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# Psychological Barriers to Energy Conservation Behavior: The Role of Worldviews and Climate Change Risk Perception

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**Abstract**

We proposed and tested a conceptual model of how cultural cognition worldviews, climate change risk perception, and psychological barriers are related to reported energy conservation behavior frequency. Egalitarian and communitarian worldviews were correlated with heightened climate change risk perception, and egalitarian worldviews were correlated with weaker perceived barriers to reported energy conservation behavior. Heightened climate change risk perception was, in turn, associated with fewer perceived barriers to engagement in energy conservation behavior and more reported energy conservation behaviors. The relation between cultural worldviews and perceived barriers was partly mediated by climate change risk perception. Individuals with distinct worldviews perceived psychological barriers differently, and some barrier components were more strongly related to energy conservation behavior than others. Overall, climate change risk perception was the strongest predictor of perceived barriers and of energy conservation behavior frequency. Future efforts should focus on reducing the psychological barriers to energy conservation behavior identified in this study.

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Anthropogenic greenhouse gas (GHG) emissions are modifying climate patterns on a global scale and posing physical, psychological, and economic risks to humans through increased mortality and morbidity in periods of extreme heat, food insecurity caused by changes in precipitation patterns, disrupted livelihoods in coastal zones, reductions in fisheries, and many other ecological shifts (IPCC, 2014). The severity of human risks from climate change will increase with additional warming.

Facilitating lifestyle changes will be fundamental for mitigating climate change (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007), but psychological barriers hinder the willingness to adopt lifestyle changes in the form of pro-environmental behavior (Blake, 1999; Gifford, 2011; Lorenzoni et al., 2007; Patchen, 2010; Stoll-Kleemann, O'Riordan, & Jaeger, 2001; Takacs-Santa, 2007). How are these barriers perceived by different individuals? This study proposes and examines a model of how cultural cognition worldviews, climate change risk perception, and barriers to pro-environmental behavior predict self-reported energy conservation behavior. It also explores how climate change knowledge, education, gender, and age may also play a role in the model.

## Cultural Cognition

Cultural cognition theory posits that sociopsychological mechanisms (e.g., biased assimilation, identity-protective cognition) explain why individuals with different worldviews perceive risks differently (Kahan, 2012). It also explains why individuals have different policy preferences, according to ". . . the psychological disposition of persons to conform their factual beliefs about the instrumental efficacy (or perversity) of law to their cultural evaluations of the activities subject to regulation" (Kahan & Braman, 2006, p. 152).

Cultural cognition stems from previous anthropological work on the grid-group typology (Douglas, 1982) and cultural theory (Dake, 1991; Thompson, Ellis, & Wildavsky, 1990). The grid-group typology proposes that all social relations are structured according to two continuous dimensions: the degree of incorporation into a bounded social unit (i.e., group) and the extent of the rules or externally prescribed restrictions dictating how persons relate to another (i.e., grid; Douglas, 1970).

Cultural theory extends this typology and proposes that worldviews affect risk perception (Dake, 1991; Thompson et al., 1990) and that cultural biases

function as decision heuristics guiding individual action (i.e., "oriented action," Dake, 1991, p. 78; Thompson et al., 1990). The four main worldviews in cultural theory are hierarchical (i.e., high group, high grid), egalitarian (i.e., high group, low grid), individualist (i.e., low group, low grid), and fatalistic (i.e., low group, high grid; Thompson et al., 1990). Cultural theory has been used to explain global warming opinions and risk perception, environmental beliefs, and policy preferences (Jones, 2011; Leiserowitz, 2006; Poortinga, Steg, & Vlek, 2002; Steg & Sievers, 2000).

However, cultural theory has been criticized for conceptual inconsistencies, difficulties in testing the theory (Boholm, 1996), and scale measurement problems (i.e., internal reliability and construct validity; Leiserowitz, 2006; Lima & Castro, 2005; Marris, Langford, & O'Riordan, 1998; Rippl, 2002; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). More specifically, survey instruments developed to measure cultural theory (Dake, 1991, 1992) often fail to assign participants to a single cultural group, and sometimes participants simultaneously express cultural biases that are meant to be opposed theoretically (Marris et al., 1998; Rippl, 2002).

Cultural cognition theory attempts to solve some of these problems by using psychometric scales that measure worldviews based on two continuous grid and group dimensions (Kahan, 2012). The hierarchy-egalitarianism (i.e., grid) dimension and the individualism-communitarianism (i.e., group) dimension appropriately fit the original conception of the grid-group typology (see Douglas, 1970). The items from these scales generate two orthogonal principal components and can be treated as continuous scales, which is psychometrically preferable to splitting the sample into categorical groups (Kahan, 2012). The scales can nevertheless be combined to describe four cultural biases (i.e., hierarchical individualist, hierarchical communitarian, egalitarian individualist, and egalitarian communitarian) according to each person's location on a grid-group map (see Kahan, 2012; Kahan, Braman, Gastil, Slovic, & Mertz, 2007; Kahan et al., 2012).

A recent meta-analysis demonstrated that cultural cognition scales have greater internal consistency and more predictive power than Dake's (1991, 1992) cultural bias scales (Xue, Hine, Loi, Thorsteinsson, & Phillips, 2014). Despite this, cultural cognition theory explains very little variance (i.e., 5% on average) and, as a result, claims of its practical significance have been questioned (Fremling & Lott, 2003; van der Linden, 2016a). Its key theoretical constructs (i.e., values, culture, worldviews) may not be well defined and often are used interchangeably (van der Linden, 2016a). Cultural cognition theory might benefit from a more robust exploration of its role in explaining climate change risk perception, for example, by using multiple items to measure climate change risk perception rather than a single item (Kahan, Braman,

Slovic, Gastil, & Cohen, 2007) or a more general measure of environmental risks (Kahan et al., 2007).

## Climate Change Risk Perception

According to cultural cognition theory (and its aforementioned predecessors), subjective risk perceptions are beliefs unconsciously *chosen* to support an individual's way of life (Dake, 1991; Thompson et al., 1990). Each person has a set of beliefs about how the world should be, and because some risks promote particular beliefs (or worldviews) more than others, individuals "selectively . . . credit or dismiss evidence of risk in patterns that fit values they share with others" (Kahan et al., 2011, p. 148).

For example, given that egalitarians dislike unjust social disparities (Kahan, 2012; Kahan & Braman, 2003), and given that most individuals assess the climate change risks to others elsewhere around the world as higher than the risks to themselves (e.g., Gifford et al., 2009; Leiserowitz, 2005; Lima & Castro, 2005; Lorenzoni & Pidgeon, 2006; Safi, Smith, & Liu, 2012), it follows that egalitarians are more likely to be concerned with climate change because it threatens their view of a socially just and equal society. In contract, individualists typically are dismissive of environmental and technological risks because they usually want to avoid restrictions on commerce and industry (Kahan, 2012; Kahan, Jenkins-Smith, & Braman, 2011).

Those who hold hierarchical cultural beliefs tend to be dismissive of environmental and technological risks because they threaten the authority or competence of those in power (i.e., the social and governmental elite; Kahan, 2012). In contrast, communitarians generally perceive environmental and technological risks as real because they tend to dislike commerce and other self-seeking behaviors (Kahan, 2012). In sum, one might expect perception of climate change risk to decrease and climate change skepticism to increase as individuals hold more hierarchical and more individualist beliefs.

## Barriers to Pro-Environmental Behavior

Although most Americans view climate change as a serious problem (Leiserowitz, 2006) and most Canadians believe that the science is conclusive that climate change is happening and caused by human activity (The Environics Institute, 2013), most individuals in both countries in contrast engage in many GHG-emitting behaviors. This discrepancy between environmental concern and behavior is often referred to as the value-action gap or the attitude-behavior gap (Lorenzoni et al., 2007).

This gap can partly be attributed to structural deficits, such as limited access to public transport in rural areas, which are outside an individual's immediate control. However, even when these structural deficits are not present and individuals are able to make choices that limit emissions, pro-environmental behaviors are not extensively adopted. Therefore, many believe that the gap is also caused by psychological barriers that impede behavioral change (Blake, 1999; Gifford, 2011; Kollmuss & Agyeman, 2002). These include a perceived loss of comfort and freedom, beliefs that technology will solve the problem, distrust of government, lack of knowledge, social norms, and lack of political action (Blake, 1999; Lorenzoni et al., 2007; Stoll-Kleemann et al., 2001).

More recently, Gifford (2011) described 30 psychological barriers (i.e., the "dragons of inaction") to climate change mitigation in seven categories: limited cognition, ideologies, comparison with others, sunk costs, discredence, perceived risks, and limited behavior. For example, some individuals not only recognize the need to change their behavior but also perceive financial or time constraints. In a recent study, these dragons of inaction were significantly correlated with low levels of cooperation in a fishery microworld (Chen & Gifford, 2015).

## Sociodemographic Variables

Research on the links between climate change knowledge, education, gender, and age, and belief in climate change and pro-environmental behavior, is mixed. Self-reported climate change knowledge has been correlated with environmental concern, although this was more true for those who trust scientists or are not Republican (Malka, Krosnick, & Langer, 2009). It also has been correlated with greater climate change risk perception, climate policy support, buying green, and driving less (O'Connor, Bord, Yarnal, & Wiefek, 2002; Sundblad, Biel, & Gärling, 2007; Zahran, Brody, Grover, & Vedlitz, 2006). Climate change knowledge correlates with belief in climate change (Jones, 2011; van der Linden, 2015). However, others report no link between knowledge and climate policy preferences (Jones, 2011), or no relation between climate change knowledge and pro-environmental behavior (Brody, Grover, & Vedlitz, 2012) or with climate change skepticism (Whitmarsh, 2011). Many, but not all, studies conclude that higher levels of education correlate with more environmental concern (Gifford & Nilsson, 2014; van der Linden, 2015).

Correlations between gender, age, and environmental concern or behavior are also mixed. Women often report more concern than do men (Felonneau & Becker, 2008; Feygina, Jost, & Goldsmith, 2009; Gifford,

Hay, & Boros, 1982; Hunter, Hatch, & Johnson, 2004), but sometimes the opposite is found (Xiao & Hong, 2010), and sometimes no gender difference is observed for pro-environmental behaviors (Felonneau & Becker, 2008; Xiao & Hong, 2010). Some studies find that environmental concern decreases as people get older (Arcury & Christianson, 1990), while others find that it increases (Grønhøj & Thøgersen, 2009). Similarly, some find that pro-environmental behavior increases with age (Arcury & Christianson, 1990; Nord, Luloff, & Bridger, 1998), but others report less pro-environmental behavior for older individuals (Sardianou, 2007). Thus, more research is clearly warranted.

## The Present Study

Removing structural barriers, such as increasing access to public transportation, is necessary but insufficient; structural changes will contribute to climate change mitigation only if they lead to behavior changes (e.g., Gifford, 2011; Lorenzoni et al., 2007; Patchen, 2010). Therefore, many efforts have been dedicated to increasing knowledge about the social and psychological barriers that hinder the public's willingness to adopt more pro-environmental behavior (Blake, 1999; Gifford, 2011; Lorenzoni et al., 2007; Patchen, 2010; Stoll-Kleemann et al., 2001; Takacs-Santa, 2007). Furthermore, climate change information should be personally relevant and linked to individual concern and perceived barriers to increase public acceptance of, and demand for, climate policies and programs (Gifford, 2011; Lorenzoni et al., 2007; Scannell & Gifford, 2011). However, evidence about how different individuals experience these nonstructural barriers is in short supply in the literature. Also, to the best of our knowledge, the relation between nonstructural barriers and the frequency of energy conservation behavior has not been investigated.

Based on their correlation with established pro-environmental behavior measures (e.g., cultural worldviews predict scores on the New Environmental Paradigm in Overdevest & Christiansen, 2013; Poortinga et al., 2002; Price, Walker, & Boschetti, 2014; Tikir & Lehmann, 2011) and considering their past use in studying environmental policy preferences (e.g., Leiserowitz, 2006; Poortinga et al., 2002; Steg & Sievers, 2000), cultural cognition worldviews were chosen as an appropriate starting point in the present study for studying individual differences in barrier perception. Worldviews in this study refer to cultural cognition worldviews proposed by Kahan (2012), not those proposed by Dake (1991, 1992) in cultural theory.

