

**The Hierarchical Action-Based Model of Inconsistency Compensation in the Environmental Domain: Exploring the Role of Individual Differences in Distal Motivation**

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## ABSTRACT

Using the action-based model of dissonance (Harmon-Jones, Amodio, & Harmon-Jones, 2009) and self-determination theory (Deci & Ryan, 2008) as theoretical frameworks, this thesis sought to explain the motivational processes underlying the environmental belief-action gap. The thesis examined why and how people resolve inconsistencies between their favourable attitudes toward environmental protection and their environmentally harmful behaviour. I hypothesized that accounting for individual differences in autonomous and controlled distal motives for effective and unconflicted action would clarify why attitude-behaviour inconsistencies are uncomfortable and explain how people compensate for them. I carried out 3 sets of studies to test the proposed hierarchical action-based model of inconsistency compensation in the environmental domain (HABICE). The objective of the first set of 3 studies was to test hypotheses about the role of individual differences in global and contextual motivation on dissonance arousal, in response to native attitude-behaviour inconsistencies encountered across and within important life domains. The second set of 3 studies tested hypotheses about the role of individual differences in contextual motivation toward the environment on the use and choice of strategies to compensate for a recent native inconsistency in the environmental domain. Finally, the goal of the final study was to test hypotheses about the moderating effect of social factors that direct attention to public (ego-invested) versus private (authentic) aspects of the self during the perception of inconsistencies on motivation and intentions to revise pro-global warming mitigation attitudes. The results of the 7 studies (total  $N = 2,209$ ) supported the main predictions of the HABICE. The cumulative evidence supported the existence of two motivational orientations operating during inconsistency compensation processes. The autonomous motivational orientation, which embodies action tendencies to facilitate organismic integration via authentic regulation,

motivated people to compensate for attitude-behaviour inconsistencies to restore the integrity of authentic self-structures. As a result, autonomous motivation toward the environment led people to reduce dissonance and to compensate for perceived inconsistencies by bringing their behaviour in line with self-relevant attitudes. The controlled motivational orientation, which embodies action tendencies to facilitate instrumental outcomes via contingent regulation, motivated people to compensate for attitude-behaviour inconsistencies to protect ego-invested self-structures by avoiding the aversive consequences of their counter-environmental actions. When inconsistencies aroused dissonance, controlled motivation predicted the use of overt behavioural strategies, for example enacting a compensatory pro-environmental action, to reduce dissonance. However, when inconsistencies did not arouse dissonance or there were barriers to behaviour change, controlled motivation predicted the use of cognitive strategies, for example revising or distorting pro-environmental attitudes, to minimize the inconsistency. Consequently, autonomous compensation processes predicted relatively infrequent attitude-behaviour inconsistencies in the environmental domain while controlled compensation processes predicted relatively frequent inconsistencies. The results imply that controlled motivation toward the environment may be driving the environmental belief-action gap, but that finding ways to promote autonomous motivation toward the environment in the general population has the potential to alleviate the gap.

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## CONTRIBUTION OF AUTHORS

The present thesis consists of an introduction, three manuscripts in article form, a discussion, and several general appendices. The introduction provides a broad overview of the theoretical framework guiding the research. Specifically, it outlines the main predictions of the proposed hierarchical action-based model of inconsistency compensation in the environmental domain (HABICE) and explains how the model complements past research on cognitive dissonance and self-determination theory. The three manuscripts summarize the findings of the research. The first manuscript, titled *Why are attitude-behaviour inconsistencies uncomfortable? Exploring individual differences in dissonance arousal processes*, reports the results of three correlational studies. The second manuscript, titled *Individual differences in distal motivation and the choice of strategy to compensate for environmental attitude-behaviour inconsistencies*, summarizes the findings of three additional correlational studies. The third manuscript, titled *The effects of inducing public and private awareness of environmental transgressions on motivation and intentions to revise global warming attitudes*, reports the findings of the final experimental study. The discussion summarizes the findings reported in the three manuscripts and discusses the implications and limitations of the research, and identifies promising avenues for future research. Finally, the general appendices present the unpublished instruments and materials developed specifically for the purposes of the present thesis.

I am the primary author of all three manuscripts and my thesis supervisor, Luc G. Pelletier, Ph.D., is the secondary author. Dr. Pelletier made significant contributions to the research project. For example, he assisted in the formulation of the research problem and hypotheses, the conceptualization of the research studies, and the interpretation of the results. He also edited and revised the thesis and manuscripts at various stages of the writing process. For

my part, I collaborated with Dr. Pelletier in every stage of the research process, I collected all the data with the help of research assistants, I organized and conducted all the statistical analyses, and I wrote the three manuscripts as well as the other sections of the thesis.

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## INTRODUCTION

What are we to do? Concern about the state of the environment and pro-environmental efforts are on the rise. However, we live in a world that is reliant on fossil fuels and designed for overconsumption. Furthermore, market-based economies aimed at ever-increasing growth and trends toward globalization and population growth exacerbate rising demands for food, water, energy, and commodities (United Nations Environmental Programme [UNEP], 2012). These societal factors make it difficult if not impossible for environmentally conscious people to support the needs of their families and themselves, while living in strict accordance with their pro-environmental beliefs and values. These people are bound to act in ways that contradict their beliefs in the environmental domain despite their best intentions and efforts. In other words, there are important human, structural, and institutional barriers to pro-environmental behaviour change and environmental sustainability that have resulted in a significant environmental belief-action gap (Bamberg & Moser, 2007; Gifford, 2011; Kollmuss & Agyeman, 2002).

As a result of these consumption patterns, the global ecosystem is fast approaching a critical threshold beyond which changes to the life-support functions of the planet are likely to be abrupt and irrevocable (UNEP, 2012). Moreover, increasing rates of climate change due to anthropogenic emissions of gases that intensify the greenhouse effect—a phenomenon known as global warming—exacerbate pressures on the global ecosystem (Intergovernmental Panel on Climate Change, 2014). Anthropogenic disruptions to the global ecosystem are concerning because of their widespread negative impacts on the health and security of human and non-human life. Clearly, we must do more to curb environmental degradation and get people to make their behaviour congruent with their pro-environmental beliefs. Among other things, we need to identify and understand the motivational processes driving the environmental belief-action gap in

order to find ways to overcome psychological barriers to pro-environmental behaviour change (Gifford, 2011; Kollmuss & Agyeman, 2002).

The observation that people do not always act consistently with their pro-environmental beliefs implies that they are likely to encounter spontaneous attitude-behaviour inconsistencies in the environmental domain on a daily basis. Hence, a logical starting point to study the motivational processes involved in the environmental belief-action gap is to apply cognitive dissonance theories.

### **Cognitive Dissonance Theories**

Cognitive dissonance theory (CDT) is a motivational theory of inconsistency compensation (Proulx, Inzlicht, & Harmon-Jones, 2012). The theory proposes that holding two inconsistent or dissonant cognitions simultaneously arouses a negative intrapersonal state of cognitive dissonance that motivates people to reduce the dissonance by compensating for the inconsistency. The magnitude of dissonance presumably varies as a function of the dissonance ratio, which is the number of important dissonant cognitions relative to the total number of important dissonant and consonant (consistent) cognitions (Festinger, 1957). CDT posits that there are different strategies people can use to compensate for inconsistencies. On the one hand, people can directly eliminate the dissonance ratio by changing or reversing either the attitude or the 'physical trace' of the behaviour responsible for the inconsistency (Festinger, 1957). Specifically, people should be motivated to change the least resistant cognition in the dissonance ratio. Resistance to change depends on a variety of factors, such as the cognition's personal importance or consonance with other personally important cognitions, or a perceived lack of resources to enact the change (Festinger, 1957). On the other hand, people can indirectly minimize the dissonance ratio by restructuring cognitions not directly responsible for the

inconsistency. Restructuring typically involves minimizing the importance of related dissonant cognitions, maximizing the importance of related consonant cognitions, or adding related cognitions to the dissonance ratio (Leippe & Eisenstadt, 1999). Cognitive restructuring is especially likely to occur when both the attitude and the behaviour responsible for the inconsistency are resistant to change.

**Induced dissonance effects.** Most empirical research that supports Festinger's (1957) theory relies on the use of dissonance induction paradigms. Dissonance induction paradigms assume that increasing the simultaneous accessibility of conflicting cognitions induces a cognitive inconsistency (i.e., large dissonance ratio) that arouses dissonance and motivates people to compensate. The induced compliance paradigm consists of having participants comply with a request to write a counter-attitudinal advocacy, and subsequently measuring affect and changes in attitudes; for example, asking university students to write an essay in favour of raising tuition fees and subsequently asking them to indicate their support for a tuition increase at their university (Elliot & Devine, 1994). In line with CDT, researchers have found that induced compliance causes greater self-reported psychological discomfort (Elliot & Devine, 1994; Harmon-Jones, 2000; Zanna & Cooper, 1974), physiological arousal (Croyle & Cooper, 1993; Harmon-Jones, Brehm, Greenberg, Simon, & Nelson, 1996), and attitude change (see Harmon-Jones & Mills, 1999 for a review). The induced compliance effect on attitude change is largest under conditions of relatively high perceived choice, small incentive to comply, and high personal responsibility for the inconsistency (Collins & Hoyt, 1972; Festinger & Carlsmith, 1959). Presumably, when the experimental context provides sufficient justification for the compliance behaviour, it increases the consonance of the compliance behaviour and decreases the magnitude of the dissonance ratio, which inhibits dissonance arousal (Aronson, 1966).

Another popular dissonance induction paradigm is the induced hypocrisy paradigm, which consists of making a public commitment to a pro-attitudinal advocacy and subsequently recalling recent past transgressions against the advocated attitude (Stone & Fernandez, 2008). Presumably, the inconsistency conflicts with personal expectations of consistency or integrity and motivates a behavioural change, because this is the only strategy that has the potential to satisfy motives for self-consistency (Aronson, 1999; Stone & Fernandez, 2008). In line with this assumption, participants subjected to a hypocrisy induction exhibit greater (intentions to engage in) compensatory behaviour change (see Stone & Fernandez, 2008 for a review), especially when they recall a larger number of past transgressions (Fointiat, Morisot, & Pakuszewski, 2008). However, when participants are motivated to process their transgressions carefully, they exhibit greater behavioural change when they recall a smaller number of transgressions (Stone & Fernandez, 2011). Presumably, the meta-cognitive thoughts (e.g., difficulty of recalling transgressions) elicited during information processing skew the dissonance ratio. In addition to the moderating effects of the experimental context, there is also evidence that individual differences in personality and motivation moderate induced dissonance effects.

**Individual differences in induced dissonance effects.** Theoretically, when people become aware of their own counter-attitudinal actions and experience dissonance arousal, they should be inclined to reverse or weaken their initial attitudes, or to defend the transgressions rather than to engage in compensatory behaviour change. This is because using cognitive strategies to change the dissonant attitude or restructure cognitions requires less elaboration (i.e., effort) than using behavioural strategies to reverse or compensate for the transgression (Leippe & Eisenstadt, 1999). In fact, reversing the 'physical trace' of a behaviour is often impossible; for example, the greenhouse gases emitted from driving one's car cannot be 'un-emitted.' However,

this assumption is at odds with evidence showing that individual differences moderate dissonance effects, which suggests that some people may be motivated to tolerate (i.e., not to reduce) dissonance or not motivated to compensate even in the absence of dissonance arousal.

For example, the induced compliance effect on attitude change diminishes as the perceived importance of the threatened attitude increases, but only if the important attitude is salient prior to the induction (Simon, Greenberg, & Brehm, 1995; Starzyk, Fabrigar, Soryal, & Fanning, 2009). Other research shows that, following a compliance induction, participants with high levels of private versus public self-consciousness are less likely to change their attitudes and more likely to rationalize the counter-attitudinal compliance behaviour (Scheier and Carver, 1980). Similarly, participants higher in self-presentation concerns exhibit greater attitude change following induced compliance (Paulhus, 1982). When given a choice following induced compliance, participants high in preference for consistency rationalize the compliance behaviour, while those low in preference for consistency trivialize the importance of the context (Michel & Fointiat, 2002). Participants high in preference for consistency also exhibit greater behavioural change following a hypocrisy induction (Sénémeaud, Mange, Fointiat, & Somat, 2014). Finally, participants with higher levels of self-esteem exhibit more attitude change following induced compliance (Martinie & Fointiat, 2006), especially when the compliance behaviour threatens positive self-attributes (Stone & Cooper, 2003), and report stronger intentions to change their behaviour following induced hypocrisy (Peterson, Haynes, & Olson, 2008). Apparently, individual differences that increase the cognitive accessibility of important attitudes and the personal importance of acting consistently with important attitudes fosters greater motivation to compensate.

This brief review of the literature introduces CDT with a focus on the notion that

cognitive inconsistencies are uncomfortable and motivate people to compensate by changing one of the cognitions involved in the dissonance ratio. Furthermore, there is evidence that situational and personal factors moderate induced dissonance effects, presumably because they influence the type, number, and relative importance of dissonant and consonant cognitions involved in the dissonance ratio. Specifically, people experience greater dissonance arousal and are more likely to use elaborate compensation strategies as the number and relative importance of the dissonant versus consonant cognitions involved in the dissonance ratio increase. However, because of the limitations of CDT research based on dissonance induction paradigms, many questions about the motivational processes underlying the resolution of attitude-behaviour inconsistencies remain unanswered.

**Limitations of induced dissonance research.** CDT represents a popular and useful theory to understand the processes involved in inconsistency compensation. However, dissonance research often relies on experimental designs that confound the processes involved in the perception of cognitive inconsistencies, the arousal of dissonance, and the use of inconsistency compensation strategies, which impedes the study of the motivation underlying these dissonance processes and limits the ecological validity of the findings (Devine, Tauer, Barron, Elliot, & Vance, 1999; Harmon-Jones, Amodio, & Harmon-Jones, 2009). Researchers usually assume that dissonance paradigms successfully induced an inconsistency and aroused dissonance if people subjected to the induction were more likely to use a compensation strategy than were people not subjected to the induction (Devine et al., 1999; Elliot & Devine, 1994). Because of this research strategy, it is unclear why or how individual differences in self-consciousness, self-presentation concerns, preferences for consistency, and self-esteem moderate the use of inconsistency compensation strategies (Harmon-Jones et al., 2009). In other words,

CDT does not clearly elucidate the motivation underlying dissonance effects (Harmon-Jones, 1999). Festinger (1957) proposed that cognitive inconsistencies motivate people to compensate but did not explain why cognitive inconsistencies are uncomfortable or why this negative affect motivates people to compensate.

Another limitation of induced dissonance research is the common practice of offering a limited number of pre-determined inconsistency compensation strategies, which precludes the study of choice among competing strategies. Typically, only one strategy is available to reduce the dissonance. Within the induced compliance paradigm, the available strategy is usually attitude change or cognitive restructuring. Within the induced hypocrisy paradigm, the available strategy is usually compensatory behaviour change or intentions to change behaviour. In other words, dissonance research findings based on experimental designs likely do not generalize to inconsistency compensation processes triggered by spontaneous attitude-behaviour inconsistencies, where several inconsistency compensation strategies are potentially available (McGregor, Newby-Clark, & Zanna, 1999). These criticisms have led researchers to offer several revisions of CDT; one of these revisions is the action-based model of dissonance.

**Action-based model of dissonance.** The action-based model is a contemporary theory of dissonance proposed to explain the motivation underlying dissonance effects (Harmon-Jones, 1999; Harmon-Jones et al., 2009). The model assumes that most cognitions automatically activate action tendencies (i.e., information useful for action, such as goals, needs, and motives). When two related cognitions with conflicting action tendencies are simultaneously accessible, they arouse dissonance because they have the potential to interfere with goal-directed action and behavioural commitments. Therefore, the aroused dissonance motivates people to compensate for the inconsistency in order to minimize the threat to salient behavioural goals and

commitments. In other words, the action-based model posits that the dissonance aroused by cognitive inconsistencies serves as the proximal motivation that energizes compensation processes, whereas broader behavioural goals and commitments represent the distal motivation that guides these processes (Harmon-Jones, 1999).

This alternative interpretation of the motivation underlying dissonance phenomena suggests that cognitive inconsistencies induce a form of approach motivation that is adaptive rather than maladaptive. The model also implies that dissonance processes are subject to individual and induced differences in dominant action tendencies and distal motivation. In fact, Harmon-Jones and colleagues (Harmon-Jones & Harmon-Jones, 2002; Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008) have shown that inducing an action-oriented versus a neutral mindset leads to an increased preference for the chosen versus the rejected option (i.e., spreading of alternatives) to reduce postdecisional dissonance. Furthermore, dissonance effects, particularly postdecisional spreading of alternatives and compliance-induced attitude change, appear largest among individuals with high levels of trait approach motivation (Harmon-Jones, Schmeichel, Inzlicht, & Harmon-Jones, 2011).

According to Harmon-Jones and colleagues (2009), the motivation underlying dissonance effects has been elusive because CDT researchers do not usually distinguish between the different component processes of dissonance phenomena. The authors claim that dissonance phenomena involve three distinct processes: the *perception* of cognitive inconsistencies, the *arousal* of cognitive dissonance and motivation to compensate, and the *reduction* of dissonance via the use of inconsistency compensation strategies. These distinctions seem supported by neuroscientific evidence. Harmon-Jones and colleagues (see Harmon-Jones & Harmon-Jones, 2008 for a review) have shown that dissonance arousal processes act through the anterior

cingulate cortex, involved in conflict detection, and limbic system structures (e.g., the amygdala), which regulate emotional experience (Devinsky, Morrell, & Vogt, 1995). By contrast, dissonance reduction processes recruit the left prefrontal cortex, which is involved in approach motivational processes, such as planning coordinated responses to stimuli. More importantly, other research suggests that activity in the left prefrontal cortex increases following the detection of conflict by the anterior cingulate cortex (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Miller & Cohen, 2001). In sum, the action-based model is consistent with Festinger's (1957) original theory but advances the novel hypothesis that there are two types of motivation, proximal and distal, underlying dissonance effects. The proximal motivation is the dissonance that motivates people to compensate for inconsistencies and the distal motivation is the broader goal or behaviour at risk of disruption that guides dissonance processes.

Based on these observations, the proponents of the model have argued that distinguishing between the three component processes of dissonance—perception, arousal, and reduction—should facilitate predictions about individual differences in dissonance reduction and increase the predictive power of CDT (Harmon-Jones et al., 2009). Presumably, individual differences in motivation and personality have the potential to affect the number, type, and relative importance of dissonant and consonant cognitions involved in the dissonance ratio. In addition, these differences likely influence whether or not attitude-behaviour inconsistencies are uncomfortable and why this discomfort motivates people to compensate, and may affect the choice of compensation strategy to reduce dissonance. If true, understanding the individual differences that shape dissonance processes should facilitate predictions about the choice of strategy to compensate for inconsistencies in general and in the environmental domain in particular.

Furthermore, the authors of the action-based model posit that accounting for the distal

motives guiding inconsistency compensation processes may explain poorly understood dissonance phenomena (Harmon-Jones et al., 2009). For example, differences in distal motives for effective and unconflicted action could explain why people sometimes tolerate dissonance rather than reduce it immediately. People may be motivated to wait until a strategy that satisfies distal motives becomes available rather than to use an available strategy that has the potential to exacerbate the dissonance ratio. Similarly, individual differences in distal motives may lead some people to compensate for attitude-behaviour inconsistencies even though dissonance was not aroused. In other words, differences in the distal motives guiding dissonance processes could account for the lack of correlation between psychological discomfort and attitude change reported by some researchers (e.g., Elliot & Devine, 1994; Harmon-Jones, 2000). However, these alternative explanations of dissonance phenomena remain untested.

The action-based model is particularly appealing to explore individual differences in inconsistency compensation processes because it acknowledges that pre-existing (distal) motives influence the perception, arousal, and reduction components of dissonance processes.

Furthermore, distinguishing between the three components of dissonance makes it possible to study dissonance processes that occur outside the laboratory using self-report methods (Harmon-Jones et al., 2009). In the context of the present research, I used self-determination theory to quantify distal motives for effective and unconflicted action and to test the action-based model.

### **Self-Determination Theory**

Self-determination theory (SDT) is meta-theory of motivation and personality that assumes all individuals have the innate desire to interact with their social environment and to engage in activities to satisfy the basic needs to feel autonomous, competent, and closely connected to others (Deci & Ryan, 2008). Like the action-based model, SDT: (a) recognizes that

people hold many competing action tendencies, (b) distinguishes between the quantity of motivation energizing behaviour versus the quality of motivation guiding behaviour, and (c) recognizes that motivation elicited for a given task results from the interaction of individual differences and social factors. In particular, the general causality orientations, a sub-theory of SDT (Deci & Ryan, 1985a; 1985b), describes individual differences in how people orient toward and interact with their social environments, and how these individual differences manifest themselves in terms of motivation and behaviour. Furthermore, the hierarchical model of extrinsic and intrinsic motivation (HMEIM; Vallerand, 1997) puts forth specific hypotheses about the hierarchical nature of motivation and the top-down, bottom-up, and reciprocal effects of motivation at different levels of generality. The HMEIM adheres to the postulates of the organismic integration theory, which is another complementary sub-theory of SDT. In other words, SDT and its sub-theories are well suited to formulate testable hypotheses about individual differences in inconsistency compensation processes, operationalize and quantify distal motives for effective and unconflicted action, and test the action-based model of dissonance. We explore these two models, general causality orientations and the HMEIM, in detail below.

**General causality orientations theory.** The general causality orientations theory posits that all individuals embody three qualitatively different causality orientations to varying degrees: the autonomous orientation, the controlled orientation, and the impersonal orientation (Deci & Ryan, 1985a). These individual differences have implications for the quality of motivation and the regulation of behaviour. The autonomous orientation describes the innate action tendency to orient toward and interact with elements of the social environment to satisfy basic needs integral to authentic self-structures. The controlled causality orientation describes the socially acquired action tendency to orient toward and interact with elements of the social environment to satisfy

substitute needs, for example the desire for wealth, fame, or public recognition. Finally, the impersonal orientation describes the acquired feelings of helplessness or incompetence that arise when people do not have control over their environment or feel unable to regulate their behaviour effectively. In sum, the three general causality orientations embody qualitatively different action tendencies that manifest as qualitatively different motives for effective and unconflicted action.

*Action tendencies.* The conceptual definitions of the three general causality orientations proposed by Deci and Ryan (1985a) provide each causality orientation with a unique set of action tendencies. The autonomous causality orientation embodies action tendencies to facilitate organismic integration via authentic regulation while the controlled causality orientation embodies action tendencies to facilitate instrumental outcomes via contingent regulation. The impersonal causality orientation does not embody action tendencies or promote behavioural regulation. In line with this assumption, the three causality orientations have been associated with differences in goals, need satisfaction, and motives.

Research has shown that, in general, autonomy-oriented individuals tend to strive for mastery goals (e.g., learning, challenge), control-oriented individuals tend to strive for performance-approach (e.g., obtain high grades, prove ability to others) and performance-avoidance (i.e., avoid failure) goals, and impersonally-oriented individuals tend to strive for performance-avoidance goals (Koestner and Zuckerman, 1994; Lee, Sheldon, & Turban, 2003). For example, a recent study in physical activity found that participants primed for autonomy versus control set exercise goals that were longer in intended duration; furthermore, intended duration mediated the positive relationship between the autonomy prime and the actual length of subsequent exercise sessions (Magaraggia, Dimmock, & Jackson, 2014). In a similar study,

autonomy-primed versus control-primed participants reported stronger intentions to exercise, exerted greater effort during exercise, exercised for longer, and reported greater enjoyment from exercising (Banting, Dimmock, & Grove, 2011). There is also evidence that framing a task as a game to foster task-involvement versus as a test of ability to foster ego-involvement leads to greater intrinsic motivation, which supports the autonomy orientation (Koestner, Zuckerman, & Koestner, 1987). Furthermore, the type of induced involvement interacted with the type of praise delivered, such that task-involved participants exhibited greater motivation when they received effort praise while ego-involved participants exhibited greater motivation when they received ability praise.

Though all individuals embody all three causality orientations, Deci and Ryan (1985a) claim that there are individual differences in the relative importance or strength of the causality orientations that characterize individual personalities. These individual differences manifest as differences in motivation, engagement, and behaviour (Deci & Ryan, 1985a). In other words, dominant action tendencies vary from one individual to the next, which has implications for the quality of motivation for effective and unconflicted action.

***Motivation for effective and unconflicted action.*** According to Deci & Ryan (1985a), the three general causality orientations relate to the overarching concept of self-determination, which corresponds to the perceived locus of causality (PLOC) of behaviour. In their discussion (see Deci & Ryan, 1985a, p. 131, second paragraph), the authors claim that a dominant autonomy orientation disposes people to exhibit autonomous motives (i.e., identification, integration, and intrinsic motivation), which promote authentic regulation and self-determined behaviour. A person who exhibits autonomous motivation tends to engage in behaviours that are consistent with deeply held beliefs within and across important life domains. By contrast, the authors posit

that a dominant controlled orientation disposes people to exhibit controlled motives (i.e., external regulation and introjection), which promote contingent regulation and non self-determined behaviour. A person who exhibits controlled motivation tends to engage in behaviours to avoid negative outcomes (e.g., criticism) or to obtain positive outcomes (e.g., praise). Finally, a dominant impersonal orientation disposes people to lack clear motives (i.e., amotivation), which undermines effective behavioural regulation. A person who exhibits amotivation is often unable to cite a specific reason for their actions.

Moreover, Deci and Ryan (1985a, p. 131) explicitly acknowledge that PLOC motivation scales, such as the one developed by Ryan and Connell (1989), are valid operational definitions of individual differences in the *manifestation* of general causality orientations. Empirical research supports this assumption. For example, Sharp, Pelletier, Blanchard, and Séguin-Lévesque (2003) have shown that the six subscales of the Global Motivation Scale, a validated multi-dimensional measure of PLOC for activities in general, related in predictable ways to causality orientations measured with the General Causality Orientations Scale (GCOS). The authors found that the autonomous causality orientation is associated with less amotivation and introjection (the negative correlation with scores of external regulation was not significant), and with greater identification, integration, and intrinsic (i.e., autonomous) motivation. The controlled causality orientation is associated with greater amotivation, external regulation, and introjection, and is not associated with autonomous forms of motivation. Finally, the impersonal causality orientation is associated with higher scores of amotivation, external regulation, and introjection, and with lower scores of integration and intrinsic motivation (the negative correlation with the identification subscale was not significant). Furthermore, scores of amotivation, external regulation, and introjection were associated with less perceived satisfaction

of the three basic needs proposed by SDT, whereas scores of identification, integration, and intrinsic motivation were associated with greater perceived need satisfaction. This convergent evidence suggests that one way to operationalize distal motives for effective and unconflicted action is to measure the PLOC of behaviour.

A major advantage of the PLOC measurement approach is that researchers have developed several reliable and valid multi-dimensional scales to assess the motivation underlying the regulation of behaviour in general and across a wide range of life domains (see Vallerand, 1997 for a review), including the environmental domain (Pelletier, Tuson, Green-Demers, Beaton, & Noels, 1998). By contrast, the GCOS does not account for the full range of motives underlying the self-determination continuum proposed by SDT, particularly introjection, identification, and integration (Koestner & Zuckerman, 1994; Ryan & Connell, 1989; Vallerand & Bissonnette, 1992; Vallerand, 1997). In addition, there is no scale based on the GCOS that has been validated or developed in the environmental domain so far. By contrast, multi-dimensional PLOC measures, such as the Global Motivation Scale (Sharp et al., 2003) and the Motivation Toward the Environment Scale (Pelletier et al., 1998), typically measure all the sub-types of motivation, and their subscales show a simplex pattern of correlations that support the self-determination continuum. Furthermore, person-centered analyses of these types of scales support a functional distinction between levels of autonomous motivation (i.e., composite scores of identification, integration, and intrinsic regulation), controlled motivation (i.e., composite scores of external regulation and introjection), and amotivation (i.e., impersonal regulation) in the prediction of behavioural outcomes (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009).

Another advantage of measuring motivation using PLOC scales is that it makes it

possible to apply the HMEIM (Vallerand, 1997) to formulate testable hypotheses about motivation operating at different levels of generality. In other words, the organismic integration sub-theory of SDT (Deci & Ryan, 2008) is better suited to operationalize the constructs and test the predictions of the action-based model (Harmon-Jones et al., 2009).

**Hierarchical model of extrinsic and intrinsic motivation.** Like the general causality orientations theory, the HMEIM (Vallerand, 1997) proposes that individual differences in the manifestation of the three causality orientations produces individual differences in motivation. However, the HMEIM goes a step further; it hypothesizes that motivation exists at three levels of generality. Motivation at the global level concerns the regulation of personality processes and characterizes general behavioural tendencies across life domains. Motivation at the contextual level concerns the regulation of domain-specific processes and characterizes behavioural tendencies in a given life domain. Finally, motivation at the situational level concerns regulation of situational processes and characterizes behavioural tendencies for a specific event or process at a specific time. In addition, the HMEIM proposes that motivation at higher levels of generality exert top-down effects on motivation at lower levels of generality, and that the presence of social factors that support or frustrate innate organismic integration tendencies moderate these effects.

Previous research supports the predictions made by the HMEIM. For example, Guay, Mageau, and Vallerand (2003) conducted two longitudinal studies to examine the stability and the reciprocal effects of self-determined motivation at the global and contextual (i.e., academic) levels of generality over one-year and five-year periods. The results indicate that self-determined motivation at both levels of generality is relatively stable over time but exerts reciprocal top-down and bottom-up effects across levels of generality. Lavigne and Vallerand (2010) obtained similar findings between motivation at contextual and situational levels of generality via a

longitudinal study that assessed high school students' contextual motivation for science courses and situational motivation for specific science class activities over a four-month period.

Furthermore, the authors found evidence that contextual motivation changes over time via a dynamic process that involves reciprocal effects between motivation at the two levels of generality. Blanchard, Mask, Vallerand, de la Sablonnière, and Provencher (2007), and Lavigne and colleagues (2009) have reported similar findings in the physical activity domain.

The distinction between motivation at the global, contextual, and situational levels of generality is an important one because each level regulates different processes (Vallerand, 1997). These processes presumably have implications for the perception of attitude-behaviour inconsistencies, the arousal of dissonance, and the use and choice of inconsistency compensation strategies.

***Global motivation and personality processes.*** According to the HMEIM, motivation at the global level of abstraction should be associated with differences in the tendency to attend to self-structures to regulate behaviour (Hodgins & Knee, 2002; Ryan & Deci, 2004) and the processing of self-threatening information (Hodgins, 2008). These characteristics imply that global motivation is involved in dissonance perception and arousal processes in general.

***Self-directed attention and conflict perception.*** Due to the differences in action tendencies implied by the three causality orientations, SDT proposes that causality orientations are associated with differences in the tendency to attend to the self versus to the social environment to regulate behaviour (Deci & Ryan, 1985a). Individual differences in self-directed attention are particularly relevant to the study of dissonance processes engendered by native attitude-behaviour inconsistencies, because the detection of cognitive inconsistencies requires that people attend to their actions to evaluate their self-relevance. According to SDT, the autonomous

motivational orientation, which promotes organismic integration via authentic regulation, should be associated with chronic awareness of the private aspects of the self—for example, needs, goals, and beliefs—and the tendency to monitor and regulate actions relative to these authentic self-structures. By contrast, the controlled motivational orientation promotes the satisfaction of substitute needs that support ego-invested self-structures via contingent regulation. Therefore, this orientation leads people to monitor and regulate behaviour through chronic awareness of the overt, external, and public aspects of the self, particularly how others might perceive their mannerisms, expressive behaviour, and actions. Finally, the impersonal motivational orientation, which does not promote the satisfaction of specific needs or the regulation of behaviour, is not associated with the tendency to monitor or regulate actions because it disposes people to perceive their behaviour as inevitable or as determined by luck or fate (Hodgins, 2008; Hodgins & Knee, 2002; Ryan & Deci, 2004).

In line with these hypotheses, research has shown that motivational orientations (measured via the GCOS and PLOC scales) show different patterns of association with dispositional constructs related to self-regulation. The autonomous motivational orientation is associated with greater private self-consciousness (Deci & Ryan, 1985a; Deponete, 2004), openness to experience (Olesen, 2011), conscientiousness (Koestner, Bernieri, & Zuckerman, 1992), state and trait mindfulness (Brown & Ryan, 2003; Lévesque & Brown, 2007), and ego development (Deci & Ryan, 1985a). The controlled motivational orientation is associated with greater public and private self-consciousness (Deci & Ryan, 1985a), though only the former association seems reliable (Deponete, 2014). This orientation has also been associated with stronger beliefs that outcomes are contingent on behaviour (i.e., locus of control), and is not associated with ego development (Deci & Ryan, 1985a). The impersonal motivational orientation

has been associated with greater public and private self-consciousness but, especially, with greater social anxiety; it is also associated with more self-derogation and less ego development (Deci & Ryan, 1985a). Furthermore, Di Domenico, Fournier, Ayaz, and Ruocco (2013) have demonstrated that perceived basic need satisfaction predicts greater activity in the medial prefrontal cortex, a brain region involved in the processing of self-relevant information and conflict resolution, during high-conflict situations. In other words, basic need satisfaction, which promotes self-determined motivation (Sharp et al., 2003), disposes people to recruit self-representations when resolving decisional conflicts, thereby facilitating integrative processes and authentic functioning. This conclusion seems supported by the research of Koestner and colleagues (1992), which showed that the attitudes and behaviours of autonomy-oriented individuals were consistent (i.e. positively correlated) whereas those of control-oriented individuals were inconsistent (i.e., uncorrelated).

These findings support SDT and imply that the autonomous motivational orientation should dispose people to encounter infrequent attitude-behaviour inconsistencies on a daily basis, and to perceive a cognitive inconsistency whenever they engage in counter-attitudinal actions. The controlled motivational orientation should dispose people to frequent attitude-behaviour inconsistencies on a daily basis, and to perceive a cognitive inconsistency when they engage in counter-attitudinal actions only if these actions have the potential to engender negative social evaluative reactions. Finally, the impersonal causality orientation should dispose people to encounter very frequent attitude-behaviour inconsistencies on a daily basis, but not to perceive a cognitive inconsistency when they engage in counter-attitudinal actions. Furthermore, these differences in self-directed attention seem to support different behavioural regulation styles that have implications for the processing of self-threatening information.

*Threat responses and coping strategies.* According to SDT, motivational orientations are associated with distinct patterns of affective, cognitive, and behavioural responses to self-threatening information (Ryan & Deci, 2004; Hodgins & Knee, 2002; Hodgins, 2008; Niemiec, Ryan, & Brown, 2008). Specifically, the autonomy orientation disposes people to attend to information that threatens authentic self-structures willingly and objectively for the purposes of facilitating a coordinated, adaptive response that promotes organismic integration. This orientation motivates people to convert authentic self-threats into opportunities to satisfy basic needs. The controlled orientation disposes people to attend to information that threatens instrumental outcomes reluctantly and defensively for the purposes of avoiding or minimizing aversive consequences for the ego-invested self. The impersonal orientation disposes people to feel overwhelmed by self-threatening information. The body of literature on defensiveness and coping seems to support these distinctions.

Research shows that priming the control versus the autonomy orientation causes greater defensive responding—for example, stronger desires to escape the situation and a greater tendency to exhibit self-serving attributional biases and to use self-handicapping strategies (Hodgins, Yacko, & Gottlieb, 2006; Knee and Zuckerman, 1996; 1998). However, priming the impersonal orientation causes the most defensive responding. Similarly, Hodgins and colleagues (2010) have shown that participants primed for control versus for autonomy exhibit a larger cardiovascular threat response and more nonverbal defensive behaviour (e.g., fake smiles) during a stressful interview, and poorer performance during a subsequent public speech. Control- versus autonomy-oriented individuals also appear more likely to ruminate over their negative emotions, leading them to exhibit less energy and well-being when they do not have an opportunity to express their negative emotions to cope with a distressing situation (Weinstein & Hodgins,

2009). Finally, among students transitioning to university, levels of global self-determined motivation seem to predict the use of adaptive task-oriented strategies, such as seeking out instrumental social support, and the avoidance of maladaptive disengagement-oriented strategies, such as blaming the university for one's difficulties (Amiot, Blanchard, & Gaudreau, 2008).

In sum, the reviewed literature suggests that motivation at the global level could explain individual differences in the arousal of dissonance when people engage in counter-attitudinal behaviour in general. Specifically, global autonomous motivation should not facilitate dissonance arousal because it disposes people to respond objectively and proactively to self-threatening information. Global controlled motivation should facilitate dissonance arousal because it disposes people to react defensively to self-threatening information. Finally, global amotivation should inhibit dissonance arousal and foster indifference because it should not dispose people to attend to their counter-attitudinal actions. Taking into account individual differences in motivational orientations should help clarify why attitude-behaviour inconsistencies are more threatening for some individuals than for others.

Though global motivational orientations are likely to regulate dissonance perception and arousal processes across important life domains, the HMEIM posits that contextual motivational orientations should be better predictors of affective, cognitive, and behavioural outcomes in a specific life domain (Vallerand, 1997). Therefore, in order to test the action-based model and to understand the motivational processes driving the environmental belief-action gap, there is a need to account for individual differences in contextual motivation toward the environment.

***Contextual motivation and domain-specific processes.*** Because motivation at the global level exerts top-down effects on motivation at the contextual level (Vallerand, 1997), motivational orientations toward the environment should exert similar effects on dissonance

perception and arousal processes as their global counterparts (see previous section). However, contextual versus global motivation should show stronger linkages to outcomes in the corresponding life domain (e.g., psychological distress; Julien, Guay, Sénécal, & Poitras, 2009). Therefore, contextual motivational orientations toward the environment should be better predictors of dissonance processes in response to native inconsistencies in the environmental domain, in part because they reflect the perceived self-relevance of the environmental domain. Individual differences in motivation toward the environment have implications for the strength and stability of pro-environmental attitudes, the regulation of pro-environmental behaviour, and responses to environmental attitude-behaviour inconsistencies.

*Autonomous compensation processes.* The manifestation of the autonomous causality orientation in the environmental protection domain is associated with strong and stable pro-environmental attitudes, and the authentic regulation of pro-environmental behaviour. Autonomous motivation toward the environment appears reliably associated with greater perceived importance of environmental issues (Pelletier, Green-Demers, & Béland, 1997) and with favourable attitudes toward environmental protection (Pelletier et al., 1998). Autonomous motivation is also associated with stronger intentions to engage in pro-environmental behaviour (de Groot & Steg, 2010) and with frequent self-reported pro-environmental behaviour (Green-Demers, Pelletier, & Ménard, 1997; Lavergne, Sharp, Pelletier, & Holtby, 2010; Pelletier et al., 1997; 1998). Similarly, self-determined motivation toward the environment (i.e., weighted composite scores of relative autonomy) is associated with stable pro-environmental attitudes and with a greater number of discrete pro-environmental behaviours (Villacorta, Koestner, & Lekes, 2003), and with a greater likelihood of acting in accordance with self-selected environmental goals (Osbaldiston & Sheldon, 2003). This review implies that, like global autonomous

motivation, contextual autonomous motivation toward the environment should dispose people to encounter infrequent native inconsistencies in the environmental domain.

However, because levels of autonomous motivation toward the environment reflect the self-relevance of pro-environmental attitudes, this motivation should facilitate dissonance arousal because counter-environmental actions conflict with organismic integration tendencies.

Therefore, autonomous motivation should lead people to compensate for inconsistencies to restore self-integrity, and to use behavioural modification strategies to minimize the inconsistency and to reduce dissonance. In other words, autonomous motivation should foster compensatory behaviour change that is “energized by the motive that emerges from the emotion” of dissonance (Deci & Ryan, 1985b, p. 233). Autonomous motivation should also dispose people to avoid using cognitive restructuring strategies that could exacerbate the authentic self-integrity threat. Furthermore, the reviewed literature suggests that factors that direct attention to authentic self-structures during perception processes should favour autonomous compensation processes among people who truly value environmental protection. Specifically, when people exhibit high levels of autonomous motivation and hold authentic pro-environmental attitudes, directing attention to the private or covert aspects of the self should dispose them to perceive an authentic self-integrity threat and to use effortful inconsistency compensation strategies that uphold pro-environmental attitudes. In other words, a dominant autonomy orientation should explain dissonance phenomena poorly explained by CDT thus far (Harmon-Jones et al., 2009) and foster increased attitude-behaviour consistency.

*Controlled compensation processes.* The manifestation of the controlled causality orientation in the environmental protection domain (i.e., external and introjected motives) is associated with unstable pro-environmental attitudes and contingent regulation of pro-

environmental behaviour. For example, some research suggests that external regulation is associated with less positive attitudes toward the environment and less perceived importance of environmental issues (Pelletier et al., 1998); however, other research does not support these associations (Pelletier et al., 1997). Similarly, external regulation has been associated with frequent self-reported pro-environmental behaviour in some research (Pelletier et al., 1997), but not in other research (Pelletier et al., 1998). By contrast, introjection scores have been reliably associated with greater perceived importance of environmental issues and with positive attitudes toward environmental protection (Pelletier et al., 1997; 1998). Introjection has also been associated with stronger intentions to engage in pro-environmental behaviour and with frequent self-reported pro-environmental behaviour (de Groot & Steg, 2010; Green-Demers et al., 1997; Koestner, Houliort, Paquet, & Knight, 2001). However, participants with greater levels of introjection toward the environment are more vulnerable to persuasion, which implies “that introjection will be associated with greater instability of attitudes and lower levels of attitude-behavior consistency” (Koestner et al., 2001, p. 2558). In fact, controlled motivation toward the environment is not reliably associated with the frequency of self-reported pro-environmental behaviour (Lavergne et al., 2010), especially as the perceived difficulty of these behaviours increases (Green-Demers et al., 1997). These findings imply that, like global controlled motivation, contextual controlled motivation toward the environment should dispose people to encounter frequent native inconsistencies in the environmental domain.

However, perceived inconsistencies should arouse dissonance only if they represent an immediate and tangible threat to the desirable instrumental outcomes that support ego-invested self-structures (Hodgins, 2008). Instrumental outcomes, such as rewards, praise, or criticism, are contingent on the evaluative reactions of others (Assor, Roth, & Deci, 2004; Crocker & Knight,

2005). Therefore, inconsistencies engendered by public counter-environmental actions (i.e., actions that may be seen by important others) should arouse dissonance, whereas inconsistencies engendered by private counter-environmental actions should not arouse dissonance. When dissonance is aroused, controlled motivation should dispose people to use overt inconsistency compensation strategies that are likely to engender favourable social evaluative reactions, such as behaviour change or modification. These hypotheses imply that controlled motivation will predict compensatory behaviour change that is “energized directly by an unintegrated emotion” (Deci & Ryan, 1985b, p. 233). When dissonance is not aroused, controlled motivation should dispose people to use whichever strategy is available to resolve the cognitive inconsistency. The above literature review suggests that controlled motivation should dispose people to use relatively effortless cognitive restructuring strategies, such as attitude change, trivialization, and rationalization, to minimize perceived inconsistencies that do not arouse dissonance because they are easier to implement.

Furthermore, the reviewed literature suggests that factors that direct attention to ego-invested self-structures (i.e., public aspects of the self) during perception processes should promote controlled compensation processes. Similarly, factors that direct attention to authentic self-structures during perception processes should favour controlled compensation processes among people who value the contingencies of environmentally protective behaviours. In other words, directing attention to the public or overt aspects of the self, or directing attention to the private or covert aspects of the self among people with high levels of controlled motivation should have the same effect on inconsistency compensation processes. In both cases, people should perceive their counter-environmental actions as an ego-invested self-threat and be motivated to change the least resistant cognition in the dissonance ratio. In other words, a

dominant control orientation should account for the classic dissonance effects proposed by Festinger (1957) and foster attitude-behaviour inconsistency.

*Amotivation and non-compensation.* Finally, research shows that the manifestation of the impersonal causality orientation in the environmental protection domain is associated with weak, non-integrated pro-environmental attitudes and infrequent pro-environmental behaviour. Several studies associate amotivation toward the environment with less perceived importance of environmental issues and less positive attitudes toward environmental protection (Pelletier et al., 1997; 1998). Amotivation has also been associated with weaker intentions to engage in pro-environmental behaviour (de Groot & Steg, 2010) and with infrequent self-reported pro-environmental behaviour (Green-Demers et al., 1997; Lavergne et al., 2010; Pelletier et al., 1997; 1998). These patterns imply that, like global amotivation, contextual amotivation toward the environment should dispose people to encounter frequent inconsistencies in the environmental domain. However, the perception of native attitude-behaviour inconsistencies in the environmental domain should not arouse dissonance or motivate people to compensate, because these inconsistencies do not threaten specific action tendencies. In other words, amotivation does not embody motives for effective and unconflicted action.

Predictions about individual differences in inconsistency compensation processes in general and in the environmental domain derived from the action-based model and SDT led to the elaboration of the hierarchical action-based model of inconsistency compensation in the environmental domain.

### **Hierarchical Action-Based Model of Inconsistency Compensation in the Environmental Domain (HABICE)**

The goal of the present research was to elucidate individual differences in the

motivational mechanisms underlying inconsistency compensation processes in the environmental domain. Because the HMEIM assumes that global motivational orientations exert top-down effects on contextual motivation, it was necessary to test our hypotheses on a global level before focusing on inconsistency compensation processes in the environmental domain. Specifically, we hypothesized that:

1. Global motivational orientations would be associated with differences in dissonance perception and arousal processes in general.
  - 1.1. Global autonomous motivation should be associated with relatively infrequent native inconsistencies across important life domains and with a lack of dissonance arousal when native inconsistencies arise.
  - 1.2. Global controlled motivation should be associated with relatively frequent native inconsistencies across important life domains and with dissonance arousal when native inconsistencies arise.
  - 1.3. Global amotivation should be associated with relatively frequent native inconsistencies across life domains and with indifference when native inconsistencies arise.
2. Individual differences in motivational orientations at the global and contextual levels of generality should show similar patterns of associations with constructs relevant to dissonance processes; however, contextual motivational orientations should be more strongly associated with context-specific constructs than global motivational orientations.

In terms of specific predictions within the environmental domain, the HABICE (see Figure 1) posits that becoming aware of one's own counter-environmental actions should induce

a cognitive inconsistency and arouse dissonance among people who hold pro-environmental attitudes. Furthermore, contextual autonomous motivation should facilitate the arousal of dissonance and motivate the use of inconsistency compensation strategies that uphold pro-environmental attitudes, because perceived inconsistencies should conflict with authentic self-structures. Conversely, contextual controlled motivation should facilitate the arousal of dissonance and motivate the use of inconsistency compensation strategies to avoid aversive consequences, because perceived inconsistencies should threaten the instrumental outcomes that support ego-invested self-structures. Because the HABICE concerns the use and choice of inconsistency compensation strategies by individuals who endorse pro-environmental beliefs and intend to regulate actions relative to these beliefs, it excludes amotivation toward the environment. As is shown in Figure 1, I hypothesized that:

3. Contextual autonomous motivation toward the environment should motivate people to compensate when counter-environmental actions threaten organismic integration, favouring the use of strategies that uphold authentic pro-environmental attitudes.

3.1. Autonomous motivation should predict the use of behavioural modification strategies both to resolve inconsistencies induced by counter-attitudinal actions and to reduce the dissonance aroused by these perceived inconsistencies.

3.2. Autonomous motivation should predict the avoidance of cognitive restructuring strategies that would exacerbate perceived inconsistencies.

4. Contextual controlled motivation toward the environment should motivate people to compensate when counter-environmental actions have the potential to engender aversive consequences for ego-invested self-structures; however, the choice of strategy will depend on whether or not those actions arouse dissonance.

- 4.1. Controlled motivation should predict the use of cognitive restructuring strategies when inconsistencies do not arouse dissonance (i.e., the threat to ego-invested self-structures is private), because the individual lacks a source of controlled motivation to modify his or her behaviour and because it is easier to restructure cognitions than it is to modify one's behaviour.
  - 4.2. Controlled motivation should predict the use of behavioural modification strategies when inconsistencies arouse dissonance (i.e., the threat to ego-invested self-structures is public), because the aroused dissonance should pressure the individual to change his or her behaviour.
5. Manipulating the direction of self-focused attention during dissonance perception processes should moderate the effects of autonomous and controlled motivation toward the environment on inconsistency compensation processes.
- 5.1. Directing attention to authentic self-structures should (a) promote autonomous compensation processes among people with high levels of autonomous motivation and low levels of controlled motivation toward the environment, and (b) promote controlled compensation processes among people with high levels of controlled (or with low levels of autonomous) motivation toward the environment.
  - 5.2. Directing attention to ego-invested self-structures should promote controlled compensation processes.

### **Present Research<sup>1,2</sup>**

The purpose of the present research was to test complementary hypotheses derived from the action-based model and SDT about the role of individual differences in distal motivation on the use and choice of inconsistency compensation strategies, particularly in the environmental

domain. My co-author and I reasoned that gaining a better understanding of individual differences in inconsistency compensation processes would provide insight into the motivational mechanisms underlying the environmental belief-action gap. We tested the HABICE and its underlying assumptions via three sets of studies.

The first article, titled *Why are attitude-behaviour inconsistencies uncomfortable? Exploring individual differences in dissonance arousal processes* (Lavergne & Pelletier, 2015a), reports the findings for the first set of three studies. The goal of these studies was to test basic assumptions about the role of global and contextual motivational orientations on dissonance perception and arousal processes in response to native inconsistencies encountered across and within important life domains. Study 1 examined associations between global motivational orientations and the frequency of dissonance arousal in response to native inconsistencies across four important life domains. Studies 2 and 3 tested associations between contextual motivational orientations toward the environment and the arousal of dissonance in response to native inconsistencies within the environmental domain. We hypothesized that autonomous motivation would promote the objective processing of native inconsistencies at the global level of abstraction and the arousal of dissonance at the contextual level of abstraction in order to facilitate organismic integration. We expected controlled motivation to promote the defensive processing of native inconsistencies and the arousal of dissonance at both levels of abstraction in order to protect ego-invested self-structures. Finally, we anticipated that amotivation would undermine dissonance arousal processes and foster indifference because it does not promote intentionality or the regulation behaviour.

The second article, titled *Individual differences in distal motivation and the choice of strategy to compensate for environmental attitude-behaviour inconsistencies* (Lavergne &

Pelletier, 2015b), presents the results of the second set of three studies. The purpose of these studies was to test hypotheses about individual differences in contextual motivation on the choice of strategy to compensate for a recent native inconsistency in the environmental domain. Studies 1 and 2 aimed to define two broad categories for the strategies used to compensate for native inconsistencies in the environmental domain using exploratory and confirmatory factor analyses. We expected to distinguish cognitive restructuring strategies, which impede organismic integration but effectively minimize inconsistencies that do not conflict engender negative social evaluation reactions, from behaviour modification strategies that facilitate organismic integration and the reduction of dissonance. Study 3 tested the HABICE (see Figure 1) predictions about the role of autonomous and controlled motivation toward the environment on the choice of strategy to compensate for a native inconsistency in the environmental domain using multi-sample path analyses. We anticipated that autonomous motivation would predict the use of behaviour modification strategies to minimize the perceived inconsistency and to reduce dissonance, and the avoidance of cognitive restructuring strategies that might exacerbate the perceived inconsistency. Conversely, we expected that controlled motivation would predict the use of overt and effortful behaviour modification strategies to reduce dissonance, and the use of covert and relatively effortless cognitive restructuring strategies to minimize the inconsistency when dissonance is not aroused.

Finally, the article titled *The effects of inducing public and private awareness of environmental transgressions on motivation and intentions to revise global warming attitudes* (Lavergne & Pelletier, 2015c) reports the results of the final experimental study. The study tested the HABICE (see Figure 1) predictions about the role of self-directed attention on inconsistency compensation processes. We used the hypocrisy paradigm to manipulate commitment to a pro-

attitudinal advocacy in favour of global warming mitigation (private versus public) and awareness of recent greenhouse-gas emitting actions (no recall versus recall of three past transgressions). We predicted that inducing awareness of past transgressions would arouse psychological discomfort and engender stronger intentions to revise pro-environmental attitudes when there were barriers to pro-environmental behaviour change. Furthermore, we hypothesized that inducing awareness following a private attitude commitment—but not following a public attitude commitment—would facilitate the manifestation of individual differences in autonomous and controlled motivation toward the environment on intentions to revise pro-environmental attitudes. Specifically, we expected that, under these conditions, people with high levels of autonomous motivation and low levels of controlled motivation would report weaker intentions to revise their attitudes than would participants with other motivational profiles.

Taken together, these studies tested the overarching hypothesis that inconsistency compensation processes guided by the autonomous motivational orientation alleviate the environmental belief-action gap and favour increased environmental sustainability, whereas those guided by the controlled and impersonal motivational orientations exacerbate the gap and favour continued environmental degradation.

Running head: INDIVIDUAL DIFFERENCES IN DISSONANCE AROUSAL

Why Are Attitude-Behaviour Inconsistencies Uncomfortable? Exploring Individual Differences  
in Dissonance Arousal Processes

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## Abstract

Despite having good intentions, everyone occasionally acts in ways contrary to his or her expressed beliefs, intentions, and goals in socially valued life domains that promote well-being, such as the environmental protection domain. However, we know relatively little about the motivational consequences of these spontaneous native attitude-behaviour inconsistencies. Combining cognitive dissonance theory, the action-based model, and self-determination theory, we explored the role of individual differences in dissonance arousal processes within samples of undergraduate students via 3 studies. Study 1 ( $N = 382$ ) demonstrated that individual differences in distal global motivation affect the relative frequency of native inconsistencies across important life domains and the frequency of dissonance arousal relative to such inconsistencies. Studies 2 ( $N = 282$ ) and 3 ( $N = 202$ ) showed that individual differences in contextual motivation toward the environment predict the relative frequency of counter-environmental actions, the magnitude of dissonance, and the quantity and quality of proximal motivation to compensate for native inconsistencies. Distal autonomous motivation disposed people to perceive counter-attitudinal actions as a threat to organismic integration, which motivated them to reduce the aroused dissonance by restoring self-integrity. Distal controlled motivation disposed people to perceive counter-attitudinal actions as a threat to behavioural contingencies, which motivated them to reduce the aroused dissonance to avoid the implied ego-invested self-threat. Finally, distal amotivation disposed people to be indifferent and to lack motives to compensate. Individual differences in distal motivation seem to clarify why inconsistencies are uncomfortable and motivate people to compensate for self-regulation failures.

## **Why Are Attitude-Behaviour Inconsistencies Uncomfortable? Exploring Individual Differences in Dissonance Arousal Processes**

Despite having good intentions, everyone occasionally acts in ways contrary to his or her expressed beliefs, intentions, and goals in important life domains. The lack of consistency between attitudes and behaviour has been the focus of intense scrutiny in psychology (Glasman & Albarracín, 2006; Gross & Niman, 1975; Kim & Hunter, 1993). The fact that attitudes do not always translate into consistent actions implies that people are likely to encounter attitude-behaviour inconsistencies in their daily lives. These inconsistencies can impede successful goal pursuit in life domains that have important implications for the well-being of self and society, such as health (Rhodes & Bruijn, 2013) and environmental protection (Kollmuss & Agyeman, 2002). We know relatively little about the motivational consequences of attitude-behaviour inconsistencies encountered in day-to-day life. However, the motivational state induced by an attitude-behaviour inconsistency could have important implications for the use and choice of self-regulatory strategies to deal with the inconsistency, and for future success in goal pursuits.

### **Cognitive Dissonance Theory**

Cognitive dissonance theory (CDT; Festinger, 1957) is particularly relevant to study the motivational states elicited by attitude-behaviour inconsistencies. According to CDT (Festinger, 1957), holding two conflicting cognitions simultaneously arouses a state of psychological discomfort (PD) called dissonance that motivates individuals to reduce the dissonance by compensating for the inconsistency. The theory states that the quantity of motivation to compensate is directly proportional to the magnitude of aroused dissonance. In addition, CDT assumes that the magnitude of dissonance is directly proportional to the size of the dissonance ratio, which is the proportion of dissonant cognitions relative to the total number of relevant

dissonant and consonant cognitions weighted by their perceived importance (Festinger, 1957). In sum, CDT posits that the simultaneous accessibility of conflicting cognitions and the perceived importance of domain-relevant cognitions determine the quantity of motivation to compensate for an inconsistency.

Research based on the induced compliance paradigm supports CDT. For example, having participants freely comply to write a counter-attitudinal statement that conflicts with an important attitude causes greater levels of self-reported PD (Elliot & Devine, 1994; Harmon-Jones, 2000), physiological arousal (Croyle & Cooper, 1983; Elkin & Leippe, 1986), and attitude change (see Leippe & Eisenstadt, 2010 for a review). However, although CDT research supports the idea that conflicting cognitions arouse dissonance, it has failed to support the hypothesized direct relationship between dissonance arousal and reduction (Harmon-Jones, Amodio, & Harmon-Jones, 2009). In fact, the direction of attitude change following induced compliance tends to vary across studies (Leippe & Eisenstadt, 2010) and the correlation between dissonance-induced PD and attitude change has proven unreliable (Harmon-Jones et al., 2009). Part of the reason for this gap in the literature is that CDT does not clearly elucidate *why* cognitive inconsistencies are uncomfortable (Proulx, Inzlicht, & Harmon-Jones, 2012).

Understanding why cognitive inconsistencies are uncomfortable is crucial, because these reasons could have implications for the use and choice of inconsistency compensation strategies. Specifically, the reasons for the discomfort could clarify whether people will be motivated to compensate for inconsistencies by bringing their attitudes in line with the dissonant behaviour, or by bringing the dissonant behaviour in line with their attitudes (Festinger, 1957). Clearly, behaviour change strategies are desirable for reinforcing pro-social attitudes and behaviour in important domains. However, behavioural changes are more difficult to implement

and, therefore, require more effort than attitude change (Leippe & Eisenstadt, 1999). Fortunately, effort is not the only factor informing the choice of compensation strategy. Research suggests that there are appreciable individual differences in inconsistency compensation processes as a function of personal attributes, which suggests that these individual differences affect the processes involved in the arousal of dissonance.

When participants have more than one option to reduce dissonance following induced compliance, individual differences seem to predict the use of different dissonance reduction strategies. Within this paradigm, participants usually have the option to change either the attitude directly responsible for the inconsistency, or a related attitude—for example, trivializing the perceived importance of the domain or rationalizing the compliance behaviour. Because rationalization requires more cognitive elaboration than trivialization and trivialization requires more cognitive elaboration than attitude change, researchers assume that the choice of strategy reflects the quantity of motivation to compensate (Leippe & Eisenstadt, 1999). Induced compliance fosters the use of more elaborate strategies among people who hold highly-important attitudes (Starzyk, Fabrigar, Soryal, & Fanning, 2009), give more attention to the covert (i.e., internal thoughts and feelings) versus the overt (i.e., how others perceive one's behaviour) aspects of the self (Scheier & Carver, 1980), and prefer to be or to appear consistent (Michel & Fointiat, 2002). Furthermore, when important attitudes are salient prior to the compliance induction, some people seem motivated to tolerate the aroused dissonance rather than to change their attitudes (Simon, Greenberg, & Brehm, 1995; Starzyk et al., 2009). Presumably, individual differences that increase the cognitive accessibility of important attitudes and the importance of acting consistently foster greater motivation to compensate.

However, because most CDT research relies on the use of dissonance induction

paradigms that confound the processes involved in the perception of inconsistencies and the arousal and the reduction of dissonance, it is unclear *why* individual differences relate to dissonance reduction (Devine, Tauer, Barron, Elliot, & Vance, 1999; Harmon-Jones et al., 2009). As suggested by the action-based model (Harmon-Jones et al., 2009), it seems plausible that individual differences in the reasons for discomfort following inconsistency result in qualitatively different motives to compensate, which may account for individual differences in the use of inconsistency compensation strategies.

### **Action-Based Model of Dissonance**

The action-based model is a contemporary theory of cognitive dissonance proposed, in part, to resolve the controversy about the motivation driving dissonance effects (Harmon-Jones, 1999). The model begins with the assumption that most cognitions automatically activate action tendencies, such as beliefs, knowledge, or goals that are useful for behavioural regulation. Dissonance is aroused when the action tendencies implied by one's behaviour conflict with the action tendencies implied by salient attitudes, because the inconsistency threatens effective action (Harmon-Jones et al., 2009). As a result, people are motivated to compensate for the inconsistency to satisfy action tendencies. For example, Harmon-Jones and colleagues (Harmon-Jones & Harmon-Jones, 2002; Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008) found that inducing an action-oriented versus neutral mindset leads to greater spreading of alternatives to reduce postdecisional dissonance. Furthermore, individuals with higher levels of trait approach motivation exhibit greater postdecisional spreading of alternatives and compliance-induced attitude change (Harmon-Jones, Schmeichel, Inzlicht, & Harmon-Jones, 2011).

In other words, the action-based model distinguishes between the proximal motivation

driving compensation processes (i.e., dissonance) and the distal motivation guiding these processes (i.e., dominant action tendencies; Harmon-Jones, 1999). Like CDT, the model suggests that the magnitude of dissonance determines the quantity of proximal motivation to compensate, but adds that the dominant action tendencies determine the quality of this motivation. In addition, the action-based model claims that distal motivation influences all three components of dissonance processes, including the perception, arousal, and reduction of dissonance.

Neuroscientific research supports this distinction, particularly the distinction between the conflict detection processes involved in dissonance arousal, which recruit the anterior cingulate cortex, and the subsequent planning processes involved in dissonance reduction, which recruit the left prefrontal cortex (see Harmon-Jones & Harmon-Jones, 2008 for a review). The distinction between the components of dissonance makes it possible to study individual differences in dissonance arousal processes using self-report methods (Harmon-Jones et al., 2009), which is particularly appealing to study the motivational consequences of native attitude-behaviour inconsistencies. Thus, accounting for the influence of distal motivation on dissonance processes should clarify why cognitive inconsistencies are uncomfortable and increase the predictive power of CDT (Harmon-Jones et al., 2009). In the present research, we propose that self-determination theory (Deci & Ryan, 1985a, 2008) is complementary to the action-based model and, therefore, is well suited to operationalize individual differences in distal motivation.

### **Self-Determination Theory**

Self-determination theory (SDT; Deci & Ryan, 1985a; 2008) is an organismic dialectical meta-theory of personality and motivation. The theory proposes that all humans have the innate tendency to seek opportunities to act authentically, master new challenges, and integrate new experiences within the self. The general causality orientations sub-theory of SDT

(Deci & Ryan, 1985b) describes individual differences in the manifestation of this innate tendency as a function of social factors that support or frustrate it. The theory proposes that the universal autonomous, controlled, and impersonal causality orientations embody distinct action tendencies that yield qualitatively different motives for action. In turn, the quality of motivation predicts the quality of behaviour and well-being (Deci & Ryan, 2008).

**General causality orientations.** The autonomous causality orientation refers to the innate action tendency to facilitate organismic integration. This orientation disposes us interact with the social environment to satisfy the basic needs to feel autonomous, competent, and close to others, and to increase the coherence and consistence of our values, needs, goals, and other important self-structures (Ryan & Deci, 2004). The autonomous orientation is associated with greater ego development (i.e., organismic unity and authentic functioning) and promotes self-determined behaviour, which refers to behaviour that has an internal perceived locus of causality (Deci & Ryan, 1985b). In fact, the autonomous orientation is characterized by a general tendency to regulate behaviour because the behaviour is personally important, integrated within the self, and inherently satisfying (Sharp, Pelletier, Blanchard, & Séguin-Lévesque, 2003), which are regulatory strategies that characterize autonomous motivation. In turn, autonomous motivation for activities in general is associated with greater perceived need satisfaction and well-being, and with indicators of self-determined behaviour (e.g., Mask & Blanchard, 2011; Mata et al., 2009; O'Connor & Vallerand, 1994; Pelletier & Dion, 2007; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004; Sharp et al., 2003; Sheldon, Ryan, & Reis, 1996). Individual differences in the manifestation of the autonomous causality orientation produce corresponding differences in levels of autonomous motivation (Vallerand, 1997).

However, because we all encounter controlling social factors that pressure us to think,

feel, or behave in certain ways, we also acquire the action tendency to orient toward and interact with the social environment to obtain desirable outcomes or to avoid undesirable outcomes (Deci & Ryan, 1985b). The controlled orientation disposes people to regulate behaviour relative to the social contingencies it affords, such as monetary gains or losses and the positive or negative conditional regard of others, in order to uphold ego-invested self-structures (e.g., self-worth contingent on the approval of others; Ryan & Deci, 2004). This orientation is not associated with ego development and promotes non self-determined behaviour, particularly behaviour that has an external locus of causality (Deci & Ryan, 1985b). In line with this assumption, the controlled causality orientation is associated with the general tendency to regulate behaviour because of external or internal pressures to act a certain way, or for no specific reason (Sharp et al., 2003), which is a regulatory pattern associated with controlled motivation. Controlled motivation for activities in general is associated with less perceived need satisfaction and well-being, and with indicators of non self-determined behaviour (e.g., Mask & Blanchard, 2011; O'Connor & Vallerand, 1994; Pelletier & Dion, 2007; Pelletier et al., 2004; Sharp et al., 2003). Individual differences in the manifestation of the controlled causality orientation brings about corresponding differences in levels of controlled motivation (Vallerand, 1997).

Finally, when we encounter amotivating social factors that make us feel ineffective at regulating our behaviour to obtain desired outcomes, we acquire the impersonal orientation, which disposes us to feel as though we have no control over our behaviour or our lives (Deci & Ryan, 1985b). The impersonal orientation does not dispose people to regulate behaviour to satisfy specific needs or wants. Consequently, this orientation is associated with less ego development and promotes non self-determined behaviour, particularly behaviour that lacks a clear locus of causality (Deci & Ryan, 1985b). Like the control orientation, the impersonal

orientation is associated with the general tendency to regulate behaviour because of external and internal pressures, or for no specific reason. However, the impersonal orientation is also associated with the tendency not to regulate behaviour for self-determined or autonomous reasons, which is a regulatory pattern characteristic of amotivation (Sharp et al., 2003). In turn, amotivation or the tendency to lack clear motives for activities in general is associated with maladaptive outcomes (Deci & Ryan, 1985b; Sharp et al., 2003). Individual differences in the manifestation of the impersonal causality orientation should produce corresponding differences in levels of amotivation (Vallerand, 1997).

These findings imply that one way to quantify distal motives for effective and unconflicted action is to use multi-dimensional perceived locus of causality scales to measure individual differences in the motivational *manifestation* of the three causality orientations. Multi-dimensional motivation scales, which adhere to the organismic integration sub-theory of SDT, are reliable, valid, and measure motivation at different hierarchical levels of generality (see Vallerand, 1997 for a review). This latter property is particularly useful to test the action-based model because it allows us to apply the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997) to make predictions about the top-down effects of motivation at higher levels of generality on motivation at lower levels of generality.

**Hierarchical model of extrinsic and intrinsic motivation.** According to the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997), individual differences in the manifestation of the three causality orientations in general and within specific life domains produce differences in motivation at the global and contextual levels of generality, respectively. Research by Vallerand and colleagues shows that motivation is relatively stable over time, but also fluctuates due to reciprocal effects with motivation at other levels of generality (Blanchard,

Mask, Vallerand, de la Sablonnière, & Provencher, 2007; Guay, Mageau, and Vallerand; 2003; Lavigne, Hauw, Vallerand, Brunel, Blanchard, Cadorette, & Angot, 2009; Lavigne & Vallerand, 2010). Furthermore, motivation at a given level of generality relates more strongly to outcomes (e.g., psychological distress) at that level of generality (Julien, Guay, Sénécal, & Poitras, 2009). Therefore, dissonance perception and arousal processes in response to native inconsistencies across important life domains should be associated with individual differences in global motivation, whereas those in response to native inconsistencies within a specific life domain should be associated with individual differences in contextual motivation.

***Global motivation.*** At the global level of abstraction, motivation describes general dispositions for behavioural regulation across life domains (Vallerand, 1997). In other words, global motivation reflects the manifestation of causality orientations for activities in general. Therefore, global motivational orientations should guide the personality processes involved in the perception of cognitive inconsistencies and the arousal of dissonance across life domains. This assumption seems supported by research showing that individual differences in the manifestation of the autonomous, controlled, and impersonal causality orientations are associated with differences in self-directed attention and in the processing of self-threatening information.

The autonomous motivational orientation fosters chronic awareness of the covert or internal aspects of the self (i.e., authentic self-structures) to facilitate integrative processes (Ryan & Deci, 2004). This orientation is associated with greater state and trait mindfulness (Brown & Ryan, 2003; Lévesque & Brown, 2007), and with greater private self-consciousness, but not with public self-consciousness or with social anxiety (Deci & Ryan, 1985b; Deponete, 2004). In addition, the autonomous orientation promotes the deliberate and objective processing of self-threatening information for the purposes of monitoring and maintaining the integrity of authentic

self-structures (Hodgins & Knee, 2002). When the autonomy orientation is dominant, people tend to exhibit dampened cardiovascular threat responses to psychological stressors (Hodgins et al., 2010), decreased cognitive defensiveness (Hodgins, Yacko, and Gottlieb, 2006; Knee & Zuckerman, 1996; 1998), and both increased use of adaptive and decreased use of maladaptive coping strategies (Weinstein & Hodgins, 2009; Amiot, Blanchard, & Gaudreau, 2008). These results imply that global autonomous motivation should be associated with infrequent native inconsistencies across life domains and should dampen dissonance arousal in response to these inconsistencies to facilitate an adaptive response that promotes organismic integration (Hodgins & Knee, 2002).

The controlled motivational orientation fosters chronic awareness of how others perceive the overt or external aspects of the self (e.g., expressive behaviour, actions) to facilitate desirable instrumental outcomes (Ryan & Deci, 2004). This motivation is reliably associated with greater public self-consciousness (Deponete, 2004). Some research shows controlled motivation is also associated with greater private self-consciousness (Deci & Ryan, 1985b), presumably because it disposes people to attend to private feelings of pressure or tension (Deci & Ryan, 1985a). The controlled orientation also promotes the reluctant and defensive processing of self-threatening information to avoid threats to ego-invested self-structures (Hodgins & Knee, 2002). When the controlled orientation is dominant, people tend to exhibit heightened cardiovascular threat responses to psychological stressors (Hodgins et al., 2010), greater cognitive defensiveness (Hodgins et al., 2006; Knee & Zuckerman, 1996; 1998), and increased use of maladaptive—and decreased use of adaptive—coping strategies (Weinstein & Hodgins, 2009; Amiot et al., 2008). These findings suggest that global controlled motivation should be associated with frequent native inconsistencies across important life domains and should

facilitate dissonance arousal in response to these inconsistencies to energize a defensive response to avoid the perceived self-threat (Hodgins, 2008).

The impersonal orientation, which does not embody action tendencies, disposes people to feel overwhelmed when they attend to self-structures because they feel they lack the resources necessary to effect changes in their behaviour or their environment. Amotivation has been associated to some extent with greater private and public self-consciousness; however, its positive relationship with levels of trait social anxiety is far more important (Deci & Ryan, 1985b). Presumably, when people feel unable to deal with the demands of the situation, the impersonal orientation disposes people to attend to private feelings of helplessness and anxiety elicited by the potentially negative evaluative reactions of others (Deci & Ryan, 1985a). The impersonal orientation is also associated with greater self-derogation and depression, and lower self-esteem (Deci & Ryan, 1985b). This orientation also disposes people to exhibit the most defensive responding (Hodgins et al., 2006); however, it should not dispose people to perceive a self-threat when they engage in counter-attitudinal behaviour because such behaviour does not conflict with specific action tendencies (Deci & Ryan, 1985b). Therefore, global amotivation should be associated with very frequent native inconsistencies across life domains but should inhibit dissonance arousal and foster indifference in response to these inconsistencies because they are not self-relevant.

***Contextual motivation and proximal motivation to compensate.*** At the contextual level of abstraction, motivation represents individual differences in the manifestation of causality orientations in a given life domain (Vallerand, 1997). Because contextual motivational orientations are subject to top-down effects from corresponding global motivational orientations, they should show similar effects on dissonance processes as their global counterparts. However,

motivational orientations at the contextual level should be better predictors of dissonance processes in that domain, because they reflect the domain's perceived self-relevance.

Furthermore, contextual motivation exerts top-down effects on motivation for a particular activity at a particular time; therefore, it should be associated with differences in the quantity and quality of proximal motivation to compensate for a native inconsistency. In other words, contextual motivation corresponds to individual differences in motives for effective and unconflicted action in a given life domain and should govern dissonance perception and arousal processes in that domain.

*Autonomous motivation.* Contextual autonomous motivation disposes people to regulate their actions because the behaviour is important and integral to the self or because the initiation and mastery of behaviour in that domain is inherently satisfying (Deci & Ryan, 2008; Vallerand, 1997). Thus, high levels of contextual autonomous motivation indicate that behaviour in that domain or the domain itself is self-relevant, and promote authentic regulation. For example, contextual autonomous motivation toward the environment, which corresponds to an internal perceived locus of causality for pro-environmental behaviour, is reliably associated with strong and stable favourable attitudes toward environmental protection, greater perceived competence in the environmental domain, and frequent pro-environmental behaviour (Green-Demers, Pelletier, & Ménard, 1997; Lavergne, Sharp, Pelletier, & Holtby, 2010; Pelletier, Green-Demers, & Béland, 1997; Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998). Therefore, contextual autonomous motivation, like global autonomous motivation, should dispose people to encounter infrequent native inconsistencies in the corresponding life domain. However, when pro-environmental attitudes and behaviours are self-relevant, native inconsistencies should represent a threat to organismic integration and lead to dissonance arousal.

Individual differences in contextual autonomous motivation should also affect the quantity and quality of the proximal motivation to compensate, because they reflect the degree of integration of contextual cognitions (e.g., beliefs, attitudes, goals) within authentic self-structures. Specifically, a conflict between authentic self-structures and counter-attitudinal actions should elicit a greater proportion of important cognitions that are coherent with the self-relevant attitude than important cognitions that are coherent with the counter-attitudinal action. Therefore, contextual autonomous motivation should dispose people to experience dissonance arousal and motivate them to compensate whenever they become aware of their own counter-attitudinal actions. However, the autonomous orientation should dispose people to shift their attention away from the threat and toward ways to convert the threat into an opportunity to facilitate organismic integration (Hodgins, 2008). In other words, contextual autonomous motivation should motivate people to minimize native inconsistencies to reduce dissonance and to restore the integrity of self-structures.

*Controlled motivation.* By contrast, contextual controlled motivation disposes people to regulate behaviour contingently to facilitate the instrumental outcomes (e.g., financial gains or praise, or the avoidance of criticism or guilt) that uphold ego-invested self-structures (Hodgins, 2008; Vallerand, 1997). As a result, high levels of contextual controlled motivation are indicative of the instrumental value of behaviour in that domain, and promote contingent regulation. For example, contextual controlled motivation toward the environment, which corresponds to an external perceived locus of causality for pro-environmental behaviour, is not reliably associated with pro-environmental attitudes, with perceived competence in the environmental domain, or with indicators of pro-environmental behavioural engagement (Green-Demers et al., 1997; Lavergne et al., 2010; Pelletier et al., 1997, 1998). Contextual controlled motivation, like global

controlled motivation, should dispose people to encounter frequent native inconsistencies in the corresponding life domain and to perceive these inconsistencies as a potential threat to the behavioural contingencies (e.g., positive social evaluative reactions) that support ego-invested self-structures.

However, individual differences in contextual controlled motivation should have different effects on the magnitude of dissonance and the quantity and quality of proximal motivation to compensate across situations, depending on whether or not perceived inconsistencies threaten instrumental outcomes. Instrumental outcomes that support ego-invested self-structures, such as monetary rewards or praise, are contingent on the social evaluative reactions of others (Assor, Roth, & Deci, 2004; Crocker & Knight, 2005). Therefore, counter-attitudinal actions that violate social norms or expectations and that are public (i.e., may be seen by important others) should represent a potential threat to instrumental outcomes when the control orientation is dominant. Under these conditions, the importance of cognitions that are coherent with the violated social norm should outweigh the importance of cognitions that are coherent with the counter-normative action. The resulting dissonance ratio should be large and arouse dissonance, which should motivate people to compensate for the inconsistency in order to reduce the aroused dissonance. Conversely, when counter-normative actions are private and the control orientation is dominant, the importance of cognitions that are coherent with the counter-normative action should outweigh the importance of cognitions that are coherent with the violated social norm. The resulting dissonance ratio should be too small to arouse dissonance and should not motivate people to compensate. In other words, when native inconsistencies are private, a dominant control orientation may dispose people to use justification strategies that allow for violations of self-endorsed goals (De Witt Huberts, Evers, & De Ridder, 2014). In sum,

contextual controlled motivation should facilitate dissonance arousal only when counter-attitudinal actions threaten instrumental outcomes (e.g., engender negative social evaluative reactions) and should motivate people to compensate to reduce dissonance and to protect ego-invested self-structures.

*Amotivation.* Contextual amotivation does not dispose people to regulate behaviour because the behaviour or the behavioural domain does not satisfy specific needs or wants (Vallerand, 1997). Thus, high levels of contextual amotivation indicate that behaviour in that domain or the domain itself is not self-relevant, and do not promote behavioural regulation. For example, amotivation toward the environment, which corresponds to an impersonal locus of causality for pro-environmental behaviour, is associated with very weak favourable attitudes toward the environment, less perceived competence in the environmental domain, and infrequent self-reported pro-environmental behaviour (Pelletier et al., 1997; 1998; Pelletier, Dion, Tuson, & Green-Demers, 1999). Therefore, contextual amotivation, like global amotivation, should dispose people to encounter frequent native inconsistencies in the corresponding life domain but these inconsistencies should not arouse dissonance or motivate people to compensate.

### **Present Research**

The goal of this research was to investigate the role of distal motives for effective and unconflicted action on dissonance perception and arousal processes triggered by spontaneously arising native attitude-behaviour inconsistencies. The research consisted of three studies. The objective of Study 1 was to test hypotheses about the role of global motivational orientations on the incidence of native inconsistencies across important life domains and the frequency of dissonance arousal relative to such inconsistencies. We hypothesized that: (1a) global autonomous motivation would favour infrequent native inconsistencies and infrequent

dissonance arousal, (1b) global controlled motivation would favour frequent native inconsistencies and frequent dissonance arousal, and (1c) global amotivation would favour frequent native inconsistencies but indifference regarding those inconsistencies.

The objective of Study 2 was to test hypotheses about the relative frequency of native inconsistencies and the arousal of dissonance in a specific life domain as a function of individual differences in distal contextual motivational orientations using path analyses. We hypothesized that: (2a) contextual autonomous motivation would favour infrequent native inconsistencies and lead to dissonance arousal when inconsistencies arise, (2b) contextual controlled motivation would favour frequent native inconsistencies and lead to dissonance arousal when inconsistencies arise, and (2c) contextual amotivation would favour frequent native inconsistencies but would not lead to dissonance arousal when inconsistencies arise.

The objective of Study 3 was to test hypotheses regarding individual differences in the quantity and quality of motivation to compensate for an inconsistency as a function of contextual motivational orientations using correlation and path analyses. We hypothesized that: (3a) contextual autonomous motivation would predict proximal motives to reduce dissonance and to restore the integrity of authentic self-structures, (3b) contextual controlled motivation would engender proximal motives to reduce dissonance and to protect ego-invested self-structures from social threats, and (3c) contextual amotivation would relate to a lack of proximal motivation to compensate. Studies 2 and 3 also compared predictions based on the action-based model and SDT with those based on CDT to test the assumption that accounting for distal motives for effective and unconflicted action increases the predictive power of CDT.

### **General Method**

Undergraduate students enrolled with the integrated system of participation in research

(ISPR) participated in the three studies. The ISPR is a system used to recruit participants enrolled in introductory psychology courses to participate in research studies. In exchange for their participation, students receive research credits that count as bonus points toward their final grade (up to a maximum of 4%). ISPR samples typically report a mean age of 19.5 years ( $SD = 4.0$ ) and about three-quarters are female (73%). The majority of participants report English (60%) and about a quarter report French (23%) as their first language. The remaining participants (17%) reported another first language. About 15% of students registered with the ISPR are in a psychology program. The remaining students are in programs offered by the faculties of social sciences (16%), health sciences (24%), sciences (18%), arts (8%), or other faculties (20%; “Demographics of the research participants,” n.d.). Approximately 3,500 students per year enrol with the ISPR (Anderson, 2013).

### **Study 1**

The first study sought to test hypotheses about the global motivational processes that facilitate dissonance arousal across four life domains, including obesity prevention (i.e., body weight management), financial independence (i.e., economic prosperity), racial acceptance, and environmental protection. In agreement with the proposed hypotheses, global autonomous motivation should favour infrequent native inconsistencies due, in part, to chronic awareness of the covert or internal aspects of the self (i.e., private self-consciousness). It should also lead to infrequent dissonance arousal when such inconsistencies arise to promote an adaptive response that facilitates organismic integration (Hypothesis 1a). Global controlled motivation should favour relatively frequent native inconsistencies due, in part, to chronic awareness of the overt or external aspects of the self (i.e., public self-consciousness), and frequent dissonance arousal when such inconsistencies arise to energize compensatory efforts that facilitate desired outcomes

(Hypothesis 1b). Finally, global amotivation should be associated with frequent self-inconsistent actions, but with indifference when such inconsistencies arise (Hypothesis 1c).

## **Method**

**Participants.** In total, 599 completed the survey. However, 217 participants (36.2%) provided incomplete data or responded 'N/A' to at least one item of the Frequency of Behavioural Inconsistencies scale (see below) indicating that some of the life domains under study were not personally important. We excluded these participants from analyses because we did not consider them to be part of the target population.<sup>1</sup> The effective sample size ( $N = 382$ ) was well in excess of the sample size ( $N = 73$ ) necessary to achieve 80% power to detect small effects ( $r^2 \geq .10$ ) via two-tailed correlation analyses (Faul, 2013). The mean age of the sample was 20.1 years (range: 17 – 46 years); two participants (0.5%) declined to report their age. The majority of the sample was female ( $n = 266$ ; 69.6%); one participant (0.3%) declined to report his or her gender. There were 168 participants who reported English (44.0%), 128 participants who reported French (33.5%), and 75 participants who reported another language (19.6%) as their first language learned; 11 participants (2.9%) declined to answer.

**Procedure.** Participants completed an online survey via the ISPR. We embedded the instruments used for the present study within the mass prescreening survey, which featured several psychological measurement instruments used by various researchers to select participants for research studies. Students provided informed consent before completing the online survey and received one research credit for their participation. We administered the measurement scales in English and French (participants saw both versions of the scale items side-by-side) in the following order:

***Global Motivation scale.*** An 18-item version of the Global Motivation scale (Pelletier

& Dion, 2007; Sharp et al., 2003) assessed individual differences in global motivational orientations. The scale features six subscales of three items that assess the motivational sub-types defined by SDT (Deci & Ryan, 2008). Participants were asked to indicate the extent to which each item corresponded to their own motives for performing daily activities using a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). The items measured intrinsic regulation (e.g., “because I like making interesting discoveries”), integration (e.g., “because by doing them I am fully expressing my deepest values”), identification (e.g., “in order to help myself become the person I aim to be”), introjection (e.g., “because otherwise I would feel guilty for not doing them”), external regulation (e.g., “in order to attain prestige”), and non-regulation (amotivation; e.g., “although it does not make a difference whether I do them or not”). We computed mean composite scores of autonomous motivation (i.e. intrinsic, integration, and identification subscales), controlled motivation (i.e., introjection and external regulation subscales), and amotivation (i.e., non-regulation subscale). A series of empirical studies support the reliability and validity of the Global Motivation scale on samples of Canadians and Americans (Sharp et al., 2003). Specifically, the results showed that the six subscales are reliable and form distinct factors, are internally consistent, and demonstrate a simplex pattern of correlations that supports the self-determination continuum. Furthermore, the results supported the construct validity of the scale relative to motivational antecedents (e.g., need satisfaction) and outcomes (e.g., well-being) hypothesized by SDT, and the scale’s test-retest reliability over a 6-week period.

***Revised Self-Consciousness scale.*** The Revised Self-Consciousness scale (Scheier & Carver, 1985) measured trait levels of private self-consciousness, which refers to self-focused attention directed at the covert aspects of the self, such as thoughts, feelings, and aspirations (9

items; e.g., “I’m always trying to figure myself out.”). The scale also measured trait levels of public self-consciousness, which refers to concerns with how others perceive the overt aspects of the self, such as behaviour, mannerisms, and appearance (7 items; e.g., “I usually worry about making a good impression.”). We did not include the social anxiety subscale (6 items). Items were measured on a 4-point Likert scale ranging from 0 (*not like me at all*) to 3 (*a lot like me*). Scheier and Carver (1985) have demonstrated that the Revised Self-Consciousness scale developed using an American sample of college students has a similar factor structure and comparable psychometric properties to the original scale (Fenigstein, Scheier, & Buss, 1975). Furthermore, Scheier and Carver found the subscales to be internally consistent and to produce reliable scores at test and at retest 4 weeks later.

***Frequency of Behavioural Inconsistencies scale (General Appendix A).*** We developed a four-item scale to assess the frequency of attitude-behaviour inconsistencies across life domains in day-to-day life. Participants responded to the following four scenarios describing attitude-behaviour inconsistencies in different life domains:

“Many people value and wish to achieve/maintain [a specific body weight/ economic prosperity/ racial tolerance/ an environmentally sustainable lifestyle], however, they sometimes act in ways that are inconsistent with these values and goals (e.g., [wanting to lose weight but skipping a workout or eating too many sweets/ wanting to set money aside but splurging on expensive things or unplanned expenses/ wanting to be tolerant of people of different races but laughing at a racially discriminating joke/ wanting to reduce their greenhouse gas emissions but taking their car when they could have walked, biked, or taken public transit]). In everyday life, how often do you detect inconsistencies between your personal attitudes, beliefs, and goals about your [body weight/ economic prosperity/ racial tolerance/ environmental sustainability] and your actions?”

Participants could indicate the domain was not personally important by selecting the “N/A”

response option, or respond to the scenarios on a 7-point Likert scale (1 *never*, 7 *often*).

***Frequency of Negative Affect scale (General Appendix B).*** We assessed the frequency of experiencing negative affect following the perception of native attitude-behaviour inconsistencies using a 5-item scale. Participants answered the question: “Generally, when you detect an inconsistency between your personal values or goals and your actual behaviours, how often do you feel \_\_\_\_\_?” The items consisted of four negative emotions (i.e., “guilty,” “insincere,” “hypocritical,” and “bad about yourself”), and indifference (i.e., “no different than usual”). Participants responded on a 7-point Likert scale (1 *never* to 7 *always*).

## **Results**

We conducted all analyses in SPSS (2012). We recoded extreme scores of autonomous motivation, amotivation, and public self-consciousness that produced large standardized scores ( $z > 3.29, p < .001$ ) disconnected from the other  $z$ -scores in the distribution to minimize the impact of outliers on the mean (Tabachnick & Fidell, 2006). Raw scores corresponding to the four negative emotions of the Frequency of Negative Affect scale were internally consistent ( $\alpha = .82$ ); therefore, a mean composite score was computed and analyzed. Descriptive statistics of the study variables are in Table 1. Independent samples  $t$ -tests and one-way analyses of variance (ANOVA) revealed no gender and language differences on the set of study variables ( $\alpha = .001$ ). On average, participants reported that they *sometimes* become aware of inconsistencies between their attitudes and behaviour in important life domains and that these types of inconsistencies *sometimes* arouse negative affect.

To test our hypotheses, we computed two-tailed Pearson correlation coefficients between all pairs of index variables (Variables 1 through 6) and Spearman Rho correlation coefficients between all other pairs of variables (presented in Table 2). Because only three

participants (0.8%) had one or two missing values, we used listwise deletion. As expected, autonomous motivation was associated with greater private self-consciousness and infrequent native inconsistencies in the body weight management, economic prosperity, and racial tolerance domains. Controlled motivation was associated with greater private and public self-consciousness, though the correlation with public self-consciousness was larger. Amotivation was also associated with greater public self-consciousness. In addition, controlled motivation and amotivation were associated with frequent negative affect and frequent behavioural inconsistencies in the body weight management and environmental protection domains, in agreement with our hypotheses.

We also computed two-tailed partial correlations between the trait variables (Variables 1 through 5) and all other variables (Variables 6 through 11), controlling for the four other trait variables (see Table 2). A pattern more consistent with our hypotheses emerged based on partial correlations. As expected, autonomous motivation was associated with somewhat infrequent negative affect but not with indifference, and with infrequent inconsistencies in all life domains except the environmental protection domain. Controlled motivation was associated with frequent negative affect and with somewhat infrequent indifference, and with somewhat frequent inconsistencies in the body weight management. Amotivation was associated with somewhat frequent indifference but not with negative affect, and with somewhat frequent inconsistencies in the environmental domain. Finally, public self-consciousness was associated with somewhat frequent negative affect.

## **Discussion**

The observed pattern of partial correlations suggests that global autonomous motivation dampened dissonance arousal, global controlled motivation facilitated dissonance arousal, and

global amotivation inhibited dissonance arousal in response to native inconsistencies across important life domains, which supports Hypotheses 1a through 1c. However, the effects of motivation on the frequency of behavioural inconsistencies across life domains were not fully consistent with our hypotheses and the magnitude of the correlations was small ( $r^2 \leq .08$ ). Furthermore, we assumed that the four domains were personally important if participants provided responses to the Frequency of Behavioural Inconsistencies scale, but we did not actually measure levels of perceived importance. Therefore, the objective of Study 2 was to assess dissonance arousal processes relative to a single recent native inconsistency. We adopted this approach to test the hypothesized influence of individual differences in domain importance and in contextual motivation on dissonance arousal, which should be better predictors of dissonance processes in a given life domain.

## Study 2

Study 2 focused on a specific life domain in order to address the limitations of Study 1 and to test Hypotheses 2a through 2c about the role of contextual motivational orientations on dissonance arousal processes. We assumed that focusing on a single life domain would also facilitate the comparison of the antecedents of dissonance arousal proposed by CDT with those proposed by the action-based model. CDT posits that dissonance arousal is subject to individual differences that affect the domain's perceived importance and the simultaneous accessibility of conflicting cognitions (Festinger, 1957; McGregor, Newby-Clark, & Zanna, 1999)—for example, differences in levels of private and public self-consciousness (Fenigstein et al., 1975; Scheier & Carver, 1985). By contrast, the action-based model (Harmon-Jones et al., 2009) claims that dissonance arousal processes are due to individual differences in dominant action tendencies, which we operationalized as individual differences in the perceived locus of causality

of pro-environmental behaviour measured via the Motivation Toward the Environment scale (Pelletier et al., 1998). We chose to focus on the environmental protection domain because native inconsistencies in this domain contribute to the ‘environmental belief-action gap’ and undermine environmental sustainability efforts (Kollmuss & Agyeman, 2002). Therefore, society has much to gain from understanding the motivational processes underlying inconsistency compensation in the environmental domain.

## **Method**

**Participants.** Undergraduate students registered with the ISPR who completed the mass prescreening survey in exchange for one research credit could sign up for the present study titled “Why do you act the way you do?” Participants received an additional research credit for their participation in the study. In total, 339 consented to participate in the study. However, 57 participants (16.8%) either did not provide a response, recalled a pro-environmental action, responded “N/A,” or entered a nonsensical string of numbers and letters for the Recall a Recent Behavioural Inconsistency scale (see below for a description of the scale). These 57 participants were excluded from analyses.<sup>2</sup> The effective sample size ( $N = 282$ ) was well in excess of the 50 to 200 cases recommended to obtain unbiased parameter estimates and fit indices for single-indicator path models (Iacobucci, 2010; Jackson, 2003). The mean age of the sample was 19.1 years (range: 17 – 36 years); five participants (1.8%) declined to report their age. The majority of the sample was female ( $n = 220$ ; 78.0%). Two participants (0.7%) did not report their gender. In terms of first language learned, 148 participants (52.4%) reported English, 84 participants (29.8%) reported French, and 46 participants (16.3%) reported another language; four participants (1.4%) declined to answer.

**Procedure.** Participants completed the Global Motivation scale (see Study 1 for a

description of the scale) and the Motivation Toward the Environment scale prior to participating in the study as part of the ISPR mass prescreening survey. We administered the remaining scales including the Revised Self-Consciousness scale (see Study 1 for a description of the scale) via LimeSurvey (Schmitz, 2012). Participants provided written informed consent (General Appendix C) before completing the surveys. Each page of the questionnaire bore the instructions “There are no right or wrong answers to these questions. Please answer as HONESTLY as possible.” Participants completed the scales in the following order (the English and French versions of the scale items were presented side-by-side).

***Motivation Toward the Environment scale.*** The Motivation Toward the Environment scale (Pelletier et al., 1998) consists of 24 items that answer the question “Why are you doing things for the environment?” The items form six subscales of four items corresponding to the regulation styles proposed by SDT: intrinsic regulation (e.g., “For the pleasure I experience when I find new ways to improve the quality of the environment.”), integration (e.g., “Because taking care of the environment is an integral part of my life.”), identification (e.g., “Because it is a reasonable thing to do to help the environment.”), introjection (e.g., “Because I would feel guilty if I didn't.”), external regulation (e.g., “For the recognition I get from others.”), and non-regulation (amotivation; e.g., “I don't really know; I can't see what I'm getting out of it.”). Participants responded on a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). We computed mean composite scores of autonomous motivation (i.e., intrinsic, integration, and identification subscales), controlled motivation (i.e., introjection and external regulation subscales), and amotivation (i.e., non-regulation subscale). Confirmatory factor analyses support the factorial structure of the scale, and the subscales show satisfactory levels of internal consistency and a simplex pattern of correlations that supports the self-determination

continuum (Pelletier et al., 1998). In addition, the scale demonstrates satisfactory test-retest reliability over multiple time points measured at 3- to 5-week intervals, and adequate construct validity when correlated with related psychological and environmental constructs (Pelletier et al., 1998; Villacorta, Koestner, & Lekes, 2003). The scale also shows acceptable convergent validity relative to peer reports of environmental self-regulation and discriminant validity relative to self-reports of behavioural regulation in the academic and political domains (Villacorta et al., 2003).

***Pro-Environmental Attitude Strength scale (General Appendix D).*** A scale similar to attitude strength scales used in previous research (Brannon, Tagler, & Eagly, 2007; Krosnick, Boninger, Chuang, Berent, & Carnot, 1993; Pomerantz, Chaiken, & Tordesillas, 1995) was developed to measure the strength of favourable attitudes toward environmental protection. Among other things, these types of scales assess domain importance and attitudinal resistance to change, two dimensions assumed to influence dissonance processes (Festinger, 1957). Two items assessed pro-environmental attitude position relative to the statements: (a) “human activities have a harmful impact on the environment” and (b) “humans need to take action to reduce their harmful impact on the environment.” Participants responded on a 7-point Likert scale (1 *do not agree*, 7 *completely agree*). Six additional items measured other aspects of attitude strength; specifically, the amount of knowledge about environmental issues, the personal importance of environmental issues, the attitude’s centrality relative to one’s self-concept, the attitude’s representativeness of values, the attitude’s certainty, and the likelihood of changing the attitude (reverse-coded). Participants responded to these items on a 7-point Likert scale (1 *not at all*, 7 *very much*). Attitude strength is a multidimensional construct that is reliably associated with stronger intentions to act consistently with the measured attitude (Krosnick et al., 1993; Pomerantz et al., 1995). Taken together, the items seem internally consistent and useful to

predict behaviour (Brannon et al., 2007). Therefore, we computed a composite score of pro-environmental attitude strength by taking the mean of the eight items.

***Frequency of Behavioural Inconsistencies in the Environmental Domain scale (General Appendix E).*** We assessed the frequency of behavioural inconsistencies in the environmental domain using a four-item scale. Participants responded to four items completing the statement: “How often do you become aware of inconsistencies or contradictions between your personal attitudes, beliefs, and goals about \_\_\_\_\_ and your actual day-to-day activities (either immediately or shortly after the inconsistency has taken place)?” Responses were provided on a 7-point Likert scale (1 *never*, 7 *often*). The specific attitudinal domains were the reduction of greenhouse gas emissions (GHG), waste reduction, water conservation, and environmental sustainability in general. Participants read examples of inconsistencies for each of the targeted domains. We computed a mean composite score of frequency of environmental attitude-behaviour inconsistencies by taking the mean of the four items.

***Recall of a Recent Behavioural Inconsistency scale (General Appendix F).*** Next, we administered a scale that asked participants to recall and describe a recent behavioural inconsistency or transgression in the environmental domain. Specifically, participants provided an open-ended answer to the following instructions: “Thinking about all of your activities and actions over the past month, please describe an action you did that was inconsistent or contradictory with your environmental beliefs and attitudes.” We asked participants to keep the recalled transgression in mind when answering the rest of the questionnaire. Only participants who recalled a recent transgression completed the Psychological Discomfort scale.

***Psychological Discomfort scale (General Appendix G).*** Participants reported how they felt following the recalled transgression using an 18-item scale. Specifically, participants

responded to items completing the statement “Following the inconsistent action, I felt...” on a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). The items consisted of adjectives related to different negative and positive emotions. Based on Elliot & Devine (1994), the adjectives “bothered,” “uncomfortable,” and “uneasy” were included to assess the general motivational state of PD described by CDT. However, several other negative emotions were included to account for the possibility that PD subsumes a wider range of negative affective reactions (as suggested by Stone & Cooper, 2001). Specifically, nine adjectives were included to assess the arousal of self-conscious negative emotions (i.e., “hypocritical,” “guilty,” and “ashamed”), dejection-related emotions (i.e., “discouraged,” “dissatisfied,” and “disappointed”), and anxiety-related emotions (i.e., “agitated,” “anxious,” and “nervous”). In addition, we included six adjectives corresponding to positive emotions (i.e., “proud,” “calm,” “pleased,” “content,” “relaxed,” and “happy”) to minimize demand characteristics.

***Frequency of Recent Environmentally Relevant Actions scale (General Appendix H).***

Finally, participants reported the frequency of nine recent pro-environmental (e.g., “Purchased local foods”) and nine recent counter-environmental actions (e.g., “Took a bath or a long shower (> 10 min.)”). Participants responded to the statement: “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.” Response options were restricted to integers between 0 and 20.<sup>3</sup> The featured actions were related to water conservation (6 items; e.g., “Turned off the water while brushing teeth”), waste reduction (6 items; e.g., “Used the double-sided option to print/copy on both sides of the page”), and the reduction of greenhouse gas emissions (6 items; e.g., “Used an electric clothes dryer) to match the domains featured in the Frequency of Behavioural Inconsistencies in the Environmental Domain scale. Pro-environmental actions (9 items; e.g., “Brought reusable

bags when shopping”) were matched with counter-environmental actions (9 items; e.g., “Took plastic bags at the grocery/store check-out (instead of no bags or reusable bags).”) in order to calculate a ratio corresponding to the relative frequency of counter-environmental actions. We calculated the ratio by dividing the sum of the 9 counter-environmental items by the sum of all 18 items in the scale.

## Results

We screened the data for violations of basic statistical assumptions in SPSS (2012). The positive (all except “calm,” skewness = 0.75) and anxious emotions of the Psychological Discomfort scale were positively skewed (skewness  $\geq |1.22|$ ) indicating that, on average, perceived inconsistencies did not arouse positive affect or anxious affect. Therefore, we did not analyze these items. By contrast, the dissonance, dejection, and negative self-conscious emotions were relatively normal (skewness  $\leq |0.60|$ ) and internally consistent ( $\alpha = .92$ ), as were the four Frequency of Behavioural Inconsistencies in the Environmental Domain scale items (skewness  $\leq |0.12|$ ,  $\alpha = .77$ ). Furthermore, a confirmatory factor analysis<sup>4</sup> supported the unidimensionality of the two constructs; therefore, we computed mean composite scores of PD (9 items) and of frequency of behavioural inconsistencies (4 items). As in Study 1, there were no significant gender or first language differences across the study variables. All the valid recalled transgressions related to the behavioural domains featured in the Frequency of Behavioural Inconsistencies in the Environmental Domain scale—that is, water conservation, waste diversion, or the reduction of greenhouse gas emissions.

**Descriptive statistics and correlations.** Descriptive statistics are presented in Table 3. Again, participants reported moderate levels of PD. The pattern of two-tailed correlations (see Table 4) between the global and contextual motivation variables was consistent with the

hierarchical model of extrinsic and intrinsic motivation (Vallerand, 1997). Motivational orientations at the global level of generality correlated positively with corresponding orientations at the contextual level, but showed stronger associations with levels of trait self-consciousness. Autonomous motivation was associated with greater private self-consciousness at the global level only, whereas controlled motivation was associated with greater public-self-consciousness at both levels of generality. Amotivation did not relate to self-consciousness.

By contrast, the contextual motivational orientations were more strongly associated with domain-specific constructs, as expected. Autonomous motivation was associated with stronger pro-environmental attitudes and relatively infrequent counter-environmental actions (CEA) at both levels of generality, but only contextual autonomous motivation was associated with greater PD. Controlled motivation at the contextual, but not at the global level, showed the same pattern of associations with dissonance constructs as contextual autonomous motivation. Amotivation at both levels of generality was unrelated to PD and associated with relatively frequent CEA. Contextual, but not global, amotivation was associated with weaker pro-environmental attitudes. Finally, attitude strength was associated with relatively infrequent CEA and greater PD, and the relative frequency of CEA was associated with less PD. The frequency of behavioural inconsistencies was associated with greater public self-consciousness but no other correlations were significant. Because the pattern of correlations did not support this variable's construct validity, we dropped the frequency of behavioural inconsistencies variable from the analyses.

**Path analyses.** We conducted path analyses to compare the predictors of PD and the relative frequency of CEA proposed by CDT to those proposed by the action-based model and SDT. We multiplied the relative frequency of CEA scores by 5 to rescale the covariance matrix. There were no other violations of the assumptions of covariance structural modeling (Kline,

2011). However, because the multivariate normality assumption is difficult to test (Kline, 2011), we used the Full Information Maximum Likelihood Robust method in Mplus (Muthén & Muthén, 2012) to estimate the covariance matrix (see Table 4) from all available data (Schlomer, Bauman, & Card, 2010) with robust standard errors. We assessed the fit of the model by examining the Satorra-Bentler scaled model chi-square statistic (Satorra & Bentler, 1994). A significant model chi-square statistic ( $\alpha = .05$ ) leads to the rejection of the exact fit hypothesis and suggests that the specified model is not a good fit to the data.

The CDT path model (see Figure 1a) tested the assumption that the relative frequency of CEA (i.e., native inconsistencies) decreases and the magnitude of dissonance increases as attitude importance increases (Festinger, 1957).<sup>5</sup> The model also tested the assumption that individual differences which affect the simultaneous accessibility of conflicting cognitions facilitate dissonance arousal processes. Specifically, we tested the hypothesis that public self-consciousness facilitates the perception of behavioural transgressions whereas private self-consciousness facilitates the arousal of dissonance (Scheier & Carver, 1980). We specified covariances between the three exogenous variables (i.e., predictors) and the two endogenous variables (i.e., outcomes). The model fit well,  $\chi^2(2) = 0.78, p = .68$  (see Figure 1a for the parameter estimates). As expected, pro-environmental attitude strength predicted infrequent CEA and greater PD, whereas private self-consciousness predicted greater PD. The direct effect of public self-consciousness on the relative frequency of CEA was positive but not significant ( $p = .11$ ). The model explained 7% of the variance in PD and 22% of the variance in the relative frequency of CEA.

The action-based SDT path model (see Figure 1b) tested the hypothesis that accounting for distal motives for effective and unconflicted action increases the predictive power of CDT

because distal motives clarify why attitude-behaviour inconsistencies are uncomfortable. Specifically, we tested the hypothesis that contextual autonomous and controlled motivational orientations, but not amotivation, toward the environment make independent contributions to the magnitude of dissonance following native inconsistencies in the environmental domain. In addition, we tested the idea that accounting for contextual motivation would fully account for the variance in PD and the frequency of native inconsistencies explained by the CDT predictors. We specified covariances between the six exogenous variables and between the two endogenous variables. The model fit well,  $\chi^2(8) = 7.34, p = .50$  (see Figure 1b for the parameter estimates). As expected, accounting for individual differences in contextual motivational orientations fully explained the variance in PD and the relative frequency of CEA predicted by attitude strength and self-consciousness in the CDT model. The action-based SDT model explained 11% of the variance in PD and 34% of the variance in the relative frequency of CEA.

## **Discussion**

The results of the present study provided some support for Hypotheses 2a to 2c. As expected based on CDT (Festinger, 1957), individual differences in attitude importance and self-consciousness facilitated perception and arousal processes. In accordance with the action-based model, accounting for distal motives for effective and unconflicted action in the environmental domain clarified the discomfort associated with actions that are inconsistent with important attitudes. Apparently, dissonance arousal depends not only on differences in levels of self-consciousness and attitude strength, but also on the reasons for these individual differences. As expected, contextual autonomous and controlled motivation, but not amotivation toward the environment, facilitated dissonance arousal processes, which supports the assumption that amotivation does not embody motives for effective and unconflicted action. The pattern of

results provided preliminary support for the notion that the perception of attitude-behaviour inconsistencies guided by action tendencies to facilitate organismic integration versus instrumental outcomes arouses dissonance for different reasons. However, hypothesized differences in the quality of proximal motivation remain untested; Study 3 tested these hypotheses.

### Study 3

Study 3 tested the hypothesis that contextual autonomous and controlled motivational orientations both lead to dissonance arousal and foster proximal motivation to compensate, but for qualitatively different reasons. We expected that contextual autonomous motivation would predict a tendency to compensate to restore self-integrity (Hypothesis 3a) while contextual controlled motivation would predict a tendency to compensate to protect ego-invested self-structures (Hypothesis 3b). We thought amotivation toward the environment would predict a lack of motivation to compensate (Hypothesis 3c). In line with CDT (Festinger, 1957), we expected that PD would predict greater motivation to compensate in general, particularly in the case of inconsistency minimization motives that are not directed toward the satisfaction of specific goals or needs (Elliot & Devine, 1994).

### Method

**Participants.** The recruitment protocol was identical to the one described in the Study 2 Method section. In total, 261 consented to participate in the study and completed the online survey. However, we excluded from analyses 59 participants (22.6%) who did not describe a counter-environmental action via the Recall of a Recent Behavioural Inconsistency scale (see Study 2 for a description of the scale).<sup>6</sup> The effective sample size ( $N = 202$ ) was sufficient to obtain unbiased parameter estimates and fit indices via covariance path modeling (Iacobucci,

2010; Jackson, 2003). The majority of the sample reported being 18 to 20 years old ( $n = 143$ , 70.8%). There were seven participants (3.5%) under the age of 18, and 50 participants (24.7%) over the age of 20. Two participants did not report their age group (1.0%). Three-quarters of the sample were female ( $n = 150$ ; 74.3%). In terms of first language learned, 71 participants (35.1%) reported English, 96 participants (47.5%) reported French, and 33 (16.3%) participants reported another language. Two participants (1.0%) declined to report their gender or first language.

**Procedure.** After providing written informed consent (General Appendix C), participants completed the Motivation Toward the Environment scale, Pro-Environmental Attitude Strength scale, Recall of a Recent Behavioural Inconsistency scale, and Psychological Discomfort scale in order via LimeSurvey (Schmitz, 2012; see the Study 2 Method for a description of the scales). We omitted the Frequency of Behavioural Inconsistencies in the Environmental Domain scale but included the examples of behavioural inconsistencies provided with this scale in the Recall of a Recent Behavioural Inconsistency scale instructions. In addition, we added two newly developed scales at the end of the questionnaire to assess the quantity and quality of motivation to compensate.

***Inconsistency Compensation Strategy Recall scale (General Appendix I).*** Immediately after responding to the Psychological Discomfort scale, participants indicated which strategy, among a list of twelve strategies, most closely corresponded to their response to the statement: “Following the inconsistent action, I reacted by...” The strategies assessed by the scale included behaviour modification or change strategies (3 items; e.g., “Making 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.”). The scale also included examples of non-behavioural strategies, such as passive forgetting or distraction (3 items; e.g., “Putting the inconsistency out

of my mind.”) and attitude change or cognitive restructuring (6 items; e.g., “Questioning whether environmental sustainability is really that important to me personally.”). We included this scale to facilitate responses to the Motivation to Compensate scale below.

***Motivation to Compensate scale (General Appendix J).*** We developed a scale to assess qualitatively different motives to compensate for a recent native inconsistency in the environmental domain. Participants responded to 12 items completing the statement: "I reacted this way following the inconsistent action because..." on a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). The items corresponded to qualitatively different proximal motives to compensate, including self-integrity restoration motives (3 items; e.g., "I wanted to act in a way that maintains my integrity."), ego-invested self-protection motives (3 items; e.g., "I wanted to save face."), and a lack of specific motives or amotivation to compensate (3 items; e.g., "I did not know what else to do."). The scale also measured the quantity of proximal motivation to minimize the perceived inconsistency (e.g., "I could not get the inconsistent action out of my mind.") or to reduce the aroused dissonance (e.g., "I wanted to rid myself of the negative emotions I was feeling."), that is, inconsistency minimization motives to compensate (3 items).

## **Results**

We used SPSS (2012) to conduct preliminary data screening procedures. The results of a confirmatory factor analysis<sup>7</sup> indicated that the items corresponding to the self-integrity restoration, ego-invested self-protection, and dissonance minimization subscales of the Motivation to Compensate scale were distinct but related constructs. The three sets of items were also internally consistent (see Table 5); therefore, we computed mean composite scores. The three lack of motives (amotivation) to compensate subscale items showed modest inter-

correlations (see Table 6), so we analyzed them separately. Only three recalled behavioural transgressions did not relate to water conservation, waste diversion, or the reduction of greenhouse gas emissions.

**Descriptive statistics and correlations.** Descriptive statistics are presented in Table 5. Participants reported moderate levels of PD, of self-integrity restoration motives, and of a lack of motives to compensate, as well as moderately low levels of inconsistency minimization and ego-invested self-protection motives to compensate. Before proceeding to the correlation analyses, we transformed the amotivation toward the environment and ego-invested self-protection motives variables to correct their skewed distributions (see Table 5; Tabachnick & Fidell, 2006). We computed two-tailed Pearson correlation coefficients between all pairs of continuous variables (Variables 1 through 7) and Spearman rho correlation coefficients for all other pairs of variables (see Table 6). Again, we found that contextual autonomous and controlled motivations (but not amotivation) were associated with greater PD. PD was positively associated with inconsistency minimization, self-integrity restoration, and ego-invested self-protection motives to compensate, and with a lack of specific motives due to perceived incompetence. Though the latter correlation was unexpected, it is reasonable to believe that, at times, people may be motivated to compensate but may lack the resources to implement a strategy that satisfies particular motives.

Autonomous motivation was positively associated with inconsistency minimization and self-integrity restoration motives to compensate, as predicted. Controlled motivation was positively associated with inconsistency minimization and ego-invested self-protection motives to compensate, and with a lack of motives due to perceived incompetence and indifference. The latter two correlations are consistent with research showing that controlled motivation is

associated with less perceived competence in the environmental domain (Pelletier et al., 1997; 1998) and with an amotivational state in the absence of behavioural contingencies (Deci, Koestner, & Ryan, 1999). Amotivation was associated with a lack of motives due to indifference and for no specific reason, as expected. The three types of motives to compensate were positively inter-correlated. However, self-integrity restoration motives showed a negative relationship with a lack of motives for no specific reason, whereas ego-invested self-protection and dissonance minimization motives showed a positive relationship with a lack of motives to compensate due to perceived incompetence and indifference.

**Path analyses.** We conducted path analyses to compare the effects of PD, autonomous motivation, and controlled motivation on the different motives to compensate. Because amotivation toward the environment and a lack of motives to compensate due to indifference and for no specific reason were unrelated to PD (see Table 6), we excluded these variables from analyses. We multiplied scores on the ego-invested self-protection motives variable by 5 to rescale the covariance matrix; there were no other violations of the assumptions of covariance structural modeling (Kline, 2011). Again, we conducted analyses in Mplus using the Full Information Maximum Likelihood Robust estimation method. The path models featured the same three exogenous variables or predictors, namely PD, autonomous motivation, and controlled motivation toward the environment. They also had the same four endogenous variables, namely inconsistency minimization, self-integrity restoration, and ego-invested self-protection compensation motives, and a lack of motives to compensate due to perceived incompetence (i.e., incompetence non-motives). We specified covariances between each pair of exogenous variables and between each pair of endogenous variables to partial out shared variance.

In the first stage of analysis, we tested two hierarchical models to perform a test of incremental validity. First, we assessed the fit of a path model combining the predictions derived from CDT with those derived from the action-based model and SDT (see Figure 2) to ensure the hypothesized model was a good fit to the covariance matrix (see Table 6). In line with CDT predictions, we regressed the four motives onto PD. In line with the action-based model and SDT, we regressed inconsistency compensation and self-integrity restoration motives onto autonomous motivation, and we regressed inconsistency compensation and ego-invested self-protection motives, as well as incompetence non-motives onto controlled motivation. The combined model fit well,  $\chi^2(3) = 5.71, p = .13$ . The standardized path estimates (see Table 7) were all positive and significant, except for the positive effect of PD on ego-invested self-protection motives ( $p = .16$ ). The model explained 35% variance in inconsistency compensation motives, 19% variance in self-integrity restoration motives, 18% variance in ego-invested self-protection motives, and 13% variance in incompetence non-motives.

Next, we assessed the model fit of a less restrictive nested model corresponding to predictions derived from CDT only (see Figure 2) and compared it to the fit of the combined model by way of a chi-square difference test (Satorra & Bentler, 2001). A significant chi-square difference test indicates that the less restrictive model—in this case the combined model—fits significantly better (i.e., explains more variance) than the more restrictive nested model. The nested CDT model fit poorly,  $\chi^2(8) = 57.89, p < .001$ , and had worst fit than the combined model,  $\Delta\chi^2(5) = 52.40, p > .001$ , as expected. This finding supports the assumption that accounting for motives for effective and unconflicted action increases the predictive power of CDT.

In the second stage of analysis, we performed tests of path invariance on the combined

model. First, we constrained each pair of direct effects converging on the same outcome variable to equality in turn, and compared the constrained models to the combined model using chi-square difference tests (see Table 7). A significant chi-square difference test indicates that the invariance hypothesis is not tenable or, in other words, that the effect sizes are not equal (Kline, 2011). In terms of inconsistency minimization motives, we found that the effect of PD ( $\lambda = .43$ ) was significantly larger than the effect of autonomous motivation ( $\lambda = .18$ ) but equal to the effect of controlled motivation ( $\lambda = .17$ ); the effects of the two motivational orientations were equal. The effects of autonomous motivation ( $\lambda = .34$ ) and PD ( $\lambda = .21$ ) on self-integrity restoration motives were equal. As expected, the effect of controlled motivation on ego-invested self-protection motives ( $\lambda = .39$ ) was larger than the effect of PD ( $\lambda = .10$ ). The effects of PD ( $\lambda = .17$ ) and controlled motivation ( $\lambda = .27$ ) on incompetence non-motives were also equal.

Finally, we assessed the invariance of each pair of direct effects originating from the same predictor variable to equality in turn (see Table 7). The effect of PD on inconsistency compensation motives was significantly larger than its effect on ego-invested self-protection and self-integrity restoration motives, as expected, but equal to its effect on incompetence non-motives, which we had not anticipated. The effect of autonomous motivation on self-integrity restoration motives was larger than its effect on inconsistency compensation motives, as expected. Finally, the effect of controlled motivation on ego-invested self-protection motives was larger than its effect on inconsistency minimization motives and incompetence non-motives, as hypothesized.

**Post-hoc *t*-tests.** Preliminary analyses indicated there might be motivational differences based on the type of strategy reported on the Inconsistency Compensation Strategy Recall scale, particularly between participants who recalled using a behavioural ( $n = 73$ ) versus another type

of strategy ( $n = 111$ ). Therefore, we conducted post-hoc independent samples  $t$ -tests of the study variables by type of recalled strategy to compare these two groups of participants (see Table 8). After correcting for the familywise error rate ( $\alpha = .05/10 = .005$ ), the only difference was in the lack of motives due to indifference. In line with SDT, participants who used a behaviour change strategy reported less indifference than did other participants. However, there were five small to moderate non-significant effects (i.e., Cohen's  $d$  values between .20 and .50; Cohen, 1992), suggesting the conservative alpha level may have led us to make a Type II error. These five trends are also in line with SDT: participants who reported using behaviour change strategies reported less contextual amotivation toward the environment and less amotivation to compensate for no specific reason, as well as more contextual autonomous motivation toward the environment, PD, and self-integrity restoration motives than did other participants. In sum, the overall pattern of results suggests that the quantity and quality of contextual motivation and proximal motivation to compensate may influence the choice of compensation strategy.

## **Discussion**

The results suggest that individual differences in contextual motivational orientations affect the quantity and quality of proximal motivation to compensate because of differences in the type of self-threat induced by perceived attitude-behaviour inconsistencies. The pattern of results seemed to support Hypotheses 3a to 3c and the idea that contextual autonomous and controlled motivational orientations embody action tendencies that serve as distal motives for effective and unconflicted action whereas amotivation does not. The autonomous motivational orientation elicits inconsistency minimization and self-integrity restoration motives to compensate, which seems to dispose people to use behavioural inconsistency compensation strategies. This pattern of results supports the assumption that autonomous motivation embodies

action tendencies to facilitate organismic integration via authentic regulation. By contrast, the controlled motivational orientation elicits inconsistency minimization and ego-invested self-protection motives, or incompetence non-motives when the magnitude of dissonance is large. There were no clear strategic preferences associated with any of these motives. However, this orientation seems to elicit a lack of motives to compensate due to indifference when inconsistencies fail to arouse dissonance, which apparently disposes people to favour non-behavioural compensation strategies. These findings support the assumption that controlled motivation embodies action tendencies to facilitate desired outcomes via contingent regulation.

### **General Discussion**

The purpose of the present research was to explore the motivational consequences of native attitude-behaviour inconsistencies encountered spontaneously in daily life. We tested complementary hypotheses derived from CDT (Festinger, 1957), the action-based model (Harmon-Jones et al., 2009), and SDT (Deci & Ryan, 2008) about the role of individual differences on dissonance arousal processes. The results of correlation analyses (Studies 1 to 3) and path analyses (Studies 2 and 3) supported the assumption that autonomous and controlled motivation, but not amotivation, act as distal motives for effective and unconflicted action that regulate dissonance arousal processes. Moreover, the pattern of results indicates that individual differences in contextual motivation affect both the quantity but, particularly, the quality of proximal motivation to compensate, which clarifies why native inconsistencies are uncomfortable and increases the predictive power of CDT. The tendency to regulate behaviour in a given domain relative to authentic self-structures (i.e., for autonomous reasons) motivates people to compensate for inconsistencies to reduce dissonance and to restore self-integrity, presumably to minimize self-integrity threats via authentic regulation. The tendency to regulate

behaviour in a given domain relative to the behaviour's contingencies (i.e., for controlled reasons) motivates people to compensate for inconsistencies to reduce dissonance and to protect ego-invested self-structures, presumably to avoid the aversive consequences of counter-attitudinal actions via contingent regulation.

### **Implications**

The major implication of the present research is that individual differences in inconsistency compensation processes (see Harmon-Jones et al., 2009; Leippe & Eisenstadt, 2010 for reviews) may be due to individual differences in distal motives that affect the quantity and quality of proximal motivation to compensate. In line with our hypotheses, the magnitude of dissonance (i.e., PD) had a larger effect on the quantity of proximal motivation to compensate for native inconsistencies, whereas contextual autonomous and controlled motivation had larger effects on the quality of motivation to compensate. Furthermore, there was some evidence that the choice of inconsistency compensation strategy relates to the quality rather than to the quantity of proximal motivation. The magnitude of dissonance was somewhat larger among people who used behavioural versus non-behavioural inconsistency compensation strategies. However, the magnitude of dissonance was also associated with other types of motives to compensate, including inconsistency minimization motives, ego-invested self-protection motives, and incompetence non-motives that were not associated with strategic preferences. In fact, the strategic preferences associated with PD seem attributable to the positive effect of PD on self-integrity restoration motives.

Furthermore, individual differences in distal motivation may explain why people use inconsistency compensation strategies even when inconsistencies do not arouse dissonance, which is one of the dissonance phenomena poorly explained by CDT but that could explain the

unreliable correlation between PD and attitude change (see Harmon-Jones et al., 2009 for a discussion). Specifically, the findings suggest that people may be motivated to compensate for inconsistencies to satisfy distal motives even in the absence of dissonance arousal. A dominant autonomy orientation in the threatened domain seems to motivate people to use behavioural strategies to uphold self-relevant attitudes in order to restore self-integrity, even in the absence of dissonance arousal. By contrast, a dominant control orientation seems to dispose people to use non-behavioural strategies that undermine attitudes when inconsistencies do not arouse dissonance.

### **Limitations and Future Research**

The results imply that individual differences in inconsistency compensation processes may be due to the influence of distal motives on dissonance perception processes. The results provided indirect support for the idea that, when people become aware of their own counter-attitudinal actions, distal autonomous motivation leads them to perceive an authentic self-integrity threat while distal controlled motivation leads them to perceive an ego-invested self-threat. However, there is a need to test these hypotheses directly. Because perception processes are more conducive to manipulation than measurement (Harmon-Jones et al., 2009), a thorough test of this hypothesis requires the use of an experimental dissonance induction paradigm to increase the salience of or direct attention to authentic versus ego-invested self-structures during perception processes. Furthermore, the present research relied on categorical responses to explore the relationship between the quantity and quality of motivation to compensate and the use of inconsistency compensation strategies. Therefore, there is a need to replicate the findings of this research using a reliable and valid multi-dimensional measure of inconsistency compensation strategies, or by observing the use of inconsistency compensation strategies

following the induction of an attitude-behaviour inconsistency. Finally, we did not plan or control for the time lag between the measurement of motivational orientations and the measurement of dissonance constructs in Study 2. However, because the results of Study 2 seemed to agree with those of Study 3, in which there was no measurement time lag, there is no reason to believe that the time lag had any effect on the results.

## **Conclusion**

Inconsistency compensation processes appear guided by two distinct motivational orientations that reside within all individuals and have implications for successful goal pursuit and well-being. Counter-attitudinal actions that conflict with innate action tendencies toward organismic integration motivate people to restore authentic self-integrity, rather than simply to reduce dissonance, following a self-regulation failure. In other words, inconsistency compensation processes guided by the autonomous orientation put people on the path to successful goal pursuit and increased well-being. Counter-attitudinal actions that conflict with acquired action tendencies to approach desirable outcomes and to avoid undesirable outcomes do not necessarily motivate people to compensate following a self-regulation failure, especially when the inconsistency does not arouse dissonance. Put differently, inconsistency compensation processes guided by the controlled orientation are likely to lead to more self-regulation failure and, eventually, may lead to disengagement from self-improvement goals and decreased well-being. In the interest of promoting self-improvement in socially valued life domains, there is a need to promote autonomous motivation and downplay controlled motivation, particularly when people deal with self-regulatory failures in their daily lives.

## References

- Amiot, C. E., Blanchard, C. M., & Gaudreau, P. (2008). The self in change: A longitudinal investigation of coping and self-determination processes. *Self and Identity, 7*, 204–224. doi: 10.1080/15298860701580793
- Anderson, C. (2013). *The integrated system of participation in research (ISPR)*. University of Ottawa, School of Psychology, Ottawa, Ontario, Canada. Retrieved from [http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/value\\_of\\_the\\_ispr\\_11\\_4\\_13.pdf](http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/value_of_the_ispr_11_4_13.pdf)
- Assor, A., Roth, G., & Deci, E. L. (2004). The Emotional Costs of Parents' Conditional Regard: A Self-Determination Theory Analysis. *Journal of Personality, 72*, 47–88. doi: 10.1111/j.0022-3506.2004.00256.x
- Blanchard, C. M., Mask, L., Vallerand, R. J., de la Sablonnière, R., & Provencher, P. (2007). Reciprocal relationships between contextual and situational motivation in a sport setting. *Psychology of Sport and Exercise, 8*, 854–873. doi: 10.1016/j.psychsport.2007.03.004
- 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
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822–848. doi: 10.1037/0022-3514.84.4.822
- Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155–159. doi: 10.1037/0033-2909.112.1.155

- Crocker, J., & Knight, K. M. (2005). Contingencies of self-worth. *Current Directions in Psychological Science, 14*, 200–203. doi: 10.1111/j.0963-7214.2005.00364.x
- Croyle, R. T., & Cooper, J. (1983). Dissonance arousal: Physiological evidence. *Journal of Personality and Social Psychology, 45*, 782–791. doi: 10.1037/0022-3514.45.4.782
- De Witt Huberts, J. C., Evers, C., & De Ridder, D. T. D. (2014). “Because I am worth it” A theoretical framework and empirical review of a justification-based account of self-regulation failure. *Personality and Social Psychology Review, 18*, 119–138. doi: 10.1177/1088868313507533
- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*, 627–668. doi: 10.1037/0033-2909.125.6.627
- Deci, E. L., & Ryan, R. M. (1985a). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.
- Deci, E. L., & Ryan, R. M. (1985b). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*, 109–134. doi: 10.1016/0092-6566(85)90023-6
- Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life’s domains. *Canadian Psychology/Psychologie Canadienne, 49*, 14–23. doi: 10.1037/0708-5591.49.1.14
- Demographics of the research participants of the ISPR. (n.d.). Retrieved August 28, 2014 from [http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/demographics\\_overview\\_of\\_the\\_ispr\\_as\\_of\\_2014.pdf](http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/demographics_overview_of_the_ispr_as_of_2014.pdf)
- Deponte, A. (2004). Linking motivation to personality: Causality orientations, motives and self-

- descriptions. *European Journal of Personality*, *18*, 31–44. doi: 10.1002/per.503
- Devine, P. G., Tauer, J. M., Barron, K. E., Elliot, A. J., & Vance, K. M. (1999). Moving beyond attitude change in the study of dissonance-related processes. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 297–323). Washington, DC: American Psychological Association.
- Elkin, R. A., & Leippe, M. R. (1986). Physiological arousal, dissonance, and attitude change: Evidence for a dissonance-arousal link and a “Don’t remind me” effect. *Journal of Personality and Social Psychology*, *51*, 55–65. doi: 10.1037/0022-3514.51.1.55
- 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*, 382–394. doi: 10.1037/0022-3514.67.3.382
- Faul, F. (2013). G\*Power (Version 3.1.7) [Computer software]. Kiel, Germany: Universität Kiel.
- Fazio, R. H., & Zanna, M. P. (1978). Attitudinal qualities relating to the strength of the attitude-behavior relationship. *Journal of Experimental Social Psychology*, *14*, 398–408. doi: 10.1016/0022-1031(78)90035-5
- Fenigstein, A., Scheier, M. F., & Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology*, *43*, 522–527. doi: 10.1037/h0076760
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, Illinois: Row, Peterson and Company.
- Glasman, L. R., & Albarracín, D. (2006). Forming attitudes that predict future behavior: A meta-analysis of the attitude-behavior relation. *Psychological Bulletin*, *132*, 778–822. doi: 10.1037/0033-2909.132.5.778

- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, 29, 157–166. doi: 10.1037/0008-400X.29.3.157
- Gross, S. J., & Niman, C. M. (1975). Attitude-behavior consistency: A review. *Public Opinion Quarterly*, 39, 358–368. doi: 10.1086/268234
- Guay, F., Mageau, G. A., & Vallerand, R. J. (2003). On the hierarchical structure of self-determined motivation: A test of top-down, bottom-up, reciprocal, and horizontal effects. *Personality and Social Psychology Bulletin*, 29, 992–1004. doi: 10.1177/0146167203253297
- Harmon-Jones, E. (1999). Toward an understanding of the motivation underlying dissonance effects: Is the production of aversive consequences necessary? In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 71–99). Washington, DC: American Psychological Association.
- Harmon-Jones, E. (2000). Cognitive dissonance and experienced negative affect: Evidence that dissonance increases experienced negative affect even in the absence of aversive consequences. *Personality and Social Psychology Bulletin*, 26, 1490–1501. doi: 10.1177/01461672002612004
- 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. *Advances in Experimental Social Psychology*, 41, 119–166. doi: 10.1016/S0065-2601(08)00403-6
- Harmon-Jones, E., & Harmon-Jones, C. (2002). Testing the action-based model of cognitive

dissonance: The effect of action orientation on postdecisional attitudes. *Personality and Social Psychology Bulletin*, *28*, 711–723. doi: 10.1177/0146167202289001

Harmon-Jones, E., & Harmon-Jones, C. (2008). Action-Based Model of Dissonance: A Review of Behavioral, Anterior Cingulate, and Prefrontal Cortical Mechanisms. *Social and Personality Psychology Compass*, *2*, 1518–1538. doi: 10.1111/j.1751-9004.2008.00110.x

Harmon-Jones, E., Harmon-Jones, C., Fearn, M., Sigelman, J., & Johnson, P. (2008). Left frontal cortical activation and spreading of alternatives: Tests of the action-based model of dissonance. *Journal of Personality and Social Psychology*, *94*, 1–15. doi: 10.1037/0022-3514.94.1.1

Harmon-Jones, C., Schmeichel, B. J., Inzlicht, M., & Harmon-Jones, E. (2011). Trait approach motivation relates to dissonance reduction. *Social Psychological and Personality Science*, *2*, 21–28. doi: 10.1177/1948550610379425

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, DC: American Psychological Association.

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). Rochester, NY: University of Rochester Press.

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

- Hodgins, H. S., Yacko, H. A., & Gottlieb, E. (2006). Autonomy and nondefensiveness. *Motivation and Emotion, 30*, 283–293. doi: 10.1007/s11031-006-9036-7
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55. doi: 10.1080/10705519909540118
- Iacobucci, D. (2010). Structural equations modeling: Fit Indices, sample size, and advanced topics. *Journal of Consumer Psychology, 20*, 90–98. doi: 10.1016/j.jcps.2009.09.003
- Jackson, D. L. (2003). Revisiting sample size and number of parameter estimates: Some support for the N:q hypothesis. *Structural Equation Modeling: A Multidisciplinary Journal, 10*, 128–141. doi: 10.1207/S15328007SEM1001\_6
- Julien, É., Guay, F., Sénechal, C., & Poitras, S.-C. (2009). Subjective psychological distress among young adults: The role of global and contextual levels of self-determined motivation. *Hellenic Journal of Psychology, 6*, 145–168. Abstract retrieved from <http://www.pseve.org/journal.asp>
- Kim, M.-S., & Hunter, J. E. (1993). Relationships among attitudes, behavioral intentions, and behavior: A meta-analysis of past research, part 2. *Communication Research, 20*, 331–364. doi: 10.1177/009365093020003001
- Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). New York, NY: Guilford Press.
- Knee, C. R., & Zuckerman, M. (1996). Causality orientations and the disappearance of the self-serving bias. *Journal of Research in Personality, 30*, 76–87. doi: 10.1006/jrpe.1996.0005
- Knee, C. R., & Zuckerman, M. (1998). A nondefensive personality: Autonomy and control as

- moderators of defensive coping and self-handicapping. *Journal of Research in Personality*, 32, 115–130. doi: 10.1006/jrpe.1997.2207
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8, 239–260. doi: 10.1080/13504620220145401
- Krosnick, J. A., Boninger, D. S., Chuang, Y. C., Berent, M. K., & Carnot, C. G. (1993). Attitude strength: One construct or many related constructs? *Journal of Personality and Social Psychology*, 65, 1132–1151. doi: 10.1037/0022-3514.65.6.1132
- 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. doi: 10.1016/j.jenvp.2009.11.002
- Lavigne, G. L., Hauw, N., Vallerand, R. J., Brunel, P., Blanchard, C., Cadorette, I., & Angot, C. (2009). On the dynamic relationships between contextual (or general) and situational (or state) motivation toward exercise and physical activity: A longitudinal test of the top-down and bottom-up hypotheses. *International Journal of Sport and Exercise Psychology*, 7, 147–168. doi: 10.1080/1612197X.2009.9671897
- Lavigne, G. L., & Vallerand, R. J. (2010). The dynamic processes of influence between contextual and situational motivation: A test of the hierarchical model in a science education setting. *Journal of Applied Social Psychology*, 40, 2343–2359. doi : 10.1111/j.1559-1816.2010.00661.x
- 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).

Washington, DC: American Psychological Association.

- Leippe, M. R., & Eisenstadt, D. (2010). Self-persuasion when it matters to self: Attitude importance and dissonance reduction after counterattitudinal advocacy. In M. H. Gonzales, C. Tavis, & J. Aronson (Eds.), *The Scientist and the Humanist: A Festschrift in Honor of Elliot Aronson* (pp. 175–199). New York, NY: Psychology Press.
- Lévesque, C., & Brown, K. W. (2007). Mindfulness as a moderator of the effect of implicit motivational self-concept on day-to-day behavioral motivation. *Motivation and Emotion*, *31*, 284–299. doi: 10.1007/s11031-007-9075-8
- Mask, L., & Blanchard, C. M. (2011). The protective role of general self-determination against “thin ideal” media exposure on women’s body image and eating-related concerns. *Journal of Health Psychology*, *16*, 489. doi: 10.1177/1359105310385367
- Mata, J., Silva, M. N., Vieira, P. N., Carraça, E. V., Andrade, A. M., Coutinho, S. R., ... Teixeira, P. J. (2009). Motivational “spill-over” during weight control: Increased self-determination and exercise intrinsic motivation predict eating self-regulation. *Health Psychology*, *28*, 709–716. doi: 10.1037/a0016764
- McGregor, I., Newby-Clark, I. R., & Zanna, M. P. (1999). “Remembering” dissonance: Simultaneous accessibility of inconsistent cognitive elements moderates epistemic discomfort. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 325–353). Washington, DC: American Psychological Association.
- Michel, S., & Fointiat, V. (2002). Trivialisation versus rationalisation cognitive: Quand l’adhésion à la norme de consistance guide le choix du mode de réduction de la

dissonance. [Trivialization versus cognitive rationalization.]. *Cahiers Internationaux de Psychologie Sociale*, 56, 58–63. Retrieved from <http://www.cairn.info/revue-les-cahiers-internationaux-de-psychologie-sociale.htm>

Muthén, L. K., & Muthén, B. O. (2012). Mplus (Version 7) [Computer software]. Los Angeles, CA: Authors.

O'Connor, B. P., & Vallerand, R. J. (1994). Motivation, self-determination, and person-environment fit as predictors of psychological adjustment among nursing home residents. *Psychology and Aging*, 9, 189–194. doi: 10.1037/0882-7974.9.2.189

Pelletier, L. G., & Dion, S. C. (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, 303–333. doi: 10.1521/jscp.2007.26.3.303

Pelletier, L. G., Dion, S. C., Slovinec-D'Angelo, M., & Reid, R. (2004). Why do you regulate what you eat? Relationships between forms of regulation, eating behaviors, sustained dietary behavior change, and psychological adjustment. *Motivation and Emotion*, 28, 245–277. doi: 10.1023/B:MOEM.0000040154.40922.14

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. doi: 10.1111/j.1559-1816.1999.tb00122.x

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, 145–156. doi: 10.1037/0008-400X.29.3.145

Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The Motivation Toward the Environment Scale (MTES). *Journal of Applied Social Psychology*, 28, 437–468. doi: 10.1111/j.1559-1816.1998.tb01714.x

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

Proulx, T., Inzlicht, M., & Harmon-Jones, E. (2012). Understanding all inconsistency compensation as a palliative response to violated expectations. *Trends in Cognitive Sciences*, 16, 285–291. doi: 10.1016/j.tics.2012.04.002

Rhodes, R. E., & de Bruijn, G.-J. (2013). How big is the physical activity intention–behaviour gap? A meta-analysis using the action control framework. *British Journal of Health Psychology*, 18, 296–309. doi: 10.1111/bjhp.12032

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* (pp. 449–479). New York, NY: Guilford Press.

Satorra, A., & Bentler, P. M. (1994). Corrections to test statistics and standard errors in covariance structure analysis. In A. von Eye & C. C. Clogg (Eds.), *Latent variables analysis: Applications for developmental research* (pp. 399–419). Thousand Oaks,

USA: Sage.

- Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*, 507–514. doi: 10.1007/BF02296192
- Scheier, M. F., & Carver, C. S. (1980). Private and public self-attention, resistance to change, and dissonance reduction. *Journal of Personality and Social Psychology*, *39*, 390–405. doi: 10.1037/0022-3514.39.3.390
- Scheier, M. F., & Carver, C. S. (1985). The Self-Consciousness Scale: A revised version for use with general populations. *Journal of Applied Social Psychology*, *15*, 687–699. doi: 10.1111/j.1559-1816.1985.tb02268.x
- Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology*, *57*, 1–10. doi: 10.1037/a0018082
- Schmitz, C. (2012). LimeSurvey (Version 1.92) [Open source survey tool]. Hamburg, Germany: LimeSurvey Project.
- Sharp, E., Pelletier, L. G., Blanchard, C., & Séguin-Lévesque, C. (2003). The global motivation scale: Its validity and usefulness in predicting success and failure at self-regulation. Poster session presented at the *4th Annual Meeting of the Society for Personality and Social Psychology*, Los Angeles, CA.
- Sheldon, K. M., Ryan, R., & Reis, H. T. (1996). What Makes for a Good Day? Competence and Autonomy in the Day and in the Person. *Personality and Social Psychology Bulletin*, *22*, 1270–1279. doi: 10.1177/01461672962212007
- Simon, L., Greenberg, J., & Brehm, J. (1995). Trivialization: the forgotten mode of dissonance reduction. *Journal of Personality and Social Psychology*, *68*, 247–260. doi:

10.1037/0022-3514.68.2.247

SPSS (Version 21.0) [Computer software]. (2012). Armonk, NY: IBM Corporation.

Starzyk, K. B., Fabrigar, L. R., Soryal, A. S., & Fanning, J. J. (2009). A painful reminder: The role of level and salience of attitude importance in cognitive dissonance. *Personality and Social Psychology Bulletin*, *35*, 126–137. doi: 10.1177/0146167208325613

Stone, J., & Cooper, J. (2001). A Self-Standards Model of Cognitive Dissonance. *Journal of Experimental Social Psychology*, *37*, 228–243. doi: 10.1006/jesp.2000.1446

Tabachnick, B. G., & Fidell, L. S. (2006). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon.

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in experimental social psychology*, *29*, 271–360. doi: 10.1016/S0065-2601(08)60019-2

Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the Motivation Toward the Environment Scale. *Environment and Behavior*, *35*, 486–505. doi: 10.1177/0013916503035004003

Weinstein, N., & Hodgins, H. S. (2009). The moderating role of autonomy and control on the benefits of written emotion expression. *Personality and Social Psychology Bulletin*, *35*, 351–364. doi: 10.1177/0146167208328165

## Footnotes

<sup>1</sup> Participants who were excluded from analyses ( $n = 217$ ) reported similar levels of global motivation and self-consciousness as participants who were included in analyses ( $n = 382$ ; see Table 1), and there were no differences in gender or first language composition across the two groups ( $\alpha = .05$ ).

<sup>2</sup> Compared to participants who were included in analyses ( $n = 282$ ; see Table 3), participants who were excluded from analyses ( $n = 57$ ,  $M = 4.25$ ,  $SD = 1.09$ ) reported weaker pro-environmental attitudes,  $t(337) = -2.55$ ,  $p = .01$ , 95% CI  $[-.68, -.09]$ , Cohen's  $d = .28$ . There were no group differences on scores of global or contextual motivation, self-consciousness, or the relative frequency of CEA, or in gender or first language composition ( $\alpha = .05$ ).

<sup>3</sup> The intended scale was 0 to 21 to allow for frequencies of up to three times per day. However, due to a typo when constructing the survey, the actual scale was 0 to 20. Because we computed a ratio score, we assumed the error had a negligible impact on the reliability of the scores.

<sup>4</sup> We conducted a confirmatory factor analysis specifying the nine PD items as indicators of one latent variable and the four Frequency of Behavioural Inconsistencies in the Environmental Domain scale items as indicators of a second latent variable. Covariance structural modeling procedures were identical to those described in the Study 2 Results section. The path corresponding to one indicator per latent variable was fixed to 1 and uncorrelated residual error terms were specified for each indicator. Because the exact fit hypothesis is often untenable for latent models with large sample sizes ( $N > 200$ ; Kline, 2011), we also evaluated the model's relative fit using the cut-offs proposed by Hu & Bentler (1999). Good relative fit should produce a small root mean square of error approximation statistic ( $RMSEA \leq .06$ ) and upper-limit for the

90% the confidence interval ( $UL \leq .08$ ); a large (i.e., 'close to' .95) comparative fit index (CFI) and Tucker-Lewis index (TLI); and a small standardized root mean square residual (SRMR < .08). The uncorrelated factor model fit reasonably well,  $n = 282$ ,  $\chi^2(65) = 131.09$ ,  $p < .001$ , RMSEA = .06, 90% CI [.05, .08], CFI = .95, TLI = .94, SRMR = .05. The model also fit relatively well without multivariate outliers,  $n = 277$ ,  $\chi^2(65) = 135.33$ ,  $p < .001$ , RMSEA = .06, 90% CI [.05, .08], CFI = .95, TLI = .94, SRMR = .05. All indicators had substantive loadings on their respective factors ( $\lambda \geq .60$ ,  $p < .001$ ) and were reliable ( $R^2 \geq .36$ ,  $p < .001$ ).

<sup>5</sup> Festinger (1957) did not explicitly theorize about the relationship between attitude importance and the incidence of native attitude-behaviour inconsistencies. However, previous research implies that strong attitudes characterized by high confidence (i.e., certainty) and a wide latitude of rejection (i.e., extremity) bolster attitude-behaviour consistency (Fazio & Zanna, 1978). These two attitudinal dimensions are captured by the measure of pro-environmental strength used in this study.

<sup>6</sup> Compared to participants who were included in analyses ( $n = 202$ ; see Table 5), those who were excluded from analyses ( $n = 57$ ,  $M = 0.39$ ,  $SD = .23$ ) reported greater amotivation toward the environment,  $t(253) = 2.37$ ,  $p = .02$ , 95% CI [.01, .16], Cohen's  $d = .30$ . There were no group differences on scores of autonomous or controlled motivation toward the environment or in gender or first language composition ( $\alpha = .05$ ).

<sup>7</sup> We performed a confirmatory factor analysis specifying three correlated latent variables corresponding to the three items of the self-integrity restoration, ego-invested self-protection, and dissonance minimization subscales of the motivation to compensate scale. We used the same covariance structural modeling procedures and fit indices described in the Study 2 Results section and in Footnote 4. Raw scores corresponding to the ego-invested self-protection and

inconsistency minimization subscale items were log-transformed prior to analysis due to positive skewness and multiplied by 5 to rescale the covariance matrix. We fixed the path corresponding to one indicator per latent variable to 1 and specified uncorrelated residual error terms for each indicator. The correlated factor model fit well,  $n = 189$ ,  $\chi^2(24) = 30.14$ ,  $p = .18$ , RMSEA = .04, 90% CI [.00, .07], CFI = .99, TLI = .99, SRMR=.03. The model also fit well without multivariate outliers,  $n = 187$ ,  $\chi^2(24) = 25.29$ ,  $p = .39$ , RMSEA = .02, 90% CI [.00, .06], CFI=1.00, TLI=1.00, SRMR=.03. All indicators had substantive loadings on their respective factors ( $\beta \geq .66$ ,  $p < .001$ ) and were reliable ( $R^2 \geq .44$ ,  $p < .001$ ).

Table 1

*Descriptive Statistics of the Study 1 Variables*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>α</i>	Range		
					Potential	Actual	Skew
Global motivation							
Autonomous	382	4.88	0.88	.62-.85 <sup>a</sup>	1-7	2.3-7.0	-0.17
Controlled	382	4.03	1.09	.75-.79 <sup>a</sup>	1-7	1.0-7.0	-0.11
Amotivation	382	2.92	1.07	.71	1-7	1.0-6.3	0.11
Self-consciousness							
Private	382	1.81	0.49	.71	0-3	0.3-3.0	-0.02
Public	382	1.95	0.58	.80	0-3	0.2-3.0	-0.34
Affect							
Negative	381	4.20	1.24	.82	1-7	1.0-7.0	-0.26
Indifference	379	3.44	1.53		1-7	1-7	0.19
FBI by domain							
Body weight management	382	4.30	1.58		1-7	1-7	-0.14
Economic prosperity	382	4.11	1.52		1-7	1-7	0.05
Racial tolerance	382	3.16	1.62		1-7	1-7	0.44
Environmental protection	382	3.73	1.37		1-7	1-7	0.10

*Note.* FBI = frequency of behavioural inconsistencies.

<sup>a</sup>Range of Cronbach alphas for the composite subscales.

Table 2

*Bivariate and Partial Correlations of the Study 1 Variables*

Variable	1	2	3	4	5	6	7	8	9	10	11
Global motivation											
1. Autonomous	---	.35***	.06	.21***	.05	.02	-.07	-.09 <sup>†</sup>	-.10*	-.14**	.03
2. Controlled		---	.34***	.17**	.40***	.26***	-.09	.15**	.08	.00	.12*
3. Amotivation			---	.02	.15**	.13**	.08	.11*	.03	.01	.13*
Self-consciousness											
4. Private				---	.46***	.18***	-.05	.08	.05	-.03	.05
5. Public					---	.22***	-.07	.15**	.15**	.04	.09 <sup>†</sup>
Affect											
6. Negative	-.09 <sup>†</sup>	.19***	.05	.11 <sup>†</sup>	.06	---	-.43***	.20***	.10 <sup>†</sup>	.04	.05
7. Indifference	-.02	-.10 <sup>†</sup>	.11 <sup>†</sup>	.01	-.05		---	-.05	.00	.05	.04
FBI by domain											
8. Body weight management	-.16**	.10 <sup>†</sup>	.07	.06	.07			---	.27***	.26***	.27***
9. Economic prosperity	-.13*	.06	-.02	.03	.08				---	.22***	.30***
10. Racial tolerance	-.12*	.03	-.01	-.01	.04					---	.20***
11. Environmental protection	-.02	.05	.10 <sup>†</sup>	.02	.02						---

*Note.* Bivariate correlations are shown above the diagonal. Pearson coefficients are presented for the intercorrelations between variables 1 to 6. Spearman Rho coefficients are presented for the correlations between all other pairs of variables. Partial correlations between trait variables (1 to 5) and dissonance variables (6 to 11) controlling for all other trait variables are shown below the diagonal. FBI = frequency of behavioural inconsistencies.

<sup>†</sup>p < .10. \*p < .05. \*\* p < .01. \*\*\* p < .001.

Table 3

*Descriptive Statistics of the Study 2 Variables*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	$\alpha$	Range		
					Potential	Actual	Skew
Global motivation							
Autonomous	280	4.98	0.81	.51-.86 <sup>a</sup>	1-7	2.9-7.0	-0.08
Controlled	280	4.14	1.05	.67-.80 <sup>a</sup>	1-7	1.2-7.0	0.05
Amotivation	280	2.80	1.05	.71	1-7	1.0-5.7	0.18
Contextual motivation							
Autonomous	280	4.33	1.21	.86-.90 <sup>a</sup>	1-7	1.0-7.0	-0.16
Controlled	280	3.28	0.96	.82-.84 <sup>a</sup>	1-7	1.0-5.9	0.11
Amotivation	280	2.47	1.29	.86	1-7	1.0-7.0	1.00
Self-consciousness							
Private	270	1.96	0.58	.78	0-3	0.4-3.0	-0.29
Public	270	2.07	0.60	.79	0-3	0.1-3.0	-0.45
Attitude strength	282	4.64	1.03	.71	1-7	2.1-7.0	-0.01
Relative frequency of CEA	270	0.42	0.18		0-1	.02-.92	0.31
Frequency of inconsistencies	282	4.17	1.27	.77	1-7	1.0-7.0	0.25
Psychological discomfort	268	3.64	1.55	.92	1-7	1.0-7.0	0.13

*Note.* CEA = counter-environmental actions.

<sup>a</sup>Range of Cronbach alphas for the composite subscales.

Table 4

*Intercorrelations, Covariances, and Variances of the Study 2 Variables*

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Global motivation												
1. Autonomous	---	.25***	-.13*	.35***	.09	-.07	.27***	-.08	.15*	.06	-.15*	-.07
2. Controlled	---	---	.29***	.05	.39***	.16**	.11	.28***	.02	.09	.11	.09
3. Amotivation	---	---	---	-.03	.17**	.25***	-.01	.08	-.07	.04	.12*	.03
Contextual motivation												
4. Autonomous	---	---	---	<b>1.55</b>	.36***	-.45***	.08	-.06	.66***	.28***	-.45***	.04
5. Controlled	---	---	---	0.40	<b>0.92</b>	.15*	.02	.15*	.24***	.27***	-.06	.09
6. Amotivation	---	---	---	-0.85	0.20	<b>1.89</b>	-.04	-.01	-.34***	-.09	.40***	.06
Self-consciousness												
7. Private	---	---	---	0.05	0.01	-0.02	<b>0.33</b>	.27***	.04	.13*	.02	.04
8. Public	---	---	---	-0.07	0.09	0.03	0.09	<b>0.37</b>	-.04	.07	.11	.19**
9. Attitude strength	---	---	---	0.85	0.23	-0.49	0.02	-0.03	<b>1.07</b>	.23***	-.46***	-.02
10. Psychological discomfort	---	---	---	0.55	0.39	-0.23	0.11	0.05	0.38	<b>2.41</b>	-.14*	.08
11. Relative frequency of CEA <sup>a</sup>	---	---	---	-0.83	-0.01	0.98	0.03	0.14	-0.54	-0.31	<b>2.01</b>	.07
12. Frequency of inconsistencies	---	---	---	---	---	---	---	---	---	---	---	---

*Note.* Pearson correlation coefficients are above the diagonal. The covariance matrix corresponding to the action-based SDT path analyses is below the diagonal; covariances are below the diagonal and variances are on the diagonal in bolded characters.

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

Table 5

*Descriptive Statistics of the Study 3 Variables*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	<i>α</i>	Range		Skew
					Potential	Actual	
Contextual motivation							
Autonomous	199	4.59	1.36	.89-.90 <sup>a</sup>	1-7	1.4-7.0	-0.37
Controlled	199	3.45	1.01	.79-.86 <sup>a</sup>	1-7	1.0-6.3	-0.28
Amotivation	197	2.35	1.39	.87	1-7	1.0-7.0	1.11
Psychological discomfort	194	3.55	1.43	.90	1-7	1.0-6.4	0.03
Motives to compensate							
Inconsistency minimization	188	2.28	1.34	.81	1-7	1.0-5.7	0.85
Self-integrity restoration	189	3.45	1.74	.84	1-7	1.0-7.0	0.19
Ego-invested self-protection	188	2.00	1.22	.82	1-7	1.0-6.0	1.18
Lack of motives to compensate							
Incompetence	184	2.63	1.76		1-7	1-7	0.77
Indifference	187	3.51	2.04		1-7	1-7	0.18
No specific reason	182	3.65	2.16		1-7	1-7	0.20

<sup>a</sup>Range of Cronbach alphas for the composite subscales.

Table 6

*Intercorrelations, Variances, and Covariances of the Study 3 Variables*

Variables	1	2	3	4	5	6	7	8	9	10
Contextual motivation										
1. Autonomous	<b>1.84</b>	.46***	-.38***	.18*	.28***	.33***	.11	.15*	-.11	-.11
2. Controlled	0.63	<b>1.02</b>	-.01	.32***	.32***	.09	.36***	.33***	.15*	.01
3. Amotivation <sup>a</sup>	---	---	---	.00	.03	-.08	.14	.11	.23**	.19*
4. Psychological discomfort	0.38	0.47	---	<b>2.04</b>	.51***	.28***	.23***	.27***	.00	-.02
Motives to compensate										
5. Dissonance minimization	0.49	0.42	---	0.91	<b>1.47</b>	.50***	.54***	.41***	.18*	-.03
6. Self-integrity restoration	0.80	0.16	---	0.70	1.10	<b>3.02</b>	.42***	.14	-.06	-.28***
7. Ego-invested self-protection <sup>b</sup>	0.18	0.43	---	0.38	0.84	0.84	<b>1.35</b>	.40***	.21**	-.02
Lack of motives to compensate										
8. Incompetence	0.31	0.56	---	0.65	0.85	0.29	0.73	<b>3.12</b>	.27***	.18*
9. Indifference	---	---	---	---	---	---	---	---	---	.23**
10. No specific reason	---	---	---	---	---	---	---	---	---	---

*Note.* Correlations are above the diagonal. The correlations between Variables 1 through 7 are Pearson correlation coefficients and the remaining correlations are Spearman's rho correlation coefficients. The covariance matrix for the path analyses is below the diagonal; covariances are below the diagonal and variances are on the diagonal in bolded characters.

<sup>a</sup>The variable was log-transformed. <sup>b</sup>The variable was square root-transformed and scores were multiplied by 5 to rescale the covariance matrix; the table shows the rescaled variances and covariances.

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

Table 7

*Standardized Path Estimates and 95% Confidence Intervals (CI), and Path Invariance Tests of the Study 3 Combined Path Model of Motives to Compensate*

Path	$\lambda$	95% CI	Chi-Square Difference Tests ( $\Delta\chi^2$ , $df=1$ )							
			2	3	4	5	6	7	8	9
Inconsistency minimization on:										
1 Psychological discomfort	.43***	[.32, .53]	6.19*	1.54	5.44*	---	23.37***	---	1.84	---
2 Autonomous motivation	.18**	[.08, .27]	---	1.54	---	21.03***	---	---	---	---
3 Controlled motivation	.17*	[.06, .29]	---	---	---	---	---	7.55**	---	---
Self-integrity restoration on:										
4 Psychological discomfort	.21**	[.10, .33]	---	---	---	1.38	9.07**	---	0.38	---
5 Autonomous motivation	.34***	[.23, .44]	---	---	---	---	---	---	---	---
Ego-invested self-protection <sup>a</sup> on:										
6 Psychological discomfort	.10	[-.02, .21]	---	---	---	---	---	10.22**	3.94*	---
7 Controlled motivation	.39***	[.29, .48]	---	---	---	---	---	---	---	7.26**
Incompetence non-motives on:										
8 Psychological discomfort	.17*	[.04, .31]	---	---	---	---	---	---	---	1.45
9 Controlled motivation	.27**	[.14, .39]	---	---	---	---	---	---	---	---

<sup>a</sup>The variable was log-transformed.

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

Table 8

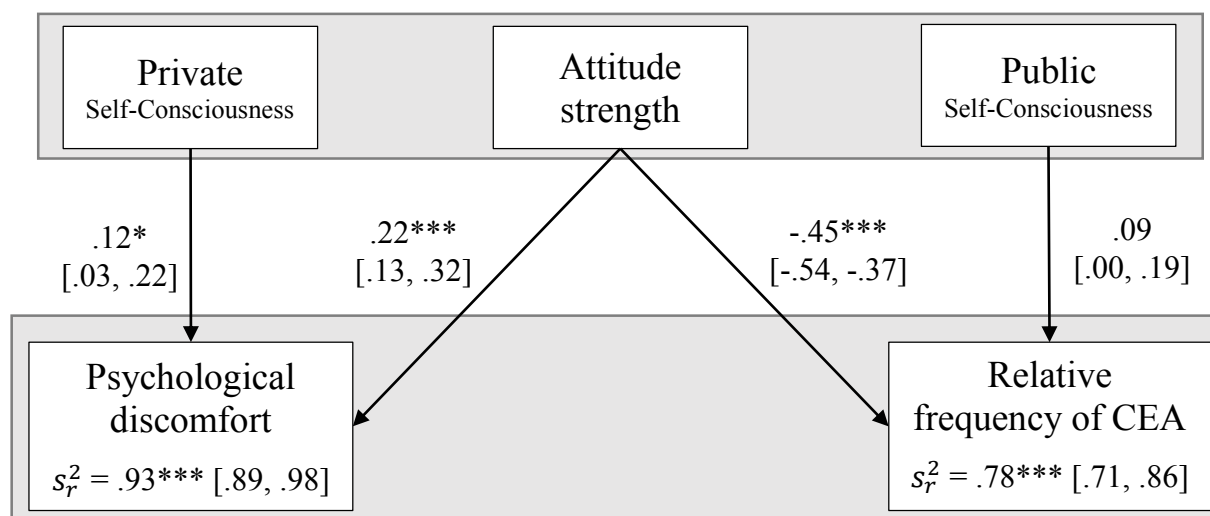
*Post-Hoc Independent Samples t-Tests of the Study 3 Variables by Recalled Compensation Strategy Type*

Variable	Behavioural strategy			Other strategy			<i>t</i>		95% CI		Cohen's <i>d</i>
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	Statistic	<i>p</i>	LL	UL	
Contextual motivation											
Autonomous	73	4.77	1.28	108	4.44	1.36	-1.67	.10	-0.73	0.06	0.25
Controlled	73	3.49	1.08	108	3.41	0.9	-0.49	.63	-0.36	0.22	0.07
Amotivation <sup>a</sup>	73	0.25	0.22	107	0.35	0.25	2.75	.01	0.03	0.17	0.41
Psychological discomfort	73	3.84	1.34	111	3.45	1.44	-1.87	.06	-0.81	0.02	0.28
Motives to compensate											
Dissonance minimization	72	2.26	1.3	109	2.33	1.39	0.38	.71	-0.33	0.48	0.06
Self-integrity restoration	72	3.81	1.66	110	3.16	1.73	-2.54	.01	-1.16	-0.15	0.38
Ego-invested self-protection <sup>b</sup>	72	1.37	0.4	109	1.36	0.41	-0.05	.96	-0.12	0.12	0.01
Lack of motives to compensate											
Incompetence	70	2.43	1.76	108	2.78	1.78	1.28	.20	-0.19	0.89	0.19
Indifference	71	2.97	1.84	109	3.87	2.09	2.95	.004	0.30	1.50	0.44
No specific reason	70	3.20	2.16	105	3.97	2.12	2.34	.02	0.12	1.42	0.36

*Note.* CI = confidence interval. LL = lower limit. UL = upper limit.

<sup>a</sup>The variable was log-transformed. <sup>b</sup>The variable was square root-transformed.

## a) CDT Path Model



## b) Action-Based SDT Model

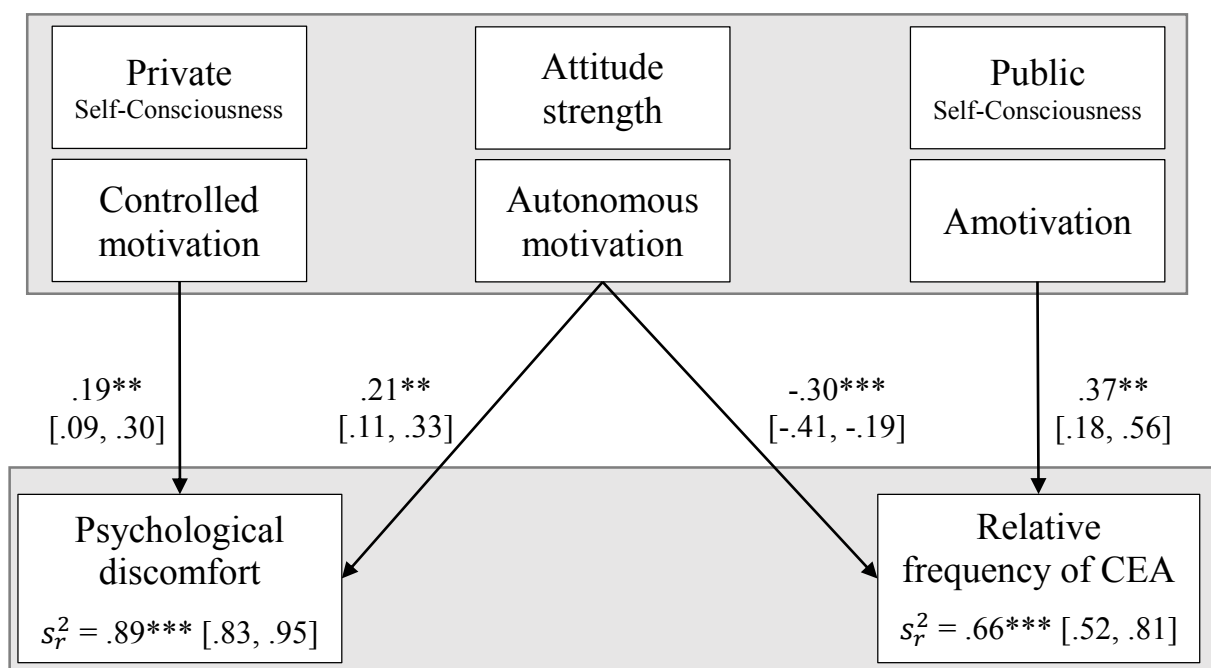
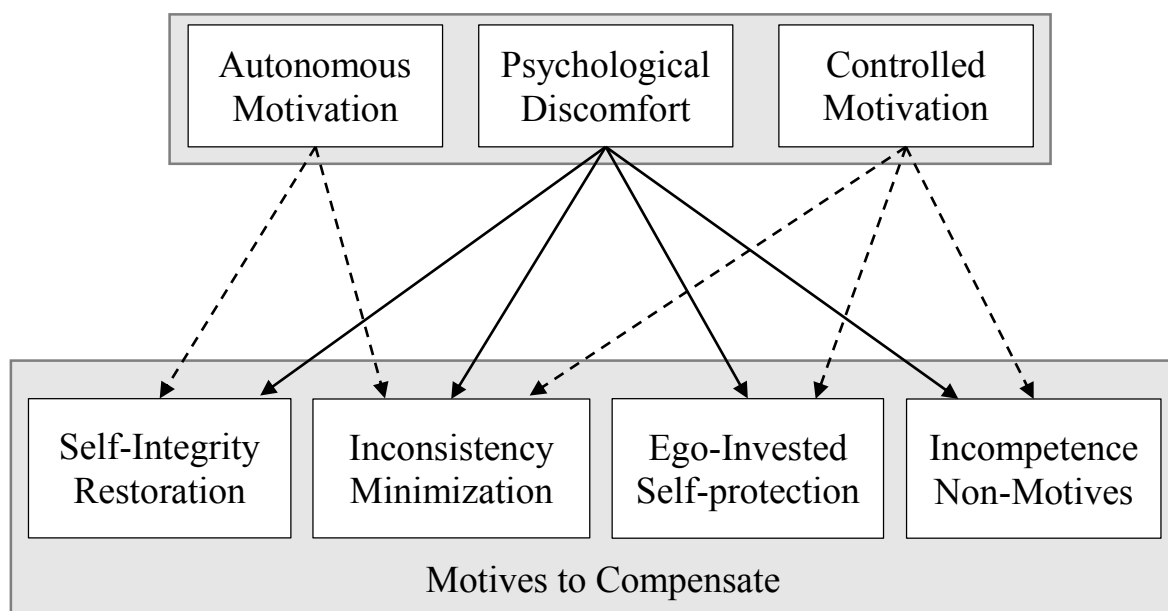


Figure 1. Standardized parameter estimates for the path model analyses of Study 2 ( $N = 282$ ). The top panel (a) shows the path model testing the predictors of dissonance arousal processes proposed by cognitive dissonance theory (CDT). The bottom panel (b) shows the path model testing the predictors of dissonance arousal processes proposed the action-based model and self-determination theory (SDT), controlling for CDT predictors. The figure shows standardized path estimates ( $\lambda$ ), residual variances ( $s_r^2$ ), and 95% confidence intervals (in square brackets). The covariances between all pairs of variables within the shaded boxes were freely estimated. CEA = counter-environmental actions.

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



*Figure 2.* The combined path model of motives to compensate for inconsistencies in the environmental domain of Study 3. The solid arrows represent the hypothesized positive effects of psychological discomfort on motives to compensate predicted by cognitive dissonance theory. The broken arrows represent the hypothesized positive effects of contextual motivational orientations toward the environment on motives to compensate predicted by the action-based model and self-determination theory. The covariances between all pairs of variables within the shaded boxes were freely estimated.

Running head: INDIVIDUAL DIFFERENCES IN INCONSISTENCY COMPENSATION

Individual Differences in Distal Motivation and the Choice of Strategy to Compensate for  
Environmental Attitude-Behaviour Inconsistencies

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### Abstract

The proposed hierarchical action-based model of inconsistency compensation in the environmental domain suggests mechanisms to explain how people deal with inconsistencies between their pro-environmental attitudes and their counter-environmental actions. Using the action-based model and self-determination theory, we suggest that people use one of two types of inconsistency compensation strategies—behaviour modification (BM) or cognitive restructuring (CR)—depending on the distal motives, autonomous or controlled, guiding these processes. BM strategies consist of reversing or offsetting the impact of counter-environmental actions. CR strategies consist of trivializing pro-environmental attitudes or rationalizing counter-environmental actions. Exploratory (Study 1  $N = 429$ ) and confirmatory (Study 2  $N = 257$ ) factor analyses, and multi-sample path analyses (Study 3  $N = 301 + 248$ ) supported the proposed model. The results supported the functional significance distinction between BM strategies that facilitate organismic integration and the reduction of dissonance, and CR strategies that impede organismic integration but facilitate the avoidance of non self-threatening inconsistencies. As expected, distal autonomous motives disposed people to use BM and to avoid CR strategies to reduce dissonance and to compensate for counter-environmental actions. Distal controlled motives disposed people to use BM strategies to reduce dissonance, presumably to avoid aversive consequences (e.g., disapproval), but to use CR strategies to minimize non-threatening inconsistencies. The authors discuss the theoretical and practical implications of their findings.

## **Individual Differences in Distal Motivation and the Choice of Strategy to Compensate for Environmental Attitude-Behaviour Inconsistencies**

Canadians are increasingly concerned about the environment (Institute for Social Research, 2007, 2009) but continue to engage in environmentally harmful behaviour at alarming rates. For example, Canadians continue to drive to work despite having access to public transit (Statistics Canada, 2008), to consume large amounts of fresh water resources despite increased water conservation incentives and technologies (Environment Canada, 2011), and to fill landfills and incinerators with waste despite improvements in diversion programs, such as recycling and composting (Statistics Canada, 2012). These trends suggest there is a significant belief-action gap between Canadians' concern for the environment and their day-to-day behaviour (Kollmuss & Agyeman, 2002), which implies that Canadians are likely to act against their own pro-environmental attitudes frequently in their daily lives. This inconsistency is troubling, because the choice of strategy to deal with inconsistencies has implications for environmental protection efforts. For example, resolving the inconsistency by changing or compensating for the harmful action should bolster pro-environmental attitudes and behaviour. Conversely, resolving the inconsistency by deprecating pro-environmental attitudes or justifying harmful actions should reinforce counter-environmental behaviour. Therefore, there is a need to understand the motivational mechanisms that underlie inconsistency compensation processes and contribute to the environmental belief-action gap.

### **Inconsistency Compensation Processes**

According to inconsistency compensation theories, such as cognitive dissonance theory (CDT; Festinger, 1957; Proulx, Inzlicht, & Harmon-Jones, 2012), when people hold two conflicting or dissonant cognitions simultaneously, an aversive intrapersonal state of cognitive

dissonance is aroused. In turn, the aroused psychological discomfort motivates people to compensate for the inconsistency. In line with CDT, recent research has shown that native attitude-behaviour inconsistencies encountered spontaneously in important life domains, including the environmental domain, arouse psychological discomfort and motivate people to compensate (Lavergne & Pelletier, 2015). However, there is a need to understand how people who are motivated to compensate for native inconsistencies in the environmental domain will actually resolve them, because the choice of inconsistency compensation strategy is likely to influence their future behaviour and has implications for the magnitude of the environmental belief-action gap.

**Typology of compensation strategies.** CDT distinguishes between two approaches, direct versus indirect, to compensate for cognitive inconsistencies and reduce dissonance (Festinger, 1957; Leippe & Eisenstadt, 1999). The direct approach consists of categorically changing or eliminating one of the dissonant cognitions directly responsible for the inconsistency. That means reversing the initial attitude position, called attitude change, or eliminating the *physical trace* of the behaviour, called behaviour change. For example, a person who believes that recycling is an effective means to achieve important environmental protection goals but places a recyclable plastic bottle in a waste bin should perceive an inconsistency and be motivated to compensate for it. The person could directly eliminate the inconsistency by adopting the attitude that recycling is not an effective means to protect the environment or by returning to recycle the bottle after the fact.

The indirect approach to inconsistency compensation consists of distorting or restructuring cognitions that are not directly responsible for the inconsistency using selective elaboration strategies. Selective elaboration consists of either removing or minimizing the

importance of related dissonant cognitions, or adding or maximizing the importance of related consonant cognitions involved in the dissonance ratio. The dissonance ratio refers to the total number and relative importance of dissonant cognitions relative to the total number and relative importance of all related dissonant and consonant cognitions elicited by an inconsistency (Leippe & Eisenstadt, 1999). The most often-studied indirect compensation strategies are (a) trivialization, which consists of minimizing the importance of the domain or related cognitions; (b) rationalization, which involves justifying the behavioural transgression; and (c) behaviour modification, which consists of enacting a compensatory pro-attitudinal action (Leippe & Eisenstadt, 1999). Returning to our previous example, the person who is motivated to compensate for her recycling transgression could do so by minimizing the perceived importance of environmental protection, maximizing the importance of information that denies the environmental benefits of recycling, or contacting the waste managers to request the installation of a recycling bin.

According to CDT, the use and choice of compensation strategy depends on both the magnitude of dissonance (the quantity of motivation to compensate) and the degree of resistance to change of the cognitions involved in the dissonance ratio.

**Choice of compensation strategies.** Compensation strategies, including passive forgetting (i.e., inaction), attitude change, trivialization, rationalization, and behaviour change (listed in order), presumably lie on a continuum of elaboration (Leippe & Eisenstadt, 1999). According to CDT, people should be motivated to use increasingly more elaborate and effortful strategies as the magnitude of dissonance increases (Festinger, 1957). However, because CDT does not clearly elucidate why cognitive inconsistencies arouse dissonance, or why dissonance motivates people to compensate, there is little direct evidence that the magnitude of dissonance

directly relates to the choice of inconsistency compensation strategy (Harmon-Jones, 1999; Harmon-Jones, Amodio, & Harmon-Jones, 2009). In fact, research shows that the correlation between levels of dissonance arousal and subsequent attitude change is unreliable across studies (c.f., Croyle & Cooper, 1993; Elkin & Leippe, 1986; Elliot & Devine, 1994; Harmon-Jones, 2000; Harmon-Jones, Brehm, Greenberg, Simon, & Nelson, 1996; Losch & Cacioppo, 1990). CDT (Festinger, 1957) suggests that this lack of supporting evidence could be due to differences in the relative resistance to change of the cognitions involved in the dissonance ratio.

According to Festinger (1957), when cognitive inconsistencies motivate people to compensate, people should change the cognition in the dissonance ratio that is least resistant to change. Cognitions are resistant to change when they are personally important, when changing them leads to pain or loss, when the person does not have the resources to change them, or when they are otherwise satisfying or irreversible. For example, increasing the salience (resistance to change) of important attitudes before inducing an attitude-behaviour inconsistency leads to less attitude change when no other strategy is available, and to greater rationalization than trivialization when people have a choice between the two strategies (Simon, Greenberg, & Brehm, 1995; Starzyk, Fabrigar, Soryal, & Fanning, 2009). Furthermore, “[t]o the extent that the element [i.e., cognition] is consonant with a large number of other elements and to the extent that changing it would replace these consonances by dissonances, the element will be resistant to change” (Festinger, 1957, p. 27). In line with this hypothesis, McConnell and Brown (2010) demonstrated that, when given the opportunity to change their attitudes following a dissonance induction between a publicly advocated attitude and awareness of recent counter-attitudinal actions, people with high levels of self-complexity (i.e., a greater number of meaningful self-aspects comprised of relatively unique attributes) bolstered their initial attitudes. By contrast,

people with low levels of self-complexity undermined their initial attitudes. This research suggests that individual differences in the importance or self-relevance of endorsed attitudes and of behavioural transgressions moderate dissonance reduction processes.

However, because most research on individual differences in dissonance processes have used paradigms that limit the availability of compensation strategies to one or two predetermined strategies, it is unclear which strategy people are likely to choose when all compensation strategies are potentially available (McGregor, Newby-Clark, & Zanna, 1999). In other words, findings based on dissonance induction paradigms are not likely to generalize to dissonance processes in response to spontaneous native inconsistencies. Furthermore, the tendency to study different compensation strategies in isolation suggests that the conceptual distinctions between direct and indirect compensation strategies may be a methodological artifact. In fact, most CDT research that uses ‘attitude change’ as the dependent variable reports a weakening of attitudes (i.e., less extreme attitude position) rather than a reversal of attitude position (see Leippe & Eisenstadt, 2010 for a review), which is a strategy similar to trivialization. Likewise, research that relies on ‘behaviour change’ outcomes usually reports differences in intentions to enact or in the enactment of a new pro-attitudinal action (see Stone & Fernandez, 2008 for a review), which is a strategy similar to behaviour modification. Therefore, CDT does not clearly elucidate how individual differences will affect the choice of strategy to compensate for native attitude-behaviour inconsistencies encountered outside the laboratory. CDT lacks predictive power, in part, because it does not explain why cognitive inconsistencies arouse dissonance, or why dissonance motivates people to compensate (Devine, Tauer, Barron, Elliot, & Vance, 1999; Harmon-Jones et al., 2009).

## **Motivation to Compensate**

To address the shortcomings of CDT, Harmon-Jones and colleagues have developed the action-based model of dissonance (Harmon-Jones, 1999; Harmon-Jones et al., 2009). This model rests on the assumption that dissonance is aroused when two cognitions activate conflicting action tendencies (e.g., goals, needs, behavioural commitments), because the conflict threatens effective and unconflicted action. In other words, the perceived inconsistency arouses dissonance, which determines the quantity of motivation to compensate, whereas the dominant action tendencies prime distal motives for effective and unconflicted action, which determine the quality of motivation to compensate. Based on this model, Lavergne and Pelletier (2015) have demonstrated that native inconsistencies across and within important life domains arouse dissonance and motivate people to compensate. However, they found notable differences in the quality of motivation to compensate for native inconsistencies as a function of individual differences in distal motives for effective and unconflicted action. Furthermore, there was some evidence that these differences relate to the choice of inconsistency compensation strategies.

In accordance with self-determination theory (Deci & Ryan, 2008), Lavergne and Pelletier (2015) operationalized distal motives for effective and unconflicted action as individual differences in the manifestation of the autonomous and controlled causality orientations, more specifically as differences in the internal and external perceived loci of causality of behaviour (Deci & Ryan, 1985). The autonomous causality orientation describes the innate action tendency to orient toward and interact with the social environment to satisfy basic needs, specifically the needs to feel autonomous, competent, and closely connected to others. This orientation promotes authentic self-regulation and self-determined behaviour with an internal perceived locus of causality, which facilitates organismic integration—the coherence and consistence of self-

structures (e.g., values, needs, goals, motives) across important life domains (Deci & Ryan, 1985; Pelletier & Dion, 2007; Pelletier, Dion, Slovinec-D'Angelo, & Reid, 2004; Sharp, Pelletier, Blanchard, & Séguin-Lévesque, 2003; Sheldon, Ryan, & Reis, 1996). The controlled causality orientation is the socially acquired action tendency to orient toward and interact with the social environment in order to obtain desirable instrumental outcomes. Consequently, this orientation promotes contingent regulation and non self-determined behaviour with an external perceived locus of causality, which impedes organismic integration (Deci & Ryan, 1985; Pelletier & Dion, 2007; Pelletier et al., 2004; Sharp et al., 2003). The findings of Lavergne and Pelletier (2015) suggest that measuring individual differences in the perceived locus of causality for pro-environmental behaviour via the Motivation Toward the Environment Scale (Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998) is a valid way to operationalize distal motives for effective and unconflicted action in the environmental domain.

**Autonomous motivation to compensate.** The manifestation of the autonomous causality orientation in the environmental domain disposes people to regulate pro-environmental behaviour because environmental protection is personally important or integrated within the self, or because the behaviour is inherently satisfying (Pelletier et al., 1998). In other words, individual differences in autonomous motivation toward the environment reflect the self-relevance of pro-environmental attitudes and behaviour. Autonomous motivation is reliably associated with strong pro-environmental attitudes, and with numerous, frequent, and persistent pro-environmental behaviours (Green-Demers, Pelletier, & Ménard, 1997; Lavergne, Sharp, Pelletier, & Holtby, 2010; Pelletier, Green-Demers, & Béland, 1997; Pelletier, Tuson, Green-Demers, Noels, & Beaton, 1998). Lavergne and Pelletier (2015) found that autonomous motivation is associated with infrequent native inconsistencies across and within important life

domains. In the environmental domain, autonomous motivation facilitates dissonance arousal following a native inconsistency and motivates people to compensate for the inconsistency to reduce dissonance and to restore self-integrity. There was also some evidence that autonomous motivation toward the environment and self-integrity restoration motives were associated with a preference for behavioural versus non-behavioural compensation strategies. Presumably, authentic behaviour change is the only strategy that has the potential to satisfy organismic integration action tendencies (Hodgins & Knee, 2002).

**Controlled motivation to compensate.** The manifestation of the controlled causality orientation in the environmental domain disposes people to regulate pro-environmental behaviour because the behaviour facilitates desirable outcomes, such as monetary rewards or praise, or the avoidance of undesirable outcomes, such as criticism or guilt (Pelletier et al., 1998). In other words, individual differences in controlled motivation toward the environment reflect the instrumental value of pro-environmental behaviour. Controlled motivation is not reliably associated with pro-environmental attitudes and behavioural engagement (Green-Demers et al., 1997; Lavergne et al., 2010; Pelletier et al., 1997, 1998), which is consistent with the assumption that it promotes contingent regulation. Lavergne and Pelletier (2015) found that controlled motivation predicted frequent native inconsistencies across life domains and within the environmental domain, facilitated dissonance arousal in response to native inconsistencies, and motivated people to compensate for native inconsistencies in the environmental domain to reduce dissonance and to protect ego-invested self-structures (e.g., self-worth contingent on the approval of others; Hodgins, 2008). However, Lavergne and Pelletier (2015) also found evidence that controlled motivation fosters a lack of motivation to compensate, specifically indifference, when dissonance is not aroused. Presumably, dissonance is aroused when attitude-behaviour

inconsistencies are public (i.e., may be seen by important others), because public counter-environmental actions engender negative social evaluative reactions that threaten ego-invested self-structures (Crocker & Knight, 2005; Hodgins, 2008). Distinguishing between threatening (public) and non-threatening (private) inconsistencies is important because ego-invested self-protection motives to compensate seemed unrelated to strategic preferences, whereas indifference seemed related with a preference for non-behavioural compensation strategies (Lavergne & Pelletier, 2015).

The research by Lavergne and Pelletier (2015) provides preliminary evidence that individual differences in distal motives for effective and unconflicted action may underlie the choice of strategy to compensate for native inconsistencies within the environmental domain. Therefore, the goal of the present research is to test the hypothesis that individual differences in autonomous and controlled motivation toward the environment predict differences in the choice of strategies to compensate for native inconsistencies in the environmental domain.

### **Hierarchical Action-Based Model of Inconsistency Compensation in the Environmental Domain**

We drew from the action-based model (Harmon-Jones et al., 2009) and self-determination theory (Deci & Ryan, 2008) to propose the hierarchical action-based model of inconsistency compensation in the environmental domain (HABICE). Specifically, we elaborated testable hypotheses about individual differences in inconsistency compensation processes as a function of individual differences in levels of autonomous and controlled motivation toward the environment.

**Autonomous compensation processes.** The literature reviewed herein suggests that, when people are motivated to compensate for native inconsistencies to facilitate organismic

integration, only behaviour change strategies that uphold authentic pro-environmental attitudes have the potential to satisfy these motives. Using any other strategy (e.g., attitude change, trivialization, or rationalization) would exacerbate rather than alleviate the perceived authentic self-integrity threat. In other words, autonomous motivation toward the environment should increase the resistance to change of pro-environmental attitudes relative to counter-environmental actions. In agreement with this reasoning, we hypothesized that inconsistency compensation processes guided by autonomous motivation toward the environment should lead people to change or to compensate for counter-environmental actions by bringing their behaviour in line with their pre-existing attitudes, and to avoid using cognitive restructuring strategies. Authentic behaviour change should both reduce the dissonance aroused by the perceived authentic self-integrity threat and satisfy motives to restore self-integrity. These predictions imply a functionally significant distinction between compensation strategies that facilitate versus impede organismic integration (Deci & Ryan, 1987).

**Controlled compensation processes.** When people are motivated to compensate for native inconsistencies to avoid the negative consequences of their counter-environmental actions, any compensation strategy is likely to satisfy distal motives when the action is private and has a low probability of engendering negative social evaluative reactions. This is because changing or restructuring inauthentic pro-environmental attitudes has no negative consequences for the self (Ryan & Deci, 2004). In addition, the counter-environmental action may satisfy more important or pressing needs or motives that increase its resistance to change relative to pro-environmental attitudes (Festinger, 1957). Therefore, when people do not feel pressured to change their behaviour (i.e., dissonance is not aroused), controlled motivation toward the environment should dispose them to use cognitive restructuring strategies that require less effort to implement.

However, when the counter-environmental action is public and has a high probability of engendering negative social evaluative reactions, the inconsistency should represent a potent threat to ego-invested self-structures and arouse dissonance. Under these conditions, the aroused dissonance should pressure people to change their behaviour, because behaviour change is the only strategy with the potential to minimize negative or to engender positive social evaluative reactions and to alleviate the perceived ego-invested self-threat. These results imply a functionally significant distinction between compensation strategies that facilitate the avoidance of public versus private threats to ego-invested self-structures.

**Consequences of compensation processes.** In agreement with the action-based model (Harmon-Jones et al., 2009) and self-determination theory (Deci & Ryan, 1985; 1987; 2008), we suggest that the use of compensation strategies will depend on the reasons why people are motivated to compensate for the inconsistency or, more specifically, the functional significance of inconsistency compensation strategies. Assuming that the functional significance hypothesis is valid, differences in the use of compensation strategies for autonomous versus controlled reasons could explain observed differences in the frequency of native inconsistencies (Lavergne & Pelletier, 2015). Overall, reversing the impact of past counter-environmental actions or enacting new pro-attitudinal actions to compensate for those actions should predict less frequent counter-environmental actions on a day-to-day basis. By contrast, changing or weakening the dissonant attitude, trivializing related pro-environmental attitudes, or rationalizing the counter-environmental action should dispose people to engage more frequently in counter-environmental actions on a day-to-day basis (Tiller & Fazio, 1982). Therefore, autonomous motivation toward the environment should predict infrequent native inconsistencies, in part because it fosters authentic behaviour change to facilitate organismic integration and increases the resistance to

change of pro-environmental attitudes. By contrast, controlled motivation toward the environment should predict frequent native inconsistencies, because it promotes inauthentic behaviour change to reduce dissonance and increases the resistance to change of counter-environmental actions that do not engender negative consequences.

### **Present Research**

The goal of this research was to test predictions about the effect of individual differences in autonomous and controlled motivation toward the environment on the choice of inconsistency compensation strategies proposed by the HABICE. A secondary objective was to test the assumption that accounting for individual differences in distal motivation increases the predictive power of CDT because they clarify why people are motivated to compensate for attitude-behaviour inconsistencies. We tested the functional significance distinction between behavioural strategies that facilitate organismic integration and the reduction of dissonance, and cognitive strategies that impede organismic integration but minimize non self-threatening inconsistencies by way of exploratory (Study 1) and confirmatory (Study 2) factor analyses, and via correlation analyses with conceptually related constructs. We used multi-sample path analyses (Study 3) to test hypothesized differences between the autonomous and the controlled compensation processes proposed by the HABICE (see the previous section), and to assess the generalizability of the model to the Canadian population.

### **General Method**

The samples of undergraduate students for Studies 1 through 3 were recruited via the Integrated System of Participation in Research (ISPR). The ISPR is a voluntary participant pool used to recruit introductory psychology students to participate in research studies in exchange for course credit (up to maximum of 4% of the final grade). Typically, the mean age of ISPR

samples is 19.5 years ( $SD = 4.0$ ) and about three-quarters of the participants are female (73%; (“Demographics of the research participants,” n.d.). In terms of first language learned, the majority of participants report English (60%), about a quarter report French (23%), and the remaining participants report another language (17%). On average, about 15% of students are from psychology programs. The remaining participants are from other programs offered by the faculty of social sciences (16%), or from programs offered by the faculties of health sciences (24%), sciences (18%), arts (8%), or other programs and faculties (20%). Approximately 3,500 students enrol in the ISPR every year (Anderson, 2013).

### **Study 1**

The goal of the first study was to develop a self-report instrument to assess the strategies used to compensate for a recent counter-environmental action. The scale assessed attitude change, trivialization, rationalization, behaviour modification, and behaviour change strategies, all of which are theoretically distinct strategies that fall along a continuum of increasing selective elaboration (Leippe & Eisenstadt, 1999). However, this conceptual distinction does not account the fact that, in practice, attitude change and trivialization, and behaviour modification and behaviour change are often confounded. Moreover, people do not usually have free choice among all strategies. As a competing model, the HABICE supports a distinction between two types of compensation strategies: behavioural strategies that reduce dissonance and facilitate organismic integration versus cognitive strategies that impede organismic integration but facilitate the avoidance of non-threatening inconsistencies. We used exploratory factor analysis (EFA) to identify the number and type of practically significant compensation strategies people use to compensate for native inconsistencies. We expected a minimum of two up to a maximum of four distinct categories of strategies based on the competing theories.

## Method

**Participants.** In total, 638 undergraduate students completed the survey. However, 209 (32.8%) participants did not complete the Recall of a Recent Counter-Attitudinal Action scale (see the scale description below) or did not describe a counter-environmental action. Because the planned analyses concern the Inconsistency Compensation Strategies scale, which is predicated on the recall of a counter-environmental action, these participants were excluded from analyses.<sup>1</sup> The effective sample size ( $N = 429$ ) was adequate for the purposes of EFA (Thompson, 2004). The mean age of the sample was 19.6 years (range: 16 – 43 years); seven participants (1.1%) declined to answer. The majority of the sample was female ( $n = 451$ , 70.7%); one participant (0.2%) did not report his or her gender. In terms of first language learned, 286 participants (44.8%) reported English, 209 (32.8%) reported French, and 130 (20.4%) reported another language. Thirteen participants (2.0%) did not report their first language.

**Procedure.** The ISPR mass prescreening survey, which is a tool used to obtain baseline measurements and to select participants who meet inclusion criteria, featured the measurement scales used for the present study. Participants provided informed consent and received one research credit for their participation. They completed the following scales (with the English and French versions of the instructions and items shown side-by-side) in order.

***Motivation Toward the Environment scale.*** The Motivation Toward the Environment scale (MTES; Pelletier et al., 1998) consists of 24 items that answer the question “Why are you doing things for the environment?” The scale consists of six four-item subscales corresponding to the six regulation styles proposed by self-determination theory. The subscales measure levels of 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 non-regulation (i.e., amotivation; e.g., “I don’t really know; I can’t see what I’m getting out of it.”). Items featured a 7-point Likert scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*). Autonomous motivation scores were mean composite scores of the intrinsic, integration, and identification subscales. Controlled motivation scores were mean composite scores of the introjection and external regulation subscales. Amotivation scores were mean composite scores of the non-regulation subscale. The reliability and validity of the six subscales of the Motivation Toward the Environment scale is supported by confirmatory factor analyses (Pelletier et al., 1998). The subscales have shown satisfactory levels of internal consistency, test-retest reliability over multiple time points measured at 3- to 5-week intervals, and construct validity when correlated with related psychological and environmental constructs (Pelletier et al., 1998; Villacorta, Koestner, & Lokes, 2003). The scale’s convergent validity relative to peer reports of environmental self-regulation and discriminant validity relative to self-reports of behavioural regulation in the academic and political domains has also received empirical support (Villacorta et al., 2003).

***Recall of a Recent Counter-Attitudinal Action scale (General Appendix K).*** Participants recalled and described a recent counter-attitudinal action in the environmental domain via a single item scale. Specifically, participants provided an open-ended answer to the following instructions: “Please briefly describe a specific example when you became aware that you acted inconsistently with your own attitudes, beliefs, and goals about environmental sustainability either immediately or shortly after the inconsistency took place.”

***Negative Affect scale (General Appendix L).*** Participants reported how they felt following the recalled inconsistent action using a six-item scale. Specifically, participants responded to items completing the statement “When I became aware that I acted inconsistently with my own personal beliefs and/or goals about environmental sustainability (please refer to the example cited above), I felt...” on a 7-point Likert scale (1 *do not agree* to 7 *completely agree*). The items consisted of adjectives describing negative emotions (e.g., “guilty”). We computed composite scores of negative affect by taking the mean of the six items. The scale was to help participants recall the emotional state of dissonance they may have experienced following the recalled transgression.

***Inconsistency Compensation Strategies scale (General Appendix M).*** An 18-item scale assessed the compensation strategies people used to deal with the recalled transgression at the time it occurred. The items completed the statement “When I became aware that I acted inconsistently with my own personal beliefs and/or goals about environmental sustainability (please refer to the example cited above), I reacted by...” Responses were measured on a 7-point Likert scale (1 *do not agree*, 7 *completely agree*). The items (see Table 1) represented typical compensation strategies studied by dissonance researchers (based on Leippe & Eisenstadt, 1999). Three social psychologists familiar with CDT reviewed the items. The scale assessed attitude change or trivialization (5 items; e.g., “Concluding that environmental sustainability is not a priority for me.”), rationalization (6 items; e.g., “Thinking it doesn't really matter since most people act the same way.”), and behaviour modification or change (4 items; e.g., “Immediately correcting the inconsistent action (ex: repeating the action in a more sustainable fashion.”). It also assessed inaction or passive forgetting (3 items; e.g., “Putting the inconsistency out of my mind.”) as a validity check.

## Data Analysis

We screened for violations of statistical assumptions and conducted the planned EFA in SPSS (2012). The goal of the EFA was to reduce the number of dimensions and of variables to obtain a reliable factor structure. We determined the number of factors to extract via a parallel analysis; parallel analysis rests on the assumption that true factors based on the real data should have larger eigenvalues than parallel factors derived from random data (Hayton, Allen, & Scarpello, 2004). This technique consists of applying the same EFA to both the real data and the randomly generated data sets containing the same number of variables and cases as the real data. Hayton and colleagues (2004) recommend analyzing 50 random data sets and comparing the eigenvalues based on the real data to the mean eigenvalues obtained from the random data via a scree plot. After determining the number of factors to extract, we removed unreliable variables one at a time to obtain a reliable factor structure. Unreliable variables were those with no large factor loadings across factors ( $< .50$ ) or with moderate to large factor loadings on more than one factor ( $\geq .32$ ). The criteria for a reliable factor structure were as follows (Thompson, 2004): (1) Each factor had to have at least four 'pure' variables with a large factor loading ( $\geq .50$ ) on one factor and a small factor loading on the other factor or factors ( $< .32$ ). (2) Each factor also had to have at least two 'anchor' variables with very large factor loadings ( $> .65$ ). (3) The factor solution had to explain at least 30% of the variance in individual variables (i.e., extraction communalities  $\geq .30$ ). (4) Finally, the factor solution had to explain at least 50% of the total initial variance in the set of variables and produce fewer than 10% large residual correlations ( $r > .10$ ).

## Results

**Exploratory factor analysis.** See Table 1 for the descriptive statistics of the 18 scale

items<sup>2</sup> (see Appendix A for the correlation matrix). Because the variables had few missing values (< 5%) we used listwise deletion (Tabachnick & Fidell, 2006), which yielded a sample size of 407 participants (94.9%) for the EFA. The resulting case-to-variable ratio of 23:1 was adequate (Thompson, 2004). Large Mahalanobis distances ( $\alpha = .001$ ) for the set of 18 items revealed 19 multivariate outliers (4.7%). Therefore, we conducted the EFA with and without multivariate outliers to assess their impact on the solution. A dry-run using the principal axis factoring (PAF) extraction method indicated that the assumptions of EFA were tenable (Thompson, 2004). The dry-run yielded three factors with eigenvalues greater than 1. However, the parallel analysis only supported two factors (see Appendix B). The factor correlation was small ( $r = -.05$ ); therefore, we used an orthogonal (e.g., Varimax) rotation to extract two factors (Thompson, 2004).

The EFA yielded the same pattern of results with and without outliers, with only slight variations in the magnitude of the factor loadings. The results for the initial EFA (including outliers) are in Table 2. The first factor correlated with trivialization and rationalization items. The second factor correlated with behaviour modification and behaviour change items. Non-compensation items 1 and 3 correlated negatively with the second factor and had positive cross-loadings of smaller magnitude on the first factor. We removed nine unreliable variables, including the non-compensation items, from the analysis in turn. The results of the final EFA were nearly identical for the analyses conducted with and without multivariate outliers. See Table 2 for the results for the analysis including outliers. The final two-factor solution comprised nine variables, explained 55.9% of the total initial variance, and explained at least 31.8% of the variance in the individual variables. In addition, the factor solution was consistent with the functional significance distinction between cognitive restructuring (CR) and behaviour modification (BM) strategies proposed by self-determination theory.

**Correlation analyses.** The five items corresponding to the CR strategies factor and the four items corresponding to the BM strategies factor were internally consistent (see Table 3). Therefore, we computed mean composite scores. See Table 3 for the descriptive statistics and intercorrelations of the five composite variables.<sup>3</sup> In line with previous research (Lavergne & Pelletier, 2015), autonomous and controlled motivation toward the environment showed a positive correlation with negative affect. The use of CR strategies showed a negative correlation with autonomous motivation and a positive correlation with controlled motivation, as expected. However, it had a negative relationship with psychological discomfort, which is inconsistent with CDT, and with the use of BM strategies. We observed positive correlations between the use of BM strategies and autonomous and controlled motivation toward the environment, and psychological discomfort. A pattern more consistent with hypotheses emerged when we correlated CR and BM strategies with each covariate, controlling for the other two covariates. The use of CR strategies showed the same pattern of relationships with the three covariates as before, but its negative correlation with psychological discomfort was no longer significant. The use of BM strategies still showed a positive relationship with autonomous motivation and psychological discomfort, but showed a null relationship with controlled motivation, as expected.

## **Discussion**

The purpose of this first study was to identify the types of strategies people use to compensate for native inconsistencies in the environmental domain. Though CDT distinguishes between several conceptually distinct strategies, the results supported a broader categorization of compensation strategies based on their functional significance. Specifically, the results supported the hypothesized distinction between CR and BM strategies. Furthermore, the pattern of observed correlations provided some initial support for the functional significance hypothesis.

The pattern of partial correlations indicated that regulating pro-environmental behaviour for autonomous reasons relates to the use of BM strategies and to the avoidance of CR strategies, regardless of the magnitude of dissonance. Conversely, regulating pro-environmental behaviour to approach desirable outcomes and to avoid undesirable outcomes relates to the use of CR strategies, but not to the use of BM strategies, when controlling for the magnitude of dissonance. The results suggest that people use CR strategies to avoid the inconsistency rather than to reduce dissonance when BM strategies are available. We conducted a second study to confirm the factor structure with an independent sample and to test the functional significance hypothesis further.

### **Study 2**

The goal of the second study was to carry out a confirmatory factor analysis (CFA) of the revised nine-item Inconsistency Compensation Strategies scale developed in Study 1. A two-factor structure that distinguishes between CR and BM strategies was expected. We tested the validity of the functional significance hypothesis by way of correlation analyses. If the functional significance hypothesis holds, the use of CR strategies should be positively associated with controlled motivation toward the environment and ego-invested self-protection motives. In addition, the use of these strategies should be negatively associated with pro-environmental attitude strength, autonomous motivation toward the environment, and self-integrity restoration motives to compensate. The use of BM strategies should be positively associated with autonomous motivation toward the environment, self-integrity motives to compensate, and pro-environmental attitude strength, but not with controlled motivation toward the environment or ego-invested motives to compensate. Furthermore, these correlations should persist even when controlling for individual differences shown to influence dissonance processes, but that do not account for distal motives. Specifically, we assessed preferences for consistency, which

promotes the use of more elaborate compensation strategies (see Guadagno & Cialdini, 2010 for a review); private and public self-consciousness, which leads people to use more or less elaborate strategies, respectively (Scheier & Carver, 1980); and socially desirable responding biases, which fosters greater dissonance-induced attitude change (Paulhus, 1982).

## **Method**

**Participants.** In total, 339 undergraduate students participated in the study. However, 82 (24.2%) participants did not describe a counter-environmental action; therefore, they were excluded from analyses.<sup>4</sup> Fortunately, sample sizes as small as 200 are considered adequate to obtain unbiased model fit indices and parameter estimates for relatively simple measurement models featuring latent variables with more than 3 reliable indicators (Iacobucci, 2010; Jackson, 2003). Therefore, the effective sample size ( $N = 257$ ) was adequate for CFA. The mean age of the sample was 19.1 years (range: 16 to 55 years); eight participants (3.1%) did not report their age. The majority of the sample was female ( $n = 205$ , 79.8%); five participants (1.9%) declined to report their gender. The majority of the sample reported learning English ( $n = 146$ , 56.8%) first. The rest reported learning French ( $n = 55$ , 21.4%) or another language ( $n = 43$ , 16.7%) first, or declined to answer ( $n = 13$ , 5.1%).

**Procedure.** Undergraduate students registered with the ISPR who completed the mass prescreening survey in exchange for one research credit could sign up to participate in the study. We embedded the Motivation Toward the Environment scale (see the Study 1 Method section for a description) and the Social Desirability scale within the ISPR mass prescreening survey. The ISPR study description was titled “Why do you act the way you do?” and intentionally omitted any mention of the environment to avoid having a biased sample of highly motivated individuals toward the environment. Participants provided written informed consent (General Appendix C)

before completing the online survey via LimeSurvey (Schmitz, 2012). The survey included the instructions “There are no right or wrong answers to these questions. Please answer as HONESTLY as possible.” Participants received one research credit for completing the survey and completed the following scales (with the English and French versions of the instructions and items shown side-by-side) in order.

***Social Desirability scale.*** A short-form version of the Marlowe-Crowne social desirability scale (Strahan & Gerbasi, 1972; M-C 2(10)) assessed the tendency to respond to questionnaire items in culturally sanctioned ways. The scale features 10 *true* or *false* items. Five items reflect socially desirable behaviours (e.g., “I never hesitate to go out of my way to help someone in trouble”); a *true* response to these items is indicative of a social desirability bias. Five items reflect non-socially desirable behaviours (e.g., “I sometimes feel resentful when I don’t get my way”); a *false* response to these items is indicative of a social desirability bias. We computed social desirability scores by taking the sum of socially desirable responses; scores can range between 0 (no bias) and 10 (strong bias).

***Pro-Environmental Attitude Strength scale (General Appendix D).*** The Pro-environmental Attitude Strength scale developed by Lavergne & Pelletier (2015) measures favourable attitudes toward environmental protection. The scale mirrors other widely used attitude measurement scales (Brannon, Tagler, & Eagly, 2007; Krosnick, Boninger, Chuang, Berent, & Carnot, 1993; Pomerantz, Chaiken, & Tordesillas, 1995). Among other things, the scale assesses attitude importance and resistance to change—dimensions shown to increase resistance to persuasion (i.e., attitude change; Brannon et al., 2007; Leippe & Eisenstadt, 2010; Pomerantz et al., 1995). Two items assessed agreement with two pro-environmental statements: (a) “human activities have a harmful impact on the environment” and (b) “humans need to take

action to reduce their harmful impact on the environment.” Responses were provided on a 7-point Likert scale (1 *do not agree*, 7 *completely agree*). Six items measured dimensions of attitude strength including amount of knowledge about environmental issues, personal importance of environmental issues, the attitude’s centrality relative to the self-concept, the attitude’s representativeness of personal values, attitude certainty, and the likelihood of changing the attitude (reverse-coded). Participants responded to these items on a 7-point Likert scale (1 *not at all*, 7 *very much*). We computed mean composite scores of pro-environmental attitude strength based on responses to the eight items, which were internally consistent ( $\alpha = .79$ ) in previous research (Lavergne & Pelletier, 2015).

***Recall of a Recent Behavioural Inconsistency scale (General Appendix N).*** Participants recalled and described a recent behavioural transgression in the environmental domain using the same instrument used by Lavergne and Pelletier (2015). They provided an open-ended response to the following instructions: “Thinking about all of your activities and actions over the past month, please describe an action you did that was inconsistent or contradictory with your environmental beliefs and attitudes.” Three examples of counter-environmental actions in the waste diversion, water conservation, and the reduction of greenhouse gas emissions behavioural domains aided participants with this task. The scale instructed participants to keep the recalled transgression in mind when answering the rest of the questionnaire. Participants who did not recall a recent transgression could indicate this by selecting the response option: “I did not describe an inconsistent action.” These participants did not complete the Psychological Discomfort, Inconsistency Compensation Strategies, and Motives to Compensate scale.

***Psychological Discomfort scale (General Appendix G).*** We used the 18-item scale developed by Lavergne and Pelletier (2015) to measure the emotions elicited by a recent counter-

environmental action, retrospectively. The scale items consisted of adjectives corresponding to negative and positive emotions that completed the statement “Following the inconsistent action, I felt...” and were measured on a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). Nine items measured psychological discomfort (e.g., “uncomfortable,” “disappointed,” “guilty”). In addition, there were three anxious emotions (e.g., “agitated”) and six positive emotions (e.g., “pleased”) to minimize demand characteristics. We computed composite scores of psychological discomfort by taking the mean of the nine corresponding items. A CFA and large internal consistency coefficients ( $\alpha \geq .90$ ) support the reliability of the psychological discomfort subscale (Lavergne & Pelletier, 2015).

***Inconsistency Compensation Strategies scale.*** For the CFA, we administered an abbreviated version of the Inconsistency Compensation Strategies scale developed in Study 1 (see the Method section for a description). The scale featured only the five CR and four BM items retained for the final EFA (see Table 2).

***Motivation to Compensate scale (General Appendix J).*** Participants reported why they compensated for the recalled behavioural transgression. They responded to items completing the statement: “I reacted this way following the inconsistent action because...” on a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). The items assessed qualitatively different proximal motives to compensate. We only used the self-integrity restoration motives subscale (3 items; e.g., “I wanted to act in a way that maintains my integrity.”) and ego-invested self-protection motives subscale (3 items; e.g., “I wanted to save face.”) for the present study. A CFA and internal reliability coefficients ( $\alpha \geq .81$ ) support the reliability of the items corresponding to these two subscales (Lavergne & Pelletier, 2015).

***Brief Preference for Consistency scale.*** The Brief Preference for Consistency scale

measures desires to be and to appear consistent (Cialdini, Trost, & Newsom, 1995). Participants responded to nine statements (e.g., “I typically prefer to do things the same way”) on a 7-point Likert scale (1 *disagree*, 7 *agree*). Previous research supports the reliability and validity of this scale (Cialdini et al., 1995; Guadagno & Cialdini, 2010).

***Revised Self-Consciousness scale.*** The Revised Self-Consciousness Scale (Scheier & Carver, 1985) quantified trait levels of private self-consciousness—self-focused attention directed at the covert aspects of the self, such as thoughts, feelings, and aspirations (9 items; e.g., “I’m always trying to figure myself out.”). The scale also assessed trait levels of public self-consciousness—self-focused attention directed at the overt aspects of the self or, more specifically, how others perceive one’s behaviour, mannerisms, and appearance (7 items; e.g., “I usually worry about making a good impression.”). We did not use the social anxiety subscale for the present study. Scheier and Carver (1985) have demonstrated that the Revised Self-Consciousness subscales are internally consistent and show adequate test-retest reliability.

### **Data Analysis**

We screened for violations of statistical assumptions with SPSS (2012). For the planned CFA, we used Mplus (Muthén & Muthén, 2012) with the Full Information Maximum Likelihood Robust method to estimate model fit and parameters from all available data (Schlomer, Bauman, & Card, 2010) with robust standard errors. The Satorra-Bentler scaled model chi-square statistic tests the exact fit hypothesis; the hypothesis is tenable when the test is not significant ( $p > .05$ ; Satorra & Bentler, 1994). However, because the exact fit hypothesis is often untenable for latent models tested with large sample sizes ( $N > 200$ ; Kline, 2011), we also interpreted indices of relative fit based on cut-offs proposed by Hu and Bentler (1999). Specifically, we assessed relative fit by ensuring a small (close to .06) root mean square of error approximation (RMSEA)

statistic and a small upper limit of 90% the confidence interval (close to .08). In addition, we interpreted the comparative fit index (CFI) and Tucker-Lewis index (TLI). A large statistic (close to .95) indicates relatively good fit. Relatively good fit also results in a small (close to .08) standardized root mean square residual (SRMR). We examined large modification indices (MI > 5) to identify areas of model misfit.

For the planned correlation analyses, we computed bivariate correlations between all pairs of composite variables, and partial correlations between the mean composite scores of inconsistency compensation strategies and each of the 10 covariates, controlling for the other nine covariates. The covariates refer to mean composite scores of autonomous and controlled motivation toward the environment, pro-environmental attitude strength, psychological discomfort, self-integrity restoration and ego-invested self-protection motives, preferences for consistency, private and public self-consciousness, and social desirability.

## **Results**

All the transgressions recalled via the Recall of a Recent Behavioural Inconsistency scale related to waste diversion, water conservation, or the reduction of greenhouse gas emissions, all of which are behavioural domains that correspond to the examples provided with this scale.

**Confirmatory Factor Analysis.** Descriptive statistics for the nine Inconsistency Compensation Strategies scale items are in Table 1 (see Appendix A for the covariance matrix). Seven participants provided no data at all on the scale; therefore, the sample size for the CFA was  $N = 250$ . There were eight (3.2%) multivariate outliers; we tested the model with and without outliers to assess their impact on model fit. We specified the measurement model based on the results of the EFA conducted in study 1. Specifically, the five items corresponding to the CR factor were indicators of one latent variable and the four items corresponding to the BM

factor were indicators of a second latent variable. We fixed the path corresponding to one indicator per latent variable to 1 and specified uncorrelated residual error terms for each indicator. We also fixed the factor correlation to zero.

The uncorrelated factor model fit relatively poorly when tested with multivariate outliers:  $n = 250$ ;  $\chi^2(27) = 64.17$ ,  $p < .001$ ; RMSEA = .07, 90% CI: [.05, .10]; CFI = .91; TLI = .88; SRMR = .06. However, the model fit relatively well when tested without multivariate outliers:  $n = 242$ ;  $\chi^2(27) = 52.10$ ,  $p = .003$ ; RMSEA = .06, 90% CI [.04, .09]; CFI = .95; TLI = .93; SRMR = .05. There were large modification indices suggesting that model fit could be improved by specifying covariances between the residual variances of items loading on the CR factor, however none of the modification indices supported cross-loadings across the two factors. Because the analysis supported the distinction between the two factors and there was no theoretical justification to specify covariances between indicators of either factor, we did not modify the model. Parameter estimates for the analysis without multivariate outliers ( $n = 242$ ) are presented in Table 2. All indicators had substantive factor loadings ( $> .50$ ) on their respective factors and the majority of the items were well-explained by the latent variables ( $R^2 \geq .30$ ); with the exception of Item 15 (see Table 1) of the BM factor ( $R^2 = .26$ ). Though the BM factor appeared less reliable, the factor structure was theoretically tenable and the items corresponding to both factors were internally consistent (see Table 4). Therefore, we computed composite scores corresponding to the use of CR and BM strategies to test the functional significance hypothesis.

**Correlation analyses.** See Table 4 for the descriptive statistics of the composite variables and Table 5 for their intercorrelations. The pattern of bivariate correlations between the environmental and the dissonance motivation constructs was mostly consistent with previous

research and the results of Study 1. Autonomous and controlled motivation toward the environment, and pro-environmental attitude strength, showed positive correlations with psychological discomfort. Autonomous motivation also showed a significant positive relationship with self-integrity restoration motives but not with ego-invested self-protection motives. Controlled motivation showed a positive correlation with ego-invested self-protection motives; however, contrary to previous research, its small positive correlation with self-integrity restoration motives was significant. We found that the use of CR strategies showed a negative correlation with autonomous motivation, pro-environmental attitude strength, and self-integrity restoration motives, and a positive correlation with ego-invested self-protection motives, as expected. Contrary to expectations, the use of CR strategies showed a null correlation with controlled motivation and psychological discomfort. It also had a positive correlation with social desirability and public self-consciousness, and a null correlation with private self-consciousness and preference for consistency. Finally, we found that the use of BM strategies had positive correlations with all 10 covariates; the positive correlations with controlled motivation toward the environment and ego-invested self-protection motives to compensate countered our hypotheses.

The partial correlations (see Table 5) revealed a pattern of associations more consistent with the functional significance hypothesis. The use of CR strategies showed negative correlations with autonomous motivation toward the environment, self-integrity restoration motives, and a positive correlation with ego-invested self-protection motives, as expected. Contrary to expectations, the use of CR strategies showed a negative correlation with psychological discomfort and a null correlation with controlled motivation. Conversely, the use of BM strategies showed a positive correlation with autonomous motivation toward the

environment, pro-environmental attitude strength, and self-integrity restoration motives, as expected. However, its positive correlation with preferences for consistency remained significant. This pattern of results supports the idea that BM strategies facilitate organismic integration and satisfies consistency motives. The lack of correlation between the use of BM strategies and psychological discomfort could be due to the shared variance between these two constructs and autonomous motivation, self-integrity restoration motives, and pro-environmental attitude strength.

### **Discussion**

The results of the CFA supported the distinction between CR and BM strategies; however, there were issues with the reliability of the BM factor. Although there were slight departures from our stated hypotheses, the pattern of bivariate correlations was consistent with previous research and the pattern of partial correlations partially supported the functional significance hypothesis. Again, we found evidence that people use BM strategies to reduce dissonance; however, there was stronger support for the idea that they use these strategies to facilitate organismic integration by upholding authentic pro-environmental attitudes. In addition, we found further evidence that people do not use CR strategies to reduce dissonance. Instead, they seem to use these strategies to protect ego-invested self-structures. In sum, the results support the hypothesis that compensation strategies fall into one of two broad categories: BM strategies that satisfy motives to facilitate organismic integration and to reduce dissonance, and CR strategies that satisfy motives to protect ego-invested self-structures.

### **Study 3**

The main objective of Study 3 was to test hypotheses about the direct and indirect effects of autonomous and controlled motivation toward the environment on the use of compensation

strategies and, in turn, the frequency of native inconsistencies implied by the HABICE.

According to the HABICE, autonomous motivation toward the environment should predict (a) the use of BM strategies to minimize inconsistencies and to reduce dissonance (positive direct and indirect effects) and (b) the avoidance of CR strategies that would exacerbate inconsistencies (negative direct effect), and (c) infrequent native inconsistencies in general and via inconsistency compensation processes (negative direct and indirect effects). Controlled motivation should predict (a) the use of CR strategies to minimize inconsistencies (positive direct effect) and (b) the use of BM strategies to reduce dissonance (positive indirect effect), and (c) frequent native inconsistencies via the use of CR strategies (positive indirect effect). A secondary objective of the study was to compare the predictive power of hypotheses based on the HABICE relative to hypotheses derived from CDT. We used multi-sample path analyses to test these hypotheses and to assess the generalizability of the HABICE to the Canadian population.

## **Method**

**Participants.** We recruited the student sample via the ISPR. All undergraduate students registered with the ISPR were eligible for the study. Among them, 345 agreed to participate in the study. However, 97 participants (28.1%) did not describe a counter-environmental action on the Recall of a Recent Behavioural Inconsistency scale. Due to the nature of the Inconsistency Compensation Strategies scale, only participants who recalled a counter-environmental action were included in analyses.<sup>5</sup> The mean age of the student sample ( $N = 248$ ) was 19.4 years (range: 17 to 46 years). The majority of the sample was female ( $n = 207$ ; 83.5%); one participant (0.4%) declined to report his or her gender. Participants reported French ( $n = 115$ , 46.4%), English ( $n = 96$ , 38.7%), or another language ( $n = 36$ , 14.5%) as their first language; one participant (0.4%) did not indicate his or her first language.

We recruited the general sample via Crowdfunder. Crowdfunder (2015) is a voluntary crowdsourcing service that manages the payment of its members in exchange for completing online microtasks (e.g., responding to surveys). Preliminary research of Amazon's Mechanical Turk (which is a similar crowdsourcing workplace environment) supports these types of marketplaces as a trustworthy and effective source of data (Buhrmester, Kwang, & Gosling, 2011; Mason & Suri, 2012; Rand, 2012). Crowdfunder participants residing in Canada were eligible to participate in the study. Among them, 423 agreed to participate. However, we excluded from analyses the 122 participants (28.8%) who did not recall a counter-environmental action.<sup>6</sup> The mean age of the general sample ( $N = 301$ ) was 37.2 years (range: 16 to 78). The majority of sample was female ( $n = 208$ , 69.1%) and reported English ( $n = 252$ , 83.7%) as their first language. A fraction of the sample reported French ( $n = 22$ , 7.3%) or another language ( $n = 27$ , 9.0%) as their first language. Both samples were sufficiently large to obtain unbiased model fit indices and parameter estimates via the planned multi-sample path analyses (Iacobucci, 2010; Jackson, 2003).

**Procedure.** ISPR users received one research credit and Crowdfunder contributors received \$1.00 (CAD) for agreeing to participate in the study. In order to receive the compensation, Crowdfunder contributors entered a completion code provided at the end of the survey into the Crowdfunder web interface within 30 minutes of beginning the study (mean completion time = 14 minutes; mean compensation satisfaction [ $n = 114$ ] = 4.6/5.0; Crowdfunder, Inc., 2014). Participants from both samples saw the same study description and completed the same survey titled "Why do you act the way you do?" administered via LimeSurvey (Schmitz, 2012). We did not mention the environment in the study description to avoid a self-selection bias by highly motivated individuals toward the environment. All

participants provided informed consent (General Appendix C) before completing the survey. Then, they completed the Motivation Toward the Environment scale (see the Study 1 Method section for a description) and the Pro-Environmental Attitude Strength, Recall of a Recent Behavioural Inconsistency, Psychological Discomfort, and Inconsistency Compensation Strategies<sup>7</sup> scales (see the Study 2 Method for a description). Finally, participants completed the Frequency of Recent Environmentally-Relevant Actions scale.

***Frequency of Recent Environmentally Relevant Actions scale (General Appendix H).***

We used the inventory of 18 environmentally relevant actions developed by Lavergne and Pelletier (2015) to measure the relative frequency of recent pro-environmental (9 items; e.g., “Purchased local foods”) and counter-environmental (9 items; e.g., “Took a bath or a long shower (> 10 min.)”) actions. The featured actions were selected because of their relevance to water conservation (6 items; e.g., “Turned off the water while brushing teeth”), waste reduction (6 items; e.g., “Used the double-sided option to print/copy on both sides of the page”), and the reduction of greenhouse gas emissions (6 items; e.g., “Used an electric clothes dryer). These actions were likely to match the transgressions recalled by participants based on the three examples provided with the Recall of a Recent Behavioural Inconsistency scale (see the Study 2 Method section for a description of the scale). Specifically, participants estimated how often they had engaged in each action over the past month (free recall). Pro-environmental actions (9 items; e.g., “Brought reusable bags when shopping.”) were matched with counter-environmental actions (9 items; e.g., “Took plastic bags at the grocery/store check-out (instead of no bags or reusable bags).”). We obtained a score of the relative frequency of native inconsistencies by dividing the sum of the nine counter-environmental action items by the sum of all 18 items in the scale.

## Data Analysis

Again, we screened the data for violations of basic statistical assumptions using SPSS (2012) and we conducted path analyses using Mplus with the Full Information Maximum Likelihood Robust estimation method (Muthén & Muthén, 2012; Schlomer et al., 2010). The main analyses consisted of multi-sample path analyses to test and compare path models based on CDT versus those based on the HABICE. First, we fitted both path models to the covariance matrix of each group separately to ensure the hypothesized models were a good fit to the data. Second, we tested invariance hypotheses to assess the generalizability of the two models across the two samples (Kline, 2011). We tested the *configural invariance* hypothesis by simultaneously fitting the path models to the covariance matrices of both groups and freely estimating parameters across groups (i.e., equal form model). A non-significant model chi-square leads to the retention of the configural invariance hypothesis. We tested the *full invariance* hypothesis by fixing all the paths, variances, covariances, and residual variances, to equality across the two samples (i.e., equal parameter model). The full invariance hypothesis is tenable if the more restrictive equal parameter model fits as well as the less restrictive equal form model, as indicated by a non-significant ( $\alpha = .05$ ) Satorra-Bentler scaled chi-square difference test ( $\Delta\chi^2$ ; Satorra & Bentler, 2001). We examined large modification indices ( $MI > 5$ ) to identify areas of misfit and adjust the model, if necessary. Finally, we used the non-parametric bootstrapping method (1,000 samples) to obtain 95% bias-corrected confidence intervals of standardized specific indirect, total indirect, and total effects for the exogenous predictor variables of both models (Shrout & Bolger, 2002).

## Results

All the transgressions recalled via the Recall of a Recent Behavioural Inconsistency scale

related to the behavioural domains corresponding to the examples provided with this scale.

**Sample differences.** There were significant demographic differences between the two samples. The median age of the CrowdFlower sample (35 years) was 16 years greater than the median age of the ISPR sample (19 years). There was a greater proportion of males in the CrowdFlower sample ( $n = 93$ , 30.9%) compared to the ISPR sample ( $n = 40$ , 16.2%),  $\chi^2(1) = 15.96$ ,  $p < .001$ ,  $\phi = .17$ . Proportionally, more CrowdFlower contributors reported English (adjusted residual;  $se = -10.9$ ) versus French ( $se = 10.6$ ) or another language ( $se = 2.0$ ) as their first language compared to registered ISPR users,  $\chi^2(2) = 130.29$ ,  $p < .001$ , Cramers'  $V = .49$ . In 2014, the median age of the entire Canadian population was 41.7 years and half the population was male. The majority of the population reported English (58.7%) and about one-fifth reported French (22%) as their first language (Index Mundi, 2014). Therefore, the results indicate that the CrowdFlower sample was more representative of the general population than the ISPR sample of undergraduate students. There were also significant sample differences for the variables under study. See Table 6 for descriptive statistics by sample. Compared to the student sample (i.e., ISPR users), the general sample (i.e., CrowdFlower contributors) reported significantly greater autonomous motivation,  $t(547) = -5.42$ ,  $p < .001$ , 95% CI [-.75, -.35], Cohen's  $d = 0.46$ , and controlled motivation,  $t(547) = -4.07$ ,  $p < .001$ , 95% CI [-.54, -.19], Cohen's  $d = 0.35$ . The general sample also reported stronger pro-environmental attitudes,  $t(547) = -4.12$ ,  $p < .001$ , 95% CI [-.51, -.18], Cohen's  $d = 0.35$ , and less frequent native inconsistencies,  $t(532) = 3.01$ ,  $p = .003$ , 95% CI [.02, .08], Cohen's  $d = 0.26$ .

**Multi-sample path analyses.** We used multi-sample path analyses to test the central hypotheses of the study. Specifically, we specified two competing path models to test and compare the hypothesized predictors of CR strategies and BM strategies proposed by CDT

versus the HABICE. We multiplied scores on the frequency of native inconsistencies variable by 10 to rescale the covariance matrices of both samples (see Appendix C) and conducted all analyses with and without the single multivariate outlier within the general sample. There were no other violations of assumptions.

***CDT path model.*** The first model tested hypotheses derived from Festinger's (1957) original theory (see Figure 1a). The frequency of native inconsistencies was regressed onto CR and BM. CR and BM were regressed onto psychological discomfort and attitude strength. Finally, psychological discomfort was regressed onto attitude strength. We specified residual error terms for the four endogenous variables. The model fit well within the student sample ( $n = 248$ ,  $\chi^2(2) = 2.99$ ,  $p = .22$ ) but fit poorly within the general sample ( $n = 300$ ,  $\chi^2(2) = 22.55$ ,  $p < .001$ ). Results for the general sample suggested that model fit could be significantly improved by specifying a covariance between the residual variances of BM and CR (MI = 21). This covariance is consistent with the idea that, when initial attempts to compensate for an inconsistency fail to reduce dissonance (or to satisfy distal motives), people should be inclined to use a second strategy (Gotz-Marchand, Gotz, & Irle, 1974; Simon et al., 1995). The modified path model fit well within the student sample,  $\chi^2(1) = 3.09$ ,  $p = .08$ , and the general sample,  $\chi^2(1) = 0.18$ ,  $p = .67$ .

Next, we tested invariance hypotheses. The equal form model fit well,  $\chi^2(2) = 3.28$ ,  $p = .19$ , thereby supporting the configural invariance hypothesis. The equal parameter model fit as well as the equal form model,  $\Delta\chi^2(14) = 23.65$ ,  $p = .05$ . However, the exact fit hypothesis was not tenable,  $\chi^2(16) = 26.93$ ,  $p = .04$ , and the modification indices suggested that model fit for both samples could be significantly improved by freeing the constraint imposed on the covariance between CR and BM (MI's = 9). We reasoned that, because the general sample was

more motivated toward the environment in general, these participants might have been more inclined to use a second strategy when initial attempts to restructure cognitions exacerbated the perceived threat or failed to satisfy distal motives. The modified model (see Figure 1a) fit well,  $\chi^2(15) = 17.79, p = .27$ , and fit as well as the equal form model,  $\Delta\chi^2(13) = 14.51, p = .34$ , thereby supporting partial invariance across samples. Modification indices for the student sample did not support the equality constraint imposed on the path between BM and the frequency of native inconsistencies (MI = 6). However, because the effect was consistent with theory and a priori hypotheses, we did not modify the model. The multivariate outlier had a negligible impact on the analysis.

See Figure 1a for a diagram of the final partial invariance CDT path model with standardized estimates of direct effects and covariances. Refer to Table 7 for estimates and 95% bias-corrected bootstrap confidence intervals of the indirect and total effects of pro-environmental attitude strength. As expected, pro-environmental attitude strength predicted greater psychological discomfort, greater use of BM strategies, lesser use of CR strategies, and infrequent native inconsistencies via direct effects. However, because psychological discomfort predicted the use of both types of compensation strategies, the indirect effects of attitude strength on the use of CR and BM strategies were both positive. Despite the inconsistent mediation effect—which suggests that the CDT model does not fully capture the complexity of the relationships between attitude strength, psychological discomfort, and CR (Shrout & Bolger, 2002)—the total effect of attitude strength on CR was negative and significant, in accordance with CDT. In turn, CR strategies predicted frequent native inconsistencies, whereas BM strategies predicted infrequent native inconsistencies. The negative total indirect effect of attitude strength on the frequency of native inconsistencies was significant and seemed largely

attributable to the specific indirect effect via CR. The CDT model explained 9% of the variance in psychological discomfort, 13% of the variance in the use of CR strategies, 28% of the variance in the use of BM strategies, and about 20% of the variance in the relative frequency of native inconsistencies.

***HABICE path model.*** The HABICE path model (see Figure 1b) tested an alternative account of individual differences in inconsistency compensation processes based on the action-based model and self-determination theory. To test the model, the relative frequency of native inconsistencies was regressed onto CR and BM, and onto autonomous motivation toward the environment based on previous research. Based on the results of Studies 1 and 2, CR was regressed onto autonomous and controlled motivation, but not psychological discomfort. BM was regressed onto psychological discomfort and autonomous motivation. Finally, psychological discomfort was regressed onto both types of motivation. We specified residual error terms for the four endogenous variables and covariances between autonomous and controlled motivation and between the residual variances of CR and BM. The model fit well in the general sample ( $\chi^2(4) = 5.35, p = .25$ ) and the student sample ( $\chi^2(4) = 5.09, p = .28$ ). The equal form model fit well,  $\chi^2(8) = 7.83, p = .45$ , supporting the configural invariance hypothesis. The equal parameter model fit well ( $\chi^2(25) = 36.13, p = .07$ ) but fit significantly worse than the equal form model ( $\Delta\chi^2(17) = 28.30, p = .04$ ). Freeing the equality constraint imposed on the covariance between CR and BM (MI = 8) improved the model's fit overall ( $\chi^2(24) = 27.98, p = .26$ ) and relative to the equal form model ( $\Delta\chi^2(16) = 20.14, p = .21$ ). As with the CDT model, we decided not to modify the model even though the direct effect of BM on the relative frequency of native inconsistencies was not supported within the student sample (MI = 7). The multivariate outlier had a negligible impact on the analysis.

See Figure 1b for a diagram of the final HABICE path model with standardized estimates of direct effects and covariances. Refer to Table 7 for estimates and 95% bias-corrected bootstrap confidence intervals of the indirect and total effects of autonomous and controlled motivational orientations toward the environment. In line with previous research (Lavergne & Pelletier, 2015), both motivational orientations predicted greater psychological discomfort. As expected, autonomous motivation predicted greater use of BM strategies both directly and indirectly via psychological discomfort, and lesser use of CR strategies directly. Controlled motivation predicted greater use of CR strategies directly and greater use of BM strategies indirectly via psychological discomfort. In turn, the use of CR strategies predicted frequent native inconsistencies and BM predicted infrequent native inconsistencies ( $p = .05$ ), as expected. Autonomous motivation predicted infrequent native inconsistencies directly and indirectly via the avoidance of CR strategies. Controlled motivation predicted frequent native inconsistencies indirectly via the use of CR strategies. The HABICE path model explained twice as much variance in psychological discomfort and one-fifth more variance in the use of BM strategies than the CDT model, but explained identical proportions of variance in the use of CR strategies and the relative frequency of native inconsistencies.

## **Discussion**

The present study tested the directional effects proposed by the HABICE, which is based on the action-based model and self-determination theory, and compared it to a model based on Festinger's original CDT (1957). The results corroborated CDT. People seem motivated to use increasingly more elaborate compensation strategies as attitude strength and the magnitude of dissonance increases. The results also supported the dual distal motivational mechanisms of inconsistency compensation proposed by the HABICE. As expected, action tendencies to

facilitate organismic integration implied by levels of autonomous motivation toward the environment predicted the use of BM strategies and the avoidance of CR strategies, resulting in relatively infrequent native inconsistencies in day-to-day life. Action tendencies to obtain desirable and to avoid undesirable outcomes implied by levels of controlled motivation toward the environment predicted the use of BM strategies to reduce dissonance and the use of CR strategies to minimize or avoid non-threatening inconsistencies, resulting in relatively frequent native inconsistencies in day-to-day life. Furthermore, accounting for motivational orientations toward the environment seemed to clarify the inconsistent direct and indirect effects of pro-environmental attitude strength on the use of CR strategies observed within the CDT model; the results suggest that people do not use CR strategies to satisfy distal controlled motives rather than to reduce dissonance when BM strategies are available. Finally, both models appeared generalizable to distinct samples of Canadians despite significant group differences.

### **General Discussion**

The goal of the present research was to understand and explain individual differences in compensation processes, particularly choices among different types of compensation strategies, in response to spontaneous native environmental attitude-behaviour inconsistencies encountered in the environmental domain. The overall pattern of results provided support for the HABICE predictions based on the action-based model of dissonance and self-determination theory. Central to the HABICE is the idea that people consider environmental protection personally important for different reasons and that these reasons determine the functional significance of inconsistency compensation strategies. On the one hand, inconsistency compensation processes guided by organismic integration tendencies (i.e., autonomous motivation toward the environment) seem to dispose people to use BM strategies and to avoid CR strategies in order to restore the integrity of

authentic self-structures. On the other hand, inconsistency compensation processes guided by tendencies to avoid aversive instrumental outcomes (i.e., controlled motivation toward the environment) seem to dispose people to use BM strategies to avoid threatening inconsistencies but to use CR strategies to avoid non-threatening inconsistencies. The findings imply that accounting for individual differences in the distal motives guiding inconsistency compensation processes increases the predictive power of CDT and that these differences could explain the motivational processes underlying the environmental belief-action gap.

### **Implications**

CDT proposes that people are more likely to compensate for attitude-behaviour inconsistencies as the magnitude of aroused dissonance increases (Festinger, 1957). Although we found relatively strong support for the idea that the magnitude of dissonance motivates people to use BM strategies, we failed to find reliable evidence that it motivates people to use CR strategies. Apparently, when people have the choice between all possible compensation strategies to reduce the dissonance aroused by native inconsistencies, they tend to use BM but not CR strategies. In fact, we found a consistently negative or null relationship between psychological discomfort and the use of CR strategies across studies, except for the Study 3 CDT path model, which showed that psychological discomfort predicts the use of CR strategies when controlling for levels of pro-environmental attitude strength. In accordance with the HABICE, however, the use of CR strategies showed a consistently negative relationship with autonomous motivation across studies, a positive relationship with controlled motivation in Studies 1 and 3, and a positive relationship with ego-invested self-protection motives to compensate in Study 2. The results of Study 3, in particular, suggest that the use of CR strategies emerges because of the contingent regulation tendencies associated with controlled motivation toward the environment.

Controlled motivation seems to dispose people either to avoid the dissonance aroused by threatening inconsistencies, which is consistent with CDT, or to minimize the inconsistency to avoid it or to avoid arousing dissonance, which is consistent with a justification-based account of self-regulation failure (De Witt Huberts, Evers, & De Ridder, 2014). In other words, individual differences in distal motives could explain the unreliable association between indicators of dissonance arousal and attitude change reported in the literature (see Harmon-Jones et al., 2009).

Furthermore, CDT (Festinger, 1957) posits that people who are motivated to compensate for cognitive inconsistencies will change the least resistant cognition in the dissonance ratio, but few studies have tested this hypothesis empirically. The present research suggests that accounting for individual differences in the reasons why people consider life domains important facilitates predictions about the relative resistance to change of cognitions in that domain, without resorting to complex computations of the dissonance ratio (e.g., Sakai, 1999). When people accord importance to pro-environmental attitudes and behaviour because these cognitions are central to authentic self-structures, the authentic attitude appears more resistant to change than the inauthentic action. By contrast, when people accord importance to pro-environmental behaviour because these behaviours afford desirable contingencies, the resistance to change of cognitions seems to fluctuate, presumably as a function of social factors. When social factors are absent or do not support behavioural contingencies in the environmental domain, the counter-environmental action is likely to be more resistant to change than the pro-environmental attitude because actions are generally more difficult to change. However, when salient controlling social factors offer desirable contingencies for pro-environmental behaviour, the pro-environmental attitude is likely to be more resistant to change than the counter-environmental action because changing the attitude would engender negative consequences.

These results also have important implications for environmental protection efforts. On the one hand, controlled compensation processes in the environmental domain seem directed at avoiding or minimizing aversive consequences rather than at protecting the environment. Furthermore, the results of Study 3 suggest that controlled compensation processes could lead to decreased motivation toward the environment over time. When people use BM strategies strictly to reduce dissonance, they should not identify with the compensatory action because the dissonance, not the self, caused the behaviour (Deci & Ryan, 2008). Worse yet, the observation that one freely chose to revise his or her pro-environmental attitudes should lead people to infer they hold weak pro-environmental attitudes (Fazio, Zanna, & Cooper, 1978). Over time, controlled compensation processes could therefore lead to the extinction of pro-environmental attitudes and foster amotivation toward the environment (Pelletier, Dion, Tuson, & Green-Demers, 1999). On the other hand, autonomous compensation processes seem directed at resolving the inconsistency by protecting the environment, rather than merely at reducing dissonance, because protecting the environment is self-fulfilling. When people use BM strategies for autonomous reasons, they should identify more strongly with the compensatory action because it is self-determined (Deci & Ryan, 2008). Authentic behaviour change should also lead people to infer that they hold strong pro-environmental attitudes based on the considerable amount of effort they freely chose to invest to compensate for their counter-environmental actions (Fazio et al., 1978). Over time, autonomous compensation processes could therefore lead to more resistant pro-environmental attitudes and increased autonomous motivation toward the environment.

### **Limitations and Future Research**

Because the research used retrospective self-reported data, it was difficult to determine

the precise nature of the psychological discomfort measure. It seems plausible that the reported levels of psychological discomfort reflect the dissonance aroused by the behavioural transgression or by the recall task itself, or both. Furthermore, if the recalled transgression did arouse sufficient dissonance to motivate the use of a compensation strategy, and that strategy was successful, people may have been unable or unwilling to recall the amount of psychological discomfort aroused by the transgression. Similarly, people may have exhibited biases when recalling the compensation strategies they used to deal with the recalled transgression, especially if the recall task aroused dissonance. This latter explanation seems supported by the direction of the correlations found between the social desirability measure and the use of BM (positive) and CR (negative) strategies in Study 2 (see Table 5). Any of these confounds could explain the null relationship between psychological discomfort and the use of CR strategies. In other words, there is a need to replicate the findings using observable and unbiased indicators of dissonance arousal and of CR and BM strategies. Finally, there was an uncontrolled time lag between the measurement of motivational orientations and the measurement of dissonance constructs in Study 2 but not in Studies 1 and 3. Because the results of Study 2 converged with those of Studies 1 and 3, there is no reason to believe that the time lag affected the results.

## **Conclusion**

The results of the present research suggest that inconsistency compensation processes in the environmental domain have implications for the environmental belief-action gap and for environmental protection efforts. On the one hand, controlled compensation processes have the potential to weaken pro-environmental attitudes and to increase the frequency of counter-environmental actions. In other words, controlled motivation toward the environment appears to exacerbate the environmental belief-action gap and, worse, may narrow the gap in favour of

continued environmental degradation over time. By contrast, autonomous compensation processes have the potential to strengthen pro-environmental attitudes and to decrease the frequency of counter-environmental actions. Therefore, it appears possible to harness autonomous motivation toward the environment to alleviate the gap and favour increased environmental sustainability. The results suggest there is a need to persuade Canadians of the personal relevance of environmental protection and of the importance of regulating pro-environmental behaviours for autonomous reasons in order to foster an upward spiral of positive pro-environmental behaviour change.

## References

- Anderson, C. (2013). *The integrated system of participation in research (ISPR)*. University of Ottawa, School of Psychology, Ottawa, Ontario, Canada. Retrieved August 28, 2014 from [http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/value\\_of\\_the\\_ispr\\_11\\_4\\_13.pdf](http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/value_of_the_ispr_11_4_13.pdf)
- 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*, 145–156. doi: 10.1037/0008-400X.29.3.145
- 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
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk a new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, *6*, 3–5. doi: 10.1177/1745691610393980
- Cialdini, R. B., Trost, M. R., & Newsom, J. T. (1995). Preference for consistency: The development of a valid measure and the discovery of surprising behavioral implications. *Journal of Personality and Social Psychology*, *69*, 318–328. doi: 10.1037/0022-3514.69.2.318
- Crocker, J., & Knight, K. M. (2005). Contingencies of self-worth. *Current Directions in Psychological Science*, *14*, 200–203. doi: 10.1111/j.0963-7214.2005.00364.x

- Croyle, R. T., & Cooper, J. (1983). Dissonance arousal: Physiological evidence. *Journal of Personality and Social Psychology*, *45*, 782–791. doi: 10.1037/0022-3514.45.4.782
- CrowdFlower, Inc. (2014). Contributor Exit Survey - Job 407109 [Summary statistics]. Retrieved from <http://crowdflower.com>
- CrowdFlower, Inc. (2015). CrowdFlower [Online crowdsourcing service]. Retrieved from <http://crowdflower.com>
- De Witt Huberts, J. C., Evers, C., & De Ridder, D. T. D. (2014). “Because I am worth it” A theoretical framework and empirical review of a justification-based account of self-regulation failure. *Personality and Social Psychology Review*, *18*, 119–138. doi : 10.1177/1088868313507533
- Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*, 109–134. doi:10.1016/0092-6566(85)90023-6
- Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology*, *53*, 1024–1037. doi: 10.1037/0022-3514.53.6.1024
- Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life’s domains. *Canadian Psychology/Psychologie Canadienne*, *49*, 14–23. doi: 10.1037/0708-5591.49.1.14
- Demographics of the research participants of the ISPR. (n.d.). Retrieved August 28, 2014 from [http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/demographics\\_overview\\_of\\_the\\_ispr\\_as\\_of\\_2014.pdf](http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/demographics_overview_of_the_ispr_as_of_2014.pdf)

- Devine, P. G., Tauer, J. M., Barron, K. E., Elliot, A. J., & Vance, K. M. (1999). Moving beyond attitude change in the study of dissonance-related processes. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 297–323). Washington, DC: American Psychological Association.
- Elkin, R. A., & Leippe, M. R. (1986). Physiological arousal, dissonance, and attitude change: Evidence for a dissonance-arousal link and a “Don’t remind me” effect. *Journal of Personality and Social Psychology*, *51*, 55–65. doi: 10.1037/0022-3514.51.1.55
- 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*, 382–394. doi: 10.1037/0022-3514.67.3.382
- Environment Canada. (2011). *2011 Municipal Water Use Report: Municipal Water Use 2009 Statistics* (No. En11-2/2009E). Retrieved from <http://www.ec.gc.ca.proxy.bib.uottawa.ca/Publications/default.asp?lang=En&xml=B77CE4D0-80D4-4FEB-AFFA-0201BE6FB37B>
- Fazio, R. H., Zanna, M. P., & Cooper, J. (1978). Direct Experience and Attitude-Behavior Consistency: An Information Processing Analysis. *Personality and Social Psychology Bulletin*, *4*, 48–51. doi: 10.1177/014616727800400109
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, Illinois: Row, Peterson and Company.
- Gotz-Marchand, B., Gotz, J., & Irle, M. (1974). Preference of dissonance reduction modes as a function of their order, familiarity and reversibility. *European Journal of Social Psychology*, *4*, 201–228. doi: 10.1002/ejsp.2420040206

- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, *29*, 157–166. doi: 10.1037/0008-400X.29.3.157
- Guadagno, R. E., & Cialdini, R. B. (2010). Preference for consistency and social influence: A review of current research findings. *Social Influence*, *5*, 152–163. doi: 10.1080/15534510903332378
- Harmon-Jones, E. (1999). Toward an understanding of the motivation underlying dissonance effects: Is the production of aversive consequences necessary? In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 71–99). Washington, DC: American Psychological Association.
- Harmon-Jones, E. (2000). Cognitive dissonance and experienced negative affect: Evidence that dissonance increases experienced negative affect even in the absence of aversive consequences. *Personality and Social Psychology Bulletin*, *26*, 1490–1501. doi: 10.1177/01461672002612004
- 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. *Advances in Experimental Social Psychology*, *41*, 119–166. doi: 10.1016/S0065-2601(08)00403-6
- Harmon-Jones, E., Brehm, J. W., Greenberg, J., Simon, L., & Nelson, D. E. (1996). Evidence that the production of aversive consequences is not necessary to create cognitive dissonance. *Journal of Personality and Social Psychology*, *70*, 5–16. doi: 10.1037/0022-3514.70.1.5

- Hayton, J. C., Allen, D. G., & Scarpello, V. (2004). Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. *Organizational Research Methods, 7*, 191–205. doi: 10.1177/1094428104263675
- 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, DC: American Psychological Association.
- 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). Rochester, NY: University of Rochester Press.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55. doi: 10.1080/10705519909540118
- Iacobucci, D. (2010). Structural equations modeling: Fit Indices, sample size, and advanced topics. *Journal of Consumer Psychology, 20*, 90–98. doi: 10.1016/j.jcps.2009.09.003
- Index Mundi. (2014). Canada Demographics Profile 2014. Retrieved August 28, 2014 from [http://www.indexmundi.com/canada/demographics\\_profile.html](http://www.indexmundi.com/canada/demographics_profile.html)
- Institute for Social Research. (2007). *Canadian Election Study, 2004* [Summary statistics]. Retrieved from [www.queensu.ca/cora/ces.html](http://www.queensu.ca/cora/ces.html)
- Institute for Social Research. (2009). *Canadian Election Study, 2008* [Summary statistics]. Retrieved from [www.queensu.ca/cora/ces.html](http://www.queensu.ca/cora/ces.html)
- Jackson, D. L. (2003). Revisiting sample size and number of parameter estimates: Some support for the  $N:q$  hypothesis. *Structural Equation Modeling: A Multidisciplinary Journal, 10*, 128–141. doi: 10.1207/S15328007SEM1001\_6

- Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling* (3rd ed.). New York, NY: Guilford Press.
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8, 239–260. doi: 10.1080/13504620220145401
- Krosnick, J. A., Boninger, D. S., Chuang, Y. C., Berent, M. K., & Carnot, C. G. (1993). Attitude strength: One construct or many related constructs? *Journal of Personality and Social Psychology*, 65, 1132–1151. doi: 10.1037/0022-3514.65.6.1132
- Lavergne, K. J., & Pelletier, L. G. (2015). *Why are attitude-behaviour inconsistencies uncomfortable? Exploring Individual Differences in Dissonance Arousal Processes*. Manuscript submitted for publication.
- 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. doi: 10.1016/j.jenvp.2009.11.002
- 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). Washington, DC: American Psychological Association.
- Leippe, M. R., & Eisenstadt, D. (2010). Self-persuasion when it matters to self: Attitude importance and dissonance reduction after counterattitudinal advocacy. In M. H. Gonzales, C. Tavis, & J. Aronson (Eds.), *The Scientist and the Humanist: A Festschrift in Honor of Elliot Aronson* (pp. 175–199). New York, NY: Psychology Press.

- Losch, M. E., & Cacioppo, J. T. (1990). Cognitive dissonance may enhance sympathetic tonus, but attitudes are changed to reduce negative affect rather than arousal. *Journal of Experimental Social Psychology, 26*, 289–304. doi: 10.1016/0022-1031(90)90040-S
- Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods, 44*, 1–23. doi: 10.3758/s13428-011-0124-6
- McConnell, A. R., & Brown, C. M. (2010). Dissonance averted: Self-concept organization moderates the effect of hypocrisy on attitude change. *Journal of Experimental Social Psychology, 46*, 361–366. doi: 10.1016/j.jesp.2009.10.019
- McGregor, I., Newby-Clark, I. R., & Zanna, M. P. (1999). "Remembering" dissonance: Simultaneous accessibility of inconsistent cognitive elements moderates epistemic discomfort. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 325–353). Washington, DC: American Psychological Association.
- Muthén, L. K., & Muthén, B. O. (2012). Mplus (Version 7) [Computer software]. Los Angeles, CA.
- Paulhus, D. (1982). Individual differences, self-presentation, and cognitive dissonance: Their concurrent operation in forced compliance. *Journal of Personality and Social Psychology, 43*, 838–852. doi: 10.1037/0022-3514.43.4.838
- Pelletier, L. G., & Dion, S. C. (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*, 303–333. doi: 10.1521/jscp.2007.26.3.303

- Pelletier, L. G., Dion, S. C., Slovinec-D'Angelo, M., & Reid, R. (2004). Why do you regulate what you eat? Relationships between forms of regulation, eating behaviors, sustained dietary behavior change, and psychological adjustment. *Motivation and Emotion, 28*, 245–277. doi: 10.1023/B:MOEM.0000040154.40922.14
- 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. doi: 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 Environment Scale (MTES). *Journal of Applied Social Psychology, 28*, 437–468. doi: 10.1111/j.1559-1816.1998.tb01714.x
- 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
- Proulx, T., Inzlicht, M., & Harmon-Jones, E. (2012). Understanding all inconsistency compensation as a palliative response to violated expectations. *Trends in Cognitive Sciences, 16*, 285–291. doi: 10.1016/j.tics.2012.04.002
- Rand, D. G. (2012). The promise of Mechanical Turk: How online labor markets can help theorists run behavioral experiments. *Journal of Theoretical Biology, 299*, 172–179. doi: 10.1016/j.jtbi.2011.03.004
- 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* (pp. 449–479). New York, NY: Guilford Press.
- Satorra, A., & Bentler, P. M. (1994). Corrections to test statistics and standard errors in covariance structure analysis. In A. von Eye & C. C. Clogg (Eds.), *Latent variables analysis: Applications for developmental research* (pp. 399–419). Thousand Oaks, USA: Sage.
- Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*, 507–514. doi: 10.1007/BF02296192
- Sakai, H. (1999). A multiplicative power-function model of cognitive dissonance: Toward an integrated theory of cognition, emotion, and behavior after Leon Festinger. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 267–294). Washington, DC: American Psychological Association.
- Scheier, M. F., & Carver, C. S. (1980). Private and public self-attention, resistance to change, and dissonance reduction. *Journal of Personality and Social Psychology*, *39*, 390–405. doi: 10.1037/0022-3514.39.3.390
- Scheier, M. F., & Carver, C. S. (1985). The Self-Consciousness Scale: A revised version for use with general populations. *Journal of Applied Social Psychology*, *15*, 687–699. doi: 10.1111/j.1559-1816.1985.tb02268.x
- Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology*, *57*, 1–10. doi: 10.1037/a0018082
- Schmitz, C. (2012). LimeSurvey (Version 1.92) [Open source survey tool]. Hamburg, Germany: LimeSurvey Project.

- Sharp, E., Pelletier, L. G., Blanchard, C., & Séguin-Lévesque, C. (2003). The global motivation scale: Its validity and usefulness in predicting success and failure at self-regulation. Presented at the *4th Annual Meeting of the Society for Personality and Social Psychology*, Los Angeles, CA.
- Sheldon, K. M., Ryan, R., & Reis, H. T. (1996). What Makes for a Good Day? Competence and Autonomy in the Day and in the Person. *Personality and Social Psychology Bulletin*, *22*, 1270–1279. doi: 10.1177/01461672962212007
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*, 422–445. doi: 10.1037/1082-989X.7.4.422
- Simon, L., Greenberg, J., & Brehm, J. (1995). Trivialization: the forgotten mode of dissonance reduction. *Journal of Personality and Social Psychology*, *68*, 247–260. doi: 10.1037/0022-3514.68.2.247
- SPSS (Version 21.0) [Computer software]. (2012). Armonk, NY: IBM Corporation.
- Starzyk, K. B., Fabrigar, L. R., Soryal, A. S., & Fanning, J. J. (2009). A painful reminder: The role of level and salience of attitude importance in cognitive dissonance. *Personality and Social Psychology Bulletin*, *35*, 126–137. doi: 10.1177/0146167208325613
- Statistics Canada. (2008). *Commuting Patterns and Places of Work of Canadians, 2006 Census* (No. 97-561-X). Retrieved from <http://www12.statcan.gc.ca.proxy.bib.uottawa.ca/english/census06/analysis/pow/pdf/97-561-XIE2006001.pdf>
- Statistics Canada. (2012). *Human Activity and the Environment: Waste Management in Canada — Updated* (No. 16-201-X). Retrieved from <http://www.statcan.gc.ca.proxy.bib.uottawa.ca/pub/16-201-x/16-201-x2012000-eng.pdf>

- Stone, J., & Fernandez, N. C. (2008). To practice what we preach: The use of hypocrisy and cognitive dissonance to motivate behavior change. *Social and Personality Psychology Compass*, 2, 1024–1051. doi: 10.1111/j.1751-9004.2008.00088.x
- Strahan, R., & Gerbasi, K. C. (1972). Short, homogeneous versions of the Marlowe-Crowne Social Desirability Scale. *Journal of Clinical Psychology*, 28, 191–193. doi: 10.1002/1097-4679(197204)28:2<191::AID-JCLP2270280220>3.0.CO;2-G
- Tabachnick, B. G., & Fidell, L. S. (2006). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn & Bacon.
- Thompson, B. (2004). *Exploratory and confirmatory factor analysis understanding concepts and applications*. Washington, DC: American Psychological Association.
- Tiller, M. G., & Fazio, R. H. (1982). The relation between attitudes and later behavior following dissonance-produced attitude change. *Personality and Social Psychology Bulletin*, 8, 280–285. doi: 10.1177/0146167282082015
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the Motivation Toward the Environment Scale. *Environment and Behavior*, 35, 486–505. doi: 10.1177/0013916503035004003

## Footnotes

<sup>1</sup> Compared to participants who recalled a counter-environmental action ( $N = 429$ ; see Table 3), participants who did not recall a counter-environmental action ( $N = 209$ ) reported less autonomous motivation toward the environment ( $n = 205$ ,  $M = 3.98$ ,  $SD = 1.32$ ),  $t(631) = -4.83$ ,  $p < .001$ , 95% confidence interval (CI)  $[-.72, -.31]$ , Cohen's  $d = 0.38$ . They also reported less controlled motivation toward the environment ( $n = 205$ ,  $M = 3.13$ ,  $SD = 1.17$ ),  $t(631) = -2.50$ ,  $p = .01$ , 95% CI  $[-.41, -.05]$ , Cohen's  $d = 0.20$ . There were no differences in gender or first language composition ( $\alpha = .05$ ).

<sup>2</sup> Males ( $n = 117$ ,  $M = 3.97$ ,  $SD = 1.75$ ) endorsed item 9 (see Table 1) more strongly than females ( $n = 289$ ,  $M = 3.12$ ,  $SD = 1.73$ ),  $t(404) = -4.56$ ,  $p < .001$ , 95% CI  $[-1.22, -.48]$ , Cohen's  $d = 0.45$ . There were no first language differences ( $\alpha = .001$ ).

<sup>3</sup> Males ( $n = 122$ ,  $M = 3.50$ ,  $SD = 1.37$ ) reported significantly less negative affect than females ( $n = 306$ ,  $M = 4.28$ ,  $SD = 1.39$ ),  $t(426) = 5.25$ ,  $p < .001$ , 95% CI  $[.49, 1.07]$ , Cohen's  $d = 0.51$ . There were no first language differences ( $\alpha = .001$ ).

<sup>4</sup> Compared to participants who recalled a counter-environmental action ( $N = 257$ ; see Table 4), participants who did not recall a counter-environmental action ( $N = 82$ ) reported weaker pro-environmental attitudes ( $n = 66$ ,  $M = 3.81$ ,  $SD = 1.05$ ),  $t(321) = -3.65$ ,  $p < .001$ , 95% CI  $[-.80, -.24]$ , Cohen's  $d = 0.41$ . They also reported less autonomous motivation toward the environment ( $n = 81$ ,  $M = 3.60$ ,  $SD = 1.34$ ),  $t(331) = -2.45$ ,  $p = .02$ , 95% CI  $[-.72, -.08]$ , Cohen's  $d = 0.27$ . There were no differences in gender or first language composition ( $\alpha = .05$ ).

<sup>5</sup> ISPR users who were included ( $N = 248$ ; see Table 6) and excluded ( $N = 97$ ) from analyses reported similar levels of autonomous and controlled motivation toward the environment, pro-environmental strength, and relative frequency of counter-environmental actions ( $\alpha = .05$ ).

Proportionally, there were more females who recalled a counter-environmental action ( $n = 207$ , 83.8%) versus females who did not ( $n = 66$ , 69.5%),  $\chi^2(1) = 8.75$ ,  $p = .003$ ,  $\phi = .16$ . There were no differences in first language composition ( $\alpha = .05$ ).

<sup>6</sup> Compared to CrowdFlower contributors who recalled a counter-environmental action ( $N = 301$ ; see Table 6), those who did not recall a counter-environmental action ( $N = 122$ ) reported weaker pro-environmental attitudes ( $n = 108$ ,  $M = 4.19$ ,  $SD = 1.29$ ),  $t(407) = -5.67$ ,  $p < .001$ , 95% CI [-.93, -.45], Cohen's  $d = 0.56$ . They also reported less autonomous motivation toward the environment ( $n = 108$ ,  $M = 4.62$ ,  $SD = 1.41$ ),  $t(407) = -3.08$ ,  $p = .002$ , 95% CI [-.69, -.15], Cohen's  $d = 0.31$ . There were no differences in gender or first language composition ( $\alpha = .05$ ).

<sup>7</sup> A CFA of the Inconsistency Compensation Strategies scale items supported the two-factor structure within the general sample. Assumption testing and covariance structural modeling procedures were identical to the ones described in Study 2 (see the Results section). The uncorrelated factor model fit poorly, so we freed the covariance between the CR and BM factors. The correlated model fit relatively poorly when tested with multivariate outliers,  $n = 288$ ;  $\chi^2(26) = 84.46$ ,  $p < .001$ , RMSEA = .09, 90% CI [.07, .11], CFI = .95, TLI = .92, SRMR = .07. However, the model fit relatively well when tested without outliers,  $n = 281$ ,  $\chi^2(26) = 58.85$ ,  $p < .001$ , RMSEA = .07, 90% CI [.04, .09], CFI = .97, TLI = .96, SRMR = .06. All indicators had substantive loadings ( $> .50$ ) on their respective factors and the latent variables explained a substantial amount of variance for each item ( $R^2 > .30$ ).

Table 1

*Descriptive Statistics for the Inconsistency Compensation Strategies Scale Items of Studies 1 and 2*

Item	Study 1			Study 2			
	<i>M</i>	<i>SD</i>	Skew	<i>n</i>	<i>M</i>	<i>SD</i>	Skew
Non-compensation							
1. Doing nothing at all.	2.71	1.80	0.78				
2. Putting the inconsistency out of my mind.	3.99	1.69	-0.07				
3. Simply shrugging it off.	3.15	1.83	0.56				
Attitude Change/Trivialization							
4. Concluding that my action toward the environment is an indication of my true attitudes and beliefs about the environment.	2.96	1.67	0.54				
5. Questioning whether environmental sustainability is really that important to me personally.	2.44	1.52	0.95	244	2.89	1.64	0.50
6. Thinking that the issue of environmental sustainability has been blown out of proportion.	2.47	1.52	0.96	244	2.59	1.60	0.84
7. Reassessing the importance I attribute to environmental sustainability.	3.01	1.68	0.41				
8. Concluding that environmental sustainability is not a priority for me.	2.44	1.53	0.93	250	2.88	1.65	0.68
Rationalization							
9. Thinking that my individual action probably had no measurable impact on the environment.	3.37	1.78	0.28				
10. Thinking it doesn't really matter since most people act the same way.	2.77	1.70	0.70	247	3.71	1.90	0.14
11. Concluding that I could not have acted in any other way under the circumstances.	2.69	1.77	0.85				

Table 1 (Continued)

Item	Study 1			Study 2			
	<i>M</i>	<i>SD</i>	Skew	<i>n</i>	<i>M</i>	<i>SD</i>	Skew
12. Thinking I cannot be held personally responsible for environmental sustainability.	3.24	1.68	0.36	244	3.21	1.79	0.38
13. Mentally listing reasons why it wasn't my fault.	2.47	1.55	0.92				
14. Thinking that the action I just did, despite being unsustainable, was consistent with other values and goals I consider important.	2.78	1.65	0.71				
Behaviour Modification/Behaviour Change							
15. Acting sustainably (consistently) when I found myself in a similar situation at a later time.	4.63	1.72	-0.48	245	4.20	2.12	-0.17
16. Making 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.	3.85	1.89	-0.04	245	3.69	1.97	0.05
17. Actively looking for opportunities to act sustainably (consistently) in other situations.	3.93	1.72	-0.02	243	3.85	1.97	-0.07
18. Immediately correcting the inconsistent action (ex: repeating the action in a more sustainable fashion).	3.64	1.89	0.11	244	3.00	1.94	0.59

*Note.* Study 1  $n = 407$ . Study 2  $N = 250$ . Items complete the statement: "When I became aware that I acted inconsistently with my own personal beliefs and/or goals about environmental sustainability, I reacted by..." The potential and actual range of observed values were 1 (*do not agree*) to 7 (*completely agree*).

Table 2

*Factor Loadings for the Exploratory Factor Analyses (EFA) With Principal Axis Factoring and Varimax Rotation of Study 1 (N = 407) and the Confirmatory Factor Analysis (CFA) of Study 2 (N = 250)*

Item <sup>a</sup>	Strategy	Study 1 initial EFA			Study 1 final EFA			Study 2 CFA		
		RFL		Extraction Communality	RFL		Extraction Communality	$\lambda$		$R^2$
		CR	BM		CR	BM		Unstd. [95% CI]	Std.	
6	T	<b>.65</b>	-.10	.43	<b>.71</b>	.03	.50	0.72 [0.58, 0.87]	.62	.39
5	T	<b>.64</b>	.01	.41	<b>.63</b>	.08	.40	0.98 [0.87, 1.09]	.81	.66
8	T	<b>.61</b>	-.33	.49	<b>.70</b>	-.19	.53	---	.83	.69
10	R	<b>.60</b>	-.40	.52	<b>.65</b>	-.27	.50	0.91 [0.76, 1.06]	.64	.41
12	R	<b>.56</b>	-.17	.35	<b>.53</b>	-.08	.29	0.91 [0.75, 1.06]	.68	.46
9	R	<b>.53</b>	-.38	.42						
13	R	<b>.52</b>	.02	.27						
4	T	<b>.51</b>	.09	.26						
14	R	<b>.50</b>	.03	.25						
7	T	.47	.30	.31						
11	R	.36	-.06	.13						
2	N	.32	-.27	.18						
18	B	.04	<b>.69</b>	.47	-.06	<b>.72</b>	.52	0.99 [0.73, 1.25]	.55	.30
16	B	.12	<b>.68</b>	.47	.01	<b>.71</b>	.50	1.32 [0.81, 1.83]	.73	.53
17	B	.13	<b>.62</b>	.40	-.02	<b>.56</b>	.32	1.18 [0.73, 1.63]	.65	.42
1	N	.32	<b>-.60</b>	.46						
3	N	.36	<b>-.60</b>	.48						
15	B	-.12	<b>.55</b>	.31	-.23	<b>.58</b>	.39	---	.51	.26

*Note.* Large rotated factor loadings ( $\geq .50$ ) of the Study 1 EFA's are in boldface. The standardized path estimates ( $\lambda$ ) of the Study 2 CFA are significant ( $p$ 's  $< .001$ ). The symbol "---" indicates a fixed path ( $\lambda = 1$ ). RFL = rotated factor loading. CR = cognitive restructuring. BM = behaviour modification. Unstd. = unstandardized. CI = confidence interval. Std. = standardized. T = trivialization. R = rationalization. N = non-compensation. B = behaviour modification.

<sup>a</sup>See Table 1 for a complete list of items.

Table 3

*Descriptive Statistics and Bivariate and Partial Correlations of the Study 1 Composite Variables*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Skew	$\alpha$	Range	Correlations				
							1	2	3	4	5
Motivation constructs											
1. Autonomous motivation	428	4.50	1.23	-0.29	.84 <sup>a</sup>	1.00-7.00		.46***	.49***	-.30***	.44***
2. Controlled motivation	428	3.36	1.05	-0.05	.80 <sup>a</sup>	1.00-6.50			.40***	.10*	.23***
3. Negative affect	429	4.05	1.43	-0.09	.89	1.00-7.00				-.16**	.45***
Compensation strategies											
4. Cognitive restructuring	429	2.68	1.17	0.55	.78	1.00-6.60	-.35***	.30***	-.07		-.18***
5. Behaviour modification	429	4.02	1.34	-0.05	.74	1.00-7.00	.28***	-.04	.30***		

*Note.* All variables had a potential range of 1 to 7. Bivariate correlations are above the diagonal. Partial correlations between the compensation strategies (Variables 4 and 5) and each motivation construct (Variables 1 through 3) controlling for the other two motivation constructs are below the diagonal in italics.

<sup>a</sup>Cronbach alpha corresponding to the least internally consistent composite subscale.

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

Table 4

*Descriptive Statistics of the Study 2 Composite Variables*

Variables	<i>n</i>	<i>M</i>	<i>SD</i>	$\alpha$	Range		
					Potential	Actual	Skew
Environmental constructs							
Autonomous motivation	252	4.00	1.24	.87 <sup>a</sup>	1-7	1.00-7.00	-0.06
Controlled motivation	252	3.05	0.97	.87 <sup>a</sup>	1-7	1.00-5.75	-0.21
Attitude strength	257	4.34	1.03	.77	1-7	1.75-7.00	0.06
Dissonance motivation constructs							
Psychological discomfort	252	3.50	1.50	.92	1-7	1.00-7.00	0.17
Self-integrity restoration	248	3.36	1.72	.80	1-7	1.00-7.00	0.28
Ego-invested self-protection	248	2.08	1.38	.85	1-7	1.00-7.00	1.21
General constructs							
Private self-consciousness	255	1.91	0.56	.74	0-3	0.11-3.00	-0.18
Public self-consciousness	255	2.09	0.66	.83	0-3	0.00-3.00	-0.84
Preference for consistency	254	4.35	1.20	.86	1-7	1.00-7.00	-0.40
Social desirability	252	5.23	2.04	.56	0-10	1-10	0.09
Compensation strategies							
Cognitive restructuring	250	3.06	1.31	.82	1-7	1.00-7.00	0.27
Behaviour modification	249	3.71	1.46	.70	1-7	1.00-7.00	0.01

Note. *N* = 257.

<sup>a</sup>Cronbach alpha corresponding to the least internally consistent composite subscale.

Table 5

*Bivariate and Partial Correlations of the Study 2 Composite Variables*

Variables	<i>n</i>	1	2	3	4	5	6	7	8	9	10	11	12
Environmental constructs													
1. Autonomous motivation	252	---	.41***	.34***	.58***	.37***	.10	.21***	.08	.19**	.17**	-.40***	.39***
2. Controlled motivation	252		---	.13*	.15*	.14*	.30***	.15*	.23***	.26***	-.12	-.01	.15*
3. Attitude strength	257			---	.30***	.41***	.09	.13*	.02	.09	.17**	-.42***	.34***
Dissonance motivation constructs													
4. Psychological discomfort	252				---	.47***	.42***	.22***	.16*	.10	-.01	-.11	.44***
5. Self-integrity restoration	248					---	.49***	.21**	.11	.17**	.14*	-.20**	.44***
6. Ego-invested self-protection <sup>a</sup>	248						---	.18**	.24***	.24***	-.04	.18**	.27***
General constructs													
7. Private self-consciousness	255							---	.55***	.24***	-.19**	.07	.14*
8. Public self-consciousness	255								---	.33***	-.19**	.14*	.13*
9. Preference for consistency	254									---	.09	-.02	.22***
10. Social desirability	252										---	-.16*	.15*
Compensation strategies													
11. Cognitive restructuring	250	-.22**	.05	-.03	-.20**	-.15*	.26***	.12	.06	-.05	.02	---	-.04
12. Behaviour modification	249	.15*	-.03	.24***	.06	.17**	.02	-.05	.05	.13*	.08		---

*Note.*  $N = 257$ . Bivariate correlations are above the diagonal. Partial correlations between the two compensation strategies (variables 11 and 12) and each covariate (variables 1 through 10) controlling for the other nine covariates are below the diagonal in italics.

<sup>a</sup>The variable was log-transformed to correct the skewed distribution.

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

Table 6

*Descriptive Statistics of the Study 3 Variables by Sample*

Variable	General sample ( $N = 301$ )						Student sample ( $N = 248$ )					
	$n$	$M$	$SD$	$\alpha$	Range	Skew	$n$	$M$	$SD$	$\alpha$	Range	Skew
Autonomous motivation	301	5.04	1.14	.89 <sup>a</sup>	1.42-7.00	-0.34	248	4.49	1.23	.88 <sup>a</sup>	1.08-7.00	-0.43
Controlled motivation	301	3.83	0.97	.84 <sup>a</sup>	1.00-6.67	-0.16	248	3.46	1.13	.85 <sup>a</sup>	1.00-6.25	-0.04
Attitude strength	301	4.88	1.00	.81	2.25-7.00	-0.07	248	4.54	0.96	.73	2.00-6.75	-0.37
Psychological discomfort	285	3.67	1.54	.94	1.00-7.00	-0.03	243	3.44	1.51	.92	1.00-7.00	0.17
Cognitive restructuring	288	2.58	1.31	.87	1.00-6.20	0.50	241	2.78	1.23	.78	1.00-6.60	0.47
Behaviour modification	288	3.58	1.49	.82	1.00-7.00	-0.08	241	3.79	1.41	.75	1.00-7.00	-0.18
Frequency of native inconsistencies	294	3.83	1.88	---	.00-.94	0.47	238	4.31	1.80	---	.00-.88	0.16

*Note.* The frequency of native inconsistencies variable had a potential range of 0 to 1. All other variables had a potential range of 1 to 7.

<sup>a</sup>Cronbach alpha corresponding to the least internally consistent composite subscale.

Table 7

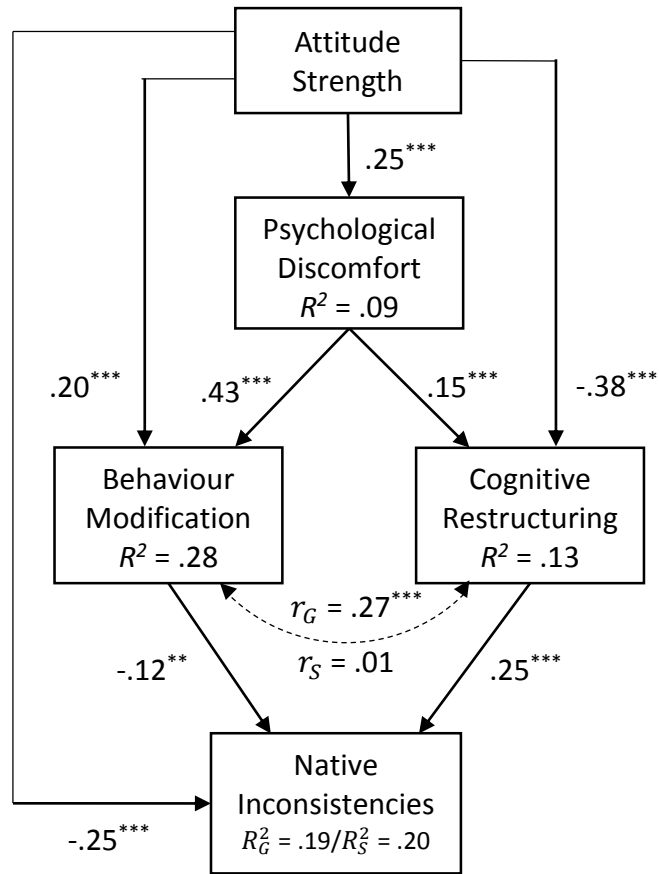
*Indirect and Total Effects Corresponding to the Predictor Variables of the Final Partial Invariance Multi-Sample Path Models of Study 3*

Effect	CDT model		HABICE model			
	Attitude Strength		Autonomous Motivation		Controlled Motivation	
	Unstd. [95% BCI]	Std.	Unstd. [95% BCI]	Std.	Unstd. [95% BCI]	Std.
<b>Cognitive restructuring</b>						
Indirect total (via PD)	0.06 [ 0.03, 0.09]	.05**				
Total	-0.43 [-0.52,-0.34]	-.33***	-0.35 [-0.45,-0.27]	-.33***	0.41 [ 0.30, 0.50]	.34***
<b>Behaviour modification</b>						
Indirect total (via PD)	0.19 [ 0.13, 0.24]	.13***	0.12 [ 0.08, 0.16]	.10***	0.12 [ 0.08, 0.16]	.09***
Total	0.48 [ 0.38, 0.59]	.33***	0.54 [ 0.45, 0.61]	.44***	0.12 [ 0.08, 0.16]	.09***
<b>Native inconsistencies</b>						
Indirect via CR	-0.17 [-0.25,-0.12]	-.09***	-0.14 [-0.21,-0.10]	-.09***	0.17 [ 0.11, 0.23]	.10***
Indirect via BM	-0.05 [-0.09,-0.02]	-.03*	-0.05 [-0.10,-0.01]	-.03 <sup>†</sup>		
Indirect via PD & CR	0.02 [ 0.01, 0.04]	.01**				
Indirect via PD & BM	-0.03 [-0.06,-0.01]	-.02*	-0.01 [-0.03, 0.00]	-.01 <sup>†</sup>	-0.01 [-0.03, 0.00]	-.01 <sup>†</sup>
Indirect total	-0.23 [-0.32,-0.15]	-.12***	-0.21 [-0.29,-0.12]	-.13***	0.15 [ 0.10, 0.22]	.09***
Total	-0.69 [-0.82,-0.56]	-.37***	-0.59 [-0.71,-0.47]	-.38***	0.15 [ 0.10, 0.22]	.09***

*Note.*  $N = 549$ . CDT = cognitive dissonance theory. HABICE = hierarchical action-based model of inconsistency compensation in the environmental domain. Unstd. = unstandardized estimates. BCI = bias-corrected bootstrap confidence interval. Std. = Standardized estimates. PD = psychological discomfort. CR = cognitive restructuring. BM = behaviour modification.

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

a) CDT Model



b) HABICE Model

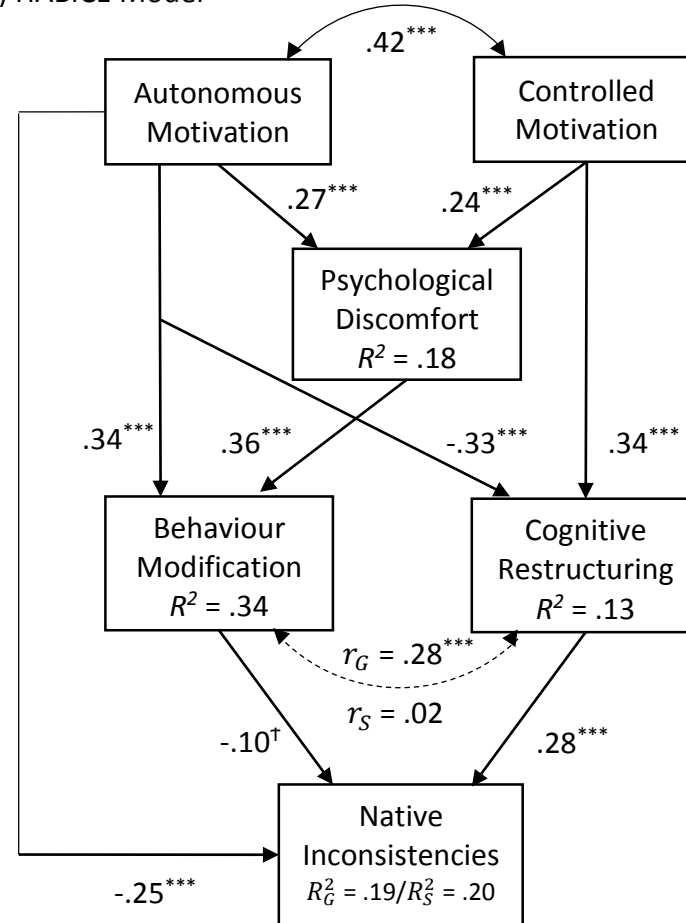


Figure 1. Model diagrams of the final partial invariance multi-sample path analyses of Study 3. Solid lines indicate parameters constrained to equality across the general ( $N = 301$ ; subscript "G") and student ( $N = 248$ ; subscript "S") samples. Broken lines indicate unconstrained parameters across the two samples. Double-headed arrows indicate a correlation ( $r$ ). Single-headed arrows indicate a directional path. Standardized path estimates ( $\lambda$ ) and proportions of explained variance ( $R^2$ ) are shown on the figure. CDT = cognitive dissonance theory. HABICE = hierarchical action-based model of inconsistency compensation in the environmental domain.

<sup>†</sup> $p < .10$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

## Appendix A

Correlation Matrix for the Exploratory Factor Analysis of Study 1 and the Covariance Matrix for the Confirmatory Factor Analysis of Study 2

Item <sup>a</sup>	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	.25**	.58**	.10*	.21**	.22**	.01	.46**	.38**	.45**	.16**	.19**	.12*	.12*	-.30**	-.32**	-.37**	-.38**
2		.35**	.17**	.16**	.13**	.06	.21**	.23**	.34**	.13**	.35**	.22**	.17**	-.16**	-.12*	-.06	-.24**
3			.16**	.19**	.28**	.00	.43**	.37**	.44**	.14**	.29**	.08	.20**	-.37**	-.35**	-.26**	-.37**
4				.33**	.27**	.28**	.33**	.20**	.23**	.18**	.29**	.22**	.30**	-.04	.09	.15**	.11*
5				<b>2.70</b>	.41**	.48**	.48**	.29**	.37**	.23**	.32**	.28**	.25**	-.10	.09	.04	-.01
6				1.10	<b>2.57</b>	.20**	.52**	.42**	.42**	.21**	.42**	.34**	.39**	-.15**	.03	-.02	.01
7							.23**	.11*	.14**	.12*	.15**	.23**	.16**	.09	.25**	.31**	.21**
8				1.57	1.26		<b>2.73</b>	.46**	.51**	.19**	.28**	.22**	.21**	-.29**	-.15**	-.18**	-.11*
9									.47**	.22**	.44**	.37**	.24**	-.16**	-.26**	-.24**	-.22**
10				1.29	1.22		1.59		<b>3.60</b>	.28**	.44**	.30**	.27**	-.28**	-.17**	-.15**	-.27**
11											.18**	.22**	.23**	-.13*	.03	.03	-.04
12				1.52	1.43		1.30		1.73		<b>3.21</b>	.36**	.29**	-.15**	-.08	.00	-.12*
13													.35**	-.04	.07	.06	.01
14														-.09	.13*	.15**	-.02
15				-0.12	-0.12		-0.23		-0.13		0.01			<b>4.50</b>	.41**	.30**	.46**
16				0.41	-0.14		-0.18		-0.47		0.04			1.15	<b>3.90</b>	.42**	.48**
17				0.14	-0.17		-0.37		-0.22		0.11			1.12	2.03	<b>3.87</b>	.41**
18				0.29	-0.01		-0.52		-0.61		0.07			1.56	1.50	1.23	<b>3.77</b>

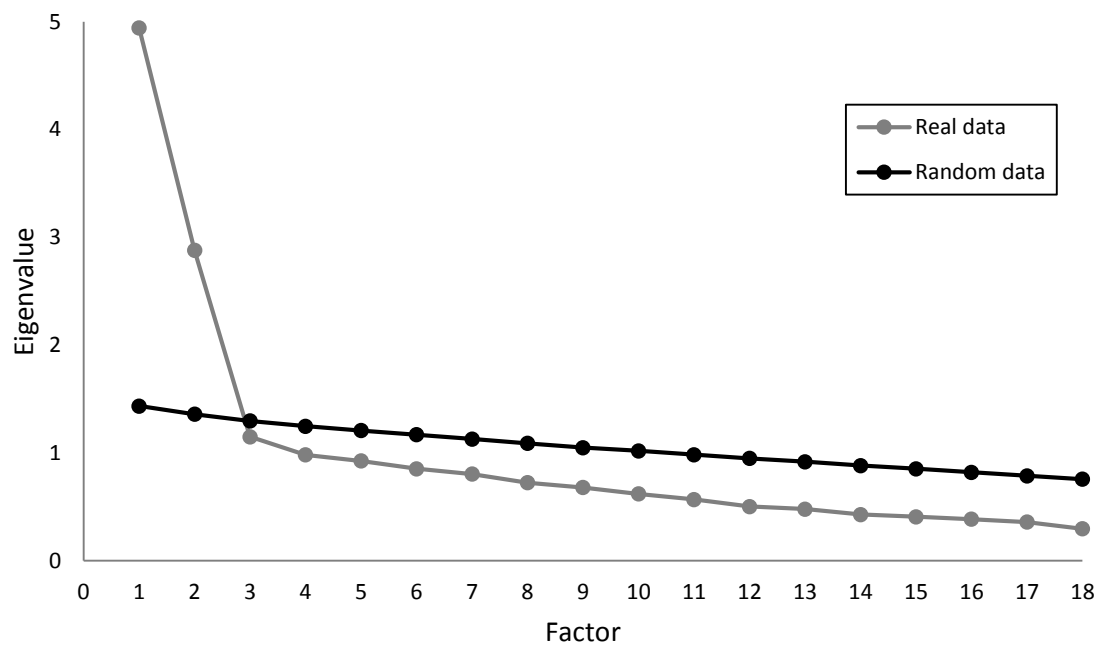
Note. Bivariate correlations of the Study 1 EFA variables ( $N = 407$ ) are above the diagonal. Variances and covariances of the Study 2 CFA variables ( $N = 250$ ) are on the diagonal (in boldface) and below the diagonal, respectively.

<sup>a</sup>See Table 1 for a complete list of items with descriptive statistics.

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

## Appendix B

Scree Plot Corresponding to the Parallel Exploratory Factor Analyses of Study 1



## Appendix C

## Covariance Matrices for the Multi-Sample Path Analyses of Study 3

Variable	1	2	3	4	5	6	7 <sup>a</sup>	<i>n</i>	<i>s</i> <sup>2</sup>
1. Autonomous motivation	---	0.46	0.81	0.57	-0.22	0.77	-0.73	301	1.30
2. Controlled motivation	0.58	---	0.23	0.53	0.27	0.47	-0.05	301	0.95
3. Attitude strength	0.74	0.21	---	0.43	-0.41	0.42	-0.64	301	1.01
4. Psychological discomfort	0.73	0.59	0.40	---	0.10	1.09	-0.44	285	2.36
5. Cognitive restructuring	-0.30	0.31	-0.41	0.05	---	0.42	0.75	288	1.71
6. Behaviour modification	0.85	0.34	0.51	1.04	-0.12	---	-0.58	288	2.22
7. Frequency of native inconsistencies <sup>a</sup>	-0.79	-0.07	-0.73	-0.49	0.75	-0.35	---	294	3.53
<i>n</i>	248	248	248	243	241	241	238		
<i>s</i> <sup>2</sup>	1.51	1.28	0.93	2.28	1.50	2.00	3.23		

*Note.* Covariances for the general sample ( $N = 301$ ) are above the diagonal and corresponding  $n$  and variances ( $s^2$ ) are in the columns on the right side of the table. Covariances for the student sample ( $N = 248$ ) are below the diagonal and corresponding  $n$  and  $s^2$  are in the rows at the bottom of the table.

<sup>a</sup>Scores were multiplied by 10 to rescale the covariance matrix.

Running head: AWARENESS OF ENVIRONMENTAL TRANSGRESSIONS

The Effects of Inducing Public and Private Awareness of Environmental Transgressions on  
Motivation and Intentions to Revise Global Warming Attitudes

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### Abstract

This research examined how people compensate for inconsistencies between their favourable attitudes toward global warming mitigation (pro-GW attitudes) and their greenhouse gas (GHG)-emitting actions. The authors used the hypocrisy paradigm to test hypotheses about the interactive effect of individual differences in autonomous and controlled motivation toward the environment, and of social factors that direct attention to the public versus private aspects of the self on inconsistency compensation processes. Participants ( $N = 108$ ) were randomly assigned to one of 4 conditions that manipulated commitment (public versus private) to a pro-attitudinal advocacy in favour of mitigating GW and awareness (induced versus not induced) of recent GHG-emitting actions. As expected, inducing awareness of past transgressions motivated people to compensate for the attitude-behaviour inconsistency. Making a public advocacy pressured people to revise their pro-GW attitudes when there was no opportunity to compensate for their GHG-emitting actions. Making a private advocacy facilitated the manifestation of individual differences in motivation toward the environment on intentions to revise pro-GW attitudes. Ironically, the results suggest that inducing public awareness of transgressions (i.e., hypocrisy) or inducing private awareness of transgressions among people with low levels of autonomous or with high levels of controlled motivation toward the environment may lead to the erosion of pro-GW attitudes when there is no opportunity to compensate for GHG-emitting actions. By contrast, people with high levels of autonomous and low levels of controlled motivation toward the environment seemed to resist the tendency to revise their pro-GW attitudes under conditions of private awareness.

## **The Effects of Inducing Public and Private Awareness of Environmental Transgressions on Motivation and Intentions to Reverse Global Warming Attitudes**

In light of the sobering report by the Intergovernmental Panel on Climate Change (2014) documenting the exacerbating effect of climate change on the dire state of the environment, it is reassuring to know that many Canadians report being increasingly concerned about the environment (Institute for Social Research, 2007, 2009; Ipsos-Reid, 2012). Unfortunately, Canadians have been slow at changing their behaviour to be in line with their environmental concerns, particularly when it comes to curbing greenhouse gas (GHG) emissions. For example, the majority of Canadians—73.3% in 1996 and 72.3% in 2006—continue to drive to work despite having access to public transportation; an environmentally harmful habit exacerbated by rising median commuting distances and population growth (Statistics Canada, 2008). In the interest of mitigating or slowing global warming (GW) and climate change, there is a need to examine how people deal with inconsistencies between their favourable attitudes toward GW mitigation and their harmful GHG-emitting actions (Gifford, 2011). This seems especially important in light of recent research showing that the choice of strategy to compensate for attitude-behaviour inconsistencies in the environmental domain has implications for the relative frequency of counter-environmental versus pro-environmental behaviour (PEB).

Lavergne and Pelletier (2015a) found that compensating for a counter-environmental action by reversing its harmful impact or performing a pro-environmental action (i.e., behaviour modification) predicted relatively infrequent native inconsistencies in day-to-day life. By contrast, compensating for a recent counter-environmental action by trivializing pro-environmental attitudes or the harmful impact of the action, or by justifying the action (i.e., cognitive restructuring) predicted relatively frequent native inconsistencies. These findings imply

that the choice of strategy to compensate for attitude-behaviour inconsistencies has implications for the persistence of pro-environmental attitudes and the frequency of PEB. However, cognitive dissonance theories (see Harmon-Jones & Mills, 1999 for a review) do not make clear predictions about which strategy people are likely to use to compensate for attitude-behaviour inconsistencies, in part, because these theories do not clearly elucidate why inconsistencies are uncomfortable (Proulx, Inzlicht, & Harmon-Jones, 2012). Fortunately, recent research suggests that accounting for individual differences in motivation toward the environment may facilitate predictions about the use and choice of inconsistency compensation strategies in the environmental domain (Lavergne & Pelletier, 2015a; 2015b).

### **Hierarchical Action-Based Model of Inconsistency Compensation in the Environmental Domain**

The research by Lavergne and Pelletier (2015a) provided support for the proposed hierarchical action-based model of inconsistency compensation in the environmental domain (HABICE). The HABICE is rooted in the action-based model of dissonance (Harmon-Jones, Amodio, & Harmon-Jones, 2009) and self-determination theory (Deci & Ryan, 1985a, 1985b; 2008; Vallerand, 1997). Specifically, the model outlines predictions about how individual differences in distal motives for effective and unconflicted action in the environmental domain affect the perception of attitude-behaviour inconsistencies, the arousal of dissonance when such inconsistencies arise, and the use and choice of strategies to compensate for these inconsistencies.

Like the action-based model of dissonance (Harmon-Jones et al., 2009), the HABICE operates on the assumption that conflicting cognitions, for example salient pro-environmental attitudes and counter-environmental actions, arouse dissonance because they activate opposing or

contradictory action tendencies—such as values, needs, goals, or behavioural commitments. As a result, these inconsistencies threaten effective action. This assumption implies that there are two types of motivation operating during dissonance processes (Harmon-Jones, 1999). The dissonance aroused by attitude-behaviour inconsistencies creates a proximal motivation that energizes inconsistency compensation processes. In addition, the dominant action tendencies elicited by such inconsistencies prime distal motives for effective and unconflicted action that guide these processes.

In accordance with self-determination theory (Deci & Ryan, 1985a; 1985b; 2008; Vallerand, 1997), the HABICE (Lavergne & Pelletier, 2015a) posits there are two types of distal motivational orientations that embody distinct action tendencies and guide inconsistency compensation processes. On the one hand, action tendencies to facilitate organismic integration via the authentic self-regulation of PEB implied by high levels of autonomous motivation toward the environment (Deci & Ryan, 1985a; Pelletier, Tuson, Green-Demers, Beaton, & Noels, 1998), foster authentic or adaptive compensation processes. On the other hand, action tendencies to facilitate desirable instrumental outcomes via the contingent regulation of PEB implied by high levels of controlled motivation toward the environment (Deci & Ryan, 1985a; Pelletier et al., 1998), foster inauthentic or maladaptive compensation processes.

**Autonomous compensation processes.** Organismic integration refers to the innate tendency to act in a way that supports the coherence and consistence of authentic self-structures—for example, needs, beliefs, values, emotions, and behavioural tendencies—in order to feel autonomous and competent (Hodgins & Knee, 2002; Ryan & Deci, 2004). Therefore, levels of autonomous motivation toward the environment, the tendency to regulate PEB because environmental protection is personally important or because PEB are inherently satisfying (i.e.,

PEB with an internal locus of causality), correspond to individual differences in the tendency to facilitate organismic integration via the authentic regulation of PEB (Deci & Ryan, 1985a; Pelletier et al., 1998). Consequently, autonomous motivation toward the environment is reliably associated with strong pro-environmental attitudes and with frequent and persistent self-determined PEB (de Groot & Steg, 2010; Green-Demers, Pelletier, & Ménard, 1997; Lavergne, Sharp, Pelletier, & Holtby, 2010; Osbaldiston & Sheldon, 2003; Pelletier, Green-Demers, & Béland, 1997; Pelletier et al., 1998; Villacorta, Koestner, & Lekes, 2003).

Lavergne and Pelletier (2015a; 2015b) found that autonomous motivation toward the environment facilitates dissonance arousal when people become aware of their own counter-environmental actions. Specifically, these inconsistencies motivate people to compensate to reduce dissonance and to restore the integrity of authentic self-structures, in this case self-relevant pro-environmental attitudes (Lavergne & Pelletier, 2015b). Presumably, when people regulate PEB because environmental protection is personally important and self-relevant, their counter-environmental actions represent an authentic self-integrity threat. As a result, autonomous motivation toward the environment disposes people to use behaviour modification strategies to compensate for the negative impact of their counter-environmental actions, for example engaging in compensatory pro-environmental actions. Furthermore, this motivational orientation disposes people to avoid using cognitive restructuring strategies, presumably because revising self-relevant attitudes would exacerbate the perceived threat (Lavergne & Pelletier, 2015a). The authentic use of compensation strategies partly explained the negative relationship between autonomous motivation toward the environment and the frequency of recent counter-environmental versus pro-environmental actions (Lavergne & Pelletier, 2015a; 2015b).

**Controlled compensation processes.** The socially acquired action tendency to act in a

way that facilitates desirable outcomes, such as praise, and deters undesirable outcomes, such as criticism, undermines organismic integration but supports ego-invested self-structures (e.g., feelings of self-worth contingent on the approval of others; Hodgins & Knee, 2002; Hodgins, 2008; Ryan & Deci, 2004). Levels of controlled motivation toward the environment correspond to individual differences in the tendency to facilitate desired instrumental outcomes via the contingent regulation of PEB (Pelletier et al., 1998). Controlled motivation disposes people to engage in PEB because of external or internal pressures to act a certain way, which implies an external perceived locus of causality (Deci & Ryan, 1985a). For these reasons, controlled motivation toward the environment is not reliably associated with pro-environmental attitudes or with the frequency or persistence of PEB (Green-Demers et al., 1997; Lavergne et al., 2010; Pelletier et al., 1997; 1998; Villacorta et al., 2003).

Controlled motivation toward the environment facilitates dissonance arousal when people become aware of their counter-environmental actions and it motivates them to compensate for inconsistencies to reduce dissonance and to protect ego-invested self-structures (Lavergne & Pelletier, 2015b). However, when the inconsistency leaves people feeling indifferent, presumably because the counter-environmental action is private and does not conflict with instrumental action tendencies, controlled motivation does not motivate them to compensate. It seems that people who regulate PEB to obtain desired contingencies or to avoid undesired contingencies perceive their counter-environmental actions as a potential threat to ego-invested self-structures. As a result, controlled motivation toward the environment disposes people to use different compensation strategies depending on whether or not the inconsistency arouses dissonance. Lavergne and Pelletier (2015a) found that controlled motivation predicted the use of overt behaviour modification strategies strictly to reduce dissonance (indirect effect). This finding

implies that the dissonance aroused by the perceived ego-invested self-threat pressured people to minimize or to avoid the aversive consequences of their actions (e.g., negative social evaluative reactions). However, when counter-environmental actions did not arouse dissonance, controlled motivation predicted the use covert cognitive restructuring strategies, presumably to minimize or avoid the cognitive inconsistency (Lavergne & Pelletier, 2015a). The contingent use of compensation strategies fully explained the positive relationship between controlled motivation toward the environment and the relative frequency of recent counter-environmental actions (Lavergne & Pelletier, 2015a; 2015b).

These findings support the notions that individual differences in autonomous and controlled motivation toward the environment act as distal motives that guide inconsistency compensation processes, and that the quality rather than the quantity of motivation predicts the choice of compensation strategy. Although previous research seems to support the HABICE, it has focused exclusively on the role of individual differences in levels of autonomous and controlled motivation, and relied on correlational research designs. Previous tests of the HABICE do not account for the moderating effects of social factors on motivation for a specific activity at a specific time, in this case the quality of motivation to compensate, as postulated by self-determination theory (Deci & Ryan, 2008; Vallerand, 1997). Therefore, the purpose of the present research was to test the assumptions of the HABICE regarding the interactive effects of individual differences in motivation toward the environment and of social factors on inconsistency compensation processes using an experimental design.

### **Hypocrisy Paradigm**

The HABICE (Lavergne & Pelletier, 2015a; 2015b) assumes that the reasons why attitude-behaviour inconsistencies motivate people to compensate should predict the choice of

compensation strategy. In accordance with the hierarchical model of extrinsic and intrinsic motivation (Vallerand, 1997), the model also assumes that social factors—the real or imagined presence of important others—moderate the top-down effects of individual differences in motivation toward the environment on motives to compensate. The influence of social factors seem particularly important during perception processes, because the real or imagined presence of evaluative or controlling others should lead people to use ego-invested self-structures to evaluate the significance of their counter-attitudinal actions. One way to test this hypothesis is to use the hypocrisy paradigm. This paradigm consists of inducing a public attitude-behaviour inconsistency (i.e., hypocrisy) by having participants make a public commitment to a pro-attitudinal course of action and by subsequently inducing awareness of recent behavioural transgressions against the advocated attitude (Stone & Fernandez, 2008).

**The standard hypocrisy effect.** The hypocrisy paradigm derives from the self-consistency revision of cognitive dissonance theory (Thibodeau & Aronson, 1992; Aronson, 1999). Self-consistency theory posits that becoming aware that one does not always practice what one preaches violates personal expectations of integrity and, therefore, induces feelings of hypocrisy that motivate people to restore self-integrity. Because the advocated attitude is personally important and public, the induced inconsistency motivates people to engage in compensatory behaviour change because, under these conditions, no other strategy has the potential to restore self-integrity (Stone & Fernandez, 2008). The positive effect of induced hypocrisy on behaviour change is the standard hypocrisy effect reported in the literature. Evidence of the standard hypocrisy effect comes from experimental research that manipulates commitment to a pro-attitudinal advocacy and awareness of recent past transgressions against the advocated attitude (see Stone & Fernandez, 2008 for a review). This research typically targets

positive behaviour change in important social domains, such as the promotion of health-enhancing behaviour (Aronson, Fried, & Stone, 1991; Freijy & Kothe, 2013; Stone, Aronson Crain, & Winslow, 1994; Stone, Wiegand, Cooper, & Aronson, 1997), PEB (Dickerson, Thibodeau, Aronson, & Miller, 1992; Fried, 1998; Fried & Aronson, 1995), and adherence to road safety and driving laws (Fointiat, 2004; 2008; Fointiat & Grosbras, 2007; Fointiat, Morisot, & Pakuszewski, 2008).

However, the results of many studies suggest that inducing a public attitude commitment without inducing awareness of past transgressions or inducing awareness of past transgressions without inducing a public attitude commitment sometimes causes as much behaviour change as inducing hypocrisy (c.f., Aronson et al., 1991; Fointiat et al., 2008; Stone et al., 1994; Stone et al., 1997). These findings suggest that manipulating either factor of the hypocrisy paradigm is sufficient to motivate behaviour change. It seems important to understand the motivation underlying these effects because recent research suggests that inducing hypocrisy may not always lead to positive behaviour change. Rubens, Gosling, Bonaiuto, Brisbois, and Moch (2015) found that inducing hypocrisy regarding the use of environmentally harmful plastic bags prior to a grocery shopping session did not lead people to accept fewer free plastic grocery bags at the checkout, compared to shoppers who were not approached by the experimenters (control condition). By contrast, inducing a public commitment to use fewer plastic bags without inducing awareness of past transgressions led people to accept fewer free plastic grocery bags compared to the hypocrisy and control conditions. This unexpected result implies that the hypocrisy condition induces a different motivational state than the public commitment-only condition, a state that may pressure people to revise or restructure their attitudes when they cannot immediately reverse or counter-balance the negative impact of their behavioural

transgressions. If this is the case, inducing hypocrisy to promote positive behaviour change could have the unintended and ironic effect of eroding important attitudes.

However, researchers have yet to study or explain these intriguing phenomena, presumably because we know relatively little about the quality of motivation induced by cognitive dissonance induction procedures, such as the hypocrisy paradigm (Harmon-Jones, 1999). Therefore, we used the HABICE to reinterpret the effects of the two factors manipulated by the hypocrisy paradigm to explain these phenomena.

**Commitment, resistance to change, and self-directed attention.** Previous research suggests that making a public commitment to an attitude or increasing the attitude's salience prior to a dissonance induction increases its resistance to change (Simon, Greenberg, & Brehm, 1995; Starzyk, Fabrigar, Soryal, & Fanning, 2009). In agreement with the HABICE, we also hypothesized that making a public versus a private commitment to a pro-attitudinal advocacy directs attention to different aspects of the self and, as a result, induces different motivational states. On the one hand, making a public commitment—believing that other people will witness the advocacy and be able to identify the participant as the author—should prime concerns with how others perceive the advocacy behaviour (Festinger, Scheier, & Buss, 1975). Therefore, the public commitment manipulation should induce a state of public self-awareness or a “private audience of internally represented significant others” (Baldwin & Holmes, 1987, p. 1087) and motivate people to act consistently with the advocated attitude to avoid appearing inconsistent to others (Festinger, 1957). In other words, the public commitment manipulation should induce a state of evaluation apprehension that pressures people to regulate their behaviour to avoid negative or to promote positive social evaluative reactions (Hodgins, 2008). This alternative interpretation could explain why inducing a public attitude commitment is sometimes sufficient

to produce levels of behaviour change on par with the standard hypocrisy effect.

By contrast, making an anonymous (i.e., private) pro-attitudinal advocacy is likely to prime concerns with the personal relevance of the advocacy behaviour and direct attention to the private aspects of the self, such as the thoughts, needs, goals, or feelings elicited by the behaviour (Fenigstein et al., 1975). In other words, the private commitment manipulation should induce a state of private self-awareness. To the extent that the advocacy behaviour is self-congruent and satisfies organismic integration, as would likely be the case among people with high levels of autonomous motivation toward the environment, the private advocacy should prime authentic self-structures and autonomous motives (Hodgins & Knee, 2002; Ryan & Deci, 2004). In the case of people with high levels of controlled motivation toward the environment, the effect of the private advocacy should be different. Because others would not be able to identify the author, there should be no perceived advantages to making a private advocacy except to obtain external rewards (e.g., compensation for participating in the research). Therefore, to the extent that the advocacy behaviour is not self-relevant or does not satisfy organismic integration action tendencies, the private advocacy should prime ego-invested self-structures and controlled motives.

To summarize, we suggest that the commitment manipulation should interact with levels of autonomous and controlled motivation toward the environment thereby inducing different motivational states in the public and private commitment conditions. The public commitment manipulation should induce a state of evaluation apprehension that leads all individuals to regulate their behaviour to avoid negative or to promote positive social evaluative reactions. The private commitment manipulation should induce a motivational state that corresponds to individual differences in motivation toward the environment. Making a private advocacy should

induce an autonomous motivational state and promote self-consistent behaviour among individuals with high levels of autonomous motivation and low levels of controlled motivation toward the environment (i.e., a “good quality” motivational profile; Ratelle, Guay, Vallerand, Larose, & Sénechal, 2007; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009). However, the private advocacy behaviour should induce a controlled motivational state and promote the same action tendencies as the public commitment manipulation among individuals with other motivational profiles.

**Awareness, simultaneous accessibility, and motivation to compensate.** Cognitive dissonance theories assume that dissonance or psychological discomfort is aroused when conflicting cognitions are simultaneously accessible (Festinger, 1957; McGregor, Newby-Clark, & Zanna, 1999; Harmon-Jones et al., 2009). In fact, this is the logic behind dissonance induction paradigms, such as the hypocrisy paradigm (Stone & Fernandez, 2008), which consist of increasing the salience of conflicting attitudes and actions (Harmon-Jones & Mills, 1999). Therefore, inducing awareness of recent past transgressions after making a pro-attitudinal advocacy should arouse dissonance and motivate people to compensate for the threatening inconsistency. However, we believe that the choice of compensation strategy will depend on the motivational state induced by the commitment manipulation. In general, the overt pro-attitudinal advocacy behaviour should be more resistant to change than the privately recalled (covert) transgressions (Fried, 1998). Therefore, inducing awareness of past transgressions should dispose people to engage in compensatory behaviour change, regardless of the type of attitudinal commitment (Stone & Fernandez, 2008). This alternative interpretation could explain why inducing awareness under conditions of private commitment is sometimes sufficient to produce levels of behaviour change on par with the standard hypocrisy effect. However, if the availability

of behaviour change strategies is blocked or delayed, the motivational states induced by the commitment manipulation should determine who will tolerate the aroused dissonance and who will reduce the dissonance using other means.

The public commitment manipulation should create a controlled motivational state of evaluation apprehension that pressures people to avoid the aversive consequences of their actions (regardless of individual differences in motivation toward the environment). According to the HABICE, these people should therefore be inclined to use cognitive restructuring strategies, such as attitude change, when they cannot change their behaviour to reduce dissonance. By contrast, the private commitment manipulation should create a motivational state that corresponds to individual differences in levels of autonomous and controlled motivation toward the environment. Therefore, people who exhibit high levels of controlled motivation (or low levels of autonomous motivation) should also reduce dissonance by revising their attitudes under conditions of private commitment. Conversely, people with high levels of autonomous motivation and low levels of controlled motivation toward the environment should perceive the induced inconsistency as an authentic self-integrity threat and be motivated to restore authentic self-integrity under conditions of private commitment. Therefore, the HABICE posits that these people should be motivated to tolerate the aroused dissonance until an authentic behaviour change strategy becomes available because restructuring attitudes would exacerbate the perceived self-threat.

To summarize, we suggest that the awareness manipulation should increase the simultaneous accessibility of conflicting cognitions, arouse dissonance, and motivate people to compensate for the perceived inconsistency by changing their behaviour. However, when people do not immediately have an opportunity to change their behaviour, the tendency to change or

restructure pro-environmental attitudes to reduce dissonance should vary according to the motivational states induced by the commitment manipulation. When the commitment manipulation induces a controlled motivational state, the aroused dissonance should pressure people to revise or restructure their pro-environmental attitudes to reduce dissonance. However, when the commitment manipulation induces an autonomous motivational state, the elicited self-integrity motives should encourage people to tolerate the aroused dissonance rather than to change their attitudes.

### **Selective Exposure to Information**

In order to test hypotheses about attitude change when there are barriers to behaviour change, we needed to avoid artificially constraining the availability of compensation strategies. Therefore, we developed a task to observe patterns of selective exposure to information. The search for domain-relevant information is an integral part of cognitive dissonance theory, which posits that people should seek out information to favour the change of the least resistant cognition responsible for the inconsistency (Festinger, 1957). In the environmental domain, seeking out information represents an effective strategy for acquiring the knowledge needed to act consistently with pro-environmental attitudes, such as favourable attitudes toward GW mitigation (Pelletier & Sharp, 2008; Séguin, Pelletier, & Hunsley, 1999). We assumed, based on previous research, that making a commitment to a pro-attitudinal advocacy, be it private or public, would give rise to preferences for attitudinally-consistent versus attitudinally-inconsistent information (i.e., a confirmation bias; Jonas, Schulz-Hardt, Fischer, & Frey, 2006). However, we expected this confirmation bias to be especially strong under conditions that induce a defensive state, specifically under conditions of public commitment or of induced awareness (Hart et al., 2009). Furthermore, we hypothesized that the information search would serve different motives

depending on the commitment and awareness manipulations, and the moderating effects of these two manipulations on motivation. The next section summarizes the research hypotheses.

### **Present Research and Hypotheses**

We used 2 x 2 between-subjects experimental design to manipulate public versus private commitment to a written advocacy statement in favour of mitigating GW and to induce versus not induce awareness of recent GHG-emitting actions. The design yielded four experimental conditions: (1) private commitment + no induced awareness (private commitment condition), (2) public commitment + no induced awareness (public commitment condition), (3) private commitment + induced awareness (private awareness condition), and (4) public commitment + induced awareness (public awareness or hypocrisy condition). We measured levels of autonomous and controlled motivation toward the environment (Pelletier et al., 1998) to examine how participants with different motivational orientations intended to use the information gathered via the Information Search task across the four experimental conditions. The goal of the study was to show that making a public (identifiable) versus a private (anonymous) advocacy induces different motivational states and that increasing the simultaneous accessibility of conflicting cognitions via the awareness manipulation arouses dissonance and motivates people to compensate in a way that satisfies these motives. We hypothesized this reinterpretation of the hypocrisy paradigm would clarify why inducing a public commitment or inducing awareness is sometimes sufficient to induce behaviour change and why the standard hypocrisy effect wanes when there are barriers to behaviour change.

**Dissonance arousal.** The standard hypocrisy effect implies that the public awareness condition should induce the largest magnitude of dissonance. By contrast, the HABICE suggests that the awareness manipulation should arouse similar amounts of dissonance across levels of the

commitment factor, albeit for different reasons, because it increases the simultaneous accessibility of conflicting cognitions. Therefore, we expected to observe a main effect of awareness on the magnitude of dissonance but not an interaction between commitment and awareness. We did not expect individual differences in motivation toward the environment to predict the quantity of motivation to compensate (i.e., psychological discomfort) under conditions of experimentally induced awareness.

**Selective exposure to global warming information.** We observed patterns of selective exposure to GW information to see if we could replicate the independent effects of the public commitment and of the induced awareness manipulations on overt behavioural responses. Based on the HABICE, we expected to observe a confirmation bias, a preference for attitudinally consistent information, across conditions because of salient pro-environmental attitudes. However, we expected the confirmation bias to be especially strong among people motivated to compensate for attitude-behaviour inconsistencies (induced awareness conditions) and among people motivated to appear consistent to others (public commitment condition). We expected people who were not motivated to compensate or to appear consistent (private commitment condition) to show a relatively weak confirmation bias. We did not expect to observe effects of autonomous or controlled motivation on patterns of selective exposure to information. According to the HABICE, individual differences in motivation toward the environment should determine the quality of motivation underlying the Information Search task rather than overt behavioural responses to the task.

**Information search intentions.** We expected people in the induced awareness conditions to be motivated to compensate for the induced attitude-behaviour inconsistency. Therefore, we hypothesized that these individuals would seek out information to facilitate compensatory

behaviour change and, to a lesser extent, attitude change because both strategies have the potential to minimize the perceived inconsistency (Festinger, 1957). In the public commitment condition, we expected people to seek out information to facilitate attitudinally consistent behaviour—but not to facilitate attitude change—to avoid appearing inconsistent to others. Finally, we expected people in the private commitment condition to evaluate relevant information objectively to determine the accuracy of their pro-environmental attitudes or to validate or defend the pro-GW mitigation advocacy behaviour (Hart et al., 2009). Therefore, we hypothesized that these people would seek information that supports PEB, but would not seek information to revise their attitudes. In sum, we hypothesized that the four conditions would produce strong intentions to seek out information to facilitate PEB. However, we expected to observe a main effect of awareness on attitude change intentions qualified by a higher-order interaction between commitment, awareness, and both motivational orientations toward the environment.

In accordance with the HABICE, we expected that the commitment factor would moderate the effect of individual differences in autonomous and controlled motivation toward the environment on intentions to revise favourable attitudes toward GW mitigation, especially under conditions of induced awareness. Under conditions of public commitment, we hypothesized that the awareness manipulation would pressure people to revise their attitudes. Under conditions of private commitment, we hypothesized that people with high levels of autonomous motivation and low levels of controlled motivation would report weaker intentions to revise their attitudes compared to people with other motivational profiles, especially under conditions of induced awareness. In other words, we expected a four-way interaction showing a simple main effect of awareness under conditions of public commitment and a simple three-way

interaction between the awareness factor and levels of autonomous and controlled motivation toward the environment under conditions of private commitment.

## **Method**

### **Design**

We conducted an experiment with a two (commitment: private versus public advocacy in favour of mitigating GW) by two (awareness: recall versus no recall of recent GHG-emitting actions) between-subjects factorial design. The outcomes were psychological discomfort, confirmation biases in the search of information, and intentions to seek out information to facilitate behaviour change and attitude change.

### **Participants**

We recruited participants via the Integrated System of Participation in Research (ISPR). The ISPR is a participant pool used to recruit students enrolled in introductory psychology courses to participate in research studies. On average, 3,500 students register with the ISPR in a given academic year (Anderson, 2013). Students registered with the ISPR are free to participate and can choose the research studies they wish to complete. In exchange for their participation, students receive research credits that count as bonus points in the course (up to maximum of 4%). In recent years, the mean age of students registered with the ISPR has been 19.5 years ( $SD = 4.0$ ) and about three-quarters of them were female (73%). In terms of first language learned, the majority of participants reported English (60%), about a quarter reported French (23%), and the remaining participants reported another language (17%). On average, participating students are registered in programs offered by faculties of social sciences (31%, including 15% registered in psychology programs), health sciences (24%), sciences (18%), arts (8%), or other programs and faculties (20%; “Demographics of the research participants,” n.d.).

According to a sensitivity power analysis (Faul, 2013), the sample size ( $N = 108$ ) yielded sufficient power ( $1 - \beta = .80$ ) to detect a moderate increase in explained variance ( $f^2 = .21$ ,  $R^2 = .17$ ) via the planned analyses of information search intentions (see the Data Analysis section). The large majority of the sample ( $n = 74$ , 68.5%) reported being 18 to 20 years old. Twelve participants (11.1%) reported being between 16 and 18 years old whereas the rest of the participants ( $n = 20$ , 18.5%) reported being 21 years or older. Two participants (1.9%) did not report their age group. In terms of first language learned, 44 participants (40.7%) reported English, 38 participants (35.2%) reported French, 23 participants (21.3%) reported another language, and three participants (2.8%) declined to answer.

### **Procedure**

Only students with favourable attitudes toward GW mitigation were eligible for the study, because the commitment manipulation (see below) required students to write a pro-attitudinal advocacy in favour of mitigating GW. Participants could register for the study only if they agreed with the statement: “Do you agree that humans must reduce their greenhouse gas emissions in order to minimize or curb global warming?” during an initial prescreening survey. The study description titled “Perceptions of Social Issues” did not mention GW or the environment to avoid a self-selection bias by highly motivated individuals toward the environment. The description invited ISPR users to participate in a 45-minute laboratory session in the official language of their choice (English or French). Prior to the laboratory session, we randomly assigned participants to one of four conditions: (1) private commitment, (2) public commitment, (3) private awareness, or (4) public awareness (i.e., hypocrisy).

The experimenter informed participants the study was about perceptions of GW information in the media when they arrived for the laboratory session (see General Appendix O

for a copy of the experimental script). Participants then provided written informed consent (General Appendix P). First, the experimenter asked participants to write a pro-attitudinal advocacy in favour of GW mitigation. The experimenter told participants that the advocacy was to gauge their opinions toward the issue and that we would use the advocacy as part of an ostensible on-campus poster campaign for the reduction of GHG emissions. The stated objective of the campaign was to raise awareness about GW and to show that students from all faculties and departments are concerned with the issue. The experimenter asked participants if they were willing to write the advocacy (all participants agreed) before introducing the standardized advocacy form (General Appendix Q). The form bore a description of the fictitious on-campus poster campaign and featured the instructions “explain in 75 words or less (3 or 4 sentences) why you think it is important to address the issue of global warming and what students can do to help the cause.” There was a space to write their program of study at the bottom of the form. The form used to induce public commitment also featured a space for participants to write their full names.

Second, participants assigned to the private and public awareness conditions completed an anonymous survey of recent GHG-emitting actions. The ostensible purpose of the survey was to tailor future awareness campaigns. Participants listed three recent GHG-emitting actions on a standardized recall form (General Appendix R). The form bore the instructions “Thinking about all your activities over the past month, please list 3 actions you did that may have contributed to global warming (avoidable actions that you know produce a considerable amount of greenhouse gas emissions).” The experimenter encouraged participants to recall their own examples but also provided them with a list of examples to help with the task (General Appendix S). To bolster the anonymity of the recall survey, the experimenter instructed participants to put the anonymous surveys in an envelope, which contained three surveys ostensibly completed by other

participants. Participants in the no-induced awareness conditions did not complete the survey and proceeded directly to the Information Search task.

Third, all participants had the opportunity to read media articles of their choice on the topic of GW. Before doing the Information Search task, the experimenter told participants “we think people’s moods and emotions might affect how they perceive, assimilate, and interpret information in the media” and asked them to complete the Psychological Discomfort scale. The experimenter then introduced the Information Search task. He or she explained that all the articles were of the same length and that there was no time limit for the task, and asked the participants to read the titles of all the articles before selecting two articles to read. The experimenter stepped out of the room while participants completed the task. Then, all participants completed a questionnaire to assess their intentions to facilitate behaviour change and attitude change via the Information Search task, their levels of autonomous and controlled motivation toward the environment, and their pro-GW mitigation attitudes.

Finally, the experimenter debriefed the participants and informed them that there was no on-campus campaign for the reduction of GHG emissions. The experimenter trimmed and destroyed the portion of the standardized advocacy form bearing the participants’ names, and revealed the real purpose of the study. Participants received one research credit as compensation.

**Motivation Toward the Environment scale.** The Motivation Toward the Environment scale (Pelletier et al., 1998) was used to assess individual differences in levels of autonomous and controlled motivation toward the environment. The scale consists of 24 items that answer the question “Why are you doing things for the environment?” on a 7-point Likert scale (1 *does not correspond at all*, 7 *corresponds exactly*). The scale features six subscales of four items that correspond to the regulation styles proposed by self-determination theory: 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 non-specific regulation (i.e., amotivation; e.g., “I don't really know; I can't see what I'm getting out of it.”). Previous research supports the scale's multi-dimensional factor structure, internal consistency, test-retest reliability over multiple time points measured at 3- to 5-week intervals, and convergent and discriminant construct validity (Pelletier et al., 1998; Villacorta et al., 2003). We computed autonomous motivation scores by taking the mean of the intrinsic ( $\alpha = .88$ ), integration ( $\alpha = .85$ ), and identification subscales ( $\alpha = .89$ ), and computed controlled motivation scores by taking the mean of the introjection ( $\alpha = .87$ ) and external regulation ( $\alpha = .80$ ) subscales.

**Pro-Global Warming Mitigation Attitude Strength scale (General Appendix T).** The Pro-Environmental Attitude Strength scale developed by Lavergne and Pelletier (2015b) was adapted to measure the strength of favourable attitudes toward GW mitigation (pro-GW attitudes). Two items assessed pro-GW attitude position extremity by asking participants to indicate their agreement (1 *do not agree*, 7 *agree completely*) with the statements “the hypothesis that greenhouse gas emissions from human activities are causing global warming” and “humans must take action to reduce their greenhouse gas emissions in order to minimize or curb global warming.” Consistent with other popular attitude strength measures (e.g., Brannon, Tagler, & Eagly, 2007), six additional items measured various dimensions of attitude strength including levels of knowledge, importance, self-concept centrality, representativeness of values, and certainty, as well as the likelihood of changing the attitude (reverse-coded) on a 7-point Likert

scale (1 *not at all*, 7 *very much*). We computed scores of pro-GW mitigation attitude strength by taking the mean of the eight items ( $\alpha = .81$ ).

**Psychological Discomfort scale (General Appendix G).** We used the Psychological Discomfort scale developed by Lavergne and Pelletier (2015a) to assess levels of induced dissonance; however, the scale instructions were adapted for the purposes of the present study. Specifically, participants responded (1 *not at all*, 7 *very much*) to the statement “To what extent are you feeling \_\_\_\_\_ right now?” Nine items measured the target construct of psychological discomfort (e.g., “uncomfortable,” “disappointed,” “hypocritical”). Scores based on these items have been found to be unidimensional and internally consistent ( $\alpha \geq .90$ ) in previous research (Lavergne & Pelletier, 2015a; 2015b); therefore, we computed scores of psychological discomfort by taking the mean of the nine items ( $\alpha = .87$ ). The scale also included three anxious emotions (e.g., “agitated”) and six positive emotions (e.g., “pleased”), which we included to minimize demand characteristics but that we did not analyze.

**Information Search task.** Participants completed a computerized reading task via the E-Prime application suite (2014) on an IBM Lenovo ThinkPad® T60 notebook computer screen. The task included written instructions about which keys to press to select articles, go to the next page of text, return to the main menu, and exit the task. Before starting the task, participants read the following definition: “Global warming refers to the hypothesis that greenhouse gas emissions due to human activities are causing a sustained increase in the average temperature at the Earth’s surface and changes in climate.” Subsequently, participants saw a menu of eight article titles and selected the first of two articles to read. After reading the first article, participants returned to the same menu of titles to make their second selection. Four articles bore titles that supported or were consistent with the anthropogenic GW hypothesis (i.e., pro-GW information; e.g., “Global

warming, a real problem”). Four articles bore titles that denied or were inconsistent with this hypothesis (i.e., counter-GW information; e.g., “Global warming is a myth”).

The information used to construct the media articles was found using a search engine and keywords, such as “global warming,” “consequences,” “causes,” and “myth.” We sourced excerpts and information from publicly-accessible books, journal and magazine articles, documents, reports, websites, and blogs (David Suzuki Foundation, n.d.; Dumas, 2006; Madrigal, 2009; Moore, 2006; National Geographic, n.d.; Patz & Khaliq, 2002; Rancourt, 2007; “Scientific opinion on climate change,” n.d.; Sierra Club, n.d.; Singer & Avery, 2008; “The lack of scientific rigour,” n.d.; Weart, 2010). In other words, we selected information people might find if they were motivated to search for GW information in their day-to-day lives. The first author edited the sourced excerpts to create articles with a consistent style for the purposes of the task. Articles were formatted to be of approximately the same length (865 to 1058 words) so they could be presented over a series of three slides or pages of text on the computer screen (35.8 centimetres). The slides (General Appendix U) were created in Powerpoint (Microsoft Office, 2007) using the Arial font size 11. We converted the slides (.ppt) to image files (.jpg) for use in E-Prime. We did not reveal the source of the information to the participants because it could have biased the perceived credibility of the information (Brannon et al., 2007). Finally, the E-Prime application suite recorded the type of information (i.e., pro- versus counter-GW) people selected to read first and second.

**Information Search Intentions scale.** Participants indicated their agreement with two items about their intentions for the Information Search task on a 7-point Likert scale (1 *do not agree*, 7 *completely agree*; see General Appendix V). The items measured intentions to seek out information to facilitate behaviour change (i.e., “I wanted to know how to change my behaviour

to be more in line with my existing opinion about global warming.”) and attitude change (i.e., “I decided it was time to find information that would allow me to change my own opinion about global warming.”).

### **Data Analysis**

We conducted all data analyses in SPSS (2012). We screened the data for violations of basic statistical assumptions (Tabachnick & Fidell, 2007). Next, we conducted a series of four planned analyses to test research hypotheses. First, we tested predictions about dissonance arousal using a 2 (commitment: public versus private) x 2 (awareness: induced versus not induced) analysis of variance (ANOVA) of psychological discomfort scores. Second, we tested hypotheses about confirmation biases in the search for GW information using a 4 x 4 chi-square test of independence to determine if patterns of selective exposure to information were contingent on experimental condition. Finally, we conducted two identical analyses of covariance (ANCOVA) of intentions to facilitate behaviour change and attitude change via the Information Search task, controlling for scores of psychological discomfort. In order to test the hypothesized four-way interaction between the commitment manipulation, the awareness manipulation, and continuous scores of autonomous and controlled motivation toward the environment, we used the hierarchical regression approach to ANOVA. Finally, we conducted simple slopes analyses to probe significant interactions between the experimental factors and motivation ( $\alpha = .05$ ; Aiken & West, 1991).

### **Results**

A series of ANOVA revealed no significant differences ( $\alpha = .001$ ) in autonomous motivation, controlled motivation, and pro-GW attitude strength between participants assigned to the four experimental conditions (equal  $n = 27$ ), indicating that the groups were homogeneous.

There were also no significant differences across the entire set of study variables between participants who reported different first languages, or who completed the study in different academic terms or with a different experimenter. Furthermore, independent samples *t*-tests showed no significant differences due to gender or experimental language (English  $n = 68$ , French  $n = 40$ ). There did not appear to be any confounding variables. There was one extreme outlier score of psychological discomfort in the public commitment condition and one in the public awareness condition ( $z > 2.58$ , disconnected from the distribution of scores). These scores were recoded to within one interval unit ( $1/9 = 0.11$ ) of the next most extreme score in the distribution to minimize the influence of outliers on their respective group means (Tabachnick & Fidell, 2007). There no other violations of assumptions. See Table 1 for descriptive statistics of the study variables by condition.

### **Dissonance Arousal**

First, we conducted the planned 2 x 2 ANOVA of psychological discomfort scores. Psychological discomfort scores were not related to autonomous motivation, controlled motivation (except in the private commitment condition,  $r = .40$ ,  $p = .04$ ), or with pro-GW attitude strength; therefore, we did not enter any covariates in the model. We entered contrast codes corresponding to the commitment (-1 private, 1 public) and awareness (-1 not induced, 1 induced) factors in Step 1,  $F(2, 105) = 1.71$ ,  $p = .19$ ,  $R^2 = .03$ , and we added the Commitment x Awareness interaction term in Step 2,  $F(3, 104) = 1.17$ ,  $p = .33$ ,  $R^2 = .03$ . Neither model was significant ( $\alpha = .05$ ) and adding the interaction term did not explain additional variance,  $\Delta F(1, 104) = 0.11$ ,  $p = .74$ ,  $\Delta R^2 < .001$ . The main effect of awareness,  $\beta = .17$ ,  $p = .07$ , was marginally significant ( $\alpha = .10$ ). As expected, psychological discomfort scores were somewhat higher in the induced awareness conditions ( $M = 2.11$ ,  $SD = 0.86$ ) than in the no-induced awareness conditions

( $M = 1.81$ ,  $SD = 0.84$ ). These results partially support the hypothesis that recalling recent transgressions following an attitude commitment facilitates the arousal of dissonance because it increases the simultaneous accessibility of conflicting cognitions. However, the results suggest that the awareness manipulation induced a small magnitude of dissonance overall.

### **Selective Exposure to Information**

Next, we examined patterns of selective exposure to information. Three quarters of participants ( $n = 81$ , 75.0%) chose to read a pro-GW information article first and about half ( $n = 56$ , 51.9%) chose to read a pro-GW information article second. As expected, there was an overall confirmation bias. However, we observed four distinct information search strategies (see Table 2): (1) a bias for pro-GW information, (2) a lack of bias with an initial preference for pro-GW information, (3) a lack of bias with an initial preference for counter-GW information, and (4) a bias for counter-GW information. Half the cells had expected frequencies smaller than 5, which prevented us from conducting a chi-square test of independence (Gravetter & Wallnau, 2014). However, the adjusted standardized residuals suggested that participants assigned to the private commitment condition were more likely to exhibit a lack of bias with an initial preference for counter-GW information than expected ( $z = 2.6$ ,  $p = .01$ ). To follow-up, we conducted a chi-square test for independence to compare initial preferences for counter-GW ( $n = 27$ ) versus pro-GW ( $n = 81$ ) information across the private commitment condition ( $n = 27$ ) versus the other three conditions ( $n = 81$ ). Participants in the private commitment condition were more likely to show an initial preference for counter-GW information ( $n = 11$ , 40.7%) than participants assigned to the other three conditions ( $n = 16$ , 19.8%),  $\chi^2(1) = 4.76$ ,  $p = .03$ ,  $\phi = .21$ . These results partially support the hypothesis that the private commitment condition produced a weaker confirmation bias than did the other three experimental conditions.

### Information Search Intentions

As expected, the sample reported stronger intentions to seek out information to facilitate behaviour change ( $M = 3.88$ ,  $SD = 1.96$ ) versus attitude change ( $M = 2.81$ ,  $SD = 1.89$ ),  $t(107) = 4.76$ ,  $p < .001$ , 95% confidence interval [0.62, 1.51], Cohen's  $d = 0.92$ . Therefore, we conducted the planned ANCOVAs of behaviour change and attitude change intentions. We entered the covariate—centered scores of psychological discomfort—in Step 1. Pro-GW attitude strength scores showed a strong positive relationship with autonomous motivation scores ( $r = .46$  to  $.72$ ,  $p \leq .03$ ) and a null relationship with controlled motivation scores ( $r = -.03$  to  $.32$ ,  $p \geq .11$ ) across conditions, as expected; we did not control for this variable to avoid issues of multicollinearity (Aiken & West, 1991). We added the four main effects, including the commitment and awareness contrast codes, as well as centered scores of autonomous and controlled motivation toward the environment, in Step 2. We added the five two-way interaction terms between the four main effects in Step 3, the four three-way interactions in Step 4, and the four-way interaction in Step 5. See Table 3 for the results of both analyses.

***Behaviour change intentions.*** The Step 1 model of behaviour change intentions explained a marginally significant amount of variance ( $R^2 = .03$ ) and the Step 2 model explained a significant amount of variance ( $R^2 = .11$ ); the increase in explained variance was marginally significant ( $\alpha = .10$ ). The Step 3 through Step 5 models were not significant (see Table 3), and adding the interaction terms did not explain additional variance. In line with previous research (Lavergne and Pelletier, 2015a), behaviour change intentions were strongest among participants with high levels of autonomous motivation toward the environment. The positive main effect of psychological discomfort was marginally significant. Contrary to the assumption underlying the standard hypocrisy effect, the main effects and interaction of the two experimental factors were

not significant, indicating that intentions to facilitate future PEB did not vary across conditions, as predicted by the HABICE.

*Attitude change intentions.* The Step 2 through Step 5 models of attitude change intentions were statistically significant (see Table 3). The effect of psychological discomfort was not significant in Step 1, which is consistent with previous research. Adding the main effects in Step 2 ( $R^2 = .16$ ), the two-way interaction terms in Step 3 ( $R^2 = .26$ ), and the three-way interaction terms in Step 4 ( $R^2 = .39$ ) explained significantly more variance in attitude change intentions; however, adding the four-way interaction in Step 5 did not. We found a positive main effect of awareness, a negative main effect of autonomous motivation, and a significant interaction between commitment and autonomous motivation qualified by higher-order interactions. The hypothesized four-way interaction was not significant; however, there were two significant three-way interactions—one between awareness, autonomous motivation, and controlled motivation, and one between commitment, autonomous motivation, and controlled motivation. See Figure 1 for plots of the three-way interactions.

*Commitment by motivation interaction.* We conducted simple slopes analyses (see Table 4) to probe the significant Commitment x Autonomous Motivation x Controlled Motivation interaction (see Figure 1a). As expected, the effects of autonomous and controlled motivation toward the environment were not significant in the public commitment conditions. The slopes across levels of autonomous motivation for participants with low and high levels of controlled motivation were not significantly different from zero or from one another. However, the motivation interaction was significant within the private commitment conditions. Participants with low levels of controlled motivation reported significantly weaker attitude change intentions if they also exhibited high (versus low) levels of autonomous motivation, whereas participants

with high levels of controlled motivation reported equally strong attitude change intentions across levels of autonomous motivation. The two slopes were significantly different from one another. Furthermore, the negative slope corresponding to participants with low levels of controlled motivation in the private commitment conditions was significantly different from the null slopes observed in the public commitment conditions. By contrast, participants with high levels of controlled motivation in the private commitment conditions did not differ from participants in the public commitment conditions. These findings are consistent with the idea that making public commitment induces public self-awareness and a controlled motivational state whereas making a private attitude commitment induces a state of private self-awareness, which allows for the manifestation of individual differences in motivation. Furthermore, the authentic pro-environmental attitudes of participants with high levels of autonomous motivation and low levels of controlled motivation toward the environment seemed resistant to change under conditions of private commitment.

*Awareness by motivation interaction.* Finally, we conducted simple slopes analyses (see Table 4) to probe the significant Awareness x Autonomous Motivation x Controlled Motivation interaction (see Figure 1b). Attitude change intentions appeared to weaken as levels of autonomous motivation increased in the no-induced awareness conditions. The slopes across levels of autonomous motivation for participants with low and high levels of controlled motivation were both negative (though the latter slope was not significant), and were not significantly different from one another. By contrast, the motivation interaction appeared significant in the awareness conditions. The null slope across levels of autonomous motivation for participants with high levels of controlled motivation differed from the negative slope observed for participants with low levels of controlled motivation. Furthermore, the null slope

corresponding to participants with high levels of controlled motivation in the induced awareness conditions was significantly different from the negative trends observed in the no-induced awareness conditions. By contrast, participants with low levels of controlled motivation in the induced awareness condition did not differ from participants in the no-induced awareness conditions. These results suggest that autonomous motivation toward the environment increased the resistance to change of pro-environmental attitudes, except among participants with high levels of controlled motivation who were motivated to compensate for an inconsistency. It seems that participants with high levels of autonomous motivation and low levels of controlled motivation were inclined to tolerate the aroused dissonance rather than to change their attitudes.

### **Discussion**

The main goal of the research was to test hypotheses derived from the HABICE about the moderating effect of social factors on the motivation underlying inconsistency compensation processes. A secondary objective was to test an alternative interpretation of the hypocrisy paradigm. The standard hypocrisy effect implies that inducing a public attitude commitment and subsequently inducing awareness of past transgressions against that attitude induces a larger magnitude of dissonance than manipulating either factor alone (Aronson, 1999; Stone & Fernandez, 2008). However, the results did not support this assumption. Instead, we found that inducing awareness was sufficient to arouse a small magnitude of dissonance following both a private and a public attitude commitment, which is consistent with Festinger's (1957) original cognitive dissonance theory. Furthermore, we found some evidence that inducing a public commitment or inducing awareness is sufficient to produce a similar overt behavioural response (i.e., a strong confirmation bias) as inducing hypocrisy. This finding seems to replicate the unexplained independent effects of public commitment and awareness on behaviour change

reported by some researchers (see Aronson et al., 1991; Fointiat et al., 2008; Stone et al., 1994; Stone et al., 1997). Finally, although intentions to facilitate behaviour change via the Information Search task were stronger than attitude change intentions and somewhat stronger among people who reported greater psychological discomfort, the experimental factors or their interaction had no discernible effects on these intentions. The pattern of results seemed more consistent with the proposed reinterpretation of the hypocrisy paradigm based on the HABICE.

The HABICE proposes that social factors that direct attention to public versus private aspects of the self moderate the effects of individual differences in autonomous and controlled motivation toward the environment on the use of compensation strategies in the environmental domain. In accordance with these hypotheses, the public commitment manipulation, which presumably directs attention to the overt aspects of the self (i.e., toward ego-invested self-structures), seemed to induce a controlled motivational state. Specifically, the results suggest that, when people did not have an opportunity to change their behaviour, making a public attitude commitment pressured them to seek out information to revise or to change their pro-environmental attitudes, regardless of individual differences in motivation toward the environment. The private commitment manipulation, which presumably directs attention to covert aspects of the self (i.e., toward authentic self-structures), induced a motivational state congruent with individual differences in motivation toward the environment, as hypothesized. On the one hand, people with high levels of controlled motivation or with low levels of autonomous motivation were inclined to seek out information to revise or change their pro-environmental attitudes. On the other hand, the pro-environmental attitudes of people with high levels of autonomous motivation and low levels of controlled motivation seemed resistant to change; presumably, revising their pro-environmental attitudes would have exacerbated the perceived

authentic self-integrity threat. However, the results did not support the hypothesis that the interaction between the commitment factor and levels of autonomous and controlled motivation toward the environment would be more important under conditions of induced versus no-induced awareness.

In any case, the overall pattern of results supports the action-based model, particularly the assumption that dissonance (i.e., proximal motivation) energizes inconsistency compensation processes whereas individual and induced differences in dominant action tendencies (i.e., distal motivation) guide inconsistency compensation processes (Harmon-Jones et al., 2009). The findings are also consistent with self-determination theory research showing that inducing a controlled versus an autonomous motivational state leads to greater defensive responding (Hodgins, Yacko, & Gottlieb, 2006), less effective coping (Weinstein & Hodgins, 2009), and a larger cardiovascular threat response to psychological stressors (Hodgins et al., 2010). The results have implications for interventions based on the hypocrisy paradigm in general and for GW mitigation efforts in particular.

### **Implications**

The present research suggests that inducing hypocrisy pressures people to reduce dissonance rather than to restore self-integrity, as suggested by self-consistency theory (Aronson, 1999). Therefore, using the hypocrisy paradigm to motivate behaviour change could have the unintended effect of eroding important attitudes when there are no immediate opportunities to compensate for behavioural transgressions. On average, inducing private awareness of attitude-behaviour inconsistencies appears to have the same effect on attitude change intentions as inducing hypocrisy. However, under these conditions, people who truly value environmental protection seem to resist the tendency to revise self-relevant pro-environmental attitudes.

Furthermore, inducing a public attitude commitment or inducing private awareness of attitude-behaviour inconsistencies seems to produce similar overt behavioural responses (i.e., confirmation biases) as inducing hypocrisy, albeit for different reasons. This pattern of results implies that the unexplained effects of the public commitment and of the induced awareness manipulations on compensatory behaviour change may be attributable to differences in the quality rather than the quantity of motivation, as proposed by the HABICE.

According to self-determination theory, external or internal pressure to behave a certain way gives rise to non self-determined behaviour that is unlikely to persist once the pressure is relieved (Deci, Koestner, & Ryan, 1999). This assumption implies that the standard hypocrisy effect on behaviour is likely to wane once people have reduced the aroused dissonance (e.g., Rubens et al., 2015). Therefore, using interventions that make people feel hypocritical or apprehensive about their GHG-emitting actions should foster inauthentic behaviour change, at best, and erode pro-GW attitudes, at worst. By contrast, freely choosing to behave a certain way gives rise to self-determined behaviour that is inherently satisfying and, therefore, is likely to reoccur (Deci, Eghrari, Patrick, & Leone, 1994). This assumption implies that inducing private awareness of attitude-behaviour inconsistencies is likely to produce authentic, persistent behaviour change among people who truly value environmental protection. Therefore, there is a need to find ways to increase the perceived self-relevance of environmental protection and to downplay the behavioural contingencies of environmental behaviour in the general population. Increasing levels of autonomous motivation in this way would likely motivate people to compensate for the negative impacts of their GHG-emitting actions, rather than to reduce dissonance, when they perceive attitude-behaviour inconsistencies in the GW mitigation domain.

## **Limitations and Future Research**

The low levels of psychological discomfort reported in the present study suggest that: (a) the Psychological Discomfort scale was not sufficiently sensitive to capture the experience of dissonance, (b) some people were unwilling to report negative emotions, or (c) some people used attitude change or cognitive restructuring strategies to minimize the discomfort at some point before completing the scale. All three explanations seem plausible. However, previous research based on the Psychological Discomfort scale suggests the latter two explanations are more tenable (Lavergne & Pelletier, 2015a; 2015b). In that research, psychological discomfort scores formed a normal distribution and showed an unreliable correlation with the use of cognitive restructuring strategies, such as attitude change. Therefore, future research investigating the impact of the hypocrisy paradigm on dissonance arousal should attempt to quantify psychological discomfort using methods that do not rely on self-report instruments. For example, measuring cardiovascular threat arousal responses (Blascovich, 2008) and examining whether the magnitude of threat responses varies across conditions and predicts the subsequent use of compensation strategies.

It is also important to underline the limitations associated with the Information Search task. We gave participants the choice to read different types of information to avoid imposing pre-determined compensations strategies in an effort to increase the ecological validity of the research. However, because we measured intentions to facilitate the use of these compensation strategies, but did not observe actual changes in behaviour and attitudes, there is a need to confirm that these intentions actually predict or correlate with the subsequent use of compensation strategies. This strategy would also help clarify the findings based on the Information Search Intentions scale. Because the scale relied on retrospective self-reports, it was

impossible to know which attitude people used to respond to the two intentions items; some people may have used the advocated attitude as a reference whereas others may have used the newly revised attitude. This confound seems particularly likely if people subjectively revised their attitudes at some point during the Information Search task.

Finally, although the assumption that the commitment manipulation affects the direction of self-focused attention and induces different motivational states seemed supported, it would be important to replicate the present findings using conventional procedures to manipulate self-focused attention and motivation. For example, we could use a video camera to induce public self-awareness versus a mirror to induce private self-awareness (Scheier & Carver, 1980), or use subliminal priming procedures to induce an autonomous motivational state with autonomy-related words (e.g., “choice,” “freedom”) versus a controlled motivational state with control-related words (e.g., “obey,” “duty”; Radel, Sarrazin, Legrain, & Gobancé, 2009).

## **Conclusion**

Canadians hold favourable attitudes toward GW mitigation but continue to engage in GHG-emitting actions, thereby undermining GW mitigation efforts. Therefore, it is crucial that we find ways to bring the behaviour of Canadians in line with their pro-environmental attitudes. It seems that one way to encourage positive behaviour change is to foster an autonomous motivational profile by increasing the perceived self-relevance of environmental protection and by downplaying the social contingencies of PEB. In addition, we should encourage people to reflect privately on the personal significance of their GHG-emitting actions. Making people feel hypocritical about their counter-environmental actions could have the unintended and ironic effect of eroding pro-GW mitigation attitudes when people do not have the resources needed to compensate for the negative impact of their GHG-emitting actions.

## References

- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
- Anderson, C. (2013). *The integrated system of participation in research (ISPR)*. University of Ottawa, School of Psychology, Ottawa, Ontario, Canada. Retrieved August 28, 2014 from [http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/value\\_of\\_the\\_ispr\\_11\\_4\\_13.pdf](http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/value_of_the_ispr_11_4_13.pdf)
- Aronson, E. (1999). Dissonance, hypocrisy, and the self-concept. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive Dissonance: Progress on a Pivotal Theory in Social Psychology* (pp. 103–126). Washington, DC: American Psychological Association.
- Aronson, E., Fried, C., & Stone, J. (1991). Overcoming denial and increasing the intention to use condoms through the induction of hypocrisy. *American Journal of Public Health, 81*, 1636–1638. doi: 10.2105/AJPH.81.12.1636
- Baldwin, M. W., & Holmes, J. G. (1987). Salient private audiences and awareness of the self. *Journal of Personality and Social Psychology, 52*, 1087–1098. doi: 10.1037/0022-3514.52.6.1087
- Blascovich, J. (2008). Challenge and threat. In A. J. Elliot (Ed.), *Handbook of approach and avoidance motivation* (pp. 431–445). New York, NY: Psychology Press.
- 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
- David Suzuki Foundation. (n.d.). David Suzuki's nature challenge: Green living made easy. Retrieved January 27, 2008, from <http://www.davidsuzuki.org/NatureChallenge/>

- 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*, 368–378. doi: 10.1016/j.jenvp.2010.04.002
- Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality, 62*, 119–142. doi: 10.1111/j.1467-6494.1994.tb00797.x
- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*, 627–668. doi: 10.1037/0033-2909.125.6.627
- Deci, E. L., & Ryan, R. M. (1985a). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*, 109–134. doi: 10.1016/0092-6566(85)90023-6
- Deci, E. L., & Ryan, R. M. (1985b). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum.
- Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie Canadienne, 49*, 14–23. doi: 10.1037/0708-5591.49.1.14
- Demographics of the research participants of the ISPR. (n.d.). Retrieved August 28, 2014 from [http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/demographics\\_overview\\_of\\_the\\_ispr\\_as\\_of\\_2014.pdf](http://socialsciences.uottawa.ca/sites/default/files/public/psy/eng/documents/demographics_overview_of_the_ispr_as_of_2014.pdf)
- Dickerson, C. A., Thibodeau, R., Aronson, E., & Miller, D. (1992). Using cognitive dissonance to encourage water conservation. *Journal of Applied Social Psychology, 22*, 841–854. doi: 10.1111/j.1559-1816.1992.tb00928.x

- Dumas, L. J. (2006). *Seeds of opportunity: Climate change challenges and solutions*. Retrieved from <http://civilsocietyinstitute.org/reports/041906%20Seeds%20of%20Oppty%20Dumas%20report%20FINAL.pdf>
- E-Prime (Version 2.0) [Computer software]. (2014). Sharpsburg, PA: Psychology Software Tools.
- Faul, F. (2013). G\*Power (Version 3.1.7) [Computer software]. Kiel, Germany: Universität Kiel.
- Fenigstein, A., Scheier, M. F., & Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology, 43*, 522–527. doi: 10.1037/h0076760
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, Illinois: Row, Peterson and Company.
- Fointiat, V. (2004). “I know what I have to do, but...” When hypocrisy leads to behavioral change. *Social Behavior and Personality, 32*, 741–746. doi: 10.2224/sbp.2004.32.8.741
- Fointiat, V., & Grosbras, J. M. (2007). “Dire une chose et en faire une autre”: [“Saying one thing and not doing it”]: The impact of freedom in the induced hypocrisy paradigm]. *Psychologie Francaise, 52*, 445–458. doi: 10.1016/j.psfr.2006.12.005
- Fointiat, V., Morisot, V., & Pakuszewski, M. (2008). Effects of past transgressions in an induced hypocrisy paradigm. *Psychological Reports, 103*, 625–633. doi: 10.2466/pr0.103.2.625-633
- Freijy, T., & Kothe, E. J. (2013). Dissonance-based interventions for health behaviour change: A systematic review. *British Journal of Health Psychology, 18*, 310–337. doi: 10.1111/bjhp.12035
- Fried, C. B. (1998). Hypocrisy and identification with transgressions: A case of undetected

- dissonance. *Basic and Applied Social Psychology*, 20, 145–154. doi: 10.1207/s15324834basp2002\_6
- Fried, C. B., & Aronson, E. (1995). Hypocrisy, misattribution, and dissonance reduction. *Personality and Social Psychology Bulletin*, 21, 925–933. doi: 10.1177/0146167295219007
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66, 290–302. doi: 10.1037/a0023566
- Gravetter, F. J., & Wallnau, L. B. (2014). *Essentials of statistics for the behavioral sciences* (8th ed.). Belmont, CA: Wadsworth.
- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, 29, 157–166. doi: 10.1037/0008-400X.29.3.157
- Harmon-Jones, E. (1999). Toward an understanding of the motivation underlying dissonance effects: Is the production of aversive consequences necessary? In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 71–99). Washington, DC: American Psychological Association.
- 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. *Advances in Experimental Social Psychology*, 41, 119–166. doi: 10.1016/S0065-2601(08)00403-6
- Harmon-Jones, E., & Mills, J. (1999). An introduction to cognitive dissonance theory and an overview of current perspectives on the theory. In E. Harmon-Jones & J. Mills (Eds.),

- Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 3–21).  
Washington, DC: American Psychological Association.
- Hart, W., Albarracín, D., Eagly, A. H., Brechan, I., Lindberg, M. J., & Merrill, L. (2009). Feeling validated versus being correct: A meta-analysis of selective exposure to information. *Psychological Bulletin*, *135*, 555–588. doi: 10.1037/a0015701
- 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, DC: American Psychological Association.
- 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). Rochester, NY: University of Rochester Press.
- Hodgins, H. S., Weibust, K. S., Weinstein, N., Shiffman, S., Miller, A., Coombs, G., & Adair, K. C. (2010). The cost of self-protection: Threat response and performance as a function of autonomous and controlled motivations. *Personality and Social Psychology Bulletin*, *36*, 1101–1114. doi: 10.1177/0146167210375618
- Hodgins, H. S., Yacko, H. A., & Gottlieb, E. (2006). Autonomy and nondefensiveness. *Motivation and Emotion*, *30*, 283–293. doi: 10.1007/s11031-006-9036-7
- Institute for Social Research. (2007). *Canadian Election Study, 2004* [Summary statistics]. Retrieved from [www.queensu.ca/cora/ces.html](http://www.queensu.ca/cora/ces.html)
- Institute for Social Research. (2009). *Canadian Election Study, 2008* [Summary statistics]. Retrieved from [www.queensu.ca/cora/ces.html](http://www.queensu.ca/cora/ces.html)
- Intergovernmental Panel on Climate Change. (2014). *Climate change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report* (Final

- draft report). Retrieved from <http://ipcc-wg2.gov/AR5/report/final-drafts/>
- Ipsos-Reid. (2012). *Public opinion on the environment 2012: Quantitative Research* (Report No. POR 004-12). Retrieved from [http://epe.lac-bac.gc.ca/100/200/301/pwgsc-tpsdc/por-ef/environment\\_canada/2012/004-12-e/report/quant\\_report.pdf](http://epe.lac-bac.gc.ca/100/200/301/pwgsc-tpsdc/por-ef/environment_canada/2012/004-12-e/report/quant_report.pdf)
- Jonas, E., Schulz-Hardt, S., Fischer, P., & Frey, D. (2006). Biased Information Seeking After Decisions: Cognitive and Motivational Bases. In D. Frey, H. Mandl, & L. von (Eds.), *Knowledge and action* (pp. 23–51). Ashland, OH: Hogrefe & Huber Publishers.
- Lavergne, K. J., & Pelletier, L. G. (2015a). *Individual differences in distal motivation and the choice of strategy to compensate for environmental attitude-behaviour inconsistencies*. Manuscript submitted for publication.
- Lavergne, K. J., & Pelletier, L. G. (2015b). *Why are attitude-behaviour inconsistencies uncomfortable? Exploring Individual Differences in Dissonance Arousal Processes*. Manuscript submitted for publication.
- 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. doi: 10.1016/j.jenvp.2009.11.002
- Madrigal, A. (2009, April 29). Humans halfway to causing dangerous climate change. *Wired Science*. Retrieved from <http://www.wired.com/>
- McGregor, I., Newby-Clark, I. R., & Zanna, M. P. (1999). “Remembering” dissonance: Simultaneous accessibility of inconsistent cognitive elements moderates epistemic discomfort. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 325–353). Washington, DC: American

Psychological Association.

Microsoft Office. (2007). Powerpoint Application [Computer software]. Redmond, WA:

Microsoft Corporation.

Moore, T. G. (1996). *Health and amenity effects of global warming*. Retrieved from

<http://128.118.178.162/eps/othr/papers/9604/9604001.pdf>

National Geographic. (n.d.). Global warming. Retrieved May 2, 2008, from [http://environ-](http://environment.nationalgeographic.com/environment/global-warming/)

[ment.nationalgeographic.com/environment/global-warming/](http://environment.nationalgeographic.com/environment/global-warming/)

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

environmentally responsible behavior: A prospective study of environmental goals. *Journal of Environmental Psychology*, *23*, 349–357. doi: 10.1016/S0272-4944(03)00035-5

Patz, J. A., & Khaliq, M. (2002). Global climate change and health: Challenges for future

practitioners. *Medical Student Journal of the American Medical Association*, *287*, 2283–

2284. doi: 10.1001/jama.287.17.2283-JMS0501-3-1 (Reprinted from *EcoHealth*, *7* (2010), 425-438)

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*, 145–156. doi: 10.1037/0008-400X.29.3.145

Pelletier, L. G. & Sharp, E. C. (2008). Persuasive communication and pro-environmental

behaviors: How message tailoring and message framing can improve the integration of

behaviours through self-determined motivation. *Canadian Psychology*, *49*, 210-217. doi:

10.1037/a0012755

- Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The Motivation Toward the Environment Scale (MTES). *Journal of Applied Social Psychology, 28*, 437–468. doi: 10.1111/j.1559-1816.1998.tb01714.x
- Proulx, T., Inzlicht, M., & Harmon-Jones, E. (2012). Understanding all inconsistency compensation as a palliative response to violated expectations. *Trends in Cognitive Sciences, 16*, 285–291. doi: 10.1016/j.tics.2012.04.002
- Radel, R., Sarrazin, P., Legrain, P., & Gobancé, L. (2009). Subliminal priming of motivational orientation in educational settings: Effect on academic performance moderated by mindfulness. *Journal of Research in Personality, 43*, 695–698. doi: 10.1016/j.jrp.2009.02.011
- Rancourt, D. G. (2007, February 27). Global warming: Truth or dare [Web log post]. Retrieved from <http://activistteacher.blogspot.com/search/label/environment>
- Ratelle, C. F., Guay, F., Vallerand, R. J., Larose, S., & Senecal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of Educational Psychology, 99*, 734–746. doi: 10.1037/0022-0663.99.4.734
- Rubens, L., Gosling, P., Bonaiuto, M., Brisbois, X., & Moch, A. (2015). Being a hypocrite or committed while I am shopping? A comparison of the impact of two interventions on environmentally friendly behavior. *Environment and Behavior, 47*, 3–16. doi: 10.1177/0013916513482838
- 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* (pp. 449–479). New York, NY: Guilford Press.
- Scheier, M. F., & Carver, C. S. (1980). Private and public self-attention, resistance to change, and dissonance reduction. *Journal of Personality and Social Psychology*, *39*, 390–405. doi: 10.1037/0022-3514.39.3.390
- Scientific opinion on climate change (n.d.). Retrieved February 11, 2008, from Wikipedia: [http://en.wikipedia.org/wiki/Scientific\\_opinion\\_on\\_climate\\_change](http://en.wikipedia.org/wiki/Scientific_opinion_on_climate_change)
- Séguin, C., Pelletier, L. G., & Hunsley, J. (1999). Predicting environmental behaviors: The influence of self-determination and information about environmental health risks. *Journal of Applied Social Psychology*, *29*, 1582-1600. doi: 10.1111/j.1559-1816.1999.tb02043.x
- Sierra Club. (n.d.). Global warming impacts: Health effects. Retrieved August 23, 2008 from <http://www.sierraclub.org/globalwarming/health/>
- Simon, L., Greenberg, J., & Brehm, J. (1995). Trivialization: the forgotten mode of dissonance reduction. *Journal of Personality and Social Psychology*, *68*, 247–260. doi: 10.1037/0022-3514.68.2.247
- Singer, F. S., & Avery, D. T. (2008). *Unstoppable global warming: Every 1,500 Years* (Updated and expanded ed.). New York, NY: Rowman & Littlefield Publishers, Inc.
- SPSS (Version 21.0) [Computer software]. (2012). Armonk, NY: IBM Corporation.
- Starzyk, K. B., Fabrigar, L. R., Soryal, A. S., & Fanning, J. J. (2009). A painful reminder: The role of level and salience of attitude importance in cognitive dissonance. *Personality and Social Psychology Bulletin*, *35*, 126–137. doi: 10.1177/0146167208325613
- Statistics Canada. (2008). *Commuting Patterns and Places of Work of Canadians, 2006 Census* (Catalogue No. 97-561-X). Retrieved from

<http://www12.statcan.gc.ca.proxy.bib.uottawa.ca/english/census06/analysis/pow/pdf/97-561-XIE2006001.pdf>

Stone, J., Aronson, E., Crain, A. L., & Winslow, M. P. (1994). Inducing hypocrisy as a means of encouraging young adults to use condoms. *Personality and Social Psychology Bulletin*, *20*, 116–128. doi: 10.1177/0146167294201012

Stone, J., & Fernandez, N. C. (2008). To practice what we preach: The use of hypocrisy and cognitive dissonance to motivate behavior change. *Social and Personality Psychology Compass*, *2*, 1024–1051. doi: 10.1111/j.1751-9004.2008.00088.x

Stone, J., Wiegand, A. W., Cooper, J., & Aronson, E. (1997). When exemplification fails: Hypocrisy and the motive for self-integrity. *Journal of Personality and Social Psychology*, *72*, 54–65. doi: 10.1037/0022-3514.72.1.54

Tabachnick, B. G., & Fidell, L. S. (2007). *Experimental Design Using ANOVA*. Belmont, USA: Thomson Brooks/Cole.

The lack of scientific rigour in environmental ideology. (n.d.). Retrieved from <http://www.ourcivilisation.com/aginatur/prog1.htm>

Thibodeau, R., & Aronson, E. (1992). Taking a closer look: Reasserting the role of the self-concept in dissonance theory. *Personality and Social Psychology Bulletin*, *18*, 591–602. doi: 10.1177/0146167292185010

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in experimental social psychology*, *29*, 271–360. doi: 10.1016/S0065-2601(08)60019-2

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal*

*of Educational Psychology*, 101, 671–688. doi: 10.1037/a0015083

Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the Motivation Toward the Environment Scale. *Environment and Behavior*, 35, 486–505. doi: 10.1177/0013916503035004003

Weart, S. (2010). The discovery of global warming. Retrieved from <http://www.aip.org/>

Weinstein, N., & Hodgins, H. S. (2009). The moderating role of autonomy and control on the benefits of written emotion expression. *Personality and Social Psychology Bulletin*, 35, 351–364. doi: 10.1177/0146167208328165

West, S. G., Aiken, L. S., & Krull, J. L. (1996). Experimental Personality Designs: Analyzing Categorical by Continuous Variable Interactions. *Journal of Personality*, 64, 1–48. doi: 10.1111/j.1467-6494.1996.tb00813.x

Table 1

*Descriptive Statistics by Experimental Condition*

Variable	<i>M</i>	<i>SD</i>	Range	<i>Z<sub>sk</sub></i>
Private commitment (control)				
Autonomous motivation	4.57	1.20	1.92-6.75	-1.08
Controlled motivation	3.24	0.92	1.00-5.13	-0.94
Pro-GW attitude strength	5.07	0.97	3.13-6.88	-0.69
Psychological discomfort	1.75	0.66	1.11-3.56	3.36
Behaviour change intentions	3.78	1.87	1-7	0.61
Attitude change intentions	2.59	1.91	1-7	2.55
Public commitment				
Autonomous motivation	4.47	1.18	1.58-7.00	-0.08
Controlled motivation	3.25	1.00	1.00-5.25	-0.77
Pro-GW attitude strength	4.87	0.82	3.25-6.50	-0.83
Psychological discomfort <sup>a</sup>	1.87	1.01	1.00-4.11	2.91
Behaviour change intentions	4.04	2.30	1-7	-0.39
Attitude change intentions	2.07	1.38	1-6	3.04
Private awareness				
Autonomous motivation	4.52	1.12	2.25-6.42	-0.85
Controlled motivation	3.01	0.81	1.00-5.13	-0.24
Pro-GW attitude strength	4.92	1.04	3.38-6.38	-0.68
Psychological discomfort	2.10	0.95	1.00-4.11	1.20
Behaviour change intentions	3.70	1.90	1-7	0.54
Attitude change intentions	3.37	2.02	1-7	0.72
Public awareness (hypocrisy)				
Autonomous motivation	4.60	1.46	1.08-7.00	-1.22
Controlled motivation	3.09	1.18	1.38-5.13	0.12
Pro-GW attitude strength	4.73	1.07	3.38-6.38	0.14
Psychological discomfort <sup>a</sup>	2.12	0.78	1.00-3.67	1.35
Behaviour change intentions	4.00	1.84	1-7	-0.89
Attitude change intentions	3.22	1.97	1-7	1.30

*Note.* Experimental condition  $n = 27$ . All variables had a potential range of 1 to 7.  $Z_{sk}$  = standardized skewness statistic.

<sup>a</sup>An extremely high score (outlier) was recoded to minimize its influence on the mean.

Table 2

*Contingency Table of Information Search Strategies by Experimental Condition*

Statistic	Pro-GW bias	Pro-GW + Counter-GW	Counter-GW + Pro-GW	Counter-GW bias	Total
<b>Private commitment</b>					
Observed frequency	8	8	7	4	27
Standardized residual	-1.2	-0.7	2.6	0.3	
<b>Public commitment</b>					
Observed frequency	12	10	2	3	27
Standardized residual	0.6	0.2	-0.9	-0.3	
<b>Private awareness</b>					
Observed frequency	13	7	2	5	27
Standardized residual	1.0	-1.2	-0.9	1.0	
<b>Public awareness</b>					
Observed frequency	10	13	2	2	27
Standardized residual	-0.3	1.6	-0.9	-1.0	
<b>Total</b>	<b>43</b>	<b>38</b>	<b>13</b>	<b>14</b>	<b>108</b>

*Note.* GW = global warming.

Table 3

*Hierarchical Regression ANCOVA of Information Search Intentions*

Variable	Behaviour change			Attitude change		
	$\beta$	$R^2$	$\Delta R^2$	$\beta$	$R^2$	$\Delta R^2$
Step 1		.03 <sup>†</sup>	.03 <sup>†</sup>		.02	.02
Psychological discomfort <sup>a</sup>	.18 <sup>†</sup>			.15		
Step 2		.11 <sup>*</sup>	.08 <sup>†</sup>		.16 <sup>**</sup>	.13 <sup>**</sup>
Commitment <sup>b</sup> (CMT)	.06			-.10		
Awareness <sup>b</sup> (AWR)	-.04			.26 <sup>**</sup>		
Autonomous motivation <sup>a</sup> (AUT)	.21 <sup>*</sup>			-.28 <sup>**</sup>		
Controlled motivation <sup>a</sup> (CTL)	.11			.15		
Step 3		.13	.02		.26 <sup>**</sup>	.10 <sup>*</sup>
CMT x AWR	.01			.04		
CMT x AUT	.01			.22 <sup>*</sup>		
CMT x CTL	.06			.07		
AWR x AUT	.06			.04		
AWR x CTL	.06			.12		
AUT x CTL	-.05			.14		
Step 4		.16	.03		.39 <sup>***</sup>	.13 <sup>**</sup>
CMT x AWR x AUT	-.07			.08		
CMT x AWR x CTL	.07			.03		
CMT x AUT x CTL	-.13			-.39 <sup>***</sup>		
AWR x AUT x CTL	.13			.24 <sup>*</sup>		
Step 5		.17	.02		.40 <sup>***</sup>	.01
CMT x AWR x AUT x CTL	-.18			-.16		

<sup>a</sup>Centered scores.<sup>b</sup>Contrast code of private commitment (-1) versus public commitment (1).<sup>c</sup> Contrast code of no-induced awareness (-1) versus induced awareness (1).\*\*\*  $p < .001$ . \*\*  $p < .01$ . \*  $p < .05$ . <sup>†</sup> $p < .10$ .

Table 4

*Simple Slope Analyses of Attitude Change Intentions Across Levels of Autonomous Motivation Toward the Environment for the Significant Three-Way Interactions*

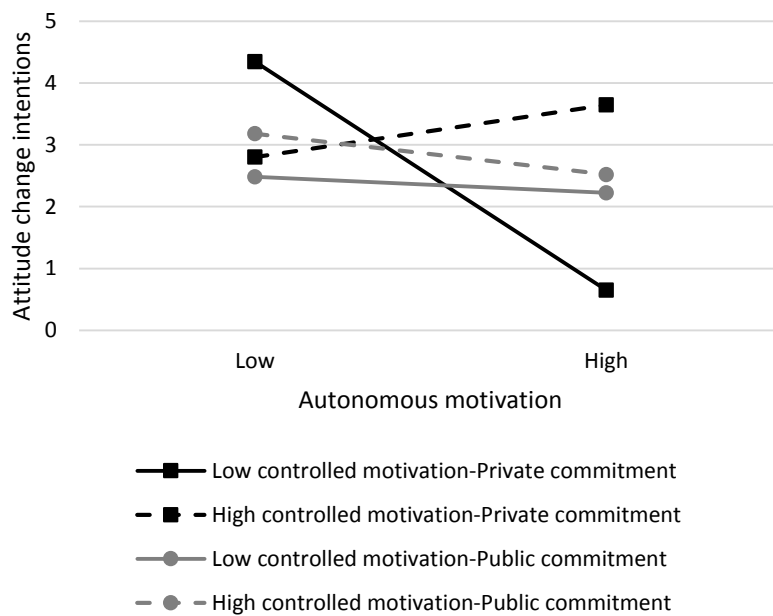
Slopes	Commitment interaction <sup>a</sup>			Awareness interaction <sup>b</sup>		
	<i>b</i>	<i>t</i>	<i>p</i>	<i>b</i>	<i>t</i>	<i>p</i>
Simple slopes						
(1) Low controlled motivation @ Private/No awareness	-1.50	-5.65	< .001	-0.66	-2.78	.007
(2) High controlled motivation @ Private/No awareness	0.34	0.99	.33	-0.43	-1.54	.13
(3) Low controlled motivation @ Public/Awareness	-0.11	-0.51	.61	-0.95	-4.23	< .001
(4) High controlled motivation @ Public/Awareness	-0.27	-0.85	.40	0.51	1.34	.18
Slope differences						
(1) versus (2)		3.98	< .001	0.67	.51	
(1) versus (3)		4.13	.001	-0.92	.36	
(1) versus (4)		2.91	.005	2.56	.01	
(2) versus (3)		1.12	.27	1.40	.17	
(2) versus (4)		-1.34	.18	2.04	.04	
(3) versus (4)		-0.53	.60	3.32	.001	

*Note.* Each slope is based on  $n = 54$ .

<sup>a</sup>Commitment (private versus public) x Autonomous Motivation x Controlled Motivation three-way interaction (see Figure 1a).

<sup>b</sup>Awareness (no-induced awareness versus induced awareness) x Autonomous Motivation x Controlled Motivation three-way interaction (see Figure 1b).

## a) Commitment by Motivation Interaction



## b) Awareness by Motivation Interaction

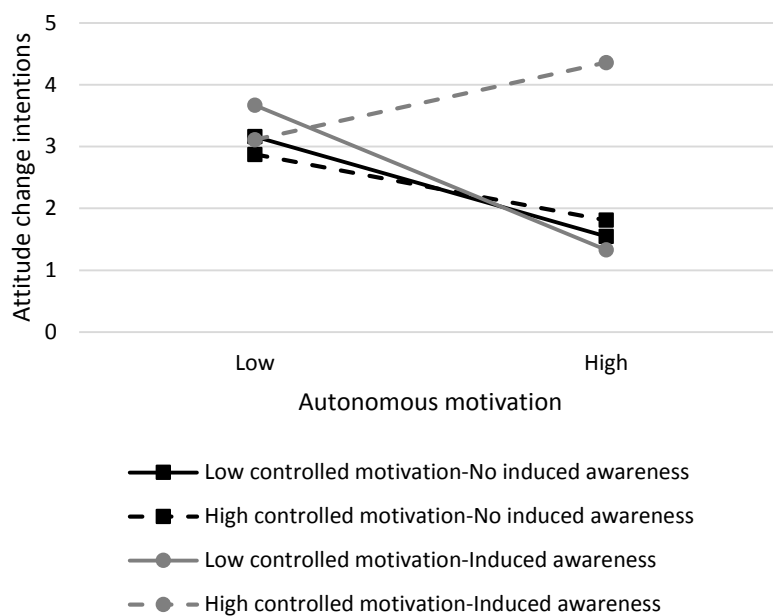


Figure 1. Plots of the significant three-way interactions of attitude change intentions. Panel a) shows the Commitment x Autonomous Motivation x Controlled Motivation interaction. Panel b) shows the Awareness x Autonomous Motivation x Controlled Motivation interaction.

## DISCUSSION

Environmental concerns are on the rise, yet Canadians continue to engage in environmentally harmful activities at alarming rates because of psychological, structural, and institutional barriers to pro-environmental behaviour change (Bamberg & Moser, 2007; Gifford, 2011; Kollmuss & Agyeman, 2002). This environmental belief-action gap implies that Canadians are likely to act inconsistently with their own pro-environmental attitudes on a daily basis, which undermines environmental protection efforts. However, we know relatively little about the motivational consequences of spontaneous attitude-behaviour inconsistencies. These consequences are important to understand because the choice of strategy to resolve inconsistencies in the environmental domain have implications for the stability of pro-environmental attitudes and engagement in pro-environmental behaviour. Weakening or distorting pro-environmental beliefs and attitudes to minimize the inconsistency is likely to promote counter-environmental behaviour and exacerbate the belief-action gap, while reversing or counter-balancing the negative impact of counter-environmental actions to minimize the inconsistency is likely to promote pro-environmental behaviour and alleviate the gap. Therefore, the goal of the present research was to explore the motivational processes underlying inconsistency compensation processes in order to identify ways to overcome the environmental belief-action gap.

To this end, we tested the proposed HABICE to examine the role of distal motives for effective and unconflicted action on the perception and resolution of environmental attitude-behaviour inconsistencies. The HABICE (see Figure 1) derives from the action-based model of dissonance (Harmon-Jones, Amodio, & Harmon-Jones, 2009) and SDT (Deci & Ryan, 1985a; 1985b; 2008; Vallerand, 1997). The model assumes that individual differences in distal

motivation influence all aspects of inconsistency compensation processes: the perception of attitude-behaviour inconsistencies in the environmental domain, the quantity and quality of motivation to compensate for these inconsistencies (i.e., dissonance arousal), and the use and choice of inconsistency compensation strategies (i.e., dissonance reduction). Specifically, we hypothesized that distal motivation, particularly motivation toward the environment, influences the self-structures—ego-invested versus authentic—people use to evaluate the personal significance of their counter-environmental actions. In addition, we assumed that social factors that direct attention to the public or private aspects of the self moderate the top-down effects of distal motivation on inconsistency compensation processes. Inconsistencies that threaten instrumental action tendencies, for example public environmental transgressions that engender potentially negative social evaluative reactions, induce an ego-invested self-threat and a controlled motivational state. Conversely, inconsistencies that threaten organismic integration action tendencies—actions that are incongruent with important self-relevant pro-environmental attitudes—induce an authentic self-integrity threat and an autonomous motivational state. In turn, the quality of motivation to compensate and the functional significance of compensation strategies determine whether people will use behaviour modification or cognitive restructuring strategies to compensate for the inconsistency.

### **Summary of the Findings**

We carried out three sets of studies to test the proposed HABICE. The first set of studies (Lavergne & Pelletier, 2015a) tested hypotheses about the role of individual differences in global and contextual motivation on dissonance arousal processes triggered by native attitude-behaviour inconsistencies encountered across and within important life domains. The second set of studies (Lavergne & Pelletier, 2015b) tested hypotheses about the role of individual differences in

contextual motivation toward the environment on the use and choice of strategies to compensate for a recent native inconsistency in the environmental domain. Finally, the last study (Lavergne & Pelletier, 2015c) tested hypotheses about the moderating effect of social factors that direct attention to public (ego-invested) versus private (authentic) aspects of the self on inconsistency compensation processes using an experimental design. The overall pattern of results supported the main predictions of the HABICE.

Specifically, the results supported the assumption that autonomous and controlled motivational orientations—which embody organismic integration and instrumental action tendencies, respectively—serve as distal motives that guide inconsistency compensation processes. Amotivation, which refers to the manifestation of the impersonal orientation and does not embody specific action tendencies (Deci & Ryan, 1985a; Vallerand, 1997), does not appear to guide these processes (Lavergne & Pelletier, 2015a). As expected, both autonomous and controlled motivational orientations toward the environment predicted dissonance arousal following the perception of a counter-environmental action; however, they elicited qualitatively different motives to compensate for the inconsistency. Autonomous motivation elicited self-integrity restoration motives while controlled motivation elicited ego-invested self-protection motives and a lack of specific motives due to perceived incompetence and indifference (Lavergne & Pelletier, 2015a). As a result, autonomous and controlled motivational orientations toward the environment predicted the use of different compensation strategies.

Autonomous motivation toward the environment led people to report using behaviour modification strategies and avoiding cognitive restructuring strategies to compensate for a recent counter-environmental action. Presumably, this pattern emerged because behaviour modification minimized the threatening inconsistency in a way that satisfied integrative processes, while

cognitive restructuring likely would have exacerbated the authentic self-integrity threat and impeded integrative processes (Lavergne & Pelletier, 2015b). Furthermore, autonomous motivation toward the environment seemed to alleviate intentions to revise pro-environmental attitudes when there were barriers to behaviour change, especially under conditions of private self-focus and among people with low levels of controlled motivation toward the environment (Lavergne & Pelletier, 2015c). The authentic use of inconsistency compensation strategies partly explained the negative relationship between autonomous motivation toward the environment and the relative frequency of native inconsistencies (Lavergne & Pelletier, 2015a; 2015b).

Conversely, controlled motivation toward the environment led people to use cognitive restructuring strategies to minimize inconsistencies that failed to arouse dissonance, presumably because the counter-environmental action was private and changing inauthentic attitudes does not engender aversive consequences for ego-invested self-structures. However, this motivational orientation led people to use behavioural modification strategies to reduce dissonance; presumably, because the counter-environmental action was public and, therefore, reversing the action's impact was the only strategy with the potential to minimize aversive consequences (e.g., negative social evaluative reactions; Lavergne & Pelletier, 2015b). Furthermore, the dissonance aroused by an experimentally induced attitude-behaviour inconsistency seemed to pressure people with high levels of controlled motivation to revise pro-environmental attitudes when there were barriers to behaviour change (Lavergne & Pelletier, 2015c). The contingent use of inconsistency compensation strategies fully explained the tenuous positive relationship between controlled motivation toward the environment and the relative frequency of native inconsistencies (Lavergne & Pelletier, 2015a; 2015b).

Across the studies, the relationships between autonomous motivation and the use of

behaviour modification strategies, the avoidance of cognitive restructuring strategies, and the infrequency of native inconsistencies were consistent (c.f., Lavergne & Pelletier, 2015a; 2015b; 2015c). These relationships were reliable even when controlling for other variables, such as levels of private and public self-consciousness, socially desirable responding biases, preferences for consistency, and specific motives to compensate (Lavergne & Pelletier, 2015a; 2015b), and even when dissonance was experimentally induced (Lavergne & Pelletier, 2015c). By contrast, the relationships between controlled motivation and the use of cognitive restructuring and the use of behaviour modification strategies, as well as between controlled motivation and the frequency of native inconsistencies varied across studies. For example, the correlation between controlled motivation and the use of cognitive restructuring and the use of behaviour modification strategies was sometimes positive (Lavergne & Pelletier, 2015b) and sometimes null (Lavergne & Pelletier, 2015a; 2015b; 2015c). Similarly, controlled motivation was sometimes associated with relatively frequent native inconsistencies (Lavergne & Pelletier, 2015a; 2015c) and sometimes unrelated to the frequency of native inconsistencies (Lavergne & Pelletier, 2015a). However, because controlled motivation promotes contingent regulation, the fluctuating relationships could merely reflect varying contingencies across situations. In any case, the research has important implications for motivational theories and environmental protection efforts.

### **Implications of the Research**

The results support the notion that attitude-behaviour inconsistencies arouse dissonance and motivate people to minimize the inconsistency, as proposed by Festinger (1957). In that regard, the present research is consistent with previous research showing that inducing an attitude-behaviour inconsistency causes dissonance arousal, attitude change, cognitive restructuring, and behaviour change (see Harmon-Jones et al., 2009; Harmon-Jones & Mills,

1999; Leippe & Eisenstadt, 1999; Stone & Fernandez, 2008 for reviews). However, previous research based on CDT (Festinger, 1957) seems to have low predictive power relative to individual differences in the use and choice of inconsistency compensation strategies. This shortcoming is probably because this research has neglected the distal motives guiding compensation processes and limited the availability of compensation strategies following dissonance induction. The present research suggests that findings based on dissonance induction paradigms may not generalize to inconsistency compensation processes triggered by spontaneous attitude-behaviour inconsistencies encountered in daily life. This lack of ecological validity is likely because dissonance induction paradigms, particularly the hypocrisy paradigm, promote controlled compensation processes that drive dissonance reduction and undermine autonomous compensation processes that promote organismic integration (Lavergne & Pelletier, 2015c).

Apparently, using research methods that account or allow for the manifestation of both autonomous and controlled compensation processes increases the predictive power of CDT and seems to explain phenomena poorly understood by CDT thus far—particularly, the tenuous relationship between dissonance arousal and attitude change. The contingent use of inconsistency compensation strategies associated with controlled motivation suggests that people use cognitive restricting strategies to avoid non self-threatening inconsistencies rather than to reduce dissonance (Lavergne & Pelletier, 2015a; 2015b). Furthermore, the authentic use of inconsistency compensation strategies associated with autonomous motivation clarifies why some people choose to live with or to tolerate the aroused dissonance rather than to change their attitudes following a dissonance induction (Lavergne & Pelletier, 2015c). In sum, these effects seemed to account for the spurious correlations observed between dissonance arousal and attitude change or cognitive restructuring.

Harmon-Jones and colleagues (2009) were the first researchers to use self-report methods to quantify individual differences in dissonance arousal and reduction processes; however, they did not qualify the distal motives underlying these differences. The present research suggests that multi-dimensional motivation scales that measure the perceived loci of causality of behaviour (e.g., Pelletier et al., 1998; Sharp et al., 2003) are a valid way to operationalize individual differences in distal motives for effective and unconflicted action. The results support the existence of at least two distinct types of distal motives—autonomous and controlled—that reliably predict individual differences in dissonance processes. Furthermore, the present research suggests that the distal motives guiding earlier components of dissonance processes are not necessarily the same as those guiding later components, which supports the distinction between perception, arousal, and reduction processes proposed by Harmon-Jones and colleagues (2009). For example, when the controlled orientation is dominant, inconsistencies that threaten ego-invested self-structures seem to induce a controlled motivational state that drives people to compensate, whereas inconsistencies that do not threaten these self-structures lead to indifference. By contrast, a dominant autonomous motivational orientation seems to induce an autonomous motivational state that promotes authentic behaviour change, regardless of whether dissonance is aroused (Lavergne & Pelletier, 2015a; 2015b). In sum, the findings presented herein support the action-based model but offer a novel conception of distal motives for effective and unconflicted action that increases the predictive validity of the model.

The action-based model operates on the assumption that dissonance processes are fundamentally adaptive but that they can be maladaptive at times (Harmon-Jones et al., 2009). Similarly, SDT assumes that motivational processes that promote organismic integration and authentic self-regulation are adaptive because these action tendencies satisfy basic needs for

autonomy and competence, whereas motivational processes that impede these tendencies are maladaptive because they thwart basic need satisfaction (Deci & Ryan, 2008). Therefore, the distinction between inconsistency compensation processes guided by autonomous versus controlled motivation seems to clarify for whom and under what conditions inconsistency compensation processes are adaptive versus maladaptive. On the one hand, autonomous compensation processes seem adaptive because they foster authentic behaviour change (Deci & Ryan, 2008). Therefore, the results suggest that high levels of autonomous motivation toward the environment foster adaptive inconsistency compensation processes, especially under conditions of private self-focus. On the other hand, controlled inconsistency processes appear maladaptive, at least within the environmental domain, because they foster inauthentic behaviour change or, worse, attitude change via cognitive restructuring. Therefore, high levels of controlled motivation toward the environment and conditions that induce a public self-focus, such as the hypocrisy paradigm, foster maladaptive inconsistency compensation processes.

More importantly, the research has implications for the motivational processes underlying the environmental belief-action gap. According to SDT, behaviour that is freely chosen and endorsed by the self leads people to identify more strongly with the behaviour, resulting in increased autonomous motivation; this process is called internalization (Deci & Ryan, 2008). Similarly, the HMEIM (Vallerand, 1997) suggests that motivation manifested at lower levels of abstraction exert bottom-up effects on motivation at higher levels of abstraction. Therefore, autonomous inconsistency compensation processes in the environmental domain may assist internalization processes and create an upward spiral of pro-environmental behaviour change that has the potential to alleviate the environmental belief-action gap (Osbaldiston & Sheldon, 2003). Conversely, SDT posits that people do not identify with behaviour coerced by external or internal

pressures to act a certain way (Deci & Ryan, 2008). Furthermore, cognitive restructuring (e.g., trivializing the importance of environmental protection) could lead people to become indifferent or apathetic toward environmental protection, resulting in increased amotivation (Pelletier, Dion, Tuson, & Green-Demers, 1999). Therefore, controlled compensation processes in the environmental domain could engender greater controlled motivation and amotivation toward the environment over time via bottom-up effects (Vallerand, 1997). At best, controlled compensation processes appear to favour unchanged environmental attitudes and behaviour; at worse, they could create a downward spiral of counter-environmental attitude change, especially when there are barriers to behaviour change. This interpretation implies that controlled motivation toward the environment may be driving the environmental belief-action gap.

### **Limitations and Future Research**

In an effort to bolster the ecological validity of the findings, the present research used novel measurement approaches reliant on self-report data collection methods. The use of self-report methods was well suited to explore inconsistency compensation processes triggered by native attitude-behaviour inconsistencies that arise spontaneously in day-to-day life. However, the use of these methods also constitutes an important limitation of the research.

**Magnitude of the dissonance ratio.** Cognitive dissonance theory assumes that the magnitude of psychological discomfort aroused by an inconsistency is proportional to the magnitude of the dissonance ratio (Festinger, 1957). However, we did not quantify or manipulate the dissonance ratio. Instead, we asked participants to recall one or more recent counter-environmental actions freely using an open-ended format. It seems plausible that the recalled transgressions varied along a number of dimensions, for example perceived importance, difficulty, efficacy, severity, or self-relevance, that have implications for the magnitude of the

dissonance ratio. Furthermore, there is no way of knowing which other related cognitions entered the dissonance ratio. These factors are important considerations because the HABICE suggests that distal motivation has implications for the self-structures used to evaluate the significance of behavioural transgressions, which implies that distal motivation moderates the magnitude of the dissonance ratio. Therefore, future tests of the HABICE should attempt to quantify or manipulate the magnitude of the dissonance ratio. For example, we could use the multiplicative power-function model of dissonance to determine the magnitude of the dissonance ratio (Sakai, 1999), or manipulate the number or type of recalled transgressions used to induce dissonance via the hypocrisy paradigm (Fointiat, Morisot, & Pakuszewski, 2008; Stone & Fernandez, 2011).

**Quantification of psychological discomfort.** The pattern of findings also suggests that using a self-report instrument to assess levels of psychological discomfort may interact with the processes under study. Asking people to report levels of psychological discomfort via an online questionnaire produced moderate scores with a relatively normal distribution (Lavergne & Pelletier, 2015a; 2015b); doing so in the laboratory produced low scores with a relatively skewed distribution (Lavergne & Pelletier, 2015c). There are at least two plausible explanations for this discrepancy. People could have been more willing to report psychological discomfort via an anonymous questionnaire completed outside the laboratory than they were in the presence of an experimenter or an implied evaluative audience in the laboratory. Alternatively, the dissonance induced in the laboratory may have motivated people to use cognitive restructuring strategies to avoid the aroused dissonance at some point before completing the affect scale. Both explanations are consistent with the HABICE and the idea that dissonance induction paradigms may be promoting controlled compensation processes; they also suggest the need to quantify the magnitude of dissonance using observational methods. Recent neuroscientific research suggests

that it might be possible to infer dissonance arousal using psychophysiological methods.

The same brain structures involved in dissonance arousal and reduction (i.e., the anterior cingulate cortex (ACC) and the left prefrontal cortex (LPFC), respectively; Harmon-Jones, Gerdjikov, & Harmon-Jones, 2008; Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008; Harmon-Jones & Harmon-Jones, 2008; Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006), also intervene in reward processing and vary as a function of motivational states. For example, activity in the ACC is greater when people are motivated to do a task for extrinsic or controlled reasons (e.g., for money, extra class credit, or awards) versus for intrinsic or autonomous reasons (e.g., out of interest, enjoyment, or choice; Lee, Reeve, Xue, & Xiong, 2012). This difference seems especially large among people who report greater levels of extrinsic motivation (Linke et al., 2010). Similarly, Murayama, Matsumoto, Izuma, and Matsumoto (2010) observed greater LPFC activity when they offered study participants extrinsic (money) versus intrinsic (points) rewards for a boring task. Taken together, these findings imply that the controlled motivational orientation increases the responsiveness of the brain regions involved in the arousal and reduction of dissonance. Therefore, it should be possible to infer the magnitude of dissonance arousal using psychophysiological methods, because the ACC and LPFC are also involved in the body's stress response.

The activation of the stress system's central components, which include the ACC and the PFC, activates its peripheral components resulting in sympathetic arousal to facilitate effective action. At the level of cardiovascular system, this challenge response results in increased heart rate, ventricular contractility, cardiac output, and vasodilation (Blascovich, 2008). The magnitude of the cardiovascular challenge response is therefore a reliable indicator of effort and engagement (Kelsey, 2012). However, as the potency of stressors increases, for example when

individuals feel unable to avoid negative social evaluative reactions, people are more likely to make a threat appraisal than a challenge appraisal of the situation (Dickerson & Kemeny, 2004). Specifically, individuals are more likely to judge that they lack the resources required to overcome the demands of the situation (Blascovich, 2008). Threat appraisals activate the hypothalamic-pituitary-adrenal (HPA) axis of the stress response, which exacerbates sympathetic arousal at the level of the heart but causes vasoconstriction rather than vasodilation. As a result, the HPA axis attenuates the increase in cardiac output because of increased total peripheral resistance (TPR), which is the force working against the heart as it tries to pump blood into the vasculature. Therefore, we should be able to infer the magnitude of dissonance arousal by quantifying the magnitude of cardiovascular challenge and threat responses (Blascovich, 2008).

Hodgins and colleagues (2010) have successfully used this quantification approach to demonstrate that priming the controlled orientation produces a greater cardiovascular threat response to psychological stressors than priming the autonomous orientation. Previous research on defensiveness and coping also supports the idea that controlled motivation disposes people to exhibit a stronger threat response than autonomous motivation (Amiot, Blanchard, & Gaudreau, 2008; Hodgins, Yacko, & Gottlieb, 2006; Knee and Zuckerman, 1996; 1998; Weinstein & Hodgins, 2009). These research findings imply that, all other things being equal, controlled versus autonomous motivation toward the environment should predict a larger cardiovascular threat response when an attitude-behaviour inconsistency is public and a smaller threat response when it is private. Future tests of the HABICE should investigate this hypothesis.

**Choice of inconsistency compensation strategies.** Hypotheses about the use and choice of compensation strategies seemed supported by the research (Lavergne & Pelletier, 2015a; 2015b); however, the findings derive almost exclusively from self-reported data. Therefore, there

is a need to replicate the findings of the present research using observational methods to quantify the use and choice of compensation strategies following the perception of an attitude-behaviour inconsistency in the environmental domain. For example, we could conduct an experiment to observe which compensation strategy people with favourable attitudes toward the environment use when they are confronted with their counter-environmental actions. We could show participants photographs of themselves engaged in a counter-environmental action (e.g., putting a recyclable item in the waste bin) and present them with a choice between a cognitive task (e.g., waste behaviour questionnaire) that allows them to restructure their attitudes and a behavioural task (e.g., waste sorting task) that allows them to enact a compensatory pro-environmental action. Similarly, the assumption that the use of cognitive restructuring strategies leads to more frequent native inconsistencies whereas the use of behaviour modification strategies leads to less frequent native inconsistencies seems supported by correlational data (Lavergne & Pelletier, 2015a; 2015b). However, in the future, we should use an experimental design to test causality or a cross-lagged longitudinal design to track these dynamic changes over time. We could employ a diary study to record the number of native inconsistencies encountered on a daily basis and the strategies used to compensate for them over a period of a few weeks. We would also need to measure levels of motivation toward the environment and pro-environmental attitude strength at multiple time points during the study to assess changes in motivation and attitudes over time.

**Excluded non-respondents.** Finally, about one fifth of participants recruited for the correlational studies using a generic study description that did not mention the environment, did not recall a recent counter-environmental action as instructed (Lavergne & Pelletier, 2015a; 2015b). These non-respondents appeared less motivated toward the environment and reported weaker pro-environmental attitudes than the participants who recalled counter-environmental

actions. We assumed that the non-compliant participants were not part of the target population—Canadians who endorse pro-environmental attitudes and sometimes engage in counter-environmental actions. However, it seems plausible that recalling recent transgressions was itself uncomfortable and that non-compliance represents an attempt to avoid self-threatening information. This alternative explanation implies that the recall task may have induced controlled compensation processes among the least motivated individuals, which is consistent with the HABICE. Future research should adopt more inclusive methods and procedures to study how unmotivated individuals react to their own counter-environmental actions under different conditions. For example, we could use experimental methods to study how individuals who do not endorse pro-environmental attitudes react to manipulations that direct attention to ego-invested versus authentic self-structures, or to social factors that frustrate versus support the needs for autonomy or competence during inconsistency perception processes. This line of research could offer insights into how to motivate the least motivated individuals who, presumably, make the largest contribution to environmental degradation.

## **Conclusion**

Controlled inconsistency compensation processes appear to drive the environmental belief-action gap and to favour continued environmental degradation. Therefore, while persuasive strategies that promote controlled inconsistency compensation processes may appear effective at motivating pro-environmental behaviour change in the short-term, the effectiveness of these strategies is likely to wane once the contingencies of behaviour are removed (Deci, Koestner, & Ryan, 1999). In other words, the use of these strategies could result in a plateau or rebound effect on motivation in the long-term. Furthermore, the repeated use of dissonance-based interventions to promote pro-environmental behaviour change may have the ironic effect

of eroding pro-environmental attitudes and of promoting amotivation toward the environment over time. This possibility is particularly troubling in light of pro-environmental policies and programs that use monetary incentives and disincentives to promote pro-environmental behaviour (e.g., ecoENERGY initiatives; Natural Resources Canada, 2014), and of marketing strategies that make people feel guilty or shameful about their counter-environmental actions or their lack of pro-environmental actions (Chang, 2012). Fortunately, the present research suggests that persuasive strategies that focus on increasing the perceived self-relevance of environmental protection may be more effective at motivating pro-environmental behaviour change in the long-term, because they should foster greater autonomous motivation toward the environment. It seems that promoting autonomous motivation toward the environment in the general population has the potential to strengthen pro-environmental attitudes, promote pro-environmental behaviour change, and, ultimately, alleviate the environmental belief-action gap.

## REFERENCES

- Amiot, C. E., Blanchard, C. M., & Gaudreau, P. (2008). The self in change: A longitudinal investigation of coping and self-determination processes. *Self and Identity, 7*, 204–224. doi: 10.1080/15298860701580793
- Aronson, E. (1966). The psychology of insufficient justification: An analysis of some conflicting data. In S. Feldman (Ed.), *Cognitive consistency: Motivational antecedents and behavioral consequents* (pp. 109–133). New York, NY: Academic Press.
- Aronson, E. (1999). Dissonance, hypocrisy, and the self-concept. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive Dissonance: Progress on a Pivotal Theory in Social Psychology* (pp. 103–126). Washington, DC: American Psychological Association.
- Assor, A., Roth, G., & Deci, E. L. (2004). The Emotional Costs of Parents' Conditional Regard: A Self-Determination Theory Analysis. *Journal of Personality, 72*, 47–88. doi: 10.1111/j.0022-3506.2004.00256.x
- Bamberg, S., & Moser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27*, 14–25. doi: 10.1016/j.jenvp.2006.12.002
- Banting, L. K., Dimmock, J. A., & Grove, J. R. (2011). The impact of automatically activated motivation on exercise-related outcomes. *Journal of Sport & Exercise Psychology, 33*, 569–585. Retrieved from <http://journals.humankinetics.com/jsep>
- Blanchard, C. M., Mask, L., Vallerand, R. J., de la Sablonnière, R., & Provencher, P. (2007). Reciprocal relationships between contextual and situational motivation in a sport setting. *Psychology of Sport and Exercise, 8*, 854–873. doi: 10.1016/j.psychsport.2007.03.004

- Blascovich, J. (2008). Challenge and threat. In A. J. Elliot (Ed.), *Handbook of approach and avoidance motivation* (pp. 431–445). New York, NY: Psychology Press.
- Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. D. (2001). Conflict monitoring and cognitive control. *Psychological Review*, *108*, 624–652. doi: 10.1037/0033-295X.108.3.624
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*, 822–848. doi: 10.1037/0022-3514.84.4.822
- Chang, C.-T. (2012). Are guilt appeals a panacea in green advertising? *International Journal of Advertising*, *31*, 741–771. doi: 10.2501/IJA-31-4-741-771
- Collins, B. E., & Hoyt, M. F. (1972). Personal responsibility-for-consequences: An integration and extension of the “forced compliance” literature. *Journal of Experimental Social Psychology*, *8*, 558–593. doi: 10.1016/0022-1031(72)90080-7
- Crocker, J., & Knight, K. M. (2005). Contingencies of self-worth. *Current Directions in Psychological Science*, *14*, 200–203. doi: 10.1111/j.0963-7214.2005.00364.x
- Croyle, R. T., & Cooper, J. (1983). Dissonance arousal: Physiological evidence. *Journal of Personality and Social Psychology*, *45*, 782–791. doi: 10.1037/0022-3514.45.4.782
- Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627–668. doi: 10.1037/0033-2909.125.6.627
- Deci, E. L., & Ryan, R. M. (1985a). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*, 109–134. doi: 10.1016/0092-6566(85)90023-6

- Deci, E. L., & Ryan, R. M. (1985b). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.
- Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie Canadienne*, *49*, 14–23. doi: 10.1037/0708-5591.49.1.14
- 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*, 368–378. doi: 10.1016/j.jenvp.2010.04.002
- Deponte, A. (2004). Linking motivation to personality: Causality orientations, motives and self-descriptions. *European Journal of Personality*, *18*, 31–44. doi: 10.1002/per.503
- Devine, P. G., Tauer, J. M., Barron, K. E., Elliot, A. J., & Vance, K. M. (1999). Moving beyond attitude change in the study of dissonance-related processes. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 297–323). Washington, DC: American Psychological Association.
- Devinsky, O., Morrell, M. J., & Vogt, B. A. (1995). Review article: Contribution of anterior cingulate cortex to behaviour. *Brain: A Journal of Neurology*, *118*, 279–306. doi: 10.1093/brain/118.1.279
- Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*, 355–391. doi: 10.1037/0033-2909.130.3.355
- Natural Resources Canada. (2014). ecoACTION. Retrieved from <http://www.nrcan.gc.ca/ecoaction>

- Di Domenico, S. I., Fournier, M. A., Ayaz, H., & Ruocco, A. C. (2013). In search of integrative processes: Basic psychological need satisfaction predicts medial prefrontal activation during decisional conflict. *Journal of Experimental Psychology: General*, *142*, 967–978. doi: 10.1037/a0030257
- 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*, 382–394. doi: 10.1037/0022-3514.67.3.382
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, Illinois: Row, Peterson and Company.
- Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *The Journal of Abnormal and Social Psychology*, *58*, 203. doi: 10.1037/h0041593
- Fointiat, V., Morisot, V., & Pakuszewski, M. (2008). Effects of past transgressions in an induced hypocrisy paradigm. *Psychological Reports*, *103*, 625–633. doi: 10.2466/pr0.103.2.625-633
- Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, *66*, 290–302. doi: 10.1037/a0023566
- Green-Demers, I., Pelletier, L. G., & Ménard, S. (1997). The impact of behavioural difficulty on the saliency of the association between self-determined motivation and environmental behaviours. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement*, *29*, 157–166. doi: 10.1037/0008-400X.29.3.157
- Guay, F., Mageau, G. A., & Vallerand, R. J. (2003). On the hierarchical structure of self-determined motivation: A test of top-down, bottom-up, reciprocal, and horizontal effects. *Personality and Social Psychology Bulletin*, *29*, 992–1004. doi: 10.1177/0146167203253297

- Harmon-Jones, E. (1999). Toward an understanding of the motivation underlying dissonance effects: Is the production of aversive consequences necessary? In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 71–99). Washington, DC: American Psychological Association.
- Harmon-Jones, E. (2000). Cognitive dissonance and experienced negative affect: Evidence that dissonance increases experienced negative affect even in the absence of aversive consequences. *Personality and Social Psychology Bulletin*, *26*, 1490–1501. doi: 10.1177/01461672002612004
- 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. *Advances in Experimental Social Psychology*, *41*, 119–166. doi: 10.1016/S0065-2601(08)00403-6
- Harmon-Jones, E., Brehm, J. W., Greenberg, J., Simon, L., & Nelson, D. E. (1996). Evidence that the production of aversive consequences is not necessary to create cognitive dissonance. *Journal of Personality and Social Psychology*, *70*, 5–16. doi: 10.1037/0022-3514.70.1.5
- Harmon-Jones, E., Gerdjikov, T., & Harmon-Jones, C. (2008). The effect of induced compliance on relative left frontal cortical activity: A test of the action-based model of dissonance. *European Journal of Social Psychology*, *38*, 35–45. doi: 10.1002/ejsp.399
- Harmon-Jones, E., & Harmon-Jones, C. (2002). Testing the action-based model of cognitive dissonance: The effect of action orientation on postdecisional attitudes. *Personality and Social Psychology Bulletin*, *28*, 711–723. doi: 10.1177/0146167202289001

- Harmon-Jones, E., & Harmon-Jones, C. (2008). Action-Based Model of Dissonance: A Review of Behavioral, Anterior Cingulate, and Prefrontal Cortical Mechanisms. *Social and Personality Psychology Compass*, 2, 1518–1538. doi:10.1111/j.1751-9004.2008.00110.x
- Harmon-Jones, E., Harmon-Jones, C., Fearn, M., Sigelman, J., & Johnson, P. (2008). Left frontal cortical activation and spreading of alternatives: Tests of the action-based model of dissonance. *Journal of Personality and Social Psychology*, 94, 1–15. doi: 10.1037/0022-3514.94.1.1
- Harmon-Jones, E., Lueck, L., Fearn, M., & Harmon-Jones, C. (2006). The Effect of Personal Relevance and Approach-Related Action Expectation on Relative Left Frontal Cortical Activity. *Psychological Science*, 17, 434–440. doi: 10.1111/j.1467-9280.2006.01724.x
- Harmon-Jones, E., & Mills, J. (1999). An introduction to cognitive dissonance theory and an overview of current perspectives on the theory. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 3–21). Washington, DC: American Psychological Association.
- Harmon-Jones, C., Schmeichel, B. J., Inzlicht, M., & Harmon-Jones, E. (2011). Trait approach motivation relates to dissonance reduction. *Social Psychological and Personality Science*, 2, 21–28. doi: 10.1177/1948550610379425
- 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, DC: American Psychological Association.
- 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). Rochester, NY: University of Rochester Press.

- Hodgins, H. S., Weibust, K. S., Weinstein, N., Shiffman, S., Miller, A., Coombs, G., & Adair, K. C. (2010). The cost of self-protection: Threat response and performance as a function of autonomous and controlled motivations. *Personality and Social Psychology Bulletin, 36*, 1101–1114. doi: 10.1177/0146167210375618
- Hodgins, H. S., Yacko, H. A., & Gottlieb, E. (2006). Autonomy and nondefensiveness. *Motivation and Emotion, 30*, 283–293. doi: 10.1007/s11031-006-9036-7
- Intergovernmental Panel on Climate Change. (2014). *Climate change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report* (Final draft report). Retrieved from <http://ipcc-wg2.gov/AR5/report/final-drafts/>
- Julien, É., Guay, F., Sénechal, C., & Poitras, S.-C. (2009). Subjective psychological distress among young adults: The role of global and contextual levels of self-determined motivation. *Hellenic Journal of Psychology, 6*, 145–168. Abstract retrieved from <http://www.pseve.org/journal.asp>
- Kelsey, R. M. (2012). Beta-adrenergic cardiovascular reactivity and adaptation to stress: The cardiac pre-ejection period as an index of effort. In R. A. Wright & G. H. E. Gendolla (Eds.), *How motivation affects cardiovascular response: Mechanisms and applications* (pp. 43–60). Washington, DC: American Psychological Association.
- Knee, C. R., & Zuckerman, M. (1996). Causality orientations and the disappearance of the self-serving bias. *Journal of Research in Personality, 30*, 76–87. doi: 10.1006/jrpe.1996.0005
- Knee, C. R., & Zuckerman, M. (1998). A nondefensive personality: Autonomy and control as moderators of defensive coping and self-handicapping. *Journal of Research in Personality, 32*, 115–130. doi: 10.1006/jrpe.1997.2207

- Koestner, R., Bernieri, F., & Zuckerman, M. (1992). Self-regulation and consistency between attitudes, traits, and behaviors. *Personality and Social Psychology Bulletin, 18*, 52–59. doi: 10.1177/0146167292181008
- Koestner, R., Houliort, N., Paquet, S., & Knight, C. (2001). On the risks of recycling because of guilt: An examination of the consequences of introjection. *Journal of Applied Social Psychology, 31*, 2545–2560. doi: 10.1111/j.1559-1816.2001.tb00190.x
- Koestner, R., & Zuckerman, M. (1994). Causality orientations, failure, and achievement. *Journal of Personality, 62*, 321–346. doi: 10.1111/j.1467-6494.1994.tb00300.x
- Koestner, R., Zuckerman, M., & Koestner, J. (1987). Praise, involvement, and intrinsic motivation. *Journal of Personality and Social Psychology, 53*, 383–390. doi: 10.1037/0022-3514.53.2.383
- Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*, 239–260. doi: 10.1080/13504620220145401
- Lavergne, K. J., & Pelletier, L. G. (2015a). *Why are attitude-behaviour inconsistencies uncomfortable? Exploring Individual Differences in Dissonance Arousal Processes*. Manuscript submitted for publication.
- Lavergne, K. J., & Pelletier, L. G. (2015b). *Individual differences in distal motivation and the choice of strategy to compensate for environmental attitude-behaviour inconsistencies*. Manuscript submitted for publication.
- Lavergne, K. J., & Pelletier, L. G. (2015c). *The effects of inducing public and private awareness of environmental transgressions on motivation and intentions to revise global warming attitudes*. Manuscript in preparation.

- 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. doi: 10.1016/j.jenvp.2009.11.002
- Lavigne, G. L., Hauw, N., Vallerand, R. J., Brunel, P., Blanchard, C., Cadorette, I., & Angot, C. (2009). On the dynamic relationships between contextual (or general) and situational (or state) motivation toward exercise and physical activity: A longitudinal test of the top-down and bottom-up hypotheses. *International Journal of Sport and Exercise Psychology, 7*, 147–168. doi: 10.1080/1612197X.2009.9671897
- Lavigne, G. L., & Vallerand, R. J. (2010). The dynamic processes of influence between contextual and situational motivation: A test of the hierarchical model in a science education setting. *Journal of Applied Social Psychology, 40*, 2343–2359. doi: 10.1111/j.1559-1816.2010.00661.x
- Lee, W., Reeve, J., Xue, Y., & Xiong, J. (2012). Neural differences between intrinsic reasons for doing versus extrinsic reasons for doing: An fMRI study. *Neuroscience Research, 73*, 68–72. doi: 10.1016/j.neures.2012.02.010
- Lee, F. K., Sheldon, K. M., & Turban, D. B. (2003). Personality and the Goal-Striving Process: The Influence of Achievement Goal Patterns, Goal Level, and Mental Focus on Performance and Enjoyment. *Journal of Applied Psychology, 88*, 256–265. doi: 10.1037/0021-9010.88.2.256

- 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). Washington, DC: American Psychological Association.
- Lévesque, C., & Brown, K. W. (2007). Mindfulness as a moderator of the effect of implicit motivational self-concept on day-to-day behavioral motivation. *Motivation and Emotion, 31*, 284–299. doi: 10.1007/s11031-007-9075-8
- Linke, J., Kirsch, P., King, A. V., Gass, A., Hennerici, M. G., Bongers, A., & Wessa, M. (2010). Motivational orientation modulates the neural response to reward. *NeuroImage, 49*, 2618–2625. doi: 10.1016/j.neuroimage.2009.09.013
- Magaraggia, C., Dimmock, J., & Jackson, B. (2014). Motivational priming as a strategy for maximising exercise outcomes: effects on exercise goals and engagement. *Journal of Sports Sciences, 32*, 826–835. doi: 10.1080/02640414.2013.862841
- Martinie, M., & Fointiat, V. (2006). Self-esteem, trivialization, and attitude change. *Swiss Journal of Psychology/Schweizerische Zeitschrift Fur Psychologie/Revue Suisse de Psychologie, 65*, 221–225. doi: 10.1024/1421-0185.65.4.221
- McGregor, I., Newby-Clark, I. R., & Zanna, M. P. (1999). “Remembering” dissonance: Simultaneous accessibility of inconsistent cognitive elements moderates epistemic discomfort. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 325–353). Washington, DC: American Psychological Association.
- Michel, S., & Fointiat, V. (2002). Trivialisation versus rationalisation cognitive: Quand l’adhésion à la norme de consistance guide le choix du mode de réduction de la dissonance. [Trivialization versus cognitive rationalization]. *Cahiers Internationaux de Psychologie*

- Sociale*, 56, 58–63. Retrieved from <http://www.cairn.info/revue-les-cahiers-internationaux-de-psychologie-sociale.htm>
- Miller, E. K., & Cohen, J. D. (2001). An Integrative Theory of Prefrontal Cortex Function. *Annual Review of Neuroscience*, 24, 167–202. doi: 10.1146/annurev.neuro.24.1.167
- Moore, T. G. (1996). Health and amenity effects of global warming. Retrieved from <http://128.118.178.162/eps/othr/papers/9604/9604001.pdf>
- Murayama, K., Matsumoto, M., Izuma, K., & Matsumoto, K. (2010). Neural basis of the undermining effect of monetary reward on intrinsic motivation. *PNAS Proceedings of the National Academy of Sciences of the United States of America*, 107, 20911–20916. doi: 10.1073/pnas.1013305107
- Niemiec, C. P., Ryan, R. M., & Brown, K. W. (2008). The role of awareness and autonomy in quieting the ego: A self-determination theory perspective. In H. A. Wayment & J. J. Bauer (Eds.), *Transcending self-interest: Psychological explorations of the quiet ego* (pp. 107–115). Washington, DC: American Psychological Association.
- Olesen, M. H. (2011). General causality orientations are distinct from but related to dispositional traits. *Personality and Individual Differences*, 51, 460–465. doi: 10.1016/j.paid.2011.04.015
- Osbaldiston, R., & Sheldon, K. M. (2003). Promoting internalized motivation for environmentally responsible behavior: A prospective study of environmental goals. *Journal of Environmental Psychology*, 23, 349–357. doi: 10.1016/S0272-4944(03)00035-5
- Paulhus, D. (1982). Individual differences, self-presentation, and cognitive dissonance: Their concurrent operation in forced compliance. *Journal of Personality and Social Psychology*, 43, 838–852. doi: 10.1037/0022-3514.43.4.838

- 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. doi:10.1111/j.1559-1816.1999.tb00122.x
- 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*, 145–156. doi: 10.1037/0008-400X.29.3.145
- Pelletier, L. G., Tuson, K. M., Green-Demers, I., Noels, K., & Beaton, A. M. (1998). Why are you doing things for the environment? The Motivation Toward the Environment Scale (MTES). *Journal of Applied Social Psychology, 28*, 437–468. doi: 10.1111/j.1559-1816.1998.tb01714.x
- Peterson, A. A., Haynes, G. A., & Olson, J. M. (2008). Self-Esteem Differences in the Effects of Hypocrisy Induction on Behavioral Intentions in the Health Domain. *Journal of Personality, 76*, 305–322. doi: 10.1111/j.1467-6494.2007.00487.x
- Proulx, T., Inzlicht, M., & Harmon-Jones, E. (2012). Understanding all inconsistency compensation as a palliative response to violated expectations. *Trends in Cognitive Sciences, 16*, 285–291. doi: 10.1016/j.tics.2012.04.002
- Ratelle, C. F., Guay, F., Vallerand, R. J., Larose, S., & Senecal, C. (2007). Autonomous, controlled, and amotivated types of academic motivation: A person-oriented analysis. *Journal of Educational Psychology, 99*, 734–746. doi: 10.1037/0022-0663.99.4.734

- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, *57*, 749–761. doi: 10.1037/0022-3514.57.5.749
- 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* (pp. 449–479). New York, NY: Guilford Press.
- Sakai, H. (1999). A multiplicative power-function model of cognitive dissonance: Toward an integrated theory of cognition, emotion, and behavior after Leon Festinger. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 267–294). Washington, DC: American Psychological Association.
- Scheier, M. F., & Carver, C. S. (1980). Private and public self-attention, resistance to change, and dissonance reduction. *Journal of Personality and Social Psychology*, *39*, 390–405. doi:10.1037/0022-3514.39.3.390
- Sénémeaud, C., Mange, J., Fointiat, V., & Somat, A. (2014). Being hypocritical disturbs some people more than others: How individual differences in preference for consistency moderate the behavioral effects of the induced-hypocrisy paradigm. *Social Influence*, *9*, 133–148. doi: 10.1080/15534510.2013.791235
- Sharp, E., Pelletier, L. G., Blanchard, C., & Séguin-Lévesque, C. (2003). The global motivation scale: Its validity and usefulness in predicting success and failure at self-regulation. Presented at the 4<sup>th</sup> Annual Meeting of the Society for Personality and Social Psychology, Los Angeles, CA.

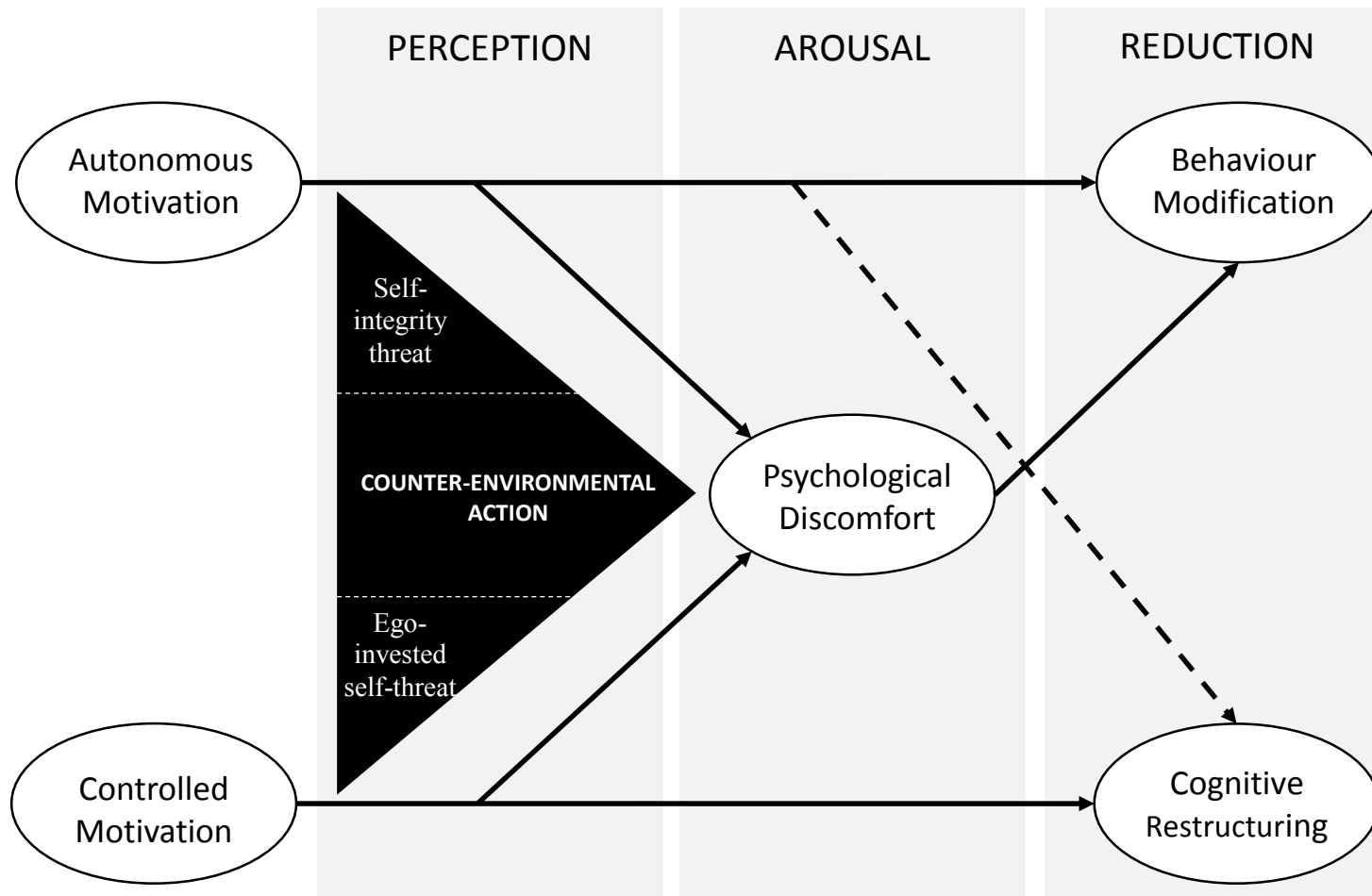
- Simon, L., Greenberg, J., & Brehm, J. (1995). Trivialization: the forgotten mode of dissonance reduction. *Journal of Personality and Social Psychology*, *68*, 247–260. doi: 10.1037/0022-3514.68.2.247
- Starzyk, K. B., Fabrigar, L. R., Soryal, A. S., & Fanning, J. J. (2009). A painful reminder: The role of level and salience of attitude importance in cognitive dissonance. *Personality and Social Psychology Bulletin*, *35*, 126–137. doi: 10.1177/0146167208325613
- Stone, J., & Cooper, J. (2003). The effect of self-attribute relevance on how self-esteem moderates attitude change in dissonance processes. *Journal of Experimental Social Psychology*, *39*(5), 508–515. doi: 10.1016/S0022-1031(03)00018-0
- Stone, J., & Fernandez, N. C. (2008). To practice what we preach: The use of hypocrisy and cognitive dissonance to motivate behavior change. *Social and Personality Psychology Compass*, *2*, 1024–1051. doi: 10.1111/j.1751-9004.2008.00088.x
- Stone, J., & Fernandez, N. (2011). When thinking about less failure causes more dissonance: The effect of elaboration and recall on behavior change following hypocrisy. *Social Influence*, *6*, 199–211. doi: 10.1080/15534510.2011.618368
- United Nations Environment Programme. (2012). *Global Environment Outlook GEO 5: Environment for the future we want*. Valletta, Malta: Malta Progress Press Ltd. Retrieved from [http://www.unep.org/geo/pdfs/geo5/GEO5\\_report\\_full\\_en.pdf](http://www.unep.org/geo/pdfs/geo5/GEO5_report_full_en.pdf)
- Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. *Advances in experimental social psychology*, *29*, 271–360. doi: 10.1016/S0065-2601(08)60019-2

- Vallerand, R. J., & Bissonnette, R. (1992). Intrinsic, Extrinsic, and Amotivational Styles as Predictors of Behavior: A Prospective Study. *Journal of Personality, 60*, 599–620. doi: 10.1111/j.1467-6494.1992.tb00922.x
- Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology, 101*, 671–688. doi: 10.1037/a0015083
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the Motivation Toward the Environment Scale. *Environment and Behavior, 35*, 486–505. doi: 10.1177/0013916503035004003
- Weinstein, N., & Hodgins, H. S. (2009). The moderating role of autonomy and control on the benefits of written emotion expression. *Personality and Social Psychology Bulletin, 35*, 351–364. doi: 10.1177/0146167208328165
- Zanna, M. P., & Cooper, J. (1974). Dissonance and the pill: an attribution approach to studying the arousal properties of dissonance. *Journal of Personality and Social Psychology, 29*, 703–709. doi: 10.1037/h0036651

## FOOTNOTES

<sup>1</sup> The University of Ottawa is officially a bilingual institution. As such, the Ethics Review Board (ERB) requires that researchers make their studies available in both official languages, English and French, whenever possible. We took measures to ensure the English and French versions of the study materials were equivalent. The measurement scales administered via the online questionnaires (Lavergne & Pelletier, 2015a; 2015b) displayed the English and French versions of the instructions and items side-by-side. Therefore, there was no way to determine whether participants responded to the English or French version of the scales. Participants who completed the laboratory study had the option to do the experiment in either English or French. There were no differences between participants who completed the experiment in English ( $n = 68$ ) versus in French ( $n = 40$ ) on any of the measured variables (Lavergne & Pelletier, 2015c). Finally, all the participants recruited for the research reported their native language; the response options included English, French, or another language. Because there were no reliable differences between participants based on language across studies (c.f., Lavergne & Pelletier, 2015a; 2015b; 2015c), we chose to present only the English versions of the study materials used in the research to simplify the presentation of information.

<sup>2</sup> The University of Ottawa ERB approved this research and the informed consent process (files no. #08-11-37 & #02-08-06). In agreement with the Canadian Tri-Council Policy Statement (TCPS): Ethical Conduct for Research Involving Humans (<http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/Default/>), all participants provided written informed consent prior to participating in the research. According to the TCPS, no parent/guardian consent is required if the project has minimal risks and the participants are at least 16 years of age (<http://www.hc-sc.gc.ca/sr-sr/advice-avis/reb-cer/consent/f-eng.php>).



*FIGURE 1.* Diagram depicting the proposed hierarchical action-based model of inconsistency compensation in the environmental domain. The light gray boxes delineate the three components of dissonance processes: perception, arousal, and reduction. Single-headed arrows indicate the hypothesized relationships between contextual motivational orientations toward the environment and dissonance constructs. Solid arrows indicate positive relationships and broken arrows indicate negative relationships. The black triangle represents the hypothesized effect of perceiving a counter-environmental action on dissonance perception and arousal processes. Perceiving the action should arouse dissonance and elicit autonomous motives when it threatens the integrity of authentic self-structures but elicit controlled motives when it threatens the behavioural contingencies (e.g., the avoidance of negative social evaluative reactions) that support ego-invested self-structures (e.g., contingent self-worth).

GENERAL APPENDIX A  
Frequency of Behavioural Inconsistencies Scale

Please circle a number (or N/A) on the scale below to indicate your response to the following items.

N/A*	Never			Sometimes			Often
0	1	2	3	4	5	6	7

\* *I do not value or wish to achieve these particular goals.*

1. Many people value and wish to achieve/maintain a specific body weight, however, they sometimes act in ways that are inconsistent with these values and goals (e.g., wanting to lose weight but skipping a workout or eating too many sweets). In everyday life, how often do you detect inconsistencies between your personal attitudes, beliefs, and goals about your body weight and your actual behaviours?
  
2. Many people value and wish to achieve economic prosperity, however, they sometimes act in ways that are inconsistent with these values and goals (e.g., wanting to set money aside but splurging on expensive things or unplanned expenses). In everyday life, how often do you detect inconsistencies between your personal attitudes, beliefs, and goals about economic prosperity and your actual behaviours?
  
3. Many people value and wish to achieve racial tolerance, however, they sometimes act in ways that are inconsistent with these values and goals (e.g., wanting to be tolerant of people of different races but laughing at a racially discriminating joke). In everyday life, how often do you detect inconsistencies between your personal attitudes, beliefs, and goals about racial tolerance and your actual behaviours?
  
4. Many people value and wish to achieve an environmentally sustainable lifestyle, however, they sometimes act in ways that are inconsistent with these values and goals (e.g., wanting to reduce their greenhouse gas emissions but taking their car when they could have walked/biked/taken public transit). In everyday life, how often do you detect inconsistencies between your personal attitudes, beliefs, and goals about environmental sustainability and your actual behaviours?

GENERAL APPENDIX B  
Frequency of Negative Affect Scale

Generally, when you are reminded of instances when you have acted in ways inconsistent with your own personal values and/or goals, how often do you feel \_\_\_\_\_? Please respond using the provided scale.

Never			Sometimes			Always
1	2	3	4	5	6	7

1. Insincere
2. Hypocritical
3. Guilty
4. Bad about yourself
5. No different than usual

## GENERAL APPENDIX C

## “Why Do You Act the Way You Do?” Consent Form

I agree to participate in the present online study conducted by University of Ottawa professor Dr. Luc G. Pelletier and Ph.D. student Karine Lavergne. The purpose of this research is to examine how people resolve discrepancies between their important beliefs and attitudes and their actual day-to-day behaviours. Specifically, if, why, and how people react when they become aware that they have acted in a manner that is inconsistent or contradictory with expressed beliefs and attitudes.

My participation in this research will consist of a single session of approximately 30 minutes during which I will be asked to complete an online questionnaire from any computer with internet access at a time of my convenience. As it was explained to me at the beginning of the semester, my participation in this study will grant me 1 point in my class.

There are no foreseeable psychological, physical, social, or economic risks associated with my participation in this study. I understand my participation is voluntary and I may drop out of the study at any time. I may skip survey items that I do not feel comfortable answering. My information will be kept strictly confidential.

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

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154, (613) 562-5387 or by email at [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

For more information about this research I can contact:

- Karine Lavergne, School of Psychology, University of Ottawa (613) 562-5800 ext. 4179 or by email [klave070@uottawa.ca](mailto:klave070@uottawa.ca)
- Dr. Luc Pelletier, School of Psychology, University of Ottawa (613) 562-5232 or by email [Luc.Pelletier@uOttawa.ca](mailto:Luc.Pelletier@uOttawa.ca)

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

- I consent to participate in the research.
- I do not consent to participate in the research.

GENERAL APPENDIX D  
Pro-Environmental Attitude Strength Scale

WHAT ARE YOUR BELIEFS AND ATTITUDES TOWARD THE ENVIRONMENT?

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

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

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

1. To what extent do you agree that human activities associated with current lifestyles have a negative impact on the state of the environment?
2. To what extent do you agree that humans need to take action to reduce their impact on the environment?

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

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

3. How important to you personally are environmental issues?
4. How central is your attitude toward the environment to your self-image/self-concept?
5. How representative of your values is your attitude toward the environment?
6. How knowledgeable are you about environmental issues?
7. How likely are you to change your opinion about the environment? (reverse-scored)
8. How sure are you that your opinion about the environment is right?

## GENERAL APPENDIX E

## Frequency of Behavioural Inconsistencies in the Environmental Domain Scale

## HOW OFTEN DO YOU ACT INCONSISTENTLY WITH YOUR ENVIRONMENTAL ATTITUDES?

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

For various reasons, people sometimes act in ways that are inconsistent or in contradiction with their own beliefs, attitudes, values, and goals in their day-to-day activities. These inconsistencies and contradictions are a normal part of life. Sometimes they go unnoticed but, other times, people become aware of the inconsistency during or immediately after they have acted inconsistently. Do you ever become aware of such inconsistencies?

Please respond to the following four items using the provided scale.

Never	Sometimes					Always
1	2	3	4	5	6	7

How often do you become aware of inconsistencies or contradictions between your personal attitudes, beliefs, and goals about \_\_\_\_\_ and your actual day-to-day activities (either immediately or shortly after the inconsistency has taken place)?

1. the reduction of greenhouse gas emissions

*For example, believing that reducing greenhouse gas emissions is important but taking the car while being or becoming aware you could have walked or taken the bus.*

2. waste reduction

*For example, believing that reducing waste is important but discarding compostable or recyclable materials in the garbage while being or becoming aware you could have composted or recycled.*

3. water conservation

*For example, believing that conserving water is important but pouring harmful chemicals down the drains while being or becoming aware you could have taken the chemicals to a hazardous waste depot.*

4. environmental sustainability in general

## GENERAL APPENDIX F

## Recall of a Recent Behavioural Inconsistency Scale

HAVE YOU ACTED INCONSISTENTLY WITH YOUR ENVIRONMENTAL ATTITUDES  
RECENTLY?

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

Thinking about all of your activities and actions over the past month, please describe an action you did that was inconsistent or contradictory with your environmental beliefs and attitudes.

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When answering the remaining questions, please try to recall the feelings and reactions you exhibited immediately following the inconsistent action you described above as honestly and accurately as possible.

- Okay
- I did not describe an inconsistent action

GENERAL APPENDIX G  
Psychological Discomfort Scale

(Online version instructions)

HOW DID YOU FEEL FOLLOWING THE INCONSISTENT ACTION?

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

Following the inconsistent action, I felt \_\_\_\_\_.

(Laboratory version instructions)

HOW ARE YOU FEELING RIGHT NOW?

To what extent are you feeling \_\_\_\_\_ right now?

(Both versions)

Please respond using the provided scale.

Not at all	Somewhat				Very much	
1	2	3	4	5	6	7
1.	discouraged*			10.	proud	
2.	guilty*			11.	relaxed	
3.	happy			12.	anxious	
4.	disappointed*			13.	dissatisfied*	
5.	uneasy*			14.	uncomfortable*	
6.	jittery			15.	calm	
7.	content			16.	bothered*	
8.	hypocritical*			17.	ashamed*	
9.	agitated			18.	pleased	

\*Items used to assess levels of psychological discomfort.

## GENERAL APPENDIX H

## Frequency of Recent Environmentally Relevant Actions Scale

## WHAT ACTIONS DO YOU DO ON A DAY-TO-DAY BASIS?

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

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

1. Used an electric clothes dryer
2. Used a clothesline or drying rack (air dry clothing)
3. Tossed compostable or recyclable waste in the garbage bin
4. Turned off the water while brushing teeth
5. Washed fruits and vegetables in a bowl (instead of under running water)
6. Brought and used reusable bags when shopping
7. Discarded paper without using both sides of the sheet
8. Ran the clothes/dish washing machine even though it wasn't full
9. Used the double-sided option to print/copy on both sides of the page
10. Purchased local foods
11. Opted to walk, cycle, skate, etc. instead of riding in a bus/car over a short distance (< 3km)
12. Took a bath or a long shower (> 10 min.)
13. Washed dishes under running water (instead of in a plugged sink)
14. Took plastic bags at the grocery/store check-out (instead of no bags or reusable bags)
15. Took the time to properly separate waste into the garbage, recycling, and composting bins
16. Bought food or merchandise without checking where it was grown or manufactured
17. Took a short shower (< 10 min.)
18. Rode in a bus or car to travel a short distance (< 3km)

Scoring key:

Pro-environmental actions: 2, 4, 5, 6, 9, 10, 11, 15, 17

Counter-environmental actions: 1, 3, 7, 8, 12, 13, 14, 16, 18

## GENERAL APPENDIX I

## Inconsistency Compensation Strategy Recall Scale

## HOW DID YOU REACT FOLLOWING THE INCONSISTENT ACTION?

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

Please indicate which of the following strategies most closely corresponds to your own reaction following the inconsistent action you described earlier. Type the appropriate number (1-12) in the space provided.

The strategy that most closely corresponds to my own reaction is: \_\_\_\_\_

1. Putting the inconsistency out of my mind.
2. Actively looking for opportunities to act sustainably (consistently) in other situations.
3. Focusing my attention on other values, goals, and activities that I consider more important.
4. Concluding that I could not have acted in any other way under the circumstances.
5. Reminding myself that I possess many other qualities and characteristics that make me a good person.
6. Deciding that there is no need to reduce my impact on the environment.
7. Concluding that my action toward the environment is an indication of my true attitudes and beliefs about the environment.
8. Questioning whether environmental sustainability is really that important to me personally.
9. Making 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.
10. Mentally listing reasons why it wasn't my fault.
11. Thinking that the action I just did, despite being unsustainable, was consistent with other values and goals I consider important.
12. Immediately correcting the inconsistent action (ex: repeating the action in a more sustainable fashion).

Scoring key:

Behavioural strategies: 2, 9, 12

Other types of strategies: 1, 3, 4, 5, 6, 7, 8, 10, 11

GENERAL APPENDIX J  
Motivation to Compensate Scale

WHY DID YOU REACT THIS WAY FOLLOWING THE INCONSISTENT ACTION?

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

Please indicate to what extent the following statements correspond to your reasons for reacting the way you did following the inconsistent action.

Does not cor- respond at all						Corresponds somewhat			Corresponds completely
1	2	3	4	5	6	7			7

I reacted this way following the inconsistent action because \_\_\_\_\_.

1. I wanted to avoid losing the respect of others.
2. I simply wanted to get on with my day.
3. I wanted to adjust my beliefs, attitudes, and actions to fit with the kind of person I really am.
4. I did not know what else to do.
5. I could not go on with my day knowing what I did.
6. I wanted to act in a way that maintains my integrity.
7. I wanted to save face.
8. I wanted to act consistently with my own beliefs, attitudes, and values.
9. I wanted others to think that I am a person of integrity.
10. I wanted to rid myself of the negative emotions I was feeling.
11. I did not have a specific reason for reacting the way I did.
12. I could not get the inconsistent action out of my mind.

Scoring key:

Self-integrity restoration motives: 3, 5, 8

Ego-invested self-protection motives: 1, 7, 9

Dissonance minimization motives: 5, 10, 12

Lack of motives: 2, 4, 11

## GENERAL APPENDIX K

## Recall of a Recent Counter-Attitudinal Action Scale

Please briefly describe a specific example when you became aware that you acted inconsistently with your own attitudes, beliefs, and goals about environmental sustainability either immediately or shortly after the inconsistency took place.

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GENERAL APPENDIX L  
Negative Affect Scale

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

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

“When I became aware that I acted inconsistently with my own personal beliefs and/or goals about environmental sustainability (please refer to the example cited above), I felt \_\_\_\_\_.”

1. hypocritical
2. guilty
3. ashamed
4. disappointed
5. regretful
6. insincere

GENERAL APPENDIX M  
Inconsistency Compensation Strategies Scale

HOW DID YOU REACT FOLLOWING THE INCONSISTENT ACTION?

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

Please respond to the following 18 statements using the provided scale.

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

“Following the inconsistent action, I reacted by \_\_\_\_\_.”

1. Immediately correcting the inconsistent action (ex: repeating the action in a more sustainable fashion).
2. Mentally listing reasons why it wasn't my fault.
3. Putting the inconsistency out of my mind.
4. Acting sustainably (consistently) when I found myself in a similar situation at a later time.
5. Concluding that my action toward the environment is an indication of my true attitudes and beliefs about the environment.
6. Questioning whether environmental sustainability is really that important to me personally.
7. Thinking that the issue of environmental sustainability has been blown out of proportion.
8. Concluding that environmental sustainability is not a priority for me.
9. Thinking that the action I just did, despite being unsustainable, was consistent with other values and goals I consider important.
10. Doing nothing at all.
11. Thinking that my individual action probably had no measurable impact on the environment.
12. Thinking it doesn't really matter since most people act the same way.
13. Simply shrugging it off.
14. Concluding that I could not have acted in any other way under the circumstances.
15. Thinking I cannot be held personally responsible for environmental sustainability.

16. Making 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.
17. Reassessing the importance I attribute to environmental sustainability.
18. Actively looking for opportunities to act sustainably (consistently) in other situations.

Scoring key:

Behaviour modification strategies: 1, 4, 16, 18

Cognitive restructuring strategies: 6, 7, 8, 12, 15

Note:

The abbreviated version of the scale includes items 1, 4, 6, 7, 8, 12, 15, 16, 18

## GENERAL APPENDIX N

## Recall of a Recent Behavioural Inconsistency Scale

HAVE YOU ACTED INCONSISTENTLY WITH YOUR ENVIRONMENTAL ATTITUDES  
RECENTLY?

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

Thinking about all of your activities and actions over the past month, please describe an action you did that was inconsistent or contradictory with your environmental beliefs and attitudes.

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When answering the remaining questions, please try to recall the feelings and reactions you exhibited immediately following the inconsistent action you described above as honestly and accurately as possible.

- Okay
- I did not describe an inconsistent action

## GENERAL APPENDIX O

## Experimental Script

GREETING: “Hello my name is \_\_\_\_\_. I will be taking you through the steps of the study on perceptions of social issues; the entire study should take about 45 minutes. The purpose of the study is to examine how people assimilate, interpret, and structure information about social issues presented in the media. The social issue under study is global warming. For ethical reasons, I’ll get you to read this consent form. If you agree to participate in the study, please sign and date it. There are two copies of the consent form one is for you to sign and the other is for you to keep.”

ADVOCACY: “The first task consists of writing a short text on the importance of addressing the issue of global warming. This will allow us to assess your existing attitudes toward global warming. In addition to analyzing your text for research purposes, we would like to use your arguments as part of an on-campus campaign for the reduction of greenhouse gas emissions set to launch next term. As part of this campaign, we would like to display the opinions of students to the whole campus using posters. We feel that students are in the best position to raise awareness among their peers about the importance of addressing global warming. To personalize the posters and show that it’s not just students in environmental studies or sciences that are concerned with this issue but all students,”

PRIVATE COMMITMENT CONDITIONS: “we would also like to post the participants’ programs of study at the bottom of the poster.”

PUBLIC COMMITMENT CONDITIONS: “we would also like to post the participants’ names and programs of study at the bottom of the poster.”

“We would really appreciate your help with this project; it would require you writing a text of about 3 or 4 sentences on why the issue of global warming is important and what students can do to minimize global warming. Do you agree to do this? Great! Here is the template I would like you to use to write your text. The first paragraph talks about the campaign I just described and the second paragraph gives you the topic. I’ll have you write a sentence or two in each space. You may also use point-form. I ask that you write the first thing that comes to mind. Don’t worry too much about spelling or grammar, the text will be revised before publication. This task usually

takes about 5 minutes. Let me know once you're done. I'll be next door."

RECALL OF PAST TRANSGRESSIONS (AWARENESS CONDITIONS ONLY): "In the context of this campaign we're also interested in identifying the most common greenhouse gas emitting behaviours performed by students. This information will be used strictly to develop future global warming awareness campaigns. Thinking about all your activities over the past month, I would like you to list 3 actions you personally did that may have contributed to global warming. So, three avoidable actions you know produce a considerable amount of greenhouse gas emissions. I would really appreciate it if you could come up with examples from your own life. However, if you are having difficulty coming up with examples here is a list of that may help you. Could you please fill out this short survey and place in this envelope when you are done? Thank you."

PSYCHOLOGICAL DISCOMFORT ASSESSMENT: "Before reading the media articles on global warming, I would like to know how you are feeling right now. We think that perceptions of information presented in the media are related to people's emotions. Therefore, it is important for us to know your state of mind before you read the articles. Could you please fill out this short questionnaire? Thank you."

INFORMATION SEARCH TASK: "The next step consists of reading articles on global warming. I ask that you read two of the eight articles. I ask that you carefully read all the titles before making your first selection. There is no time limit for this task. All the articles are of the same length. After selecting and reading the first article, you will be redirected to the same menu of eight titles to make your second selection. I'll step out of the room while you complete the task. Let me know once you're done. I'll be next door."

INFORMATION SEARCH TASK INTENTIONS ASSESSMENT: "For the final step of the study, I'd like you to complete this short questionnaire. The questionnaire asks about the the media articles you chose to read during the previous task. I'll step out while you do this; please let me know once you've completed the questionnaire."

DEBRIEFING: "The study is now over but before I let you go I just want to go over a few things with you. At the beginning of the experiment I told you that the purpose of the study was to examine how people assimilate, interpret, and structure information about the environment.

However, the real purpose of the study is to explore how motivation affects the detection and the resolution of an inconsistency between one's own environmental attitudes and their actual behaviours. To do this we have two types of experimental conditions: a hypocrisy induction type of condition and a control condition. In the hypocrisy induction condition people are reminded of instances when they have failed to act pro-environmentally while in the control condition people are not reminded of their pro-environmental behaviours. You were randomly selected to be in the \_\_\_\_\_ condition. Did you, at any point, suspect this was the true purpose of the study?

Unfortunately I can't tell you the exact hypotheses of the study because we feel that if this information got out, it might bias the results of the study. For this same reason I ask that you not discuss what we did here today with others. Okay?

That being said, we will not be using your arguments to conduct an on-campus campaign for the reduction of greenhouse gases. Your text will be analyzed for research purposes only. In fact, all the data we collected from you today is strictly confidential and anonymous. Your name will never be associated with the results of this study. To ensure confidentiality I will destroy your signature from the bottom of the text you wrote earlier.

Now that you are aware of the real goal of the study, do you still agree to us using the data we collected from you today? Thank you for coming in, we greatly appreciate your help.”

GENERAL APPENDIX P  
 “Perceptions of Social Issues” Consent Form

Luc Pelletier, Ph.D.  
 School of Psychology  
 University of Ottawa  
 136 Jean-Jacques Lussier, room 3002H  
 Ottawa, ON K1N 6N5  
 Phone: 613-562-5800 (5232)  
 Email: luc.pelletier@uottawa.ca

Karine Lavergne & Dan Baxter  
 School of Psychology  
 University of Ottawa  
 136 Jean-Jacques Lussier, room 5069  
 Ottawa, ON K1N 6N5  
 Phone: 613-562-5800 (4179)  
 Email: klave070@uottawa.ca

I, \_\_\_\_\_, agree to participate in the present laboratory study. This research project is being supervised by Luc Pelletier, Ph.D., professor at the School of Psychology. The main goal of this study is to examine how people assimilate, interpret, and structure information about social issues presented in the media.

My participation in this study will consist of one laboratory session of approximately 45 minutes in which I will be asked to write a short text describing my opinions about a specific social issue, read media articles about that issue, and answer a brief questionnaire. As it was explained to me at the beginning of the semester, my participation in this study will grant me 1 point in my class.

I understand that the data collected today is confidential and strictly for this research project. Only the researchers of this study will have access to the collected data. My name will never be in any case associated with the results.

I have been informed by the investigators responsible for this research project that the experimental procedure has been created in order to minimize all possible risks of emotional discomfort. I am aware of my rights as participant to stop at any time during the experiment or to refuse to answer any questions that make me uncomfortable.

Any questions I might have about my rights as a research participant may be addressed to Protocol Officer for Ethics in Research, 550 Cumberland St., Room 154, (613) 562-5387 or by email at [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

For more information about this research, I can contact the researchers, (613) 562-5800 ext. 4179.

There are two copies of this consent form, one of which I can keep.

Participant’s signature: \_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_

Experimenter’s signature: \_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_

## GENERAL APPENDIX Q

## Standardized Advocacy in Favour of Global Warming Mitigation Forms

(Public commitment manipulation)

**GLOBAL WARMING, I CARE!!**

In the context of the University of Ottawa's campaign for the reduction of greenhouse gas (GHG) emissions set to launch during the winter session, we wish to know the opinions of students towards the issue of global warming. We believe that students are in the best position to raise the awareness of their peers concerning the importance of global warming. It's for this reason that we wish to display posters of students' opinions across campus.

To participate in this campaign, all you need to do is explain in 75 words or less (3 or 4 sentences) **why you think it is important to address the issue of global warming** and **what students can do to help the cause**. Since your text will be revised before publication, there is no need to worry about grammar or spelling.

\*\*\*

*It is important to address the issue of global warming because...*

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---



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*We can do our part by...*

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**Given name:** \_\_\_\_\_ **Surname:** \_\_\_\_\_

**Program of study:** \_\_\_\_\_

(Private commitment manipulation)

### GLOBAL WARMING, I CARE!!

In the context of the University of Ottawa's campaign for the reduction of greenhouse gas (GHG) emissions set to launch during the winter session, we wish to know the opinions of students towards the issue of global warming. We believe that students are in the best position to raise the awareness of their peers concerning the importance of global warming. It's for this reason that we wish to display posters of students' opinions across campus.

To participate in this campaign, all you need to do is explain in 75 words or less (3 or 4 sentences) **why you think it is important to address the issue of global warming** and **what students can do to help the cause**. Since your text will be revised before publication, there is no need to worry about grammar or spelling.

\*\*\*

*It is important to address the issue of global warming because...*

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*We can do our part by...*

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**Program of study:** \_\_\_\_\_

GENERAL APPENDIX R  
Standardized Recall of Recent GHG-Emitting Actions Form

**GLOBAL WARMING, I CARE!!**

In the context of the University of Ottawa's campaign for the reduction of greenhouse gas (GHG) emissions set to launch during the winter session, we wish to identify the most common greenhouse gas emitting behaviours performed by students. This information will be used strictly to develop future global warming awareness campaigns.

**Thinking about all your activities over the past month, please list 3 actions you did that may have contributed to global warming; that is, avoidable actions that you know produce a considerable amount of greenhouse gas emissions.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Thank you for participating in this anonymous survey!

## GENERAL APPENDIX S

## List of Greenhouse-Gas Emitting Actions Examples

**Greenhouse gas emissions** refer to the release of carbon dioxide, methane, and other greenhouse gases as a result of human activities such as burning fossil fuels or deforestation; these emissions presumably cause global warming.

<i>Greenhouse gas-emitting behaviour</i>	<i>Green alternative</i>
Leave the lights on.	Turn off the lights when leaving the room. Take advantage of natural light during the day.
Leave the computer on all the time.	Enable your computer's energy saving features when not in use. Turn it off at night or when you leave the house.
Buy single-use batteries.	Buy rechargeable batteries.
Keep all your chargers plugged into the wall.	Plug all your chargers into a power bar. Switch it off when not in use.
Use a drier to dry laundry.	Hang clothes to dry.
Crank up the thermostat in the winter.	Set the temperature 2 degrees Celsius lower and wear a cozy sweater.
Use the stove to warm up soups and meals or steam vegetables.	Use the microwave oven as much as possible.
Use a hair dryer or other electric hair styling tools.	Towel dry or air dry your hair.
Take long showers.	Take shorter showers. Turn off the water while soaping or shaving.
Buy disposable products (ex: paper towels, sweeping and mop pads, etc.)	Buy and use durable or reusable products (ex: rags and cloths, brooms and mops, etc.)
Eat meat at every meal.	Eat meatless meals.
Take the elevator.	Take the stairs as much as possible.
Buy products made with or packaged in virgin paper.	Buy products made with or packaged in recycled paper.
Buy all your produce.	Grow your own produce.
Discard of newsprint in the garbage.	Recycle newsprint.
Use a drive-through window service.	Park and get serviced at the counter.
Use an electric toothbrush.	Use a manual toothbrush.
Drive alone in a car to work or school.	Carpool with co-workers or classmates.
Vote for political parties and candidates that are inactive relative to greenhouse gas emissions and energy-intensive industries.	Vote for political parties and candidates that are active relative to greenhouse gas emissions and energy-intensive industries.
Discard aluminum and steel cans in the garbage.	Recycle aluminum and steel cans.
Idle your car while running an errand.	Turn off your car.
Buy imported foods.	Buy locally-grown and/or -prepared foods.
Frequent energy-intensive establishments or organizations with a poor environmental record.	Boycott these establishments and organizations, sign petitions, participate in demonstrations, write letters to management, support environmentally-responsible establishments and organizations, etc.
Wash your clothes in warm or hot water.	Wash your clothes in cold water.
Take the car everywhere.	Walk, bike, or take public transit as much as possible.
Print on a single side of a sheet of paper.	Enable the double-sided printing option.

GENERAL APPENDIX T  
Pro-Global Warming Mitigation Attitude Strength Scale

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

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

1. To what extent do you agree with the hypothesis that greenhouse gas emissions from human activities are causing global warming?
2. To what extent do you agree that humans must take action to reduce their greenhouse gas emissions in order to minimize or curb global warming?

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

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

3. How important is global warming to you personally?
4. How central is your attitude toward global warming to your self-image/self-concept?
5. How representative of your values is your attitude toward global warming?
6. How knowledgeable are you about global warming?
7. How likely are you to change your opinion about global warming? (reverse-scored)
8. How sure are you that your opinion about global warming is right?

GENERAL APPENDIX U  
Information Search task E-Prime Slides

Introduction

**WELCOME!**

**During this task, you will be reading short media articles about global warming. Global warming refers to the hypothesis that *an increase in greenhouse gases emitted as a result of human activities is causing an increase in the Earth's average temperature and leads to changes in climate.***

**We ask that you please read a total of 2 articles.**

**Press SPACE to continue.**

Main menu

**MAIN MENU**

*Carefully read all the titles listed below before making your selection. Select the article of your choice by pressing the corresponding letter on the keyboard.*

<b>A</b> GLOBAL WARMING: A REAL PROBLEM	<b>E</b> GLOBAL WARMING IS A MYTH
<b>B</b> HUMANS ARE RESPONSIBLE FOR CLIMATE CHANGE	<b>F</b> CLIMATE CHANGE IS NOT CAUSED BY HUMAN ACTIVITIES
<b>C</b> GLOBAL WARMING WILL NEGATIVELY IMPACT HUMAN HEALTH	<b>G</b> CONSEQUENCES OF GLOBAL WARMING WILL BENEFIT HEALTH
<b>D</b> DO YOU PART: REDUCE YOUR GREENHOUSE GAS EMISSIONS	<b>H</b> REDUCING GREENHOUSE GAS EMISSIONS IS FUTILE

Article A<sup>1</sup>

## GLOBAL WARMING: A REAL PROBLEM

This article has three pages of text. Press **SPACE** to read the next page of text\*.

\*You will **NOT** be able to return to a previous page, so make sure you have fully read and understood a page before moving on to the next one.

Press **SPACE** to read this article.

OR

Press **"r"** to return to the main menu.

Current average global temperatures are now about 0.8°C above what they were in pre-<sup>1/3</sup> industrial times. The 2001 IPCC projections of the rise in average temperature likely by the end of this century (2100) range from 1.4°C to 5.8°C. If this meant that every place on earth would be only a few degrees warmer everyday than it is now, this slight change in climate (especially at the low end of these estimates) wouldn't make such a big difference. The problem is that this small average global increase does not represent a slight uniform change everywhere, but much greater changes in individual temperatures and their variation from place to place and over time that average to what looks like a small number; averages can hide a substantial amount of variability from place to place and time to time.

The ecology of the planet consists of a complex web of interdependent physical and biological systems. It is a matter of fact, not opinion, that our lives literally depend directly and indirectly on these systems. When climate changes, the balance of these systems is disrupted.

### **Effect of CO<sub>2</sub> emissions on climate**

The first of the four major findings of the recent Millennium Ecosystem Assessment Report is that "Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable time in human history." The report goes on to say, "Humans are fundamentally, and to a significant extent irreversibly, changing the diversity of life on earth, and most of these changes represent a loss of biodiversity." A 2002 report of the National Research Council points out (citing earlier biodiversity studies), "[R]ecent research suggests that the rate of species extinctions is on the order of 100 to 1000 times higher than before humans were dominant.... For example, over the last two millennia, one-fourth of all bird species are believed to have gone extinct as a result of human

<sup>1</sup>Text adapted from: Dumas, L. J. (2006). *Seeds of opportunity: Climate change challenges and solutions*. Retrieved from <http://civilsocietyinstitute.org/>

activities".

2/3

Clearly, people have impacted the ecosystem in many different ways; global warming is only one of them. Nevertheless, part of the human impact on the global environment is a result of greenhouse gas (GHG) emissions and, as the Millennium Ecosystem Assessment Report points out, about 60% of the increase in atmospheric CO<sub>2</sub> since 1750 has occurred within the past 50 years. It is difficult to separate out the ecological effects of the increase in CO<sub>2</sub> and other greenhouse gases from those of other sources of human-induced ecological change, since the ecology is, almost by definition, a complex intensely interconnected system. Still, it is clear that global warming works with these other sources of change to alter the environment.

### ***Regional changes in habitat***

The effect of rapid climate change on biodiversity is a major concern, although various plant and animal species have shown a greater ability to adapt to past climate changes than was at first thought likely. Ice core records extracted from Greenland and Antarctica in the 1990s showed considerable variability in climate over the past 200,000 years. "Yet biodiversity has survived these past rapid changes largely intact. There is no reliable record of mass extinctions in the Pleistocene." Range shifts (movement to habitats in new places), rather than genetic changes, seem to have been the main mechanism for surviving dramatic changes in climate over very long periods of time.

The migration of plant and animal species to new areas is now hampered by human activities that have destroyed or fragmented new habitats and/or blocked the routes that might have made these habitats more accessible in the very distant past. The fragmentation or outright destruction of habitats has also reduced the number of

individuals, making the species less viable. According to Thomas Lovejoy and Hannah Lee, "... the potential for rapid response is greatly constrained by habitat loss... both rapid genetic response and range shifts are jeopardized". It is extremely difficult to isolate the effects of climate change on biodiversity. Its effects are best understood in combination with those of other human-induced stresses, such as habitat destruction and environmental pollution.

3/3

### ***Exacerbating effects of arctic thaw***

Biodiversity as such is not the only relevant ecological issue. According to UNEP, not only could about 3°C- 4°C worth of global warming eliminate 85% of all remaining wetlands, it could cause the permafrost in arctic habitats to thaw, releasing vast stores of additional GHGs trapped in the soil. By this route, the global warming could make itself worse.

Researchers studying western Siberia have found that an area of permafrost the size of France and Germany combined has already begun to melt--- for the first time in 11,000 years. The entire sub-Arctic region of western Siberia is one gigantic peat bog, and as it thaws it could release billions of metric tons of methane into the atmosphere. Methane, produced as a result of the decomposition of organisms and organic waste, is a much more potent GHG than carbon dioxide. It would most likely take many decades for the Siberian permafrost to thaw, and therefore for all that methane to be released. But climate scientist Stephen Sitch and his colleagues have calculated that even if it took 100 years, it would still add 700 metric tons of carbon to the atmosphere per year. That's about as much carbon as is released each year from all the world's wetlands and agriculture. By itself, this could increase global warming by 10%-25%.

Article B<sup>2</sup>

## HUMANS ARE RESPONSIBLE FOR CLIMATE CHANGE

This article has three pages of text. Press **SPACE** to read the next page of text\*.

\*You will **NOT** be able to return to a previous page, so make sure you have fully read and understood a page before moving on to the next one.

Press **SPACE** to read this article.

OR

Press **"r"** to return to the main menu.

In the early 1970s, the rise of environmentalism raised public doubts about the benefits <sup>1/3</sup> of human activity for the planet. Curiosity about climate turned into anxious concern. Study panels began to warn that one or another kind of future climate change might pose a severe threat. One unexpected discovery was that the level of certain atmospheric gases was rising, which would add seriously to global warming and, by the late 1970s, global temperatures had evidently begun to rise.

Since 2001, greatly improved computer models and an abundance of data of many kinds strengthened the conclusion that human emissions are very likely to cause serious climate change. An intergovernmental panel reaffirmed this in a report published in 2007 stating that by the end of the century we could expect the planet's average temperature to rise anywhere between about 1.4 and 6°C. Although only a small fraction of this warming has happened so far, predicted effects are already becoming visible in some regions — more deadly heat waves, rising sea level, stronger floods and droughts, the spread of tropical diseases and the decline of sensitive species.

### **Scientific evidence**

Scientists have spent decades figuring out what is causing global warming. They've looked at the natural cycles and events that are known to influence climate. But the amount and pattern of warming that's been measured can't be explained by these factors alone. The only way to explain the pattern is to include the effect of greenhouse gases (GHGs) emitted by humans.

One of the first things scientists learned is that there are several greenhouse gases responsible for warming, and humans emit them in a variety of ways. Most come from the combustion of fossil fuels in cars, factories and electricity production. The gas responsible

<sup>2</sup>Text adapted from: (a) Madrigal, A. (2009, April 29). Humans halfway to causing dangerous climate change. *Wired Science*. Retrieved from <http://www.wired.com/>; (b) National Geographic. (n.d.). Global warming. Retrieved May 2, 2008, from <http://environment.nationalgeographic.com/environment/global-warming/>; (c) Scientific opinion on climate change (n.d.). Retrieved February 11, 2008, from Wikipedia: [http://en.wikipedia.org/wiki/Scientific\\_opinion\\_on\\_climate\\_change](http://en.wikipedia.org/wiki/Scientific_opinion_on_climate_change); and (d) Weart, S. (2010). *The discovery of global warming*. Retrieved from <http://www.aip.org/>

for the most warming is carbon dioxide, also called CO<sub>2</sub>. Other contributors include methane released from landfills and agriculture, nitrous oxide from fertilizers, gases used for refrigeration and industrial processes, and the loss of forests that would otherwise store CO<sub>2</sub>. Different GHGs have very different heat-trapping abilities. Some of them, like methane and nitrous oxide, can even trap more heat than CO<sub>2</sub>. But because their concentrations are much lower than CO<sub>2</sub>, none of these gases adds as much warmth to the atmosphere as CO<sub>2</sub> does. Since 1990, yearly emissions of GHGs have gone up by about 6 billion metric tons worldwide, more than a 20% increase. 2/3

Nowadays, most scientists recognize the human causes of climate change. In fact, national and international science academies and professional societies have assessed the current scientific opinion on global warming and found that the dominant opinion largely endorses the Intergovernmental Panel on Climate Change's (IPCC) position of January 2001 that states: "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system... There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities." Since 2007, no scientific body of national or international standing has maintained a dissenting opinion. A few organisations hold non-committal positions.

#### **Future projections**

When human injection of carbon into the atmosphere reaches 1 trillion tons, dangerous climate change with average global warming of more than 2 Celsius degrees will likely occur, a new analysis finds. And humans are hurrying toward that 1 trillion mark. So far, We've added about 520 billion tons of carbon to the atmosphere. With the addition of an estimated 9 billion tons of carbon a year — a number that's been growing since 1850 — dangerous warming is likely to occur within half a century.

What matters is the total amount of carbon that we release into the atmosphere, and focusing on that number as a budget can shape the way policymakers look at the problem, argues Myles Allen, a climatologist at the University of Oxford. Previous climate change efforts have tried to find the correct "stabilization level" for which to aim. Beyond the scientific complexity of finding what that number should be, the esoteric nature of those numbers made the climate problem difficult to communicate to populations across the world. The numbers presented in Allen's research are probabilistic. They look at different levels of carbon and carbon dioxide in the atmosphere and try to assign the likelihood that a certain emissions level would equate to a temperature change across the Earth. His team found that it's the total amount of carbon added to the atmosphere that will determine the peak warming of the globe. 3/3

Where Allen's team found that adding 480 billion tons of carbon from here on out would push the risk of 2 degrees of warming to over 50 percent, Malter Meinshausen's team at the Potsdam Institute for Climate Impact Research in Germany found even more alarming results. The German team estimates that 310 billion tons is all that would be needed. Without policy changes, that means humans would hit dangerous warming levels in 20 years (Meinshausen) to 40 years (Allen).

The evidence that humans are causing global warming is strong, but the question of what to do about it remains controversial. Even if we stopped emitting greenhouse gases today, the Earth would still warm by another degree or so. But what we do from today forward makes a big difference. Depending on our choices, scientists predict that the Earth could eventually warm by as little as 2 or as much as 8 °C.

Article C<sup>3</sup>

## GLOBAL WARMING WILL NEGATIVELY IMPACT HUMAN HEALTH

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Human activities related primarily to the burning of fossil fuels and changes in land cover such as deforestation are changing the concentration of atmospheric constituents or properties of the earth's surface that help to absorb or scatter radiant energy. Since the preindustrial mid-1800s, increases in concentrations of three major greenhouse gases, carbon dioxide, methane, and nitrous oxide, have exceeded past changes that occurred over the last 10,000 years; carbon dioxide alone has increased by 30% since the late 1800s. Warmer air, such as that resulting from the greenhouse effect, can hold more moisture and more quickly evaporate surface water, thereby increasing the frequency of severe storms, floods, and droughts. According to the United Nations Intergovernmental Panel on Climate Change (IPCC), "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system." During the 20th century, global average surface temperature increased about 0.6°C, global average sea level rose 10 cm to 20 cm, and snow and ice cover decreased. The latest IPCC report predicts that if current trends continue, sea level rise will rise 45 cm and global temperatures will increase by 3°C by the year 2100. 1/3

As part of its research the IPCC, a United Nations sponsored organization made up of over 2500 of the world's leading scientists, examined the impacts global warming will likely have on human health. They concluded that human-induced climate change "is likely to have wide-ranging and mostly adverse impacts on human health, with significant loss of life." In addition to the direct health effects caused increases in extreme weather events and air pollutants, less direct health impacts may result from the disruption of ecosystems and of water and food supplies, which in turn could affect infectious disease incidence and nutritional status. Finally, sea-level rise could lead to major population displacement and economic disruption.

<sup>3</sup>Text adapted from: (a) Patz, J. A., & Khaliq, M. (2002). Global climate change and health: Challenges for future practitioners. *Medical Student Journal of the American Medical Association*, 287, 2283–2284. doi: 10.1001/jama.287.17.2283-JMS0501-3-1 (Reprinted from *EcoHealth*, 7 (2010), 425-438); and (b) Sierra Club. (n.d.). Global warming impacts: Health effects. Retrieved August 23, 2008, from <http://www.sierraclub.org/>

### **Temperature-Related Morbidity and Mortality**

2/3

Small changes in global mean temperatures can produce relatively large changes in the frequency of extreme temperatures. Mortality rates increase at both hot and cold extremes of temperature. Increases in temperature have a direct and substantial impact on excess mortality for elderly individuals and individuals with pre-existing illnesses. Much of the mortality attributable to heat waves is a result of cardiovascular, cerebrovascular, and respiratory disease. Long-term global warming trends are further exacerbated by the "heat island" effect, whereby high concentrations of heat-retaining surfaces such as asphalt and tar roofs sustain higher temperatures through the night. Heat waves also have the secondary effect of worsening urban air pollution. Ozone, which forms chemically from precursor pollutants, is the most temperature-dependent air pollutant and may contribute to the development of asthma in children.

### **Health Effects of Extreme Weather Events**

Higher average ambient air temperatures are likely to induce more vigorous cycles of evaporation and precipitation. Indeed, a trend of increasing climate variability and extreme precipitation events has been observed over the past century, and recent models strongly correlate this trend with anthropogenic production of greenhouse gases. Human health impacts are most likely to occur where extreme weather and population vulnerability converge. At highest risk are communities that are most exposed (e.g., in floodplains and coastal zones) and that have the fewest technical and social resources. The health impacts of extreme weather events include physical injury; increases in respiratory and diarrheal diseases due to overcrowding of flood survivors and limited access to potable water; increased risk of water-related diseases due to disruption of sewage systems; and release of dangerous chemicals from storage and disposal sites into flood waters.

### **Water-Related Infectious Diseases**

3/3

Waterborne diseases in marine or coastal zones are especially sensitive to climate. During the 1997-1998 El Niño, the number of daily hospital admissions in Lima, Peru, for childhood diarrhea increased more than two fold over the averaged rate for the preceding four years. The increase in ambient temperature in excess of regular seasonal variability was found to be the main environmental variable affecting admissions: for each 1°C increase in mean ambient temperature, the number of admissions increased by 8%. Cholera outbreaks occur seasonally in Bangladesh, with consistent patterns associated with monsoon seasons, sea surface temperatures, rainfall, and zooplankton populations. In the marine environment, warm water and nitrogenous waste favor blooms of dinoflagellates. The resulting "red tides" can cause paralytic, diarrheic, and amnesiac shellfish poisoning. Finally, certain vector-borne pathogens, such as those that spend a part of their life cycle in arthropod vectors, are sensitive to ambient temperatures.

### **Sea-Level Rise**

Global mean sea level is predicted to continue to increase primarily by the loss of mass from glaciers and thermal expansion of water. Sea-level rise would especially affect coastal communities and may force population migration. Thirteen of the world's 20 major cities are situated at sea level. Nicholls and Leatherman showed that a 1-meter rise in sea level would inundate low-lying areas, affecting 18.6 million people in China, 13 million in Bangladesh, and 3.3 million in Indonesia. Furthermore, rising seas may salinate coastal freshwater aquifers and disrupt stormwater drainage and sewage disposal. Considering the health burden experienced by refugees and populations subjected to overcrowding, lack of shelter, and competition for resources, the response to displaced populations may well become the largest public health challenge posed by global climate change.

Article D<sup>4</sup>

## DO YOUR PART: REDUCE YOUR GREENHOUSE GAS EMISSIONS

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Climate change may be a big problem, but there are many little things we can do to make a difference. If we try, most of us can do our part to reduce the amount of greenhouse gases that we put into the atmosphere. Many greenhouse gases come from things we do every day. The average Canadian is responsible for around 9,000 kilograms of CO<sub>2</sub> per year just from direct consumption of energy for heat, transportation, and electricity. An additional 12,500 or so kilograms is spent on indirect uses like food transportation, product manufacturing, and waste disposal. Each one of us can have a big impact on moving us toward a greener future in the individual choices we make. It turns out we can make the biggest difference in the way we get around, the food we eat, the energy we use, and the public action we take. 1/3

**Walk, bike, carpool or take transit.** Each year, Canadians make 2,000 car trips for distances less than three kilometres. Many of these trips could easily be done on foot, transit or bicycle — healthier alternatives for humans and the planet. Someone who takes the bus every day instead of driving to work keeps 800 pounds of carbon dioxide out of the air each year. A single public bus takes 40 vehicles off the road during rush hour, saves 70,000 litres of fuel and reduces air pollutants by nine tonnes a year.

**TIPS:** (1) If you can, choose human power first. Walk, bike, scooter, skate board – you choose. (2) Take the children in your life for a transit ride. Teach them how to use the public transportation system in your community and why it's important to the environment. It's fun and it will make them better eco citizens. (3) When and where public transit is not an option – carpool!

### **Live close to work or school**

The post World War II notion that everyone can have a house in the suburbs has got to go

<sup>4</sup>Text adapted from: David Suzuki Foundation. (n.d.). David Suzuki's nature challenge: Green living made easy. Retrieved January 27, 2008, from <http://www.davidsuzuki.org/NatureChallenge/>

– we need liveable cities. Walking-oriented European cities devote less than 10 percent<sup>2/3</sup> of the land to transportation, while automobile-oriented North American cities devote up to 50 per cent to roads and off-street parking. More cars mean more roads and parking facilities, and less green spaces and recreation areas.

TIPS: (1) If you are moving, choose a home that is within a 30-minute walk, bike or transit ride from work and/or school. If you are not moving, try to get out of your car more and help reduce problems associated with being car-dependent. (2) If you're looking for a new health professional (or any other service), try someone closer to where you spend most of your time. (3) Shop close to home - support your friendly neighbourhood stores.

### ***Eat meat-free meals***

Most of the world's water is used for agriculture. But did you know that meat production and processing requires far more water than any other form of food production? Food animals are also the world's largest users of land – for pastures and land used to grow fodder crops. Vegetable and grain production uses a fraction of the resources it takes to raise the equivalent protein value in meat.

TIPS: (1) Plan ahead. If going meatless means changing your habits drastically, you'll enjoy it more if you do some research and find really yummy recipes before you go shopping. (2) Try veggie restaurants and meatless menu alternatives when you go out – they're sprouting up all over the place!

### ***Eat locally***

Anything that travels – including food – generates greenhouse gases, the main culprit in climate change, so the less distance something has to move to get to your mouth, the better. Buying local also means fewer chemicals to protect foods while they travel, which

helps conserve precious farmlands and wildlife. Organic farming is better for the environment than conventional methods but importing organic produce from far away offsets some of its environmental benefits.<sup>3/3</sup>

TIPS: (1) Read labels when you shop. The best option is local, organic produce; the next best choice is to buy local, period. (2) Talk to the produce manager where you shop. Tell them what you want and why.

### ***Maximize energy efficiency***

Energy use in the home can easily be reduced since a significant of energy is lost on non-productive activities. For example, a significant amount of energy goes to feed idle electronic equipment and recover heat lost to drafts around doors and windows.

TIPS: (1) Check walls, doors and windows for drafts and seal 'em up. (2) Any electronic gizmo that has a clock, digital timer, remote control or standby mode is sucking energy when it's not being used (it's called 'phantom electricity' – and it's scary how much of it there is!). If you're not using 'em, yank 'em! (3) Set up a 'charging station' for equipment that needs charging – plug everything into a power bar and turn that off until you actually need to charge something. (4) Think twice before you buy any electronic toys and gadgets. Even though lots of us choose more efficient models, home energy use is actually increasing just because we keep loading up on more electrical devices!

### ***Spread the word! Get involved!***

TIPS: (1) Stay informed on the issues. (2) Contact the media and/or your political representatives to let them know where you stand on the issue. (3) Get your friends, family, and neighbours on board! (4) Vote for political candidates or parties that prioritize environmental issues.

Article E<sup>5</sup>

## GLOBAL WARMING IS A MYTH

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Global warming is often presented as the greatest potential threat to humankind and as the greatest environmental and ecological threat on the planet. I argue that global warming (climate change, climate chaos, etc.) will not become humankind's greatest threat until the sun has its next hiccup in a billion years or more (in the very unlikely scenario that we are still around).

### ***Exposing the veneer***

One should first recognise that the atmospheric greenhouse effect is a well known natural phenomenon, mostly caused by atmospheric water vapour, that keeps our planet warm and habitable whereas (anthropogenic = human-made) global warming refers to a small extra greenhouse warming (0.5-1 °C / 33 °C; 1-5 %) allegedly arising from an increase in atmospheric concentration of the minority greenhouse effect gas CO<sub>2</sub> (carbon dioxide) – the later increase in turn possibly arising from fossil fuel burning.

This means that the global greenhouse effect gives earthlings a needed and much appreciated base warming of 33 °C, whereas the alleged "global warming" would contribute an extra 0.5 to 1 °C of warming (a 1 to 5 % increase), on a planet that has seen a dozen or so ice ages since human kind has appeared. The most often cited reconstructed global average temperature curves (themselves somewhat tenuous) show increases in global mean temperature of approximately 0.5-1 °C in the last 100 years.

Whereas there is evidence of negative consequences to populations from sustained regional cooling (e.g., Europe's Little Ice Age, 1300-1850 AD) and whereas global ice ages (occurring every 40-100 thousand years or so) clearly have significantly affected

<sup>5</sup>Text adapted from: Rancourt, D. G. (2007, February 27). Global warming: Truth or dare [Web log post]. Retrieved from <http://activistteacher.blogspot.com/search/label/environment>

human populations, there is no known case of a sustained warming alone having negatively impacted an entire population. As a general rule, all life on Earth does better when it's hotter. 2/3

### ***Is there global warming?***

Before 'climate chaos' became cliché, many scientists advanced evidence for detected amounts of global average Earth surface temperature increases occurring in the post-industrial age. These reports, taken as a whole, were the main original catalysts towards constructing the global warming myth, so it is useful to critically examine their validity.

It was no easy task to arrive at the most cited original estimated rate of increase of the mean global surface temperature of 0.5 °C in 100 years. As with any evaluation of a global spatio-temporal average, it involved elaborate and unreliable grid size dependent averages. In addition, it involved removal of outlying data, complex corrections for historical differences in measurement methods, measurement distributions, and measurement frequencies, and complex normalisations of different data sets. This means that determining an average of a quantity (Earth surface temperature) that is everywhere different and continuously changing with time at every point, using measurements at discrete times and places (weather stations), is virtually impossible; in that the resulting number is highly sensitive to the chosen extrapolation method(s).

As a general rule in science, if an effect is barely detectable, requires dubious data treatment methods, and is sensitive to those data treatment methods and to other approximations, then it is not worth arguing over or interpreting and should not be used in further deductions or extrapolations. The same is true in attempting to establish causal relationships. This is in contrast to the precautionary principle which, in this context,

would dictate that humans should reduce their fossil fuel burning because a resulting increase in atmospheric CO<sub>2</sub> **might** cause serious environmental harm. I argue that we should stick to known consequences and apply universally accepted norms of human justice and respect for nature in limiting exploiters' impulses. 3/3

### ***Warming, climate, and climate chaos***

The global warming myth advocates argue that global warming drives increased climate chaos. That is, overall increases in extreme weather events, such as more frequent and more intense tropical hurricanes, more frequent and more intense heat waves, more frequent and more intense droughts and floods, etc. The available data does not support these claims and does not allow one to conclude that we have entered into a period of greater climate chaos, let alone that any perceived increase in climate chaos would be caused by extra-CO<sub>2</sub>-driven planetary warming. Weather is by its nature chaotic and unpredictable. Every year weather events occur and will always occur that have never occurred before in recorded history.

Media sensationalism notwithstanding, none of the recent reports of weather events step outside of the statistical samples gathered by climatologists, as they have often informed us. Among other things, climatologists, environmental scientists, and statisticians have pointed out that: (1) North America has less frequent but more intense forest fires because foresters manage forests, (2) insurance companies pay out more natural catastrophe claims because there are more people living in more precarious areas with more expensive installations, (3) more people suffer the consequences of flooding because more people live in flood plains, (4) more urban elderly die in heat waves because they are older and live in isolation and in high rises, (5) water tables fall because of deforestation and watershed management practices, and so on.

Article F<sup>6</sup>

## GLOBAL WARMING IS NOT CAUSED BY HUMAN ACTIVITIES

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Green groups are using their influence to persuade people that an environmental disaster<sup>6</sup> of historic proportions is just around the corner. However, many scientists argue that what the Greens say about global warming and pollution is wrong. According to Piers Corbyn, Director of Weather Action, many scientists do not accept the idea that pollution is causing global warming. Environmentalists claim that world temperatures have risen 0.6 degrees Celsius in the past century, but Corbyn points out that the period they take as their starting point — around 1880 — was colder than average. What's more, the timing of temperature changes does not appear to support the theory of global warming. Most of the rise came before 1940 —before human-caused emissions of 'greenhouse' gases became significant.

According to the Greens, during the post-war boom global warming should have pushed temperatures up. But the opposite happened. "As a matter of fact, the decrease in temperature, which was very noticeable in the 60s and 70s, led many people to fear that we would be going into another ice age," remembers Fred Singer, former Chief Scientist with the US Weather Program.

Even in recent times, the temperature has not behaved as it should according to global warming theory. Over the last eight years, temperature in the southern hemisphere has actually been falling. Moreover, says Piers Corbyn, "When proper satellite measurements are done of world temperatures, they do not show any increase whatsoever over the last 20 years."

### **CO<sub>2</sub>: Overlooked sources**

Scientists also point out that nature produces far more greenhouse gases than we do. For example, when the Mount Pinatubo volcano erupted, within just a few hours it had thrown into the atmosphere 30 million tonnes of sulphur dioxide— almost twice as much as all the

<sup>6</sup>Text adapted from: (a) The lack of scientific rigour in environmental ideology. (n.d.). [Summary of the television series Against Nature episode 1 produced by RDF television and edited by P. Snyder & P. Willson]. Retrieved from <http://www.ourcivilisation.com/againatur/prog1.htm>; and (b) Rancourt, D. G. (2007, February 27). Global warming: Truth or dare [Web log post]. Retrieved from <http://activistteacher.blogspot.com/search/label/environment>

factories, power plants and cars in the United States do in a whole year. Oceans emit 90 billion tonnes of carbon dioxide, the main greenhouse gas according to Greens, every year. Decaying plants throw up another 90 billion tonnes, compared to just six billion tonnes a year from humans.

What's more, 100 million years ago, there was six times as much carbon dioxide in the atmosphere as there is now, yet the temperature then was marginally cooler than it is today. Many scientists have concluded that carbon dioxide doesn't even affect climate.

In fact, ice core data shows strong temporal correlations between average global temperature and atmospheric CO<sub>2</sub> yet these correlations do not show causal relations. CO<sub>2</sub> increases may accompany temperature increases rather than causing them. Indeed, some high resolution studies have suggested that the temperature increases precede the CO<sub>2</sub> increases. Finally, the older geological record shows several dramatic examples of where CO<sub>2</sub> concentration and global average temperature were either unrelated or even anti-correlated.

### **CO<sub>2</sub>: Wrongfully targeted**

By far the most important greenhouse active atmospheric gas is water vapour – it is a major constituent of the atmosphere whereas CO<sub>2</sub> is a trace atmospheric gas. This is well known and it is established, for example, that even doubling the present atmospheric CO<sub>2</sub> concentration, to the unattainable value of 800 ppm (parts per million) say, without changing anything else in the atmosphere, would have little discernable effect on global temperature or climate.

All of the climate models that relate CO<sub>2</sub> concentrations to climate effects do so by arbitrarily linking a model increase in CO<sub>2</sub> to an induced and larger increase in

atmospheric water vapour. In other words, all the climate models postulate a large and positive feedback between CO<sub>2</sub> and water vapour. <sup>3/3</sup>

Several scientists have argued that these models are computer realizations of the tail wagging the dog. Water vapour is the dominant greenhouse factor and the behaviour of water in the atmosphere is far more complex than that of CO<sub>2</sub> (clouds, rain, snow, evaporation, etc.) yet CO<sub>2</sub> is taken to drive the water cycle rather than water taken to drive CO<sub>2</sub> dynamics; using a fictitious multiplicative feedback factor. On the contrary, for example, water is often the determining factor in vegetation growth. Vegetation growth in turn consumes CO<sub>2</sub> and is the greatest active bound-carbon pool on the planet. Therefore, it is more correct to say that water drives the carbon cycle. Atmospheric CO<sub>2</sub> concentration is only a remote witness to all the natural and anthropogenic processes that consume and produce CO<sub>2</sub>.

There is no known mechanism whereby an increase in CO<sub>2</sub> concentration could directly cause an increase in water vapour concentration in the amount required by climate computer models. On the other hand, there are many known mechanisms whereby water vapour concentration can be dramatically affected by various external agents. Some examples are as follows: (1) solar input drives convection and winds which in turn largely determine atmospheric evaporation loading, (2) deforestation and agriculture expose soils which are sources of mineral and organic dust which in turn can induce precipitation, (3) solar winds of cosmic rays can induce cloud formation reducing solar radiation diffusion.

Just as solar radiation intensity and inclination determines our seasons and the differences between day and night, so too solar radiation variations related to solar winds, magnetic shielding, and solar intensity cycles (e.g., sunspots) probably have a greater impact on the water cycle than changes in any greenhouse active trace gas.

Article G<sup>7</sup>

## CONSEQUENCES OF GLOBAL WARMING WILL BENEFIT HEALTH

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Many researchers, environmentalists, and politicians are forecasting that rising world temperatures in the next century will have devastating effects on humans. Referring to the world as a whole, the Intergovernmental Panel on Climate Change asserted (IPCC): "Climate change is likely to have wide-ranging and mostly adverse impacts on human health, with significant loss of life."

The few studies that have examined the relation between warming and human health or mortality in depth have focused either on increases in the number of days of very hot weather and the resulting mortality or on the spread of infectious diseases by such vectors as mosquitoes, flies, and snails. These studies have generally pointed to a warmer climate being less healthful but, taken together, these same results offer some support to the claim that global warming will benefit human health.

### **Seasonal effects of global warming**

First it is important to consider the predicted warming patterns more closely. If climate change were to manifest itself as warmer winters without much of an increase in temperatures during the hot months, which some climate models predict, the change in weather could be especially beneficial to human health. The IPCC reports that over this century the weather in much of the world has been consistent with such a pattern: winter and night temperatures have risen while summer temperatures have fallen.

A sample of 45 metropolitan areas in the United States shows that for each increase of a degree in the average annual temperature, July's average temperatures go up by only 0.5 degrees while January's average temperatures climb by 1.5°. Since warming will likely exert the maximum effect during the coldest periods but have much less effect during the

<sup>7</sup>Text adapted from: Moore, T. G. (1996). *Health and amenity effects of global warming*. Retrieved from <http://128.118.178.162/eps/othr/papers/9604/9604001.pdf>

hottest months, the climate change should reduce deaths even more than any summer increase might boost them. <sup>2/3</sup>

Respiratory problems, such as pneumonia and influenza, are a particular problem in cold months (this is true in both the northern and southern hemisphere), but even the leading causes of death -- diseases of the circulatory system -- kill more people in the winter. Except for accidents, suicides, and homicides, which are slightly higher in the summer, death rates from virtually all other major causes rise in winter months. Rather than increasing mortality, medical data suggest that warmer weather should reduce it; but this possibility is rarely discussed.

#### **Studies of summer deaths**

A more recent set of studies has focused on excessive mortality related to heat spells in major cities. These studies have typically found a rise in deaths during periods of very hot weather for certain cities. The results have not, however, applied to all hot spells or to all cities. Work concerned with "killer" heat waves has generally ignored the reduction in mortality that warmer winter months would bring.

Interestingly cities with the highest average number of summer deaths are found in the Midwest or Northeast while those with the lowest number are in the South. Typically researchers have failed to find any relationship between excess mortality and temperature in southern cities. Researchers have attributed the absence of heat related deaths in southern cities to acclimatization and the prevalence of housing that shields residents from high temperatures. If temperatures rise slowly over the next century by 1 to 3.5°C, as is currently predicted, people can become acclimated and housing can and, in the normal cycle, will be replaced.

That cities in the south fail to show any relationship of deaths to high temperatures suggests that the correlation in the north may stem from deaths of the most vulnerable when the weather turns warm. And, in fact, these same studies report that those most susceptible to heat related deaths are elderly or ill. Furthermore, little attention has been devoted to whether any excess deaths represented only premature mortality of a few days of the old or sick or whether the excess deaths shortened lives significantly. <sup>3/3</sup>

#### **Vector-borne diseases**

Concern about tropical and insect-spread diseases seems overblown. Inhabitants of Singapore, Hong Kong and Hawaii, which are in the tropics, enjoy life spans as long as or longer than those of people living in Western Europe and North America. Modern sanitation in advanced countries prevents the spread of many scourges found in hot climates. Such low tech and relatively cheap devices as window screens can slow the spread of insect vectors.

Insect-spread diseases might or might not increase under the stimulus of a warmer climate. Many of the hosts or insects themselves flourish within a relatively small temperature or climatic range. Plague, for example, spreads when the temperature is between 19° and 28°C with relatively high humidity but decreases during periods of high rainfall. Malaria-bearing mosquitoes flourish under humid conditions with temperatures above 16 and below 35°C.

In addition, deaths traceable to parasitic and infectious diseases are somewhat higher in the winter than in the summer. Respiratory and heart diseases, which kill many more people annually and which the IPCC singled out as increasing under a warmer climate, peak during *winter* months, not summer months.

Article H<sup>8</sup>

## REDUCING GREENHOUSE GAS EMISSIONS IS FUTILE

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We have a large faction of intensely interested persons who say global warming is man-made, and dangerous. They say it is driven by releases of greenhouse gases such as CO<sub>2</sub> from power plants and cars, and methane from rice paddies and cattle herds. The activists tell us that modern society will destroy the planet; that unless we radically change human energy production and consumption, the globe will become too warm for farming and the survival of wild species. They warn that the polar ice caps could melt, raising sea levels and flooding many of the world's most important cities and farming regions. However, they don't have much evidence to support their position – only (1) the fact that the Earth is warming, (2) a theory that doesn't explain the warming of the past 150 years very well, and (3) some unverified computer models.<sup>1/3</sup>

Many scientists – though by no means all – agree that increased CO<sub>2</sub> emissions could be dangerous. However, polls of climate-qualified scientists show that many doubt the scary predictions of the global computer models. This doubt relies on work of many hundreds of researchers, authors, and coauthors whose work testifies to the 1,500-year cycle. There is no "scientific consensus," as global warming advocates often claim. Nor is consensus important to science; science is the process of developing theories and testing them against observations until they are proven true or false.

If we can find proof, not just that the Earth is warming, but that it is warming to dangerous levels due to human-emitted greenhouse gases, public policy will then have to evaluate such potential remedies as banning cars and air conditioners. So far, we have no such evidence.

### ***The 1,500-year climate cycle***

Paleo-oceanographer Gerard Bond and his colleagues report that the climate of the

<sup>8</sup>Text adapted from: Singer, F. S., & Avery, D. T. (2008). *Unstoppable global warming: Every 1,500 Years* (Updated and expanded ed.). New York, NY: Rowman & Littlefield Publishers, Inc.

northern North Atlantic has warmed and cooled nine times in the past 12,000 years in step with the waxing and waning of the sun. "It really looks like the sun has mattered to climate," says glaciologist Richard Alley of Pennsylvania State University... "The Bond et al., data are sufficiently convincing that [solar variability] is now the leading hypothesis to explain the roughly 1,500-year oscillation of the climate seen since the last ice age, including the Little Ice Age of the 17<sup>th</sup> century," says Allen. 2/3

How does a tiny change in the sun's irradiance make a big difference in the Earth's climate? First of all, we know that the linkage exists and is powerful, which puts the solar cycle far ahead of the Greenhouse Theory.

We now have strong, new scientific evidence of how the linkage works. The key amplifier is cosmic rays. The sun sends out a "solar wind" that protects the Earth from some of the cosmic rays bombarding the rest of the universe. When the sun is weak, however, more of the cosmic rays get through the Earth's atmosphere. There, they ionize air molecules and create cloud nuclei. These nuclei then produce low, wet clouds that reflect solar radiation back into outer space. This cools the Earth.

The second amplifier is ozone chemistry in the atmosphere. When the sun is more active, more of its ultraviolet rays hit the Earth's atmosphere, shattering more oxygen (O<sub>2</sub>) molecules – some of which reform into ozone (O<sub>3</sub>). The additional ozone molecules absorb more of the near-UV radiation from the sun, increasing temperatures in the atmosphere. Computer models indicate that a 0.1 percent change in the sun's radiation could cause a 2 percent change in the Earth's ozone concentration, affecting atmospheric heat and circulation.

### ***CO<sub>2</sub> hasn't controlled climate in the past***

3/3

According to the Greenhouse Theory, more CO<sub>2</sub> in the Earth's atmosphere will trap more the Earth's own radiated heat, warming the lower atmosphere and ultimately the surface of the planet – all other things being equal. But the fact that the Earth's temperature has warmed only slightly since 1940, despite the huge clouds of greenhouse gases emitted from human activities, provides evidence that the human greenhouse effect must be so small that it presents little threat to the planet or its people. This is especially true since each additional unit of CO<sub>2</sub> causes less warming than the previous unit.

There is no real evidence that fossil fuels are overheating the world. The Greenhouse theory says that more greenhouse gases in the atmosphere will trap more heat, but no one knows whether the amounts of heat trapped by CO<sub>2</sub> increases are significant. Nothing in the Earth's climate history confirms CO<sub>2</sub> as a strong driver of climate warming.

If CO<sub>2</sub> is not causing dangerous global warming, there is no reason not to use coal, oil shale, and tar sands. They should be used carefully but there is no virtue to leaving them in the ground for future generations that may have no more use for them than we do for the once-treasured whale oil. In a human society that as yet has no effective replacement for fossil fuels, three hundred years' worth of fossil fuels could be massively important.

Binding constraints on human emissions of greenhouse gases should not be imposed unless those who warn of climate catastrophe can demonstrate three things: (1) That the greenhouse gases are certain to raise global temperatures significantly higher than they rose during previous natural climate warming cycles; (2) That such warming would severely harm human welfare and nature; (3) That rational human actions could actually forestall whatever warming may occur.

Return to main menu or end the task

**THANK YOU!**

To return to the main menu and select the next article, please press "r".

If you have finished reading the 2 articles of your choice, please press "t".

GENERAL APPENDIX V  
Information Search Intentions Scale

WHAT SELECTION STRATEGY DID YOU USE FOR THE PREVIOUS READING TASK?

We wish to know the details of the reading task you just did. Please be as honest as possible when answering this questionnaire, your responses are confidential and will not affect your participation points in any way.

1. Did you read all the titles before selecting the first article? Please choose one item below.

- Yes, I read all the titles
- No, I only read some of the titles
- No, I chose an article randomly

Below is a list of the 8 titles you could choose from during the previous reading task. Please find the titles of the articles you selected and enter the corresponding letter in the space provided.

- |   |   |
|---|---|
| A. Global warming, a real problem                     | E. Global warming is a myth                           |
| B. Humans are responsible for climate change          | F. Climate change is not caused by human activities   |
| C. Global warming will negatively impact human health | G. Consequences of global warming will benefit humans |
| D. Do your part: Reduce your greenhouse gas emissions | H. Reducing greenhouse gas emissions is futile        |

2. The **FIRST** article I chose to read based on its title was article \_\_\_\_\_.

3. The **SECOND** article I chose to read based on its title was article \_\_\_\_\_.

Please indicate to what extent you agree with the following two statements about your reasons for selecting these two articles using the provided scale:

	<b>Do not agree</b>			<b>Somewhat agree</b>			<b>Completely agree</b>
4. I decided it was time to find information that would allow me to change my opinion about global warming.	1	2	3	4	5	6	7
5. I wanted to know how to change my behaviour to be more in line with my existing opinion about global warming.	1	2	3	4	5	6	7