .25$, $p = .01$). No significant indirect effects were present between the predicting exogenous variables (i.e., pre-task pro-environmental attitude and PEBs) and the other endogenous variables of the model. Furthermore, the data suggested that positive relationships between pre-task PEBs frequency and post-task PEBs intention ($\beta = .79$, $p < .001$), between pre-task pro-environmental attitude and post-task pro-environmental attitude ($\beta = .47$, $p < .001$), between psychological discomfort and

behavioral coping strategies ($\beta = .42$, $p < .001$), as well as between behavioral coping strategies and post-task pro-environmental attitude ($\beta = .34$, $p < .001$) were present. The data also suggested that a negative relationship between cognitive coping strategies and post-task pro-environmental attitude was present ($\beta = -.25$, $p < .001$). The results indicate that none of the variables predicted a change in in PEBS. However, pre-task SDM was significantly related to the use of behavioral strategies and, in turn, these strategies predicted a positive change in pro-environmental attitude. Also, pre-task NSDM was significantly related to the use of cognitive strategies and, in turn the use of these strategies predicted a negative change in pro-environmental attitude.

Figure 12

Hierarchical Action-Based model of Inconsistency Compensation in the Environment Domain Model Path Analysis Model Including Motivation, Psychological Discomfort, Coping Strategies, Pro-Environmental Attitude and PEBs with Standardized Coefficients for the Causes Condition



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = non-self-determined motivation towards the environment, CS = cognitive coping strategies, BS = behavioral coping strategies.

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

For the *consequences* condition, the initial proposed model was not a good fit for the data ($\chi^2(18) = 39.37$, $p = .003$, CFI = .96, TLI = .91, RMSEA = .11 CI_{90}[.00, .12], SRMR =.10). Here again, an association that was not present in the hypothesized model but that are theoretically and

empirically relevant were added to the model in order to reach acceptable model fit (Kline, 2010). With the addition of a relationship between pre-task attitude and cognitive coping strategies (see Figure 13), the model was an acceptable fit ($\chi^2(17) = 24.86$, $p = .10$, CFI = .98, TLI = .97, RMSEA = .07 CI_{90}[.05, .15], SRMR =.05).

As expected, pre-task PEB frequency was directly associated with pre-task environmental SDM ($\beta = .21$ $p = .03$). The current model explained 4.4% of the variability in pre-task PEBs. Pre-task pro-environmental attitude was directly associated with both pre-task environmental SDM ($\beta = .80$, $p < .001$) and pre-task environmental NSDM ($\beta = -.17$, $p = .004$). The current model explained 62.4% of the variability in pre-task environment attitude. Looking at coping strategies, behavioral coping strategies was, as expected, directly associated with pre-task environmental SDM ($\beta = .46$, $p < .001$). 34.6% of the variability in the intention of using behavioral strategies can be explained by the model. When it comes to the use of cognitive strategies, it was directly ($\beta = .34$, $p < .001$) and indirectly ($\beta = .06$, $p = .02$) associated with pre-task environmental NSDM. Specifically, pre-task environmental NSDM was negatively related to pre-task pro-environmental attitude ($\beta = -.17$, $p = .004$) which, in turn, was negatively related to cognitive coping strategies ($\beta = -.33$, $p < .001$). The model explained 28.8% of the variability of the use of cognitive coping strategies. Post-task pro-environmental attitude was directly ($\beta = .14$, $p = .01$) and indirectly (total indirect effect: $\beta = -.01$, $p = .04$) associated with pre-task environmental NSDM. Concretely, post-task pro-environmental attitude was indirectly associated to pre-task environmental NSDM by pre-task pro-environmental attitude ($\beta = -.13$, $p = .01$) and cognitive coping strategies ($\beta = -.08$, $p < .01$). Looking at the path with pre-task pro-environmental attitude as mediator, pre-task environmental NSDM was negatively related to pre-task pro-environmental attitude ($\beta = -.17$, $p = .004$) which, in turn, was positively related to post-

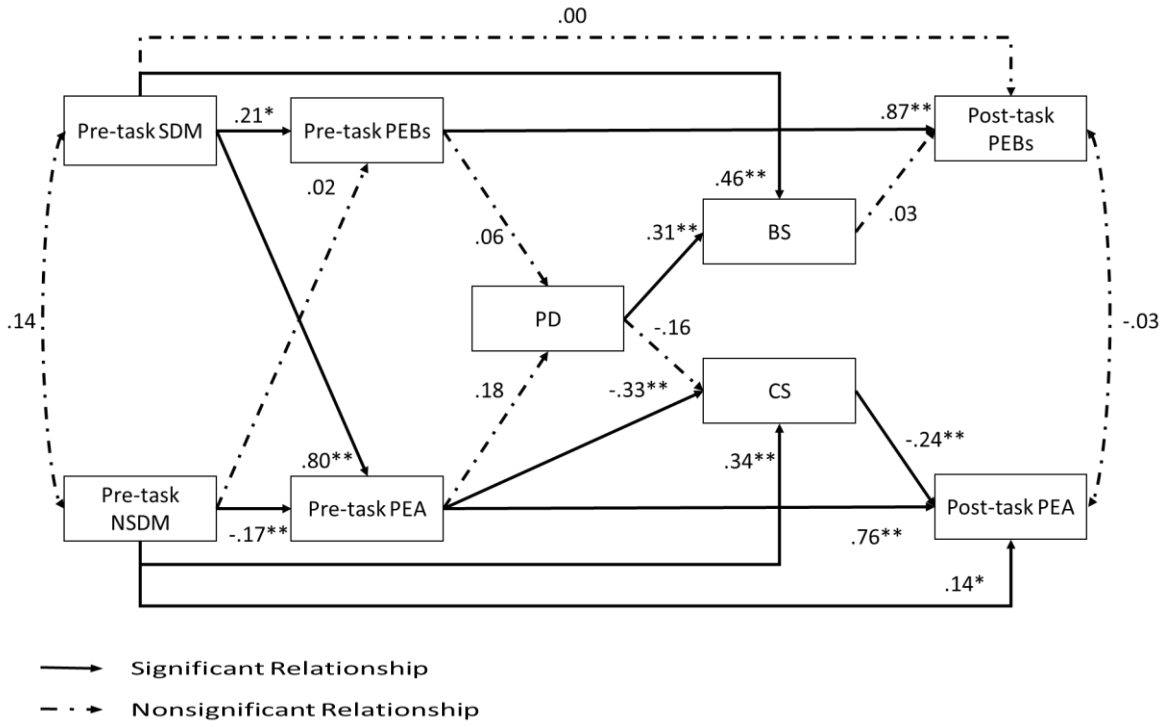
task pro-environmental attitude (β = .76, p < .001). Looking at the relationship with cognitive coping strategies as mediator, pre-task environmental NSDM was positively related to cognitive coping strategies (β = .34 p < .001) which, in turn, was negatively related to post-task pro-environmental attitude (β = -.24, p < .001). Finally, looking at the path with both mediators, pre-task environmental NSDM was negatively related to pre-task pro-environmental attitude (β = -.17, p = .004), which was negatively related to the use of cognitive coping strategies (β = -.33, p < .001), that was negatively related to post-task pro-environmental attitude (β = -.24, p < .001). The model explained 74.7% of the variability in post-task pro-environmental attitude.

Concerning other interesting relationships, the data suggested a positive relationship between pre-task PEBs and post-task PEBs (β = .87, p < .001) as well as a positive relationship between psychological discomfort and the intention of engaging in behavioral coping strategies (β = .31, p < .001).

In sum, the results indicated that none of the variables predicted a change in PEBs. However, pre-task NSDM was significantly related to the use of cognitive strategies and, in turn the use of these strategies predicted a negative change in pro-environmental attitude.

Figure 13

Hierarchical Action-Based model of Inconsistency Compensation in the Environment Domain Model Path Analysis Model Including Motivation, Psychological Discomfort, Coping Strategies, Pro-Environmental Attitude and PEBs with Standardized Coefficients for the Consequences Condition



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = non-self-determined motivation towards the environment, CS = cognitive coping strategies, BS = behavioral coping strategies.

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

For the *solutions* condition, the initial proposed model was not a good fit for the data ($\chi^2(18) = 39.66$, $p = .01$, CFI = .94, TLI = .91, RMSEA = .11 CI_{90}[.06, .15], SRMR =.10). Here again, with the addition of a relationship between pre-task attitude and cognitive coping

strategies (see Figure 14), the model was an acceptable fit ($\chi^2(17) = 27.49$, $p = .05$, CFI = .97, TLI = .93, RMSEA = .08 CI_{90}[.00, .13], SRMR =.05).

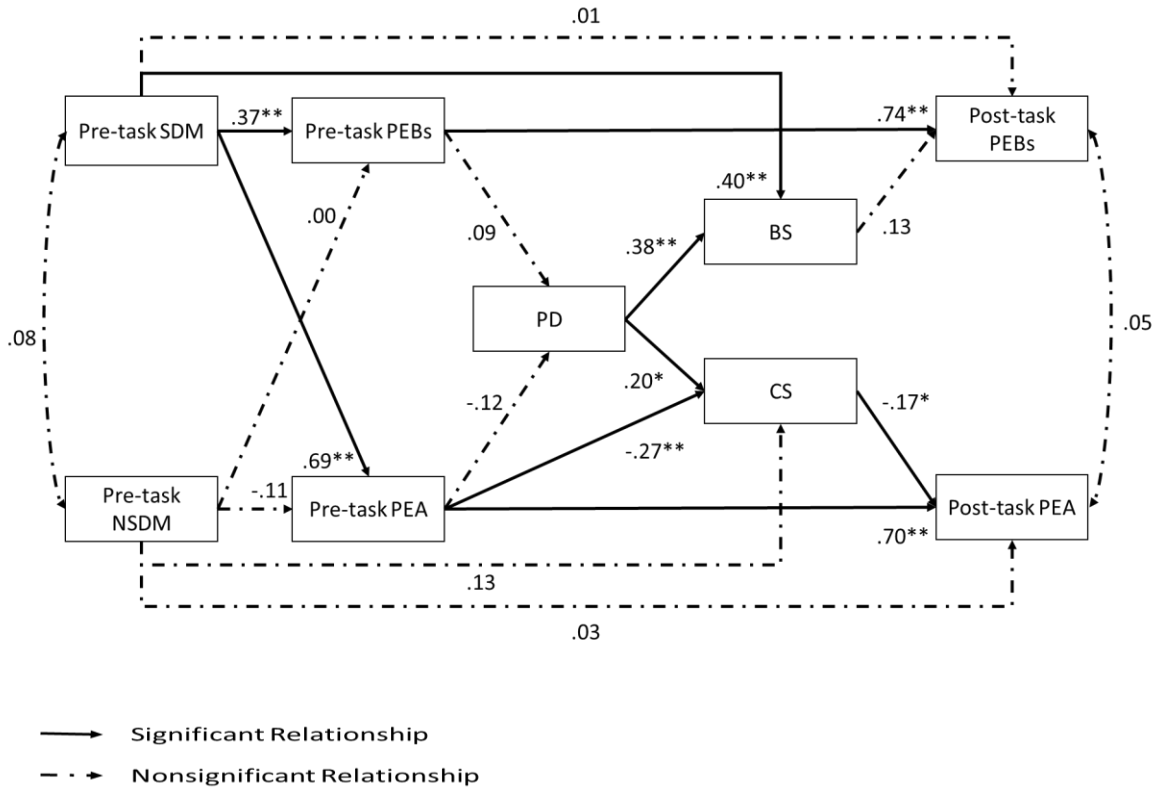
As expected, pre-task PEBs frequency was directly associated with pre-task environmental SDM ($\beta = .37$ $p < .001$). The current model explained 13.4% of the variability in pre-task PEBs. Pre-task pro-environmental attitude was directly associated with pre-task environmental SDM ($\beta = .69$, $p < .001$). The current model explained 47.3% of the variability in pre-task environment attitude. Looking at coping strategies, behavioral coping strategies was, as expected, directly associated with pre-task environmental SDM ($\beta = .40$, $p < .001$). 14.6% of the variability in the intention of using behavioral strategies can be explained by the model.

Concerning other interesting relationships, the data suggested a positive relationship between pre-task PEBs and post-task PEBs ($\beta = .74$, $p < .001$), a positive relationship between psychological discomfort and the intention of engaging in behavioral coping strategies ($\beta = .38$, $p < .001$), a positive relationship between psychological discomfort and the use of cognitive coping strategies ($\beta = .20$, $p = .03$), as well as a positive relationship between pre-task pro-environmental attitude and post-task pro-environmental attitude ($\beta = .70$, $p < .001$). Finally, the data also suggested a negative relationship between pre-task pro-environmental attitude and the use of cognitive coping strategies ($\beta = -.27$, $p = .002$) as well as a negative relationship between the use of cognitive coping strategies and post-task pro-environmental attitude ($\beta = -.17$, $p = .01$).

In sum, here again, the results indicated that none of the variables predicted a change in PEBs. However, the use of cognitive strategies predicted a negative change in pro-environmental attitude.

Figure 14

Hierarchical Action-Based model of Inconsistency Compensation in the Environment Domain Model Path Analysis Model Including Motivation, Psychological Discomfort, Coping Strategies, Pro-Environmental Attitude and PEBs with Standardized Coefficients for the Solutions Condition



Note. SDM = self-determined motivation towards the environment, NSDM = non-self-determined motivation towards the environment, PEA = pro-environmental attitude, PEBs = pro-environmental behaviors, PD = non-self-determined motivation towards the environment, CS = cognitive coping strategies, BS = behavioral coping strategies.

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

In summary, the data partially supported *hypothesis 7a* but did not support *hypothesis 7b*. Specifically, for the *consequences* and *solutions* conditions, high levels of environmental self-determination were directly related to high levels of intention of adopting behavior modification coping strategies. In addition, this relationship was also observed for the *causes* condition but the model was not a good fit for the data. For the *consequences* and the *solutions* conditions, there was no significant association between the intention of adopting behavior modification coping strategies and the intentions of engaging in PEBs in the future. Here again, this finding was present in the *causes* condition. Furthermore, the model partially supported *hypothesis 8a* and *8b*. In more details, for the *consequence* condition, high levels of environmental non-self-determination was directly related to high levels of cognitive restructuring coping strategies. This finding was also observed for the *causes* condition but the model was not a good fit for the data. Finally, for the *consequences* and *solutions* conditions, high levels of cognitive restructuring coping strategies were associated with low levels of post-task pro-environmental attitude. This was also observed for the *causes* condition.

Discussion

The main goal of this study was to identify the potential effects of viewing pictures related to the environmental conditions on individuals' changes in pro-environmental behaviors and pro-environmental attitude. In addition, I was also interested in potential relationships between different elements including motivation, psychological discomfort, coping strategies, pro-environmental behaviors, and pro-environmental attitude.

To begin, the results of the analyses conducted confirmed that the three types of images should all create some discomfort (*hypothesis 1*) and that pictures related to cause or consequence of global warming would generate more psychological discomfort than the pictures

related to solution to global warming (*hypothesis 2*). The results indicated that pictures depicting consequences of global warming were more psychologically uncomfortable than pictures depicting causes of the same environmental issue. In addition, the results indicated that the participants who viewed pictures related to solutions used less behavioral compensation strategies than the participant who viewed pictures related to causes or consequences (*hypothesis 3a*). However, this did not apply for the cognitive strategies not supporting *hypothesis 3b*. In other words, the results supported *hypothesis 3a* but not *hypothesis 3b*. The results indicated that individuals who viewed pictures depicting solutions to global warming would have the same level of intent to engage in PEBs in the future as the individuals who viewed pictures related to causes or consequences of the same environmental issue (*hypothesis 4*).

In regards to the role of motivation, the results indicated that the more environmentally self-determined an individual was, the more they experienced psychological discomfort when viewing pictures related to causes of global warming. However, environmental non-self-determination was not associated to psychological discomfort, only partially supporting *hypothesis 5a.* Findings indicated that the more environmentally non-self-determined an individual was, the more they experienced psychological discomfort when viewing pictures related to consequences of global warming. However, environmental self-determination was not associated to psychological discomfort, not supporting *hypothesis 5b*. Additionally, neither type of motivation was related to psychological discomfort when viewing pictures depicting solutions to global warming, not supporting *hypothesis 6*.

In regards to the relationship between environmental motivation, coping strategies and PEBs, results indicated that, for the individuals exposed to pictures depicting *consequences* and *solutions* to global warming, the more they were environmentally self-determined, the more they

had the intention of adopting behavior modification coping strategies, supporting *hypothesis 7a*. However, there was no significant association between the intention of adopting behavior modification coping strategies and the intention of engaging in PEBs in the near future, not supporting *hypothesis 7b*. The hypothesized relationships were also tested for the individuals exposed to pictures depicting causes of global warming, but the model results were not generalizable, not supporting both *hypothesis 7a* and *hypothesis 7b*. In short, *hypothesis 7a* was partially supported while *hypothesis 7b* was not supported at all. Finally, in regards to the relationship between environmental motivation, coping strategies and pro-environmental attitude, for the *consequences* condition, the findings indicated that the more environmentally non-self-determined an individual was, the more cognitive restructuring coping strategies they used, supporting *hypothesis 8a*. In addition, the results indicated that the more an individual used cognitive restructuring coping strategies, the lower their level of pro-environmental attitude was after viewing the images, supporting *hypothesis 8b*. This relationship between the use of cognitive strategies and its effect on pro-environmental attitudes after the viewing was also present for the *solutions* condition, supporting *hypothesis 8b*. However, there was no significant relationship between environmental non-self-determined motivation and the use of cognitive strategies, not supporting *hypothesis 8a*. The hypothesized relationships were also tested for the individuals exposed to pictures depicting causes of global warming, but the model results were not generalizable, not supporting *hypothesis 8a* and *hypothesis 8b*. In short, these findings partially supported *hypothesis 8a* and *8b*.

Other information, which was beyond the scope of the hypotheses, was obtained during this research project. To begin, neither the task nor the theme of the presented pictures appeared to significantly explain any differences in pro-environmental attitudes and behaviors. In other

words, the task failed to increase pro-environmental attitude or behaviors. The only significant difference observed was a decrease for both environmental self-determination and non-self-determination after the task regardless of the theme of the pictures viewed. It is important to note that, although these differences were statistically significant, the effect size was quite small. Despite the lack of significant differences related to the task, information on the relationships between the implicated variables was obtained.

Specifically, after testing models based on different theoretical contexts, it appeared that the models inspired from the self-determination theory and the HABICE model (i.e., a combination of concept from the cognitive dissonance theory and self-determined theory) were the only two that appropriately fitted the data. In more details, the model based on the concepts of self-determination theory was an acceptable fit for all the picture conditions. However, both environmentally self-determined and non-self-determined motivation were significant predictors of the intention to engage in pro-environmental behaviors for individuals exposed to pictures depicting causes of global warming. For the other picture themes, both types of motivation were not related to the intent of engaging in pro-environmental behaviors after the task. The model inspired by some of the concepts of action-based model (i.e., psychological discomfort, coping strategies) was not a good fit for any of the picture conditions. This theoretical framework might not have been inclusive enough in order to properly reflect the relationships among the variables. This impression was influenced by the fact that when some concepts from both theoretical frameworks were combined (HABICE model), the model had a good fit for the consequences and solutions conditions. However, the HABICE model was not a good fit for the *causes* condition. Based on the HABICE model, for the *consequences* conditions, the results indicated that environmentally self-determined individuals engaged in PEBs and had a pro-environmental

attitude prior to the task. After being exposed to pictures, the results indicated that environmentally self-determined individuals would use behavioral compensation strategies to address the psychological discomfort generated by the images. However, the use of behavioral compensation strategies was not related to the intent to engage in PEBs in the future. In regards to environmentally non-self-determined individuals, the results showed that, prior to viewing the images, their motivation type was negatively related to pro-environmental attitude and, after the task, their motivation is positively related to their pro-environmental attitude. In addition, environmentally non-self-determined individuals appeared to use cognitive compensation strategies which in turn would reduce their pro-environmental attitude. For the *solutions* condition, here again, the results indicated that environmentally self-determined individuals engaged in PEBs and had a pro-environmental attitude prior to the task. After being exposed to pictures, the results indicated that self-determined individuals would use behavioral compensation strategies to address the psychological discomfort generated by the images. Environmentally non-self-determination did not appear to play a significant role in this particular condition. In addition, looking at both the *consequences* and *solutions* conditions, there are similarities. First, environmentally self-determined individuals appeared to engage in PEBs and have a pro-environmental attitude prior to the task. In addition, environmentally self-determined individuals appeared to have the tendency to use behavioral compensation strategies in order to cope with the psychological discomfort, but this did not lead to a significant increase in PEBs. Finally, the higher the level of pro-environmental attitude prior to the task, the less individuals used cognitive compensation strategies, which, in turn, was negatively related to the level of pro-environmental attitude after exposure to images depicting consequences and solutions to global warming. In other words, the HABICE model highlighted the significant involvement of

cognitive dissonance theory concepts including psychological discomfort and coping strategies in the relationships among pro-environmental motivation and pro-environmental attitude and behaviors. One element that appeared to be constant between the self-determined theory model and the combined framework model was that pre-task pro-environmental attitude and behaviors were predictors of their post-task homologues. In short, the model based on self-determination concepts was a good fit for all conditions but the changes in pro-environmental attitude and behaviors were not related to motivation for the *consequences* and *solutions* conditions. The model based solely on concepts of cognitive dissonance theory was not a good fit for all the conditions. However, some of the shortcomings of each of the single theoretical framework appeared to be addressed when both frameworks are combined.

This study contributed to the advancement of knowledge on several fronts. In a theoretical perspective, the findings supported the concepts of self-determination theory as a good theoretical framework to understand the relationships between environmental motivation and pro-environmental behaviors after being exposed the pictures depicting causes, consequences or solution to global warming. The results did not provide support to the action-based model as a good framework to predict the relationships between psychological discomfort, coping strategies, and pro-environmental attitude and behaviors after being exposed any of the environmental pictures. More importantly, the findings supported the combination of elements of both theories, as suggested by the HABICE model, as a good theoretical framework to understand the relationships between environmental motivation, psychological discomfort, coping strategies, and pro-environmental attitude and behaviors for individuals exposed to pictures depicting consequences and solutions to global warming. This particular model contributed to the understanding of the role of environmental motivational orientation in the

choice of compensation strategies used to cope with the psychological discomfort related to the viewing of pictures related to consequences and solutions to global warming. In both conditions, environmentally self-determined individuals used behavioral compensating strategies to cope with the psychological discomfort. For the consequence condition, environmentally non-self-determined individuals used cognitive compensation strategies. This model also contributed to the understanding of the effect of cognitive compensation strategies on the level of pro-environmental attitude after viewing pictures depicting consequence and solutions to global warming. In both conditions, the use of cognitive compensation strategies led to a decrease in pro-environmental attitude after the viewing. In addition, the more elevated pro-environmental attitude was, the less individuals would use cognitive compensation strategies. This could suggest that high level of pro-environmental attitude could be a deterrent factor to the use of cognitive compensating strategies. Of note, the HABICE model appeared to be the most useful in understanding the involvement of environmental motivation on potential changes in pro-environmental attitude when individuals are exposed to pictures depicting consequences of global warming. Looking at practical implications, this research contributed in gaining knowledge towards the choice of stimuli to use in pro-environmental attitude or behaviors campaigns. More specifically, only using pictures depicting causes, consequences or solutions to global warming in these types of campaigns would likely not be effective in increasing pro-environmental behaviors or attitude. However, it might influence pro-environmental motivation. It could increase motivation for environmentally non-self-determined individuals. In addition, it could decrease motivation for environmentally self-determined individuals, which could not only interfere with the campaign goals but could also lead to a decrease in pro-environmental behaviors.

Chapter 4

General Discussion

This research had two main objectives. One of these was to examine the extent to which the communication of relatively negative and relatively positive information related to the environmental condition could generate psychological discomfort and how this discomfort could influence pro-environmental attitude and pro-environmental behaviors (PEBs). Another objective was to examine the potential influence of individuals' environmental motivation towards psychological discomfort and PEBs Since human actions are related to different environmental problems including global warming (Winter & Koger, 2014), acquiring a better understanding of how to motivate individuals to engage in PEBs is important. In order to meet those objectives two studies were created. The main purpose of the first study was to select appropriate visual stimuli to be used in subsequent studies looking at psychological discomfort towards PEBs and the strategies used to remediate to it. The purpose of the second study was to examine the validity of 3 different models, SDT, Action-Based, Hierarchical Action-Based model of Inconsistency Compensation in the Environment domain (HABICE), to explain the potential relationships between motivational orientations, the psychological discomfort generated by the exposure to images related to global warming, the reported compensation strategies, and the change in attitudes and behaviors. The findings of these studies are discussed below.

Summary of Findings

Study 1

First, I was able to acquire 24 pictures to be used in *Study 2*. In addition to this objective, other useful information was gathered from the findings. The results showed that pictures depicting causes or consequences were perceived more negatively than pictures depicting

solutions regardless if the topic was global warming or health issues. Furthermore, findings indicated that the individual's perceived level of competence towards PEBs did not influence the differences in valence between the picture themes on the topic of global warming. Finally, results suggested that the individual's motivation towards PEBs did not influence the perception of the images related to global warming. In summary, findings suggested that regardless of the individual's perceived level of competence in partaking in PEBs and their motivation towards PEBs, individuals would have a negative perception of pictures depicting causes and consequences to global warming and a positive perception of pictures related to solutions to global warming.

Study 2

This study contributed insightful information on various elements. These include information on the effects of different images related to global warming on pro-environmental attitude, PEBs, environmental motivation, psychological discomfort, as well as psychological discomfort compensation strategies. In addition, the study contributed information on the relationships between motivational orientations, the psychological discomfort generated by the exposure to environmental images, the report of compensation strategies, and the changes in attitudes and behaviors.

Concerning significant changes related to the task, findings indicated that the task did not significantly increase nor decrease the level of pro-environmental attitude and the frequency of intended PEBs in the near future, regardless of the theme of the pictures presented. Furthermore, the results indicated that the task generated significant changes in environmental motivation. Specifically, both environmental self-determination and non-self-determination were higher prior to the viewing of the picture than after, regardless of the theme of the pictures presented. In other

words, exposure to images depicting causes, consequences or solutions was not enough, on its own, to significantly change individuals' pro-environmental attitude and intentions to engage in PEBs. In addition, exposure to such images was sufficient to significantly decrease both environmental self - and non-self-determination.

In regards to the effects of the theme of the images related to global warming, psychological discomfort was present for the three environmental picture themes. Specifically, more psychological discomfort was reported for the pictures depicting causes and consequences of global warming when compared to the pictures depicting solutions to global warming. In addition, pictures depicting consequences of global warming was more psychologically uncomfortable than pictures depicting causes of the same environmental issue. Concerning psychological discomfort compensation strategies, participants who viewed pictures related to solutions used less behavioral compensation strategies than the participant who viewed pictures related to causes or consequences. However, this did not apply for the cognitive strategies.

Looking at relationships between motivation and psychological discomfort, results indicated that the more environmentally self-determined individuals were, the more they experienced psychological discomfort when viewing pictures related to causes of global warming. In addition, the more environmentally non-self-determined individuals were, the more they experienced psychological discomfort when viewing pictures related to consequences of global warming. However, neither type of environmental motivation was related to psychological discomfort in individuals who were exposed to pictures depicting solutions to global warming. Different pictures seem to have different effects on different individuals.

In order to better understand the relationships between motivation, coping strategies, PEBs, and pro-environmental attitude, I had the opportunity to assess three models based on

different theoretical frameworks. The model exclusively based on concepts of self-determination appeared to be more appropriate to predict the relationship between motivation and pro-environmental behaviors for pictures related to causes of global warming. . More specifically, when exposed to pictures depicting causes of global warming, the more environmentally self-determined individuals were, the more they reported the intention of adopting PEBs. Unfortunately, this model did not contribute to the understanding of the involvement of environmental motivation on post-task PEBs for the consequence and solution conditions. The model solely based on the action-based model was not a good fit for the prediction of pro-environmental attitude or PEBs for all three conditions. The model combining concepts from the action-based model and self-determination theory, the HABICE model, appeared to be more appropriate to predict the effects of pictures related to the consequences and solutions to global warming on environmental motivation, pro-environmental attitude and behaviors. Specifically, the HABICE model appeared to be the most useful in understanding the involvement of motivation on potential changes in pro-environmental attitude when individuals are exposed to pictures depicting consequences to global warming. More specifically, after viewing that type of picture, environmentally non-self-determined individuals used cognitive compensation strategies which, in turn, affected the change in pro-environmental attitude. The use of cognitive compensation strategies led to a decrease in pro-environmental attitude after the viewing regardless if the picture viewed were related to consequences or solutions to global warming. In addition, the more elevated pro-environmental attitude was the less individual would use cognitive compensation strategies. This could suggest that high level of pro-environmental attitude could be a deterrent factor to the use of cognitive compensating strategies. When exposed to pictures depicting consequences or solutions to global warming, environmentally

self-determined individuals used behavioral compensating strategies to cope with the psychological discomfort but those behavioral compensation strategies were not significantly related to a change in intended PEBs. Unfortunately, the results related to the HABICE model for the individuals exposed to picture depicting causes of global warming were not generalizable. In short, the HABICE model appeared to be the most useful in understanding involvement of environmental motivation towards the potential changes in pro-environmental attitude when individuals are exposed to pictures depicting consequences to global warming. Finally, looking at similarities between the SDT model and the HABICE model, it appears that the individuals' pro-environmental attitude and behaviors before the task were the most constant predictors of the pro-environmental attitude and behaviors after the viewing task.

Theoretical Implications

Self-Determination Theory

Some of the current research findings contributed to the knowledge in this particular theoretical framework. To begin, environmental competency and motivation towards PEBs did not have a significant effect on the valence perception of the pictures depicting causes, consequences or solutions to global warming. This suggested that individuals perceived the negative valence of pictures related to causes and consequences, and the more positive valence of pictures related to solutions regardless of their level of competency or motivation towards the environment. In addition, findings suggested that, once again, the SDT framework contributed to the understanding of the role of motivation in changes in PEBs specifically in the *causes* condition where environmentally self-determination was positively related to intention to engage in future PEBs and non-self-determination was negatively related to PEBs intention.

Action-Based Model

Some of the findings contributed to the knowledge of the application of this theory to a pro-environmental context. Based on the results, the action-based model was not a good fit for the prediction of changes in PEBs and pro-environmental attitude regardless of theme of the picture presented. However, past research supported the implication of the action-based model concepts in changes in PEBs (Lavergne & Pelletier, 2015). This being said, I suggest interpreting the current findings related to action-based model with caution.

Combining both Theoretical Frameworks: Hierarchical Action-Based model of Inconsistency Compensation in the Environment Domain Model

The findings of this research support the application of the HABICE model in the understanding of changes in PEBs and pro-environmental attitude. This model combined important elements from both the SDT and action-based model frameworks which contributed to a more in-depth understanding of the process leading to potential PEB and pro-environmental attitude changes. One could say that this model added predictive power to the SDT model and compensated for some of the shortcomings of the action-based model framework, especially for the consequence and solution conditions

Looking at the overall findings, it appeared that certain theoretical models were more appropriate than others in understanding the relationship between the task and PEBs or pro-environmental attitude. Specifically, it appeared that the SDT model was better at predicting the relationships between, environmental motivation and PEBs when individuals were exposed to pictures depicting causes. The HABICE model was better at predicting the relationships between environmental motivation, the selection of psychological discomfort coping strategies, and pro-environmental attitude when individuals were exposed to pictures depicting consequences and

solutions to global warming. This model was particularly useful in the understanding of the involvement of environmental motivation and coping strategies in the changes of post-task pro-environmental attitude for individuals exposed to pictures depicting consequence to global warming. Taken together, this would further suggest that the theme of the stimuli influenced the process leading to potential changes in PEBs and pro-environmental attitude.

Practical Implications

Looking at the findings in a more practical manner, when considering the overall results of the studies, some results could be useful to pro-environmental campaigning. First, only using pictures related to the causes, consequences, or solutions to global warming in an environmental campaign that aims at increasing pro-environment behaviors and attitude might not be enough to obtain that goal. Only using those stimuli could have no significant influence on pro-environmental attitude and behaviors. Although, it could increase pro-environmental motivation in environmentally non-self-determined individuals regardless of the theme of the pictures. However, it could also decrease the environmental motivation of environmentally self-determined individuals. This could be particularly problematic since one of the most recurrent predictors of pro-environmental behavior intentions after the exposure was the frequency of pro-environmental behaviors prior to exposure which in turn was related to environmental self-determination. The less environmentally self-determined an individual would be, the less they would engage in pro-environmental behaviors. In other words, instead of increasing pro-environmental behaviors, only using pictures could instead decreased the frequency of these behaviors in the future for previously more environmentally motivated individuals.

The findings suggested that the picture theme and, by extension, the psychological discomfort associated with it could have an influence on the process leading to pro-

environmental behaviors or attitude after the exposure. The different picture themes all generated different level of discomfort. Looking at pictures depicting causes of global warming, this theme generated a lower level of discomfort than pictures related to consequences and a higher level of discomfort than pictures related to solutions. In addition, the SDT model appeared to be the best suited to explain changes in PEBs for this particular picture theme. When they were exposed to pictures depicting causes of global warmings, the more environmentally self-determined individuals would have been before exposure, the more they could have the intention of engaging in pro-environmental behaviors in the future. The more environmentally non-self-determined individuals would have been before exposure, the less they could have the intent in engaging in pro-environmental behaviors in the future.

Concerning pictures depicting consequences of global warming, the HABICE model appeared to be better suited to explain changes in pro-environmental attitude and behaviors following exposure to the pictures while considering motivational orientation and coping strategies. The more environmentally self-determined an individual would have been, the more they could have engaged in pro-environmental behaviors before exposure which, in turn, could lead to more intention in engaging pro-environmental behaviors in the future. In addition, the more environmentally self-determined an individual would have been, the more they could have had high level of pro-environmental attitude before exposure which, in turn, could lead to a decrease in the use of cognitive coping strategies, which could lead to an increase in pro-environmental attitude after exposure. It's worth mentioning that, environmentally self-determined individuals would have the tendency to use behavioral compensation strategies to cope with the psychological discomfort generated by the viewing. However, behavioral compensation strategies were not significantly related to an increase in intention to engage in

PEBs. Looking at non-self-determination, the more environmentally non-self-determined an individual would have been, the lower the pro-environmental attitude could have been before exposure which, in turn, could lead to an increase in cognitive coping strategies, which could lead to a decrease in pro-environmental attitude after exposure. However, environmentally non-self-determination was also directly positively related to pro-environmental attitude after the task. This can imply that non-self-determined individual through the use of cognitive strategies could increase their pro-environmental attitude when expose to picture depicting consequence to global warming.

The HABICE model was also adequate to explain changes in pro-environmental attitude and behaviors when individuals were exposed to pictures showing solutions to global warming. Similarly, in agreement with the HABICE model for the pictures depicting consequences, the more environmentally self-determined individuals would have been, the more they could have engaged in pro-environmental behaviors before exposure which, in turn, could lead to more intention in engaging pro-environmental behaviors in the future. In addition, the more environmentally self-determined individuals would have been, the more they could have had high levels of pro-environmental attitudes before exposure which, in turn, could lead to a decrease in the use of cognitive coping strategies, which could lead to an increase in pro-environmental attitude after exposure. Here again, similarly to the exposure to consequences related pictures, environmentally self-determined individuals would have the tendency to use behavioral compensation strategies to cope with the psychological discomfort generated by the viewing. However, behavioral compensation strategies were not significantly related to an increase in intention to engage in PEBs. In regards to environmental non-self-determination, this

form of motivation would not have a significant influence on pro-environmental attitude and behaviors before and after the exposure.

In short, the findings would suggest that environmentally self-determined individuals would be more likely to maintain their pro-environmental behaviors frequency and pro-environmental attitude levels regardless of the theme of the picture presented. Environmentally non-self-determined individuals would be more likely to decrease pro-environmental behaviors when exposed to pictures depicting causes of global warming. In addition, when exposed to pictures depicting consequences of global warming, these individuals would, with the use of cognitive compensating strategies, be more likely to report higher levels of pro-environmental attitude. Finally, environmental non-self-determination would not be related to pro-environmental behaviors and attitude when individuals are exposed to pictures depicting solutions to global warming. Briefly, it appeared that the three pictures theme generated psychological discomfort. However, in reference to the action-based model, the discomfort, on itself, did not seem to explain pro-environmental attitude and behavioral change. When considering this information with the other results, it could bring one to wonder if psychological discomfort generated by pictures related to the consequences of global warming was too elevated and the discomfort for the pictures depicting solutions too little to encourage changes in pro-environmental attitude and behaviors.

Limitations

The research conducted did contribute valuable information. However, some limitations should be considered.

In regards to the second study, a limitation would be related to the use of the measures assessing behavioral coping strategies and PEBs. In regards to the frequency of PEBs prior to the

task, participants were asked to recall their PEBs over the last week which could be biased by their memory abilities as well as personal or societal biases. In addition, participants were asked to report their intention in adopting behavioral coping strategies as well as their intention in engaging in PEBs in the next seven days. Here again, their responses might have been influenced by personal and societal biases. In both cases, the data recorded might not have been the actual frequency of past or future PEBs. Furthermore, there was a methodological error related to the questionnaire measuring intention towards engaging in PEBs. Although the question was about their intent towards future PEBs, the verb tense of the items presenting different PEBs was set in the past. This might have confused the participant and affected the accuracy of their response.

Finally, for limitation affecting both studies, the questions related to the participants' sex and race were part of the Integrated System of Participation in Research demographic questionnaire. Although the information provided by the participants were about sex and race, the questions asked the participant about their gender and ethnicity respectively, limiting the capacity to clearly identify the participants' characteristics. In addition, the samples were mostly composed of female undergraduate students. This could affect the external validity and generalization of the results. Thus, further caution is required in regards to the generalization of the results. Another limitation would be in regard to the creation and the use of measures adapted from pre-exiting measures. Not all psychometric properties of the adapted measures were assessed. However, most of the changes were only directed at contextual, temporal or grammatical elements of the items which should not affect the assessment of the construct. In addition, the internal consistency of the modified measures were all satisfactory.

The mentioned limitations encourage us to cautiously interpret the results of the presented studies. However, these limitations do not discredit the research findings. After all, the

obtained results did support some of the expressed hypotheses. In closure, while considering the aforementioned limitation, I believe that this research contributed significant theoretical and practical knowledge in our understanding of the process behind motivating pro-environmental attitude and behaviors.

Future Research

Taken together, past research as well as current findings and limitations generated future research ideas. I am curious to see what the findings would be if one would replicate *Study 2* with a bigger and more diversified sample size for the different path analysis models. I would be interested in observing the potential influence of different individual differences (e.g. age group, culture, socioeconomic level) on the perception of images related to global warming as well as on their choice of coping strategies and its effect on PEB intention and pro-environmental attitudes. I would also be interested to find out if the action-based framework model would have a good fit and could explain potential changes in pro-environmental attitude and behaviors. One might also consider a more in-depth assessment of PEBs prior and after the task by including an inventory of PEBs for a few days prior and after to the task. It might be interesting to use psychophysiological measures to assess the level of discomfort experienced during the task. It could also be interesting to include the use of a daily diary to monitor the fluctuation of discomfort following the exposure to the task. The integration of such assessment tools could reflect a better depiction of reality. The current research project used pictures as visual stimuli. It could be interesting to test other type of visual stimuli including text and a combination of text and pictures. Furthermore, when considering the concepts of fear appeal, it would be highly suggested to combine threatening stimuli with a stimulus that present a solution to that threat. In other words, future research looking at increasing pro-environmental attitude and PEBs might

benefit from looking into the effect of combining cause or/and consequence stimuli with a solution stimulus.

References

Akoglu H. (2018). User's guide to correlation coefficients. *Turkish journal of emergency medicine, 18*(3), 91-93. doi:10.1016/j.tjem.2018.08.001

Aitken, N. M., Pelletier, L. G., & Baxter, D. E. (2016). Doing the difficult stuff: Influence of self-determined motivation toward the environment on transportation proenvironmental behavior. *Ecopsychology*, *8*(2), 153–162.

Archontoulis, S.V., & Miguez, F. (2015). Nonlinear Regression Models and Applications in Agricultural Research. *Agronomy Journal, 107* (2), 786-798.

Arnold, M. B. (1960). *Emotion and personality* (Vols. I and II). Columbia University.

Assis, N., Reysen, S., & Katzarska-Miller, I. (2017). Being global is being green: associations between global citizenship identification and measures of environmental motivations and attitudes. *International Journal of Energy Policy and Management, 2*(3), 13-19.

Baek, T. H., Yoon, S., & Kim, S. (2015). When Environmental Messages Should Be Assertive: Examining the Moderating Role of Effort Investment. *International Journal of Advertising*, *34*(1), 135-157. doi:10.1080/02650487.2014.993513

Babooram, A. (2008). *Canadian participation in an environmentally active lifestyle*. Statistics Canada. https://www150.statcan.gc.ca/n1/en/pub/16-002-x/16-002-x2008004-eng.pdf?st=uSocHLrb

Barbeau, K., Boileau, K., Sarr, F., & Smith, K. (2018). Path analysis in Mplus: A tutorial using a conceptual model of psychological and behavioral antecedents of bulimic symptoms in

young adults. *Tutorials in Quantitative Methods for Psychology*, *15*(1), 38–53. https://doi.org/10.20982/tqmp.15.1.p038

Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin, 107*, 238–246.

Blais, M. R., Sabourin, S., Boucher, C., Vallerand, R. J., (1990). Toward a motivational model of couple happiness. *Journal of Personality and Social Psychology, 59*(5), 1021-1031. doi:10.1037/0022-3514.59.5.1021

Brannon, L. A., Tagler, M. J., & Eagly, A. H. (2007). The moderating role of attitude strength in selective exposure to information. *Journal of Experimental Social Psychology, 43*, 611–617. doi: 10.1016/j.jesp.2006.05.001

Cacioppo, J. T., & Berntson, G. G. (1994). Relationship between attitudes and evaluative space: A critical review, with emphasis on the separability of positive and negative substrates. *Psychological Bulletin, 115*(3), 401-423. doi:10.1037/0033-2909.115.3.401

Chen, M. (2016). Impact of fear appeals on pro-environmental behavior and crucial determinants. *International Journal of Advertising*, *35*(1), 74–92. https://doi.org/10.1080/02650487.2015.1101908

Cooper, J. (2007). *Cognitive dissonance: Fifty years of a classic theory*. SAGE Publications Ltd. doi: 10.4135/9781446214282.n3

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. 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*, 227-268.

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. https://doi.org/10.1016/j.jenvp.2010.04.002

Desmarais, P. (2019). *Distinguishing pro- and harmful-environmental behaviours: the roles of motivation, stages of change, basic psychological needs, and nature relatedness* (Doctoral dissertation, University of Ottawa). uO Research. http://dx.doi.org/10.20381/ruor-24068

Dickinson, A.,& Dearing, M. F. (1979). Appetitive-aversive interactions and inhibitory processes. In A. Dickinson & R. A. Boakes (Eds.), *Mechanisms of learning and motivation* (pp. 203–231). Erlbaum.

Dillard, J. P., Plotnick, C. A., Godbold, L. C., Freimuth, V. S., & Edgar, T. (1996). The multiple affective outcomes of AIDS PSAs: Fear appeals do more than scare people. *Communication Research, 23,* 44–72. doi: 10.1177/009365096023001002

Elliot, A. J., & Devine, P. G. (1994). On the motivational nature of cognitive dissonance: Dissonance as psychological discomfort. *Journal of Personality and Social Psychology, 67*(3), 382-394. doi:10.1037/0022-3514.67.3.382

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41,* 1149-1160. Download PDF

Fazio, R., & Cooper, J. (1983). Arousal in the dissonance process. In J. Cacioppo & R. Petty (Eds.), *Social psychophysiology: A sourcebook* (pp. 122-152). Guilford Press.

Festinger, L. (1957). *A theory of cognitive dissonance*. Row, Peterson and Company.

Ferguson, C. J. (2009). An effect size primer: a guide for clinicians and researchers. *Professional Psychology: Research and Practice, 40*(5), 532-538.

Field, A. (2009). *Discovering statistics using IBM SPSS statistics: And sex and drugs and rock n roll* (3rd edition). Sage.

Frey, B. (2018). *The SAGE encyclopedia of educational research, measurement, and evaluation* (Vols. 1-4). SAGE Publications, Inc. doi: 10.4135/9781506326139

Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist, 66*, 290. doi: 10.1037/a0023566

Graves, L. M., Sarkis, J., & Zhu, Q. (2013). How transformational leadership and employee motivation combine to predict employee proenvironmental behaviors in china. *Journal of Environmental Psychology*, *35*, 81-91. doi:10.1016/j.jenvp.2013.05.002

Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioral difficulty on the saliency of the association between self-determined motivation and environmental behaviors. *Canadian Journal of Behavioral Sciences, 29*, 157–166.

Guertin, C., Rocchi, M., Pelletier, L., Émond, C., & Lalande, G. (2015). The role of motivation and the regulation of eating on the physical and psychological health of patients with cardiovascular disease. *Journal of Health Psychology, 20*(5), 543-555. doi:10.1177/1359105315573471

Harmon-Jones, E., Amodio, D. M., & Harmon-Jones, C. (2009). Action-based model of dissonance: a review, integration, and expansion of conceptions of cognitive conflict. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 41, pp. 119-166). http://dx.doi.org/10.1016/S0065-2601(08)00403-6.

Hartmann, P., Apaolaza, V., D'Souza, C., Barrutia, J., & Echebarria, C. (2014). Environmental threat appeals in green advertising: The role of fear arousal and coping

efficacy. *International Journal of Advertising*, *33*(4), 741–765. https://doi.org/10.2501/IJA-33-4-741-765

Hodgins, H. S. (2008). Motivation, threshold for threat, and quieting the ego. In H. A.Wayment & J. J. Bauer (Eds), *Transcending self-interest: Psychological explorations of the quiet ego* (pp. 117-124). Washington, WA: American Psychological Association. http://dx.doi.org/10.1037/11771-011

Hodgins, H. S., & Knee, C. R. (2002). The integrating self and conscious experience. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 87-100). University Of Rochester Press.

Hodgins, H. S., & Liebeskind, E. (2003). Apology versus defense: Antecedents and consequences. *Journal of Experimental Social Psychology, 39*(4), 297-316. doi:10.1016/S0022-1031(03)00024-6

Hodgins, H., Weibust, K., Weinstein, N., Shiffman, S., Miller, A., Coombs, G., & Adair, K. (2010). The cost of self-protection: Threat response and performance as a function of autonomous and controlled motivations. *Personality and Social Psychology Bulletin, 36*(8), 1101-1114. doi:10.1177/0146167210375618

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. doi:10.1080/10705519909540118

Institute for Social Research. (2013). *Canadian Election Study, 2011.* Retrieved July 2, 2016, from Canadian Opinion Research Archive (CORA): http://www.queensu.ca/cora/ces.html

Janis, I. L., & Feshbach, S. (1953). Effects of fear-arousing communications. *The Journal of Abnormal and Social Psychology, 48*(1), 78-92. doi:10.1037/h0060732

Kim, H.Y. (2013). Statistical notes for clinical researchers: Assessing normal distribution using skewness and kurtosis. *Restorative Dentistry and Endontics*, *38*, 52–54. doi:10.5395/rde.2013.38.1.52

Kline, R. B. (2010). *Principles and practice of structural equation modelling (3rd ed.).* New York: The Guilford Press.

Kreidler, S. M., Muller, K. E., Grunwald, G. K., Ringham, B. M., Coker-Dukowitz, Z. T., Sakhadeo, U. R., Barón, A. E., & Glueck, D. H. (2013). GLIMMPSE: Online Power Computation for Linear Models with and without a Baseline Covariate. *Journal of statistical software*, *54*(10), i10. https://doi.org/10.18637/jss.v054.i10

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychological Review*, 97(3), 377-395. doi:10.1037/0033-295X.97.3.377

Lavergne, K. J. (2015). *The hierarchical action-based model of inconsistency compensation in the environmental domain: exploring the role of individual differences in distal motivation* (Doctoral dissertation, University of Ottawa). uO Research. http://dx.doi.org/10.20381/ruor-4360

Lavergne, K. J., & Pelletier, L. G. (2015). Predicting individual differences in the choice of strategy to compensate for attitude-behaviour inconsistencies in the environmental domain. *Journal of Environmental Psychology*, *44*(C), 135-148. doi:10.1016/j.jenvp.2015.10.001

Lavergne, K. J., & Pelletier, L. G. (2016). Why are attitude–behaviour inconsistencies uncomfortable? Using motivational theories to explore individual differences in dissonance arousal and motivation to compensate. *Motivation and Emotion, 40*(6), 842–861. https://doi.org/10.1007/s11031-016-9577-3

Lavergne, K. J., Sharp, E. C., Pelletier, L. G., & Holtby, A. (2010). The role of perceived government style in the facilitation of self-determined and non self-determined motivation for pro-environmental behavior. *Journal of Environmental Psychology, 30*, 169-177.

Leech, N., Barrett, K., & Morgan, G. (2008). SPSS for Intermediate Statistics. New York: Routledge, https://doi-org.proxy.bib.uottawa.ca/10.4324/9781410616739

Leippe, M. R., & Eisenstadt, D. (1999). A self-accountability model of dissonance reduction: multiple modes on a continuum of elaboration. In E. Harmon-Jones, & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 201-232). American Psychological Association.

Maddux, J. E., & Rogers, R. W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *Journal of Experimental Social Psychology, 19,* 469–479. http://dx.doi.org/10.1016/0022-1031(83)90023-9

Nebel, S., Brick, J., Lantz, V., & Trenholm, R. (2017). Which Factors Contribute to Environmental Behaviour of Landowners in Southwestern Ontario, Canada? *Environmental Management, 60*(3), 454-463.

Osbaldiston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for environmental responsible behavior: A prospective study of environmental goals. *Journal of Environmental Psychology*, *23,* 349–357.

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). University of Rochester Press.

Pelletier, L., & Aitken, N. (2014). Encouraging environmental actions in employees and in the working environment: A self-determination theory perspective. In M. Gagné (Eds.), *The*

oxford handbook of work engagement, motivation, and self-determination theory. https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199794911.001.0001/oxfordhb-9780199794911-e-020.

Pelletier, L. G., Baxter, D., & Huta, V. (2011). Personal autonomy and environmental sustainability. In V. I. Chirkov, R. M. Ryan & K. M. Sheldon (Eds.), *Human autonomy in cross-cultural context: Perspectives on the psychology of agency, freedom, and well-being* (pp. 257-277). Springer.

Pelletier, L. G., & Dion, S. (2007). An examination of general and specific motivational mechanisms for the relations between body dissatisfaction and eating behaviors. *Journal of Social and Clinical Psychology*, *26*(3), 303-333.

Pelletier, L. G., Green-Demers, I., & Béland, A. (1997). Pourquoi adoptez-vous des comportements écologiques? Validation en langue française de l'échelle de motivation vis-à-vis les comportements écologiques [Why do people adopt certain environmental behaviors?: French validation of the Motivation Towards the Environment Scale]. *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement*, *29*(3), 145–156. https://doi.org/10.1037/0008-400X.29.3.145

Pelletier, L. G., & Sharp, E. (2008). Persuasive communication and proenvironmental behaviours: How message tailoring and message framing can improve the integration of behaviours through self-determined motivation. *Canadian Psychology/Psychologie Canadienne*, *49*(3), 210-217. doi:10.1037/a0012755

Pelletier, L. G., Dion, S., Tuson, K., & Green-Demers, I. (1999). Why do people fail to adopt environmental protective behaviors? Toward a taxonomy of environmental amotivation.

Journal of Applied Social Psychology, 29, 2481-2504. http://dx.doi.org/10.1111/j.1559-1816.1999.tb00122.x.

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 environmental scale (MTES). *Journal of Applied Social Psychology*, *28*, 437–468.

Pomerantz, E. M., Chaiken, S., & Tordesillas, R. S. (1995). Attitude strength and resistance processes. *Journal of Personality and Social Psychology*, *69*, 408–419. doi: 10.1037/0022-3514.69.3.408

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68-78. doi:10.1037//0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic dialectical perspective. In E. L. Deci, & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3-33). Rochester, NY: University of Rochester Presss.

Ryan, R. M., & Deci, E. L. (2004). Autonomy is no illusion: self-determination theory and the empirical study of authenticity, awareness, and will. In J. Greenberg, S. L. Koole, & T. Pyszczynski (Eds.), *Handbook of experimental existential psychology* (p. 449–479). Guilford Press.

Ryan, R., & Deci, Edward L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY: Guilford Press

Schneider, B. A., Eavivi-Reich, M., & Emozuraitis, M. (2015). A cautionary note on the use of the Analysis of Covariance (ANCOVA) in classification designs with and without within-subject factors. *Frontiers in Psychology, 6*, 474.

Séguin, C., Pelletier, L., & Hunsley, J. (1998). Toward a model of environmental activism. *Environment and Behavior*, *30*(5), 628-652. doi:10.1177/001391659803000503

Shah, R. B. (2012). A multivariate analysis technique: Structural equation modeling. *Asian Journal of Multidimensional Research, 1*(4), 73–81.

Sharp, D. (2015). Your Chi-Square Test is Statistically Significant: Now What?. *Practical Assessment, Research & Evaluation*, *20*(8), 1-10. Retrieved from http://pareonline.net/getvn.asp?v=20&n=8

Statistics Canada. (2015). *Table 23-10-0066-01 Sales of fuel used for road motor vehicles, annual (x 1,000).* https://doi.org/10.25318/2310006601-eng

Statistics Canada (2018) *Table 38-10-0032-01. Disposal of waste, by source*. https://doi.org/10.25318/3810003201-eng

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics (5th ed.). Boston: Pearson/Allyn & Bacon.

Tannenbaum, M. B., Hepler, J., Zimmerman, R. S., Saul, L., Jacobs, S., Wilson, K., & Albarracín, D. (2015). Appealing to fear: A meta-analysis of fear appeal effectiveness and theories. *Psychological Bulletin, 141*(6), 1178-1204. doi:10.1037/a0039729

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education*, *2*, 53–55. doi:10.5116/ijme.4dfb.8dfd

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Eds), *Advances in experimental social psychology* (Vol. 29, pp. 271-360). Elsevier Science & Technology. https://doi.org/10.1016/S0065-2601(08)60019-2

Van der Werff, E., Steg, L., & Keizer, K. (2013). It is a moral issue: The relationship between environmental self-identity, obligation-based intrinsic motivation and pro-environmental

behaviour. *Global Environmental Change, 23*(5), 1258-1265. doi:10.1016/j.gloenvcha.2013.07.018

Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the motivation toward the environment scale. *Environment and Behavior, 35*, 486–505.

Vlek, C. & Steg, L. (2007). Human Behavior and Environmental Sustainability: Problems, Driving Forces, and Research Topics. *Journal of Social Issues, 63*, 1-19.

Webb, D., Soutar, G. N., Mazzarol, T., & Saldaris, P. (2013). Self-determination theory and consumer behavioural change: Evidence from a household energy-saving behaviour study. *Journal of Environmental Psychology*, *35*(Complete), 59-66. doi:10.1016/j.jenvp.2013.04.003

Winter, D. D. N., & Koger, S. (2014). *The psychology of environmental problems: Psychology for sustainability*. Psychology Press.

Wurtele, S. K., & Maddux, J. E. (1987). Relative contributions of protection motivation theory components in predicting exercise intentions and behavior. *Health Psychology, 6*(5), 453-466. doi:10.1037/0278-6133.6.5.453

Appendices

Appendix A
Pictures' Identification, Internet Addresses, Search Keywords and Scientific Article References for Environmental Pictures

Causes of Global Warming

Picture Name (ID)	Internet Addresses	Search Keywords	Scientific Article References
Farm Methane Production 800x600 (S)	http://cdn.isciencetimes.com/data/images/full/2013/12/20/5674-cow-farm.jpg	Farm methane production	Ferreira, D. M. C. (2010). Global Warming and Agribusiness: Could Methane Gas From Dairy Cows Spark the Next California Gold Rush? *Widener Law Review*, *15*, 541.
Deforestation 800x600 (Q)	https://c1.staticflickr.com/3/2012/1524189000_b34c025e74_b.jpg	Deforestation	Fearnside, P. M. (1996). Amazonian deforestation and global warming: carbon stocks in vegetation replacing Brazil's Amazon forest. *Forest ecology and management*, *80*(1), 21-34.
Chemical Fertilizers 800x600 (P)	http://www.ubinig.org/admin_photo/210.jpg	Chemical fertilizers	Schellenberg, D. L., Alsina, M. M., Muhammad, S., Stockert, C. M., Wolff, M. W., Sanden, B. L., ... & Smart, D. R. (2012). Yield-scaled global warming potential from N 2 O emissions and CH 4 oxidation for almond (Prunus dulcis) irrigated with nitrogen fertilizers on arid land. *Agriculture, ecosystems & environment*, *155*, 7-15.
Mining 800x600 (BJ)	http://dangerousjobsguide.com/wp-content/uploads/2012/02/IMG_31011.jpg	Mining	Castleden, W. M., Shearman, D., Crisp, G., & Finch, P. (2011). The mining and burning of coal: effects on health and the environment. *The Medical Journal of Australia*, *195*(6), 333-335.
Rice Cultivation Methane 800x600 (BL)	https://eatreadsciencedotcom.files.wordpress.com/2015/07/2796902831_546d83f4af_o.jpg	Rice cultivation methane	Zhang, A., Bian, R., Hussain, Q., Li, L., Pan, G., Zheng, J., ... & Zheng, J. (2013). Change in net global warming potential of a rice–wheat cropping system with biochar soil amendment in a rice paddy from China. *Agriculture, ecosystems & environment*, *173*, 37-45.

Dumping Ground 800x600 (R)	http://msnbcmedia.msn.com/i/MSNBC/Components/Photo/_new/g-cvr-110504-debris2-10a.jpg	Dumping ground	Rawat, M., Singh, U. K., Mishra, A. K., & Subramanian, V. (2008). Methane emission and heavy metals quantification from selected landfill areas in India. *Environmental monitoring and assessment*, *137*(1-3), 67-74.
Overconsumption of Meat 800x600 (BK)	http://www.theneweconomy.com/wp-content/uploads/2014/06/meat.jpg	Overconsumption of meat	Revell, B. J. (2015, April). One Man's Meat…. 2050? Ruminations on future meat demand in the context of global warming. In *89th Annual Conference, April 13-15, 2015, Warwick University, Coventry, UK* (No. 204205). Agricultural Economics Society.
Human Sewage 800x600 (BI)	http://1.bp.blogspot.com/-nWLWP-TcgVo/Tr1PHG6pdXI/AAAAAAAAAAk/v_xgHmLCZes/s1600/dt.common.streams.StreamServer.cls.jpg	Human sewage	Oshita, K., Okumura, T., Takaoka, M., Fujimori, T., Appels, L., & Dewil, R. (2014). Methane and nitrous oxide emissions following anaerobic digestion of sludge in Japanese sewage treatment facilities. *Bioresource technology*, *171*, 175-181.
Tourists 800x600 (BM)	https://upload.wikimedia.org/wikipedia/commons/4/45/Tourist_Stall,_Trafalgar_Square,_London_-_May_2009.jpg	Tourists	Micu, I. C., TuÈ, L., & Mihai, D. (2013). Analysing The Forms Of Tourist Transportation With Major Effect On Global Warming And Sustainable Development. *Lucrări Ştiinţifice : Management Agricol,*, *15*(4), 151.
Grocery Bag Pollution 800x600 (T)	http://www.industrytap.com/wp-content/uploads/2013/11/plastic_bags.jpg	Grocery bag pollution	Khoo, H. H., & Tan, R. B. (2010). Environmental impacts of conventional plastic and bio-based carrier bags. *The international journal of life cycle assessment*, *15*(4), 338-345.
Industry 800x600 (E)	https://upload.wikimedia.org/wikipedia/commons/e/e8/Power_Plant_(Tianjin,_China).jpg	Industry	García-Gusano, D., Garraín, D., Herrera, I., Cabal, H., & Lechón, Y. (2013). Life Cycle Assessment of applying CO 2 post-combustion capture to the Spanish cement production. *Journal of Cleaner Production*, *104*(C), 328–338. https://doi.org/10.1016/j.jclepro.2013.11.056
Vehicle Pollution 800x600 (AX)	https://upload.wikimedia.org/wikipedia/commons/2/24/Trafficjamdelhi.jpg	Vehicle pollution	Halberstadt, M. L. (1990). Motor vehicles and global warming. *Journal of the Air and Waste Management Association*, *40*(3).

Lime Production 800x600 (AT)	https://upload.wikimedia.org/wikipedia/commons/e/e0/Limestone_quarry.jpg	Lime production	García-Gusano, D., Garraín, D., Herrera, I., Cabal, H., & Lechón, Y. (2013). Life Cycle Assessment of applying CO 2 post-combustion capture to the Spanish cement production. *Journal of Cleaner Production, 104(C), 328–338.* https://doi.org/10.1016/j.jclepro.2013.11.056
Electricity Consumption 800x600 (D)	http://cds.cern.ch/record/1324541/files/EnergieCERN_image.JPG	Electricity consumption	Baxter, L. W., & Calandri, K. (1992). Global warming and electricity demand: A study of California. *Energy Policy*, *20*(3), 233-244.
Tar Sands 800x600 (AU)	http://cdn.lightgalleries.net/4bd5ec0174be3/images/ts-sept-5659-2.jpg	Tar sands	Shiell, L., & Loney, S. (2007). Global Warming Damages and Canada's Oil Sands. *Canadian Public Policy*, *33*(4), 419-440.
Air Conditioners and Global Warming 800x600 (A)	http://i.unu.edu/media/ourworld.unu.edu-en/article/5122/Air_Conditioning.jpg	Air conditioners and global warming	Davis, L. W., & Gertler, P. J. (2015). Contribution of air conditioning adoption to future energy use under global warming. *Proceedings of the National Academy of Sciences*, *112*(19), 5962-5967.
Consuming Light Bulbs 800x600 (C)	https://chocolatecakequiltdesigns.files.wordpress.com/2014/04/dirty-bulbs.jpg	Consuming light bulbs	Eckelman, M. J., Anastas, P. T., & Zimmerman, J. B. (2008). Spatial assessment of net mercury emissions from the use of fluorescent bulbs. *Environmental science & technology*, *42*(22), 8564-8570.
Commercial Heating 800x600 (B)	http://www.commercialheatingmanchester.co.uk/uploads/2/2/8/8/22882014/9171467_orig.jpg	Commercial heating	Rosenthal, D. H., Gruenspecht, H. K., & Moran, E. A. (1995). Effects of global warming on energy use for space heating and cooling in the United States. *The Energy Journal*, 77-96.
Technological Causes of Global Warming 800x600 (AV)	http://i.cbc.ca/1.1382971.1435692431!/httpImage/image.jpg_gen/derivatives/16x9_1180/hi-co2-global-warming-78224.jpg	Technological causes of global warming[a]	N/A

Technological Causes of Global Warming 2 800x600 (AW)	http://static1.squarespace.com/static/55b2601fe4b0b3bd86c347af/t/55b662c4e4b057b594517c5c/1438016205504/100_0019_k9kx.jpg	Technological causes of global warming[b]	N/A

[a]Image depicted industry.
[b]Image depicted air conditioning.

Consequences of Global Warming

Picture Name (ID)	Internet Addresses	Search Keywords	Scientific Article References
Sea Level Rise 800x600 (BE)	http://www.newsworks.org/images/stories/flexicontent/l_20130923-rising-sea-level-mantoloking-1200.jpg	Sea level rise	Hekstra, G. P. (1989). Global warming and rising sea levels: the policy implications. *Ecologist*, *19*, 4-15.
Wildfire 800x600 (BH)	http://scijinks.jpl.nasa.gov/review/imet/imet-6.jpg	Wildfire	Running, S. (2006). Is global warming causing more, larger wildfires? *Science*, *313*(5789), 927–928. https://doi.org/10.1126/science.1130370
Hurricane 800x600 (M)	http://cdn2.hubspot.net/hub/254742/file-773973517-jpg/US_Navy_050709-N-0000B-004_Hurricane_Dennis_batters_palm_trees_and_floods_parts_of_Naval_Air_Station_(NAS)_Key_Westrsquo,s_Truman_Annex.jpg	Hurricane	O'Hare, G. (1999). Global warming and extreme weather: a cautionary note, *Geography*, *84*(1), 87–91.
Droughts 800x600 (H)	http://texaslivingwaters.org/wp-content/uploads/2013/03/Knox-County-Drought-Cow-Carcass-2011-Earl-Nottingham.jpg	Droughts	AghaKouchak, A., Cheng, L., Mazdiyasni, O., & Farahmand, A. (2014). Global warming and changes in risk of concurrent climate extremes: Insights from the 2014 California drought. *Geophysical Research Letters*, *41*(24), 8847-8852.

Loss of Crop Drought 800x600 (N)	http://agrodaily.com/wp-content/uploads/2015/02/drought.jpg	Loss of crop drought	Furuya, J., & Kobayashi, S. (2010). Impact of global warming on agricultural product markets: stochastic world food model analysis. *Sustainability Science, 4*(1), 71–79. https://doi.org/10.1007/s11625-008-0062-0
Melting Ice Caps 800x600 (AY)	http://www.technologybloggers.org/wp-content/uploads/2011/10/Melting-Ice-Caps.jpg	Melting Ice caps	Borgerson, S. G. (2008). Arctic meltdown. *Foreign Affairs, 87*(2), 63.
Destruction of Coral Reefs 800x600 (G)	https://cdn.reefs.com/blog/wp-content/uploads/2011/08/Untitled1.png	Destruction of coral reefs	Lesser, M. P. (2007). Coral reef bleaching and global climate change: Can corals survive the next century? *Proceedings of the National Academy of Sciences*, *104*(13), 5259-5260.
Heat Wave 800x600 (J)	http://blog.iesve.com/wp-content/uploads/2012/07/heatwave.jpg	Heat wave	Carlson, A. (2007). Heat waves, global warming, and mitigation. *UCLA Journal of Environmental Law & Policy*, *25*(2).
Hungry Polar Bear 800x600 (L)	http://m8.i.pbase.com/o6/14/755514/1/75705738.9GWBplSf.polarbearonland2OZ9W0546.jpg	Hungry Polar bear	Laurance, W. (2009). Comment: Move over, polar bear. *New Scientist, 201*(2690), 14.
Smog 800x600 (BF)	http://i.huffpost.com/gen/1430186/images/o-CHINA-SMOG-facebook.jpg	Smog	Hoag, H. (2014). Air quality to suffer with global warming. *Nature News*.
Pollen Allergen 800x600 (BC)	http://www.freedomhomecare.net/wp-content/uploads/2014/05/dandelions.jpg	Pollen allergen	Ziska, L., Knowlton, K., Rogers, C., Dalan, D., Tierney, N., Elder, M. A., ... & Frenz, D. (2011). Recent warming by latitude associated with increased length of ragweed pollen season in central North America. *Proceedings of the National Academy of Sciences, 108*(10), 4248-4251.

Ozone Layer 800x600 (BB)	https://globalroundtableissues.files.wordpress.com/2014/08/ozone-layer.jpg	Ozone layer	Rye, J. A., Strong, D. D., & Rubba, P. A. (2001). Global Warming and Ozone Layer Depletion: STS Issues for Social Studies Classrooms. *Social Education, 65*(2), 90.
Disease Spread by Mosquito 800x600 (O)	https://upload.wikimedia.org/wikipedia/commons/e/ea/Aedes_Albopictus.jpg	Disease spread by mosquito	Stone, R. (1995). If the mercury soars, so may health hazards. *Science, 267*(5200).
Polluted Water 800x600 (BD)	http://i.huffpost.com/gen/790288/images/o-SEWAGE-POLLUTION-facebook.jpg	Polluted water	Kerr, R. A. (2012). The Greenhouse Is Making the Water-Poor Even Poorer. *Science, 336*(6080), 405-405.
Ocean Acidification 800x600 (AZ)	http://oceanleadership.org/wp-content/uploads/140413135907-large.jpg	Ocean acidification	Couce, E., Ridgwell, A., & Hendy, E. J. (2013). Future habitat suitability for coral reef ecosystems under global warming and ocean acidification. *Global change biology*, *19*(12), 3592-3606.
Heavy Rainfall 800x600 (K)	http://2.bp.blogspot.com/-w7VKrhY2Eg8/U9hZ59NJhDI/AAAAAAAACU4/aDQG6XfFxbA/s1600/rain2-8-6-2011-3-06-30-pm.jpg	Heavy Rainfall	Schiermeier, Q. (2011). Increased flood risk linked to global warming. *Nature*, *470*(7334), 316-316.
Floods 800x600 (I)	http://blogs.ft.com/photo-diary/files/2014/01/Floods.jpg	Floods	Schiermeier, Q. (2011). Increased flood risk linked to global warming. *Nature*, *470*(7334), 316-316.
Desertification 800x600 (F)	https://earthhabitat.files.wordpress.com/2010/02/desertification1.jpg	Desertification	Wang, X., Yang, Y., Dong, Z., & Zhang, C. (2009). Responses of dune activity and desertification in China to global warming in the twenty-first century. *Global and Planetary Change*, *67*(3), 167-185.

Volcanic Activity 800x600 (BG)	http://assets.nydailynews.com/polopoly_fs/1.1958036!/img/httpImage/image.jpg_gen/derivatives/gallery_1200/deadly-volcano-eruption-devastates-japan.jpg	Volcanic activity	Williams, C. (2011). Earth shattering: How global warming will shake up the planet. *New Scientist, 211*(2832), 38-42.
Ocean Life Death 800x600 (BA)	http://strangesounds.org/wp-content/uploads/2014/03/dead-fish-maninjau-lake-march-2014.jpg	Ocean life death	Wernberg, T., Russell, B. D., Moore, P. J., Ling, S. D., Smale, D. A., Campbell, A., ... & Connell, S. D. (2011). Impacts of climate change in a global hotspot for temperate marine biodiversity and ocean warming. *Journal of Experimental Marine Biology and Ecology, 400*(1), 7-16.

Solutions to Global Warming

Picture Name (ID)	Internet Addresses	Search Keywords	Scientific Article References
Washing Laundry 800x600 (BW)	https://workingmomadventures.files.wordpress.com/2011/09/spinning-laundry.jpg	Washing laundry	McCoy, M. (2011). The cold facts. *Chemical & Engineering News, 89*(44), 26-27.
Recycling 800x600 (BS)	https://upload.wikimedia.org/wikipedia/commons/5/5d/Glass_and_plastic_recycling_065_ubt.JPG	Recycling	Chowdhury, M. (2009). Sustainable Curbside Recycling in the Municipal Garbage Contract. *Waste Management & Research*, *27*(10), 988–995. https://doi.org/10.1177/0734242X09335697
Compost 800x600 (AA)	http://www.gardeningknowhow.com/wp-content/uploads/2014/05/compost-pile.jpg	Compost	Boldrin, A., Andersen, J. K., Møller, J., Favoino, E., & Christensen, T. H. (2009). Composting and compost utilization: accounting of greenhouse gases and global warming contributions. *Waste Management & Research*, *27*(8), 800–812. https://doi.org/10.1177/0734242X09345275
Riding Bicycle 800x600 (BT)	http://i.huffpost.com/gen/2155472/images/o-BIKE-RIDING-CITY-facebook.jpg	Riding Bicycle	Achten, W. M., Almeida, J., & Muys, B. (2013). Carbon footprint of science: More than flying. *Ecological indicators, 34*, 352-355.
City Walking 800x600 (Z)	http://media.npr.org/assets/img/2014/01/09/istock-18821363-walking-city-crosswalk_custom-b38653b6ea3d1c937220628c3119f0f5e0099c01.jpg	City walking	Hickman, R., Ashiru, O., & Banister, D. (2010). Transport and climate change: Simulating the options for carbon reduction in London. *Transport Policy*, *17*(2), 110-125.
Trees 800x600 (BU)	https://riveranovelita.files.wordpress.com/2015/03/b12e30d1d4802f502ab31412c65a9233.jpg	Trees	Akbari, H. (2002). Shade trees reduce building energy use and CO 2 emissions from power plants. *Environmental pollution, 116* (1), S119-S126.

Unplug 800x600 (BV)	http://www.investmentnews.com/storyimage/CI/20140307/TECH/140309940/AR/0/unplugged.jpg&maxw=1000&q=90&cci_ts=20140317091052	Unplug	Chakraborty, A., & Pfaelzer, A. (2011). An overview of standby power management in electrical and electronic power devices and appliances to improve the overall energy efficiency in creating a green world. *Journal of Renewable and Sustainable Energy, 3*(2), 023112.
Planting Trees 800x600 (AD)	http://i.huffpost.com/gen/1211400/images/o-PLANTING-TREE-facebook.jpg	Planting trees	Akbari, H. (2002). Shade trees reduce building energy use and CO 2 emissions from power plants. *Environmental pollution, 116*(1), S119-S126.
Human Solutions to Global Warming 800x600 (AB)	http://c1cleantechnicacom.wpengine.netdna-cdn.com/files/2015/06/Netherlands-bicycling.jpg	Human solutions to global warming[a]	N/A
Human Solutions to Global Warming 2 800x600 (AC)	http://blog.purprojet.com/en/wp-content/uploads/2015/06/Trees4climate1.jpg	Human solutions to global warming[b]	N/A
Solar Panels 800x600 (BP)	https://upload.wikimedia.org/wikipedia/commons/d/de/Nellis_AFB_Solar_panels.jpg	Solar panels	Masson, V., Bonhomme, M., Salagnac, J. L., Briottet, X., & Lemonsu, A. (2014). Solar panels reduce both global warming and urban heat island. *Frontiers in Environmental Science, 2*(14), 1–10. https://doi.org/10.3389/fenvs.2014.00014
Wind Farm 800x600 (BR)	http://thelincolnite.co.uk/wp-content/uploads/2013/01/wind_farms.jpg	Wind farm	Wang, C., & Prinn, R. G. (2010). Potential climatic impacts and reliability of very large-scale wind farms. *Atmospheric Chemistry and Physics, 10*(4), 2053-2061.

Hydro Power 800x600 (Y)	https://shared.uoit.ca/shared/faculty-sites/sustainability-today/Images/Blog/september-december2014/hydropower-plant.jpg	Hydro power	Lenzen, M., & Schaeffer, R. (2012). Historical and potential future contributions of power technologies to global warming. *Climatic change*, *112*(3-4), 601-632.
Public Transit 800x600 (BO)	http://thermalstructures.com/wp-content/gallery/markets/light_rail_houston.jpg	Public transit	Hickman, R., Ashiru, O., & Banister, D. (2010). Transport and climate change: Simulating the options for carbon reduction in London. *Transport Policy*, *17*(2), 110-125.
Electric Vehicles 800x600 (V)	https://upload.wikimedia.org/wikipedia/commons/9/91/Ride_and_Drive_EVs_Plug'n_Drive_Ontario.jpg	Electric vehicles	Harvey, L. D. D. (2013). Global climate-oriented transportation scenarios. *Energy Policy*, *54*, 87-103.
Energy Efficient Appliances 800x600 (W)	http://wisecrib.com/wp-content/uploads/2015/05/kitchen-astounding-brown-color-wooden-laminated-floor-and-gray-color-wooden-kitchen-storage-cabinets-also-black-color-granite-countertops-with-energy-efficient-appliances-and-high-end-kitchen-applianc.jpg	Energy efficient appliances	Dutt, G. S. (1995). Energy-efficient and environment-friendly refrigerators. *Energy for Sustainable Development*, *1*(5), 57-68.

Programmable Thermostats Nest 800x600 (BN)	http://i.ytimg.com/vi/L8TkhHgkBsg/maxresdefault.jpg	Programmable thermostats nest	Suter, J. F., & Shammin, M. R. (2013). Returns to residential energy efficiency and conservation measures: A field experiment. *Energy Policy, 59*, 551-561.
Energy Efficient Light Bulb 800x600 (X)	http://www.dadlogic.net/wp-content/uploads/2013/04/GE_01.jpg	Energy efficient light bulb	Eckelman, M. J., Anastas, P. T., & Zimmerman, J. B. (2008). Spatial assessment of net mercury emissions from the use of fluorescent bulbs. *Environmental science & technology*, *42*(22), 8564-8570.
Car Tune Up 800x600 (U)	http://www.urbancultivator.net/wp-content/uploads/2015/04/tune-up2.jpg	Car tune up	Sivak, M., & Schoettle, B. (2012). Eco-driving: Strategic, tactical, and operational decisions of the driver that influence vehicle fuel economy. *Transport Policy*, *22*, 96-99.
Tidal Power 800x600 (BQ)	http://www.marineturbines.com/sites/default/files/field/image/PN201201-03_300dpi_0.jpg	Tidal power	Lee, D. H. (2012). Toward the clean production of hydrogen: Competition among renewable energy sources and nuclear power. *International journal of hydrogen energy*, *37*(20), 15726-15735.

[a]Image depicts city walking.
[b]Image depicts trees.

Appendix B
Picture Identification, Internet Addresses, and Search Keywords for Health Related Pictures

Causes of Health Problems

Picture Name (ID)	Internet Addresses	Search Keywords
Eating in Front of Television (AM)	http://www.thestar.com/content/dam/thestar/life/parent/2013/06/17/preschoolers_with_poor_eating_habits_have_greater_risk_of_heart_disease_as_adults_study_findss/eating_in_front_of_television.jpg	Eating in front of television
Watching Television (CG)	http://images.huffingtonpost.com/2015-07-25-1437813969-9907014-watchingtvtelevisionremote.jpg	Watching television
Eating in Car (AL)	http://www.washnrolltn.com/wp-content/uploads/2014/03/Guy-Eating-in-Car_Wash-N-Roll-Car-Wash.jpg	Eating in car
Computer Use (AJ)	http://www.blogcdn.com/brighthall.aol.com/media/2008/07/computer.jpg	Computer use
Playing Video Games (AN)	http://img.topyaps.com/wp-content/uploads/2013/09/Team-Spirit.jpg	Playing video games
Drinking (AK)	http://images.medicaldaily.com/sites/medicaldaily.com/files/2014/03/19/drinking-alcohol.jpg	Drinking
Sedentary (CD)	http://pain.com/wp-content/uploads/2014/02/who-is-at-risk-sedentary-world.jpg	Sedentary
Smoking (CF)	http://www.newhealthguide.org/images/10404391/smoking.jpg	Smoking
Smartphone Use (CE)	http://s3.amazonaws.com/digitaltrends-uploads-prod/2013/12/using-smartphone.jpg	Smartphone use
Refined Sugar (CC)	http://healthdecide.orcahealth.com/wp-content/uploads/2012/06/sugar.jpg	Refined sugar

Consequences of Health Problems

Picture Name (ID)	Internet Addresses	Search Keywords
High Blood Pressure (AR)	http://doctormurray.com/wp-content/uploads/2014/03/highbloodpressure.jpg	High blood pressure
Obesity (CH)	http://www.modernreaders.com/wp-content/uploads/2014/12/o-OBESITY-facebook.jpg	Obesity
Obesity 2 (CI)	https://ilovethisaimglobal.files.wordpress.com/2015/08/obesity.jpg	Obesity
Low Mood (AS)	http://hypnosissouthlondon.co.uk/images/low-mood-3.jpg	Low mood
Diabetes Injection (AO)	http://humanhealthlink.com/wp-content/uploads/2014/09/Diabetes-Injection.jpg	Diabetes injection
Heart Attack (AQ)	http://freenology.com/images/71440574467heart-attack.jpg	Heart attack
Weight Gain (CL)	http://www.blisstree.com/wp-content/uploads/2013/01/weight-gain-shutterstock.jpg	Weight gain
Sleep Problems (CK)	http://wordpress.sharphue.com/~intensei/wp-content/uploads/2012/06/insomnia-1.jpg	Sleep problems
Respiratory Illness (CJ)	http://media1.s-nbcnews.com/i/newscms/2014_36/653626/tdy_virus_140906_f0c8ad46937bfb68b21b09b0ed34a833.jpg	Respiratory illness
Fatigue (AP)	http://www.opinionlab.com/wp-content/uploads/2012/11/Screen-Shot-2012-11-29-at-1.33.13-PM.png	Fatigue

Solutions to Health Problems

Picture Name (ID)	Internet Addresses	Search Keywords
Medication (BZ)	http://www.driftmouse.com/wp-content/uploads/2014/08/file000170538321.jpg	Medication
Medication 2 (CA)	http://asianworldnews.co.uk/wp-content/uploads/Glucometer-With-Medication-And.jpg	Medication
Healthy Eating (AH)	http://www.thebreastcaresite.com/wp-content/uploads/2011/08/healthy-eating.jpg	Healthy eating
Adult Team Sports (AE)	http://kentwa.gov/assets/0/205/544/841415ff-32d8-483f-ab86-e943f0d9eed5.jpg	Adult team sports
Exercising (AF)	http://www.buykouteatoday.com/wp-content/uploads/2014/01/nation-excercise.jpg	exercising
Physical Activity (CB)	http://www.spra.sk.ca/Blog/engagingtherecsector/iStock_000020673338Large.jpg	Physical activity
Individual Sport (BY)	http://www.dotgirlproducts.com/blog/wp-content/uploads/2012/08/Olympic-swimmer.jpg	Individual sport
Healthy Diet (AG)	http://blog.rls2000.com/wp-content/uploads/2014/04/Fotolia_55126061_Subscription_Monthly_M.jpg	Healthy diet
Healthy Meals (BX)	https://fitfood-ie.com/wp-content/uploads/2015/03/healthy-food.jpg	Healthy meals
Healthy Food (AI)	http://www.healthyarea.org/wp-content/uploads/2014/12/Healthy-Food.jpg	Healthy food

Appendix C
Theme and Valence Assessment Items for Environmental Pictures
English Version

When thinking of the environment, what is your impression of the picture?

Very Negative	Negative	Slightly Negative	Neutral	Slightly Positive	Positive	Very Positive
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of the environment, to what degree do you find this picture to represent a cause?

Not at all	Very Slightly	Slightly	Moderately	Somewhat	A lot	Exactly
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of the environment, to what degree do you find this picture to represent a consequence?

Not at all	Very Slightly	Slightly	Moderately	Somewhat	A lot	Exactly
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of the environment, to what degree do you find this picture to represent a solution?

Not at all	Very Slightly	Slightly	Moderately	Somewhat	A lot	Exactly
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of the environment, which of the three categories do you associate with this picture?

- ○ Cause
- ○ Consequence
- ○ Solution
- ○ Other/None of the above

French Version

Lorsque vous pensez à l'environnement, quelle est votre impression de cette image?

Très négative	Négative	Légèrement négative	Neutre	Légèrement positive	Positive	Très positive
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à l'environnement, à quel point trouvez-vous que cette image représente une cause?

Pas du tout	Très peu	Un peu	Moyennement	Assez	Beaucoup	Exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à l'environnement, à quel point trouvez-vous que cette image représente une conséquence?

Pas du tout	Très peu	Un peu	Moyennement	Assez	Beaucoup	Exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à l'environnement, à quel point trouvez-vous que cette image représente une solution?

Pas du tout	Très peu	Un peu	Moyennement	Assez	Beaucoup	Exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à l'environnement, à quelle des trois catégories associez-vous cette image?

- ○ Cause
- ○ Conséquence
- ○ Solution
- ○ Autre/Aucune de ces réponses

Appendix D
Theme and Valence Assessment Items for Health Related Pictures

English Version

When thinking of health, what is your impression of the picture?

Very Negative	Negative	Slightly Negative	Neutral	Slightly Positive	Positive	Very Positive
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of health, to what degree do you find this picture to represent a cause?

Not at all	Very Slightly	Slightly	Moderately	Somewhat	A lot	Exactly
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of health, to what degree do you find this picture to represent a consequence?

Not at all	Very Slightly	Slightly	Moderately	Somewhat	A lot	Exactly
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of health, to what degree do you find this picture to represent a solution?

Not at all	Very Slightly	Slightly	Moderately	Somewhat	A lot	Exactly
1	2	3	4	5	6	7
○	○	○	○	○	○	○

When thinking of health, which of the three categories do you associate with this picture?

- ○ Cause
- ○ Consequence
- ○ Solution
- ○ Other/None of the above

French Version

Lorsque vous pensez à la santé, quelle est votre impression de cette image?

Très négative	Négative	Légèrement négative	Neutre	Légèrement positive	Positive	Très positive
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à la santé, à quel point trouvez-vous que cette image représente une cause?

Pas du tout	Très peu	Un peu	Moyennement	Assez	Beaucoup	Exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à la santé, à quel point trouvez-vous que cette image représente une conséquence?

Pas du tout	Très peu	Un peu	Moyennement	Assez	Beaucoup	Exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à la santé, à quel point trouvez-vous que cette image représente une solution?

Pas du tout	Très peu	Un peu	Moyennement	Assez	Beaucoup	Exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Lorsque vous pensez à la santé, à quelle des trois catégories associez-vous cette image?

- ○ Cause
- ○ Conséquence
- ○ Solution
- ○ Autre/Aucune de ces réponses

Appendix E
Motivation towards Pro-Environmental Behaviors

English Version

I do pro-environmental behaviors on a regular basis …

1. Purely for the interest and enjoyment I get out of it.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. Because something external to me is pressuring me to do it.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. To avoid feelings of anxiety and guilt.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. Because it's important for me to do it.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

5. Since, interesting or not, I feel that doing it is in line with my deepest values.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

6. I have no idea why I'm doing it.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

French Version

Je pratique régulièrement une action pro-écologique...

1. Purement pour l'intérêt et le plaisir que j'en retire.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7

2. Puisque quelque chose d'externe me pousse à le faire.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7

3. Afin d'éviter des sentiments d'anxiété et de culpabilité.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7

4. Parce que c'est important pour moi de le faire.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7

5. Puisque, intéressant ou non, je sens que cela est en lien avec mes valeurs les plus profondes.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7

6. Je n'ai aucune idée pourquoi je le fais.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7

Appendix F
Perceived Pro-Environmental Competency

English Version

The following questions are referring to your feelings of competency in different areas related to pro-environmental behaviors.

1. If I wanted to, I could easily do various pro-environmental behaviors.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. Doing various pro- environmental behaviors is, for me, ...

Not at all easy	Not easy	Slightly easy	Somewhat easy	Easy	Very easy	Extremely easy
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. I feel competent in my ability to be successful in doing various pro- environmental behaviors.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. I feel able to do various pro- environmental behaviors.

Do Not Agree at All	Very Slightly Agree	Slightly Agree	Moderately Agree	Mostly Agree	Strongly Agree	Completely Agree
1	2	3	4	5	6	7
○	○	○	○	○	○	○

French Version

Les questions suivantes font références à vos sentiments de compétence dans différents domaines relatifs aux comportements pro-écologiques.

1. Si je le voulais, je pourrais aisément effectuer des comportements pro-écologiques.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. Pour moi, effectuer divers comportements pro-écologiques est …

Pas du tout facile	Pas facile	Légèrement facile	Moyennement facile	Facile	Vraiment facile	Extrêmement facile
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. Je me sens compétent/e dans mes habiletés à avoir du succès dans divers comportements pro-écologiques.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. Je me sens capable d'effectuer divers comportements pro-écologiques.

Pas du tout en accord	Très peu en accord	Un peu en accord	Modérément en accord	Assez en accord	Fortement en accord	Complètement en accord
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Appendix G
Standardized Residuals and Assigned Theme of Pictures

Picture ID	Theme	Observed N	Expected N	Residual	Standardized Residual	Assigned Theme
A	Cause	46	23.8	22.3	4.57	Cause
	Consequence	41	23.8	17.3	3.54	
	Solution	3	23.8	-20.8	-4.26	
	Other/None of the above	5	23.8	-18.8	-3.85	
B	Cause	34	23.8	10.3	2.10	Cause
	Consequence	23	23.8	-.8	-0.15	
	Solution	13	23.8	-10.8	-2.21	
	Other/None of the above	25	23.8	1.3	.26	
C	Cause	39	23.5	15.5	3.20	Cause
	Consequence	26	23.5	2.5	0.52	
	Solution	4	23.5	-19.5	-4.02	
	Other/None of the above	25	23.5	1.5	0.31	
D	Cause	43	23.8	19.3	3.95	Cause
	Consequence	27	23.8	3.3	0.67	
	Solution	15	23.8	-8.8	-1.80	
	Other/None of the above	10	23.8	-13.8	-2.82	
E	Cause	53	23.5	29.5	6.09	Cause
	Consequence	36	23.5	12.5	2.58	
	Solution	3	23.5	-20.5	-4.23	
	Other/None of the above	2	23.5	-21.5	-4.44	

F	Cause	17	23.8	-6.8	-1.39	Consequence
	Consequence	46	23.8	22.3	4.57	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	32	23.8	8.3	1.69	
G	Cause	12	23.5	-11.5	-2.37	Consequence
	Consequence	50	23.5	26.5	5.47	
	Solution	2	23.5	-21.5	-4.44	
	Other/None of the above	30	23.5	6.5	1.34	
H	Cause	12	23.5	-11.5	-2.37	Consequence
	Consequence	65	23.5	41.5	8.56	
	Solution	1	23.5	-22.5	-4.64	
	Other/None of the above	16	23.5	-7.5	-1.55	
I	Cause	15	23.8	-8.8	-1.80	Consequence
	Consequence	71	23.8	47.3	9.70	
	Solution	5	23.8	-18.8	-3.85	
	Other/None of the above	4	23.8	-19.8	-4.05	
J	Cause	22	23.8	-1.8	-.36	Other/None of the above
	Consequence	16	23.8	-7.8	-1.59	
	Solution	15	23.8	-8.8	-1.80	
	Other/None of the above	42	23.8	18.3	3.75	
K	Cause	17	23.8	-6.8	-1.39	Other/None of the above
	Consequence	12	23.8	-11.8	-2.41	
	Solution	33	23.8	9.3	1.90	
	Other/None of the above	33	23.8	9.3	1.90	

L	Cause	6	23.8	-17.8	-3.64	Consequence
	Consequence	86	23.8	62.3	12.77	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	3	23.8	-20.8	-4.26	
M	Cause	30	23.8	6.3	1.28	Consequence
	Consequence	52	23.8	28.3	5.80	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	13	23.8	-10.8	-2.21	
N	Cause	13	23.8	-10.8	-2.21	Consequence
	Consequence	75	23.8	51.3	10.52	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	7	23.8	-16.8	-3.44	
O	Cause	30	23.8	6.3	1.28	Consequence
	Consequence	32	23.8	8.3	1.69	
	Solution	2	23.8	-21.8	-4.46	
	Other/None of the above	31	23.8	7.3	1.49	
P	Cause	32	23.8	8.3	1.69	Consequence
	Consequence	34	23.8	10.3	2.10	
	Solution	18	23.8	-5.8	-1.18	
	Other/None of the above	11	23.8	-12.8	-2.62	
Q	Cause	34	23.5	10.5	2.17	Consequence
	Consequence	57	23.5	33.5	6.91	
	Solution	1	23.5	-22.5	-4.64	
	Other/None of the above	2	23.5	-21.5	-4.44	

R	Cause	26	23.8	2.3	0.46	Consequence
	Consequence	67	23.8	43.3	8.88	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	2	23.8	-21.8	-4.46	
S	Cause	33	23.8	9.3	1.90	Cause
	Consequence	28	23.8	4.3	0.87	
	Solution	10	23.8	-13.8	-2.82	
	Other/None of the above	24	23.8	.3	0.05	
T	Cause	40	23.8	16.3	3.33	Consequence
	Consequence	50	23.8	26.3	5.39	
	Solution	1	23.8	-22.8	-4.67	
	Other/None of the above	4	23.8	-19.8	-4.05	
U	Cause	46	23.8	22.3	4.57	Cause
	Consequence	14	23.8	-9.8	-2.00	
	Solution	13	23.8	-10.8	-2.21	
	Other/None of the above	22	23.8	-1.8	-.36	
V	Cause	17	23.5	-6.5	-1.34	Solution
	Consequence	9	23.5	-14.5	-2.99	
	Solution	61	23.5	37.5	7.74	
	Other/None of the above	7	23.5	-16.5	-3.40	
W	Cause	19	23.8	-4.8	-0.98	Other/None of the above
	Consequence	15	23.8	-8.8	-1.80	
	Solution	22	23.8	-1.8	-0.36	
	Other/None of the above	39	23.8	15.3	3.13	

X	Cause	12	23.5	-11.5	-2.37	Solution
	Consequence	4	23.5	-19.5	-4.02	
	Solution	67	23.5	43.5	8.97	
	Other/None of the above	11	23.5	-12.5	-2.58	
Y	Cause	16	23.8	-7.8	-1.59	Solution
	Consequence	10	23.8	-13.8	-2.82	
	Solution	46	23.8	22.3	4.57	
	Other/None of the above	23	23.8	-.8	-0.15	
Z	Cause	12	23.8	-11.8	-2.41	Solution
	Consequence	17	23.8	-6.8	-1.39	
	Solution	37	23.8	13.3	2.72	
	Other/None of the above	29	23.8	5.3	1.08	
AA	Cause	8	23.8	-15.8	-3.23	Solution
	Consequence	5	23.8	-18.8	-3.85	
	Solution	79	23.8	55.3	11.34	
	Other/None of the above	3	23.8	-20.8	-4.26	
AB	Cause	4	23.5	-19.5	-4.02	Solution
	Consequence	3	23.5	-20.5	-4.23	
	Solution	81	23.5	57.5	11.86	
	Other/None of the above	6	23.5	-17.5	-3.61	
AC	Cause	22	23.8	-1.8	-0.36	Solution
	Consequence	6	23.8	-17.8	-3.64	
	Solution	42	23.8	18.3	3.75	
	Other/None of the above	25	23.8	1.3	0.26	

AD	Cause	8	23.5	-15.5	-3.20	Solution
	Consequence	8	23.5	-15.5	-3.20	
	Solution	73	23.5	49.5	10.21	
	Other/None of the above	5	23.5	-18.5	-3.82	
AE	Cause	8	23.8	-15.8	-3.23	Solution
	Consequence	1	23.8	-22.8	-4.67	
	Solution	84	23.8	60.3	12.36	
	Other/None of the above	2	23.8	-21.8	-4.46	
AF	Cause	10	23.8	-13.8	-2.82	Solution
	Consequence	3	23.8	-20.8	-4.26	
	Solution	80	23.8	56.3	11.54	
	Other/None of the above	2	23.8	-21.8	-4.46	
AG	Cause	17	23.8	-6.8	-1.39	Solution
	Consequence	1	23.8	-22.8	-4.67	
	Solution	74	23.8	50.3	10.31	
	Other/None of the above	3	23.8	-20.8	-4.26	
AH	Cause	9	23.8	-14.8	-3.03	Solution
	Consequence	2	23.8	-21.8	-4.46	
	Solution	82	23.8	58.3	11.95	
	Other/None of the above	2	23.8	-21.8	-4.46	
AI	Cause	5	23.8	-18.8	-3.85	Solution
	Consequence	0	23.8	-23.8	-4.87	
	Solution	86	23.8	62.3	12.77	
	Other/None of the above	4	23.8	-19.8	-4.05	

AJ	Cause	44	23.8	20.3	4.16	Cause
	Consequence	19	23.8	-4.8	-0.98	
	Solution	9	23.8	-14.8	-3.03	
	Other/None of the above	23	23.8	-.8	-0.15	
AK	Cause	46	23.8	22.3	4.57	Cause
	Consequence	36	23.8	12.3	2.51	
	Solution	1	23.8	-22.8	-4.67	
	Other/None of the above	12	23.8	-11.8	-2.41	
AL	Cause	42	23.8	18.3	3.75	Cause
	Consequence	27	23.8	3.3	0.67	
	Solution	6	23.8	-17.8	-3.64	
	Other/None of the above	20	23.8	-3.8	-0.77	
AM	Cause	52	23.8	28.3	5.80	Cause
	Consequence	36	23.8	12.3	2.51	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	7	23.8	-16.8	-3.44	
AN	Cause	36	23.8	12.3	2.51	Cause
	Consequence	20	23.8	-3.8	-0.77	
	Solution	12	23.8	-11.8	-2.41	
	Other/None of the above	27	23.8	3.3	0.67	
AO	Cause	8	23.8	-15.8	-3.23	Solution
	Consequence	21	23.8	-2.8	-0.56	
	Solution	55	23.8	31.3	6.41	
	Other/None of the above	11	23.8	-12.8	-2.62	

AP	Cause	23	23.8	-.8	-0.15	Consequence
	Consequence	62	23.8	38.3	7.85	
	Solution	5	23.8	-18.8	-3.85	
	Other/None of the above	5	23.8	-18.8	-3.85	
AQ	Cause	17	23.8	-6.8	-1.39	Consequence
	Consequence	73	23.8	49.3	10.11	
	Solution	0	23.8	-23.8	-4.87	
	Other/None of the above	5	23.8	-18.8	-3.85	
AR	Cause	6	23.8	-17.8	-3.64	Solution
	Consequence	12	23.8	-11.8	-2.41	
	Solution	58	23.8	34.3	7.03	
	Other/None of the above	19	23.8	-4.8	-0.98	
AS	Cause	32	23.5	8.5	1.75	Consequence
	Consequence	59	23.5	35.5	7.32	
	Solution	0	23.5	-23.5	-4.85	
	Other/None of the above	3	23.5	-20.5	-4.23	
AT	Cause	63	25.0	38.0	7.60	Cause
	Consequence	30	25.0	5.0	1.00	
	Solution	2	25.0	-23.0	-4.60	
	Other/None of the above	5	25.0	-20.0	-4.00	
AU	Cause	36	25.0	11.0	2.20	Consequence
	Consequence	50	25.0	25.0	5.00	
	Solution	1	25.0	-24.0	-4.80	
	Other/None of the above	13	25.0	-12.0	-2.40	

AV	Cause	60	24.8	35.3	7.09	Cause
	Consequence	35	24.8	10.3	2.06	
	Solution	2	24.8	-22.8	-4.57	
	Other/None of the above	2	24.8	-22.8	-4.57	
AW	Cause	39	24.8	14.3	2.86	Cause
	Consequence	19	24.8	-5.8	-1.16	
	Solution	18	24.8	-6.8	-1.36	
	Other/None of the above	23	24.8	-1.8	-0.35	
AX	Cause	62	25.0	37.0	7.40	Cause
	Consequence	36	25.0	11.0	2.20	
	Solution	0	25.0	-25.0	-5.00	
	Other/None of the above	2	25.0	-23.0	-4.60	
AY	Cause	10	24.8	-14.8	-2.97	Consequence
	Consequence	73	24.8	48.3	9.70	
	Solution	2	24.8	-22.8	-4.57	
	Other/None of the above	14	24.8	-10.8	-2.16	
AZ	Cause	18	24.8	-6.8	-1.36	Other/None of the above
	Consequence	31	24.8	6.3	1.26	
	Solution	12	24.8	-12.8	-2.56	
	Other/None of the above	38	24.8	13.3	2.66	
BA	Cause	16	25.0	-9.0	-1.80	Consequence
	Consequence	81	25.0	56.0	11.20	
	Solution	2	25.0	-23.0	-4.60	
	Other/None of the above	1	25.0	-24.0	-4.80	

BB	Cause	23	24.8	-1.8	-0.35	Other/None of the above
	Consequence	30	24.8	5.3	1.06	
	Solution	6	24.8	-18.8	-3.77	
	Other/None of the above	40	24.8	15.3	3.07	
BC	Cause	24	25.0	-1.0	-0.20	Other/None of the above
	Consequence	12	25.0	-13.0	-2.60	
	Solution	20	25.0	-5.0	-1.00	
	Other/None of the above	44	25.0	19.0	3.80	
BD	Cause	22	24.8	-2.8	-0.55	Consequence
	Consequence	74	24.8	49.3	9.90	
	Solution	0	24.8	-24.8	-4.98	
	Other/None of the above	3	24.8	-21.8	-4.37	
BE	Cause	19	24.8	-5.8	-1.16	Consequence
	Consequence	75	24.8	50.3	10.10	
	Solution	1	24.8	-23.8	-4.77	
	Other/None of the above	4	24.8	-20.8	-4.17	
BF	Cause	18	25.0	-7.0	-1.40	Consequence
	Consequence	60	25.0	35.0	7.00	
	Solution	4	25.0	-21.0	-4.20	
	Other/None of the above	18	25.0	-7.0	-1.40	
BG	Cause	38	25.0	13.0	2.60	Cause
	Consequence	34	25.0	9.0	1.80	
	Solution	3	25.0	-22.0	-4.40	
	Other/None of the above	25	25.0	0.0	0.00	

BH	Cause	22	25.0	-3.0	-0.60	Consequence
	Consequence	68	25.0	43.0	8.60	
	Solution	1	25.0	-24.0	-4.80	
	Other/None of the above	9	25.0	-16.0	-3.20	
BI	Cause	51	25.0	26.0	5.20	Cause
	Consequence	45	25.0	20.0	4.00	
	Solution	3	25.0	-22.0	-4.40	
	Other/None of the above	1	25.0	-24.0	-4.80	
BJ	Cause	60	25.0	35.0	7.00	Cause
	Consequence	21	25.0	-4.0	-0.80	
	Solution	4	25.0	-21.0	-4.20	
	Other/None of the above	15	25.0	-10.0	-2.00	
BK	Cause	48	24.8	23.3	4.67	Cause
	Consequence	30	24.8	5.3	1.06	
	Solution	6	24.8	-18.8	-3.77	
	Other/None of the above	15	24.8	-9.8	-1.96	
BL	Cause	18	25.0	-7.0	-1.40	Solution
	Consequence	10	25.0	-15.0	-3.00	
	Solution	54	25.0	29.0	5.80	
	Other/None of the above	18	25.0	-7.0	-1.40	
BM	Cause	32	25.0	7.0	1.40	Other/None of the above
	Consequence	13	25.0	-12.0	-2.40	
	Solution	8	25.0	-17.0	-3.40	
	Other/None of the above	47	25.0	22.0	4.40	

BN	Cause	22	24.8	-2.8	-0.55	Other/None of the above
	Consequence	9	24.8	-15.8	-3.17	
	Solution	29	24.8	4.3	0.85	
	Other/None of the above	39	24.8	14.3	2.86	
BO	Cause	10	24.5	-14.5	-2.93	Solution
	Consequence	3	24.5	-21.5	-4.34	
	Solution	72	24.5	47.5	9.60	
	Other/None of the above	13	24.5	-11.5	-2.32	
BP	Cause	3	25.0	-22.0	-4.40	Solution
	Consequence	1	25.0	-24.0	-4.80	
	Solution	92	25.0	67.0	13.40	
	Other/None of the above	4	25.0	-21.0	-4.20	
BQ	Cause	29	24.8	4.3	0.85	Other/None of the above
	Consequence	15	24.8	-9.8	-1.96	
	Solution	20	24.8	-4.8	-0.96	
	Other/None of the above	35	24.8	10.3	2.06	
BR	Cause	4	24.8	-20.8	-4.17	Solution
	Consequence	4	24.8	-20.8	-4.17	
	Solution	88	24.8	63.3	12.71	
	Other/None of the above	3	24.8	-21.8	-4.37	
BS	Cause	13	25.0	-12.0	-2.40	Solution
	Consequence	11	25.0	-14.0	-2.80	
	Solution	71	25.0	46.0	9.20	
	Other/None of the above	5	25.0	-20.0	-4.00	

BT	Cause	3	24.8	-21.8	-4.37	Solution
	Consequence	1	24.8	-23.8	-4.77	
	Solution	91	24.8	66.3	13.32	
	Other/None of the above	4	24.8	-20.8	-4.17	
BU	Cause	19	24.8	-5.8	-1.16	Solution
	Consequence	7	24.8	-17.8	-3.57	
	Solution	59	24.8	34.3	6.89	
	Other/None of the above	14	24.8	-10.8	-2.16	
BV	Cause	44	24.8	19.3	3.87	Cause
	Consequence	12	24.8	-12.8	-2.56	
	Solution	21	24.8	-3.8	-0.75	
	Other/None of the above	22	24.8	-2.8	-0.55	
BW	Cause	42	25.0	17.0	3.40	Cause
	Consequence	15	25.0	-10.0	-2.00	
	Solution	17	25.0	-8.0	-1.60	
	Other/None of the above	26	25.0	1.0	0.20	
BX	Cause	15	25.0	-10.0	-2.00	Solution
	Consequence	1	25.0	-24.0	-4.80	
	Solution	79	25.0	54.0	10.80	
	Other/None of the above	5	25.0	-20.0	-4.00	
BY	Cause	15	24.8	-9.8	-1.96	Solution
	Consequence	2	24.8	-22.8	-4.57	
	Solution	80	24.8	55.3	11.11	
	Other/None of the above	2	24.8	-22.8	-4.57	

BZ	Cause	13	25.0	-12.0	-2.40	Solution
	Consequence	34	25.0	9.0	1.80	
	Solution	35	25.0	10.0	2.00	
	Other/None of the above	18	25.0	-7.0	-1.40	
CA	Cause	17	25.0	-8.0	-1.60	Solution
	Consequence	26	25.0	1.0	0.20	
	Solution	46	25.0	21.0	4.20	
	Other/None of the above	11	25.0	-14.0	-2.80	
CB	Cause	12	25.0	-13.0	-2.60	Solution
	Consequence	1	25.0	-24.0	-4.80	
	Solution	86	25.0	61.0	12.20	
	Other/None of the above	1	25.0	-24.0	-4.80	
CC	Cause	61	25.0	36.0	7.20	Cause
	Consequence	19	25.0	-6.0	-1.20	
	Solution	1	25.0	-24.0	-4.80	
	Other/None of the above	19	25.0	-6.0	-1.20	
CD	Cause	59	24.8	34.3	6.89	Cause
	Consequence	28	24.8	3.3	0.65	
	Solution	2	24.8	-22.8	-4.57	
	Other/None of the above	10	24.8	-14.8	-2.97	
CE	Cause	50	25.0	25.0	5.00	Cause
	Consequence	18	25.0	-7.0	-1.40	
	Solution	9	25.0	-16.0	-3.20	
	Other/None of the above	23	25.0	-2.0	-0.40	

CF	Cause	62	25.0	37.0	7.40	Cause
	Consequence	35	25.0	10.0	2.00	
	Solution	0	25.0	-25.0	-5.00	
	Other/None of the above	3	25.0	-22.0	-4.40	
CG	Cause	64	25.0	39.0	7.80	Cause
	Consequence	20	25.0	-5.0	-1.00	
	Solution	2	25.0	-23.0	-4.60	
	Other/None of the above	14	25.0	-11.0	-2.20	
CH	Cause	15	24.8	-9.8	-1.96	Consequence
	Consequence	75	24.8	50.3	10.10	
	Solution	5	24.8	-19.8	-3.97	
	Other/None of the above	4	24.8	-20.8	-4.17	
CI	Cause	7	25.0	-18.0	-3.60	Consequence
	Consequence	90	25.0	65.0	13.00	
	Solution	0	25.0	-25.0	-5.00	
	Other/None of the above	3	25.0	-22.0	-4.40	
CJ	Cause	10	24.8	-14.8	-2.97	Consequence
	Consequence	55	24.8	30.3	6.08	
	Solution	26	24.8	1.3	0.25	
	Other/None of the above	8	24.8	-16.8	-3.37	
CK	Cause	43	25.0	18.0	3.60	Consequence
	Consequence	52	25.0	27.0	5.40	
	Solution	0	25.0	-25.0	-5.00	
	Other/None of the above	5	25.0	-20.0	-4.00	

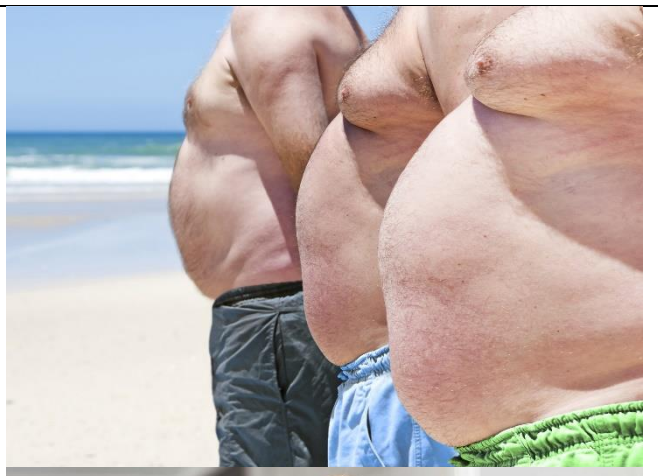
CL	Cause	26	24.8	1.3	0.25	Consequence
	Consequence	37	24.8	12.3	2.46	
	Solution	10	24.8	-14.8	-2.97	
	Other/None of the above	26	24.8	1.3	0.25	

Appendix H
Selected Practice Pictures

Causes of Health Issues

Picture Name (ID)	Image
Watching Television (CG)	
Refined Sugar (CC)	
Sedentary (CD)	

Consequences of Health Issues

Picture Name (ID)	Image
Obesity 2 (CI)	
Heart Attack (AQ)	
Obesity (CH)	

Solutions to Health Issues

Picture Name (ID)	Image
Adult Team Sports (AE)	
Physical Activity (CB)	
Healthy Eating (AH)	

Appendix I
Selected Experimental Pictures

Causes of Global Warming

Picture Name (ID)	Image
Lime Production 800x600 (AT)	
Vehicle Pollution 800x600 (AX)	
Technological Causes of Global Warming 800x600 (AV)	

Mining 800x600 (BJ)	
Industry 800x600 (E)	

Consequences of Global Warming

Picture Name (ID)	Image
Hungry Polar Bear 800x600 (L)	
Ocean Life Death 800x600 (BA)	
Sea Level Rise 800x600 (BE)	

Melting Ice Caps 800x600 (AY)	
Floods 800x600 (I)	

Solutions to Global Warming

Picture Name (ID)	Image
Solar Panels 800x600 (BP)	
Riding Bicycle 800x600 (BT)	
Wind Farm 800x600 (BR)	

Human Solutions to Global Warming 800x600 (AB)

Compost 800x600 (AA)

Appendix J
Study 2 Part 1 Participation Email

Subject (to be inserted in the subject heading): Link to the Online Survey for part 1 of the study What does this picture make you feel like?

(Le message en français suit)

Hi,

Thank you for your interest in this research project. Here is the link to the online survey for part 1 of this study: http://uottawapsy.az1.qualtrics.com/SE/?SID=SV_5duDwXDoWeG8YqF. You have 48 hours to complete this survey, starting at the time this email was received in your inbox. If you don't complete the survey within 48 hours, we will take this to mean that you are no longer interested in participating in our study and we will cancel both of your timeslots. You can complete the survey from any location that has internet access.

Thank you again,

Maxime Dorville

Bonjour,

Merci de votre intérêt pour ce projet de recherche. Voici le lien internet pour le sondage de la première partie de l'étude : http://uottawapsy.az1.qualtrics.com/SE/?SID=SV_5duDwXDoWeG8YqF. Vous avez 48 heures, débutant à l'heure de réception de ce courriel, pour compléter le sondage. Si vous ne complétez pas le sondage dans les 48 heures suivant la réception du lien internet, nous considèrerons que vous n'êtes plus intéressé(e)s à participer à notre étude et nous annulerons vos deux plages horaires ("timeslots''). Vous pouvez compléter le sondage de tous endroits ayant accès à internet.

Merci encore,

Maxime Dorville

Appendix K
Study 2 Part 2 General Instructions

In the pages that follow, you will be asked to look at several pictures and to indicate how you feel after viewing each picture. Each picture is going to be displayed for 6 seconds. Please observe each picture for the totality of the period it will be displayed. Each picture is going to be followed by a series of questions. Please read each question carefully and indicate how each picture makes you feel.

Dans les pages qui suivent, il vous sera demandé d'observer plusieurs images et d'indiquer comment vous vous sentez après chaque présentation. Chaque image sera présentée durant 6 secondes. S'il vous plait, regardez les images durant la totalité de la présentation. Chaque image sera suivie de questions. S'il vous plait, lisez les instructions des questionnaires attentivement et indiquez ce que chaque image vous fait ressentir.

Appendix L
Motivation Towards the Environment Scale

English Version

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.

1. For the pleasure I experience while I am mastering new ways of helping the environment.

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

2. Honestly, I don't know; I truly have the impression that I'm wasting my time doing things for the environment.

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

3. For the pleasure I experience when I find new ways to improve the quality of the environment.

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

4. Because it is a reasonable thing to do to help the environment.

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

5. Because I like the feeling I have when I do things for the environment.

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

6. I don't really know; I can't see what I'm getting out of it.

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

7. I think I'd regret not doing something for the environment.

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

8. I wonder why I'm doing things for the environment; the situation is simply not improving.

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

9. For the pleasure I get from contributing to the environment.

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

10. Because it's a sensible thing to do in order to improve the environment.

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

11. Because it's a way I've chosen to contribute to a better environment.

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

12. Because other people will be upset if I don't.

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

13. For the recognition I get from others.

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

14. Because I would feel bad if I didn't do anything for the environment.

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

15. Because taking care of the environment is an integral part of my life.

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

16. Because my friends insist that I do it.

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

17. Because it seems to me that taking care of myself and taking care of the environment are inseparable.

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

18. Because I would feel guilty if I didn't.

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

19. Because being environmentally-conscious has become a fundamental part of who I am.

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

20. Because it's part of the way I've chosen to live my life.

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

21. Because I would feel ashamed of myself if I was doing nothing to help the environment.

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

22. Because I think it's a good idea to do something about the environment.

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

23. To avoid being criticized.

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

24. I don't know; I can't see how my efforts to be environmentally-conscious are helping the environmental situation.

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

French Version

POURQUOI EFFECTUEZ-VOUS DES COMPORTEMENTS ÉCOLOGIQUES?

Il y a une multitude de comportements qui peuvent être effectués dans le but de préserver notre environnement. Par exemple, nous pouvons recycler les vieilles bouteilles, les papiers journaux, les papiers fins, les contenants en acier, de plastique, etc. Veuillez évaluer les énoncés présentés ci-dessous en indiquant, sur l'échelle de 1 à 7, à quel point ces énoncés correspondent aux raisons pour lesquelles vous recyclez.

1. Pour le plaisir que j'éprouve lorsque je maîtrise de nouvelles façons d'aider l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. Honnêtement, je ne sais pas; j'ai vraiment l'impression que je perds mon temps en faisant des choses pour l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. Pour le plaisir que j'éprouve lorsque je trouve de nouvelles façons d'améliorer la qualité de l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. Parce que cela me semble raisonnable d'aider à préserver l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

5. Parce que j'aime le sentiment que j'éprouve lorsque je fais des choses pour l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

6. Je ne sais pas vraiment, je ne vois pas ce que j'en retire.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

7. Parce que j'ai des remords quand je ne fais rien pour l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

8. Je me demande pourquoi je fais des choses pour l'environnement; la situation ne s'améliore tout simplement pas.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

9. Pour le plaisir que je ressens lorsque je contribue à la préservation de l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

10. Parce que ces comportements constituent des stratégies raisonnables qui peuvent améliorer l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

11. Parce que ce sont les moyens que j'ai choisis afin de contribuer à un meilleur environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

12. Parce que les autres seront contrariés si je ne fais rien.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

13. Pour la reconnaissance que les autres auront envers moi.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

14. Parce que je me sentirais mal à l'aise si je ne faisais rien pour l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

15. Parce que prendre soin de l'environnement fait partie intégrale de ma vie.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

16. Parce que mes amis insistent pour que je fasse ces comportements écologiques.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

17. Parce qu'il me semble que prendre soin de moi et prendre soin de l'environnement sont deux préoccupations inséparables.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

18. Parce que je me sentirais coupable si je ne faisais pas ces comportements pour l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

19. Parce qu' être conscient de l'environnement est devenu une partie fondamentale de qui je suis.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

20. Parce que ça fait partie de la façon dont j'ai choisi de vivre ma vie.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

21. Parce que j'aurais honte de moi si je ne faisais rien pour aider l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

22. Parce que je pense que c'est une bonne idée de faire quelque chose à propos de l'environnement.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

23. Pour éviter d'être critiqué(e).

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

24. Je ne sais pas; je ne vois pas comment mes efforts pour être conscient de l'environnement améliorent la situation environnementale.

Ne correspond pas du tout			Correspond modérément			Correspond exactement
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Appendix M
Pro-Environmental Attitude Strength Scale

English Version

Please indicate your agreement with the following two statements using the provided scale.

1. To what extent do you agree that human activities associated with current lifestyles have a negative impact on the state of the environment?

Do not agree			Somewhat agree			Completely agree
1	2	3	4	5	6	7

2. To what extent do you agree that humans need to take action to reduce their impact on the environment?

Do not agree			Somewhat agree			Completely agree
1	2	3	4	5	6	7

Please respond to the following six questions using the provided scale.

3. How important to you personally are environmental issues?

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

4. How central is your attitude toward the environment to your self-image/self-concept?

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

5. How representative of your values is your attitude toward the environment?

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

6. How knowledgeable are you about environmental issues?

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

7. How likely are you to change your opinion about the environment?

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

8. How sure are you that your opinion about the environment is right?

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

French Version

S'il vous plait indiquer votre accord envers les deux énoncés suivants en utilisant l'échelle présentée.

1. À quel point êtes-vous d'accord que les activités humaines associées aux modes de vie courants ont un impact négatif sur l'état de l'environnement?

Pas du tout d'accord			Moyennement en accord			Complètement en accord
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. À quel point êtes-vous d'accord que les humains doivent prendre des mesures afin de réduire leur impact sur l'environnement?

Pas du tout d'accord			Moyennement en accord			Complètement en accord
1	2	3	4	5	6	7
○	○	○	○	○	○	○

S'il vous plait répondre aux six questions suivantes en utilisant l'échelle présentée.

3. À quel point est-ce que les problèmes environnementaux vous sont personnellement importants?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. À quel point est-ce que votre attitude envers l'environnement est centrale à votre image de soi/concept de soi («self-image/self-concept»)?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

5. À quel point est-ce que votre attitude envers l'environnement représente vos valeurs personnelles?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

6. À quel point êtes-vous connaissant des problèmes environnementaux?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

7. À quel point est-il possible que vous changiez votre opinion sur l'environnement?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

8. À quel point êtes-vous certain que votre opinion sur l'environnement est juste?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Appendix N
Frequency of Recent Pro-Environmentally Relevant Actions Scale

English Version

Thinking about all of your activities and actions over the past week/7 days, please estimate how many times you've performed the following actions. Indicate your response using the drop-down menu.

There are no right or wrong answers to these questions. Please answer as HONESTLY as possible.

1. Used a clothesline or drying rack (air dry clothing)
2. Turned off the water while brushing teeth
3. Washed fruits and vegetables in a bowl (instead of under running water)
4. Brought and used reusable bags when shopping
5. Used the double-sided option to print/copy on both sides of the page
6. Purchased local foods
7. Opted to walk, cycle, skate, etc. instead of riding in a bus/car over a short distance (< 3km)
8. Took the time to properly separate waste into the garbage, recycling, and composting bins
9. Took a short shower (< 10 min.)

French Version

En pensant à toutes vos activités et vos actions au courant de la dernière semaine/dernier 7 jours, s'il vous plaît estimer combien de fois vous avez effectué les activités suivantes. Indiquez votre réponse à l'aide du menu déroulant.

Il n'y a pas de bonnes ou de mauvaises réponses à ces questions. S'il vous plaît répondre le plus HONNÊTEMENT possible.

1. Utiliser une corde à linge ou un étendoir (séché les vêtements à l'air)

2. Fermer le robinet pendant le brossage de dents

3. Laver les fruits et les légumes dans un bol (au lieu de sous l'eau courante)

4. Amener et utiliser des sacs réutilisables lors d'achats

5. Utiliser l'option recto-verso pour imprimer/copier sur les deux côtés de la feuille

6. Acheter de la nourriture locale

7. Choisir de marcher, de prendre le vélo, de patiner, etc. au lieu de prendre un autobus ou une automobile pour une courte distance (< 3km)

8. Prendre le temps de bien séparer les déchets dans les bacs d'ordures, de recyclage et de compostage

9. Prendre une douche courte (< 10 min.)

Appendix O
General Current Psychological Discomfort Scale

English Version

There are no right or wrong answers to these questions. Please answer as HONESTLY as possible.

1. Thinking of all the picture that were presented, to what extent are you feeling discouraged?

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

2. Thinking of all the picture that were presented, to what extent are you feeling guilty?

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

3. Thinking of all the picture that were presented, to what extent are you feeling proud?

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

4. Thinking of all the picture that were presented, to what extent are you feeling uneasy?

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

5. Thinking of all the picture that were presented, to what extent are you feeling uncomfortable?

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

6. Thinking of all the picture that were presented, to what extent are you feeling hopeful?

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

7. Thinking of all the picture that were presented, to what extent are you feeling bothered?

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

8. Thinking of all the picture that were presented, to what extent are you feeling ashamed?

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

9. Thinking of all the picture that were presented, to what extent are you feeling content?

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

French Version

Il n'y a pas de bonnes ou de mauvaises réponses aux questions suivantes. S'il vous plaît répondre le plus HONNÊTEMENT possible.

1. En pensant à toutes les images qui ont été présentées, dans quelle mesure vous sentez-vous découragé(e)?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. En pensant à toutes les images qui ont été présentées, dans quelle mesure vous sentez-vous coupable?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. En pensant à toutes les images qui ont été présentées, dans quelle mesure vous sentez-vous fier(ère)?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. En pensant à toutes les images qui ont été présentées, dans quelle mesure ressentez-vous un malaise?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

5. En pensant à toutes les images qui ont été présentées, dans quelle mesure vous sentez-vous inconfortable?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

6. En pensant à toutes les images qui ont été présentées, dans quelle mesure ressentez-vous de l'espoir?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

7. En pensant à toutes les images qui ont été présentées, dans quelle mesure vous sentez-vous tracassé(e)?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

8. En pensant à toutes les images qui ont été présentées, dans quelle mesure vous sentez-vous honteux(se)?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

9. En pensant à toutes les images qui ont été présentées,dans quelle mesure vous sentez-vous content(e)?

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Appendix P
Current Inconsistency Compensation Strategies Scale

English Version

Please respond to the following 9 statements using the provided scale.
There are no right or wrong answers to these questions. Please answer as HONESTLY as possible.

1. "When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by having the urge to immediately correct a past counter-environmental action (ex: repeating the action in a more pro-environmental fashion)."

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

2. "When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by having the urge to act in a sustainable pro-environmental behavior when I will find myself experiencing discomfort towards an environmental situation at a later time."

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

3. "When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by questioning whether environmental sustainability is really that important to me personally."

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

4. "When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by thinking that the issue of environmental sustainability has been blown out of proportion."

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

5. "When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by concluding that environmental sustainability is not a priority for me."

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

6. “When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by thinking environmental sustainability doesn't really matter since most people act the same way as I do.”

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

7. “When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by thinking I cannot be held personally responsible for environmental sustainability.”

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

8. “When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by having the urge to make changes in my surroundings (ex: placing a recycling bin where there wasn't one) that would allow me or remind me to act more sustainably in the future.”

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

9. “When I became aware of the discomfort brought forward by the viewing of the all the presented pictures, I reacted by actively looking for opportunities to act sustainably in other situations.”

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

French Version

S'il vous plaît répondre aux 9 énoncés suivants à l'aide de l'échelle présentée.
Il n'y a pas de bonnes ou de mauvaises réponses à ces questions. S'il vous plaît répondre le plus HONNÊTEMENT possible.

1. Lorsque j'ai pris conscience de l'inconfort généré par le visionnement de toutes les images présentées, j'ai réagi en ayant l'envie de corriger immédiatement une action passé non environnementale (ex. : en répétant l'action d'une façon plus pro-environnementale).

Pas du tout			Moyennement			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

2. Lorsque j'ai pris conscience de l'inconfort généré par le visionnement de toutes les images présentées, j'ai réagi en ayant l'envie d'adopter un comportement pro-environnemental durable la prochaine fois que je ressentirai un inconfort envers une situation environnementale.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

3. Lorsque j'ai pris conscience de l'inconfort généré par le visionnement de toutes les images présentées, j'ai réagi en me demandant si le maintien de l'environnement est vraiment si important pour moi personnellement.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

4. Lorsque j'ai pris conscience de l'inconfort généré par le visionnement de toutes les images présentées, j'ai réagi en pensant que l'enjeu entourant le maintien de l'environnement est exagéré.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

5. Lorsque j'ai pris conscience de l'inconfort généré par le visionnement de toutes les images présentées, j'ai réagi en concluant que le maintien de l'environnement n'est pas une priorité pour moi.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

6. Lorsque j'ai pris conscience de l'inconfort généré par le visionnement de toutes les images présentées, j'ai réagi en pensant que le maintien de l'environnement n'est pas vraiment important puisque la majorité des personnes agissent de la même façon que moi.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

7. Lorsque j’ai pris conscience de l’inconfort généré par le visionnement de toutes les images présentées, j’ai réagi en pensant que je ne peux pas être tenu personnellement responsable du maintien de l’environnement.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

8. Lorsque j’ai pris conscience de l’inconfort généré par le visionnement de toutes les images présentées, j’ai réagi en ayant l’envie d’apporter des changements dans mon environnement (ex. : placer un bac de recyclage où il n'y en avait pas) qui me permettraient ou me rappelleraient d'agir de façon plus environnementale dans le futur.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

9. Lorsque j’ai pris conscience de l’inconfort généré par le visionnement de toutes les images présentées, j’ai réagi en cherchant activement pour des occasions d'agir de manière environnementale dans d'autres situations.

Pas du tout			Un peu			Beaucoup
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Appendix Q
Pro-Environmentally Relevant Actions Intention Scale

English Version

Please estimate how many times you are intending to perform the following actions over the next week/7 days. Indicate your response using the drop-down menu.
There are no right or wrong answers to these questions. Please answer as HONESTLY as possible.

1. Used a clothesline or drying rack (air dry clothing)

2. Turned off the water while brushing teeth

3. Washed fruits and vegetables in a bowl (instead of under running water)

4. Brought and used reusable bags when shopping

5. Used the double-sided option to print/copy on both sides of the page

6. Purchased local foods

7. Opted to walk, cycle, skate, etc. instead of riding in a bus/car over a short distance (< 3km)

8. Took the time to properly separate waste into the garbage, recycling, and composting bins

9. Took a short shower (< 10 min.)

French Version

S'il vous plaît estimer combien de fois vous avez l'intention d'effectuer les activités suivantes au courant de la prochaine semaine/prochain 7 jours. Indiquez votre réponse à l'aide du menu déroulant.

Il n'y a pas de bonnes ou de mauvaises réponses à ces questions. S'il vous plaît répondre le plus HONNÊTEMENT possible.

1. Utiliser une corde à linge ou un étendoir (séché les vêtements à l'air)

2. Fermer le robinet pendant le brossage de dents

3. Laver les fruits et les légumes dans un bol (au lieu de sous l'eau courante)

4. Amener et utiliser des sacs réutilisables lors d'achats

5. Utiliser l'option recto-verso pour imprimer/copier sur les deux côtés de la feuille

6. Acheter de la nourriture locale

7. Choisir de marcher, de prendre le vélo, de patiner, etc. au lieu de prendre un autobus ou une automobile pour une courte distance (< 3km)

8. Prendre le temps de bien séparer les déchets dans les bacs d'ordures, de recyclage et de compostage

9. Prendre une douche courte (< 10 min.)

Appendix R
Study 2 Inter-Variable Correlations of all Variables per Condition

Inter-Variable Correlations of all Variables for the Causes Condition

Variable	1	2	3	4	5	6	7	8	9	10	11
1. SDM		.18	.76**	.31**	.81**	.20*	.37**	-.38**	.56**	.63**	.35**
2. NSDM			.02	.14	.13	.68**	.18	.21*	.09	.07	-.01
3. PEA				.22*	.67**	0.12	.23*	-.41**	.45**	.72**	.35**
4. PEB					.31**	.03	.22*	-.06	.37**	.30**	.83**
5. PSDM						.24*	.36**	-.46**	.62**	.74**	.37**
6. PNSDM							.22*	.17	.18	.19	-.09
7. GCPDS								-.01	.56**	.28**	.19
8. CCS									-.17	-.48**	-.12
9. BCS										.60**	.39**
10. PPEA											.36**
11. PPERAI											

Note. BCS = behavioral compensation strategies, CCS = cognitive compensation strategies, FRPERA = pre-task frequency of recent pro-environmentally relevant actions, GCPD = general current psychological discomfort, NSDM = pre-task environmental non-self-determined motivation, PEA = pre-task pro-environmental attitude strength, PPEA = post-task pro-environmental attitude strength, PPERAI = post-task pro-environmentally relevant actions intentions, PNSDM = post-task environmental non-self-determined motivation, PSDM = post-task environmental self-determined motivation, SDM = environmental self-determined motivation.

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

Inter-Variable Correlations of all Variables for the Consequences Condition

Variable	1	2	3	4	5	6	7	8	9	10	11
1. SDM		.14	.77**	.21*	.86**	.13	.18	-.30**	.51**	.69**	.20*
2. NSDM			-.06	.05	.15	.82**	.27**	.32**	.10	.02	.08
3. PEA				.11	.69**	-.06	.19	-.39**	.40**	.84**	.08
4. PEB					.26**	-.01	.08	-.09	.13	.21*	.87**
5. PSDM						.20*	.29**	-.37**	.54**	.71**	.23*
6. PNSDM							.37**	.26**	.15	.01	.05
7. GCPDS								-.13	.39**	.25*	.17
8. CCS									-.22*	-.48**	-.07
9. BCS										.44**	.14
10. PPEA											.17
11. PPEB											

Note. BCS = behavioral compensation strategies, CCS = cognitive compensation strategies, FRPERA = pre-task frequency of recent pro-environmentally relevant actions, GCPD = general current psychological discomfort, NSDM = pre-task environmental non-self-determined motivation, PEA = pre-task pro-environmental attitude strength, PPEA = post-task pro-environmental attitude strength, PPERAI = post-task pro-environmentally relevant actions intentions, PNSDM = post-task environmental non-self-determined motivation, PSDM = post-task environmental self-determined motivation, SDM = environmental self-determined motivation.

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

Inter-Variable Correlations of all Variables for the Solutions Condition

Variable	1	2	3	4	5	6	7	8	9	10	11
1. SDM		.08	.68**	.37**	.80**	-.04	-.15	-.30**	.35**	.55**	.32**
2. NSDM			-.05	.03	.01	.71**	.16	.17	.04	-.04	-.05
3. PEA				.21*	.65**	-.12	-.10	-.30**	.22*	.75**	.18
4. PEB					.31**	-.02	.07	.04	.27**	.13	.77**
5. PSDM						.01	-.05	-.27**	.42**	.67**	.33**
6. PNSDM							.25**	.21*	.19*	-.05	-.06
7. GCPDS								.25*	.33**	-.05	.02
8. CCS									.06	-.38**	.00
9. BCS										.34**	.33**
10. PPEA											.16
11. PPEB											

Note. BCS = behavioral compensation strategies, CCS = cognitive compensation strategies, FRPERA = pre-task frequency of recent pro-environmentally relevant actions, GCPD = general current psychological discomfort, NSDM = pre-task environmental non-self-determined motivation, PEA = pre-task pro-environmental attitude strength, PPEA = post-task pro-environmental attitude strength, PPERAI = post-task pro-environmentally relevant actions intentions, PNSDM = post-task environmental non-self-determined motivation, PSDM = post-task environmental self-determined motivation, SDM = environmental self-determined motivation.
* $p < .05$, ** $p < .01$.