In what we anticipated to be a logical extension of the "oriented action" cultural heuristic (i.e., individuals act according to their worldview

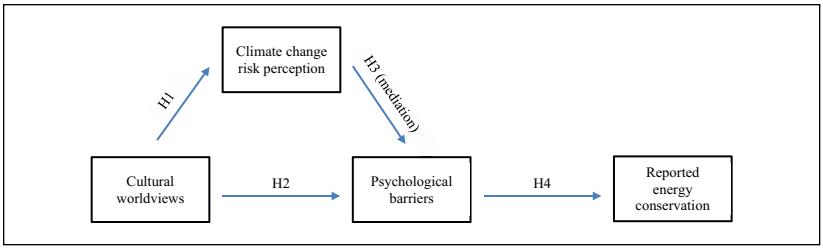


**Figure 1.** Conceptual model.

orientations; Dake, 1991), we expected to find significant relations between cultural worldviews, climate change risk perception, psychological barriers, and energy conservation behavior. We expected that broader orientations, such as worldviews, influence specific behaviors indirectly through their relation with more contextual variables, in this case climate change risk perception and psychological barriers to energy conservation behavior (Figure 1).

We propose cultural worldviews and climate change risk perception as possible avenues to address the knowledge gap about how different individuals perceive barriers. We suspect that broad worldview orientations influence more context-specific variables, such as climate change risk perception, which in turn influence behavior-specific variables, such as barriers to energy conservation behavior and self-reported frequency of energy conservation behavior (i.e., domain-context-behavior model; van der Linden, 2016b). Hence, we expected the relation between cultural worldviews and barriers to energy conservation behavior to be mediated by climate change risk perception. These are novel applications of cultural cognition theory because it has never, to the best of our knowledge, been used to study psychological barriers to pro-environmental behavior or energy conservation behavior.

## *Objectives*

The purpose of the present study is to investigate how cultural worldviews, climate change risk perception, and psychological barriers are related to frequency of self-reported energy conservation behaviors. The first objective is to examine the relation between cultural worldviews and climate change risk perception, this time in a Canadian sample. The second is to investigate the mediating role of climate change risk perception on relations between cultural worldviews and perceived psychological barriers to pro-environmental behavior. The third is to

examine empirically derived categories of psychological barriers in relation to cultural worldviews and self-reported energy conservation behavior. Finally, we will also examine the relative importance of cultural worldviews, climate change risk perception, climate change knowledge, gender, age, and education in predicting barrier perception and reported energy conservation behavior frequency.

### *Hypotheses*

We propose that the major flow of causation originates from broad orientations toward more context-specific influences. In present terms, the flow is from cultural worldviews to climate change risk perception to pro-environmental barrier perception to self-reported energy conservation behavior (Figure 1). However, this study examines correlations rather than causal relations, so we are not claiming causation. Therefore, the following hypotheses were formed:

**Hypothesis 1 (H1):** Cultural worldviews will significantly relate to climate change risk perception. Perception of risks associated with climate change will decrease for participants who are more hierarchical and more individualist.
**Hypothesis 2 (H2):** Cultural worldviews will significantly relate to barrier perception. Overall, hierarchs and individualists will report more barriers.
**Hypothesis 3 (H3):** The relation between cultural cognition worldviews and barrier perception will be mediated through climate change risk perception.
**Hypothesis 4 (H4):** Stronger barrier perceptions will be significantly correlated with less reported energy conservation behavior.

## Method

### *Procedures*

Adults (18 years of age or above) were recruited using an online panel recruitment agency. Two hundred Canadians were initially recruited. Participants were presented with a letter of information for implied consent and an online survey with five sections (i.e., cultural worldviews, barriers to behavior change and self-reported energy conservation behavior, climate change risk perception, climate change knowledge, demographics). The survey sections were randomized to avoid order effects.

## Measures

A short-form version of the Cultural Cognition Worldviews Scale was used, consisting of six items for the Hierarchy-Egalitarianism scale (e.g., "We have gone too far in pushing equal rights in this country") and six items for the Individualism-Communitarianism scale (e.g., "The government should stop telling people how to live their lives"; Kahan et al., 2011). One item was slightly modified for a Canadian sample (see Online Appendix A). The respondents were presented with the items in a random order and asked to rate their agreement with each one on a 6-point Likert-type scale, from "strongly disagree" to "strongly agree."

A Climate Change Risk Perception Index, selected from a previous study (for a complete list of items, see Leiserowitz, 2006), was used to measure the level of perceived risk (e.g., "How serious are the current impacts of global warming around the world?"). Participants were asked to respond to a series of nine questions on 4-point scales. The response wording varied slightly for these questions, from "not concerned" to "very concerned," or from "not likely" to "very likely," or from "not serious" to "very serious."

Eleven barriers were chosen to form a general Psychological Barrier scale. Barriers were selected based on theoretical (i.e., applicability to testing the cultural worldview predictions) and measurement considerations (i.e., previously established internal reliability; Kormos, Gifford, & Crawford, 2012). Each barrier was measured using two to four items, based on Gifford's (2011) exhaustive list (see Online Appendix B). Respondents were asked to rate their level of agreement with each of these items on a 7-point Likert-type scale from "strongly disagree" to "strongly agree."

A list of energy conservation behaviors (see Online Appendix C) was gathered from multiple sources (Department for Environment Food and Rural Affairs, 2008; Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Grønhøj & Thøgersen, 2012; F. G. Kaiser & Keller, 2001; Mirosa, Lawson, & Gnoth, 2011). The respondents were asked to report how often they engaged in each of the behaviors (e.g., "I buy energy-efficient light bulbs," "I line-dry clothes") on a 5-point scale from "never" to "always."

We asked the respondents 11 multiple-choice climate change knowledge questions (see Online Appendix D). This suite of questions focused on objective knowledge of the causes and processes related to climate change (e.g., "Which of the following are greenhouse gases?"; "What are the processes leading to global warming?"). Participants were assigned a score based on their number of correct answers.

Demographic data (i.e., age, gender, education, and income) were also collected. They were not central to our hypotheses but were included to increase empirical understanding in this area.

## Results

### Participants

After some participants were removed (see data screening below), 152 remained. Their mean age was 47 years ($SD$ = 17 years), and the sample included 69 males (45%) and 83 (55%) females. A few participants ($n$ = 4 or 2.6%) had not completed high school, 48 participants had a high school diploma or equivalent (31.6%), 53 had a college degree (34.9%), 31 had a bachelor's degree (20.4%), and the rest had a master's degree ($n$ = 9 or 5.9%), a professional degree ($n$ = 5 or 3.3%), or a doctorate degree ($n$ = 2 or 1.3%).

### Data Screening

To ensure quality control, two attention-checking items were included in different sections of the survey (e.g., "to validate your continued participation, please select 'strongly agree' for this question"). Seventeen participants were removed from the sample because they incorrectly answered at least one of the validation questions. To ensure high-quality data, a cutoff survey completion time of 10 min or more was preestablished, based on a pilot study; an additional 30 participants were removed because they answered the survey in less than 10 min ($M$ = 20 min 24 s, $Mdn$ = 15 min 57 s). One participant was considered an extreme case because that individual reported a total barrier perception more than 3 standard deviations from the mean.

The participants were given "not applicable" options for the behavior frequency questions to account for behavior that was beyond their control in a structural sense (e.g., apartment renters who do not have a programmable thermostat). On a participant-by-participant basis, we conducted horizontal mean imputation if participants answered at least eight of 11 items (details below). Two did not, so their behavior frequency data were excluded from the behavior frequency analyses, resulting in a sample size of 150 for these analyses.

### Reliabilities

Each scale was analyzed for internal consistency, and weak items (i.e., item-total correlation below .3) were removed. After four such items were removed, our 32-item Psychological Barrier scale had an excellent Cronbach's alpha ($\alpha$ = .95). The nine-item Climate Change Risk Perception scale also had an excellent alpha ($\alpha$ = .93). The two cultural scales were reasonably reliable; the six-item Hierarchy-Egalitarianism scale had an alpha of .72 and the six-item Individualism-Communitarianism scale had an alpha of .76. After

missing-data imputation, the 11-item Behavior Frequency scale also had a reasonable alpha (α = .74). The 11-Item Knowledge scale was treated as an omnibus measure: The number of correct answers for each participant was summed to create a global measure of knowledge.

## *Means and Standard Deviations*

On its 6-point Likert-type scale, higher scores on the Hierarchy-Egalitarianism scale indicate a more hierarchical orientation. The participants were considerably more egalitarian than hierarchical, on average ($M = 2.63$, $SD = 0.91$). Higher scores on the Individualism-Communitarianism scale indicate a more individualist orientation. The participants were slightly more individualist than communitarian, on average ($M = 3.65$, $SD = 0.84$; Table 1). On its 4-point scale, higher scores on the Climate Change Risk Perception Index indicate greater climate change risk perception. On average, climate change risk perception was between "somewhat serious" (2) and "serious" (3) ($M = 2.59$, $SD = 0.81$; Table 1). Higher scores on the 7-point Barriers scale indicate a stronger perception of barriers to pro-environmental behavior. On average, barrier perception in this sample was relatively low ($M = 2.60$, $SD = 0.90$; Table 1). Reported behavior frequency was measured on a 5-point scale. Higher scores indicate more reported energy conservation behavior frequency. On average, the participants reported mid- to high levels of behavior frequency ($M = 3.81$, $SD = 0.56$; Table 1). Horizontal mean imputation did not change the mean energy conservation behavior frequency. On the 11-point Climate Change Knowledge scale, participants had fairly low levels of climate change knowledge ($M = 3.55$, $SD = 2.04$; Table 1).

## *Findings*

H1 predicted that perception of climate change risk would decrease for participants who were more hierarchical or individualist. Hierarchy-egalitarianism ($r = -.34$, $p < .01$) and individualism-communitarianism ($r = -.19$, $p = .02$) were significantly negatively correlated with climate change risk perception. Multiple regression analysis was conducted to examine the magnitude of the relation between the two cultural worldview dimensions and climate change risk perception; together, they significantly explained 14% of the variance in risk perception ($F = 12.41$, $p < .001$, $R^2 = .14$), a medium effect size (Cohen, 1988). Hierarchy-egalitarianism ($\beta = -.30$, $p < .001$) and individualism-communitarianism ($\beta = -.16$, $p = .04$) were both significant predictors, confirming that egalitarians and communitarians perceived more climate risk than hierarchs and individualists. Therefore, H1 was supported.

**Table 1.** Correlations and Descriptives.

| Variable | Hierarchy-Egalitarianism scale | Individualism-Communitarianism scale | Behavior frequency | Barrier scale | Climate change risk | Scale range | Minimum | Maximum | *M* | *SD* |
|---|---|---|---|---|---|---|---|---|---|---|
| Hierarchy-egalitarianism | 1 | — | — | — | — | 1 to 6 | 1 | 4.83 | 2.63 | 0.91 |
| Individualism-communitarianism | .10 (.20) | 1 | — | — | — | 1 to 6 | 1 | 6 | 3.65 | 0.84 |
| Reported energy conservation | −.07 (.38) | −.02 (.78) | 1 | — | — | 1 to 5 | 2.18 | 5 | 3.81 | 0.56 |
| Psychological barriers | .39 (<.001) | .08 (.36) | −.32 (<.001) | 1 | — | 1 to 7 | 1 | 4.75 | 2.60 | 0.90 |
| Climate change risk perception | −.34 (<.001) | −.19 (.02) | .42 (<.001) | −.58 (<.001) | 1 | 1 to 4 | 1 | 4 | 2.59 | 0.81 |
| Climate change knowledge | −.06 (.47) | −.03 (.70) | .10 (.21) | −.13 (.12) | .14 (.08) | 0 to 11 | 0 | 8 | 3.55 | 2.04 |

*Note.* Larger values indicate greater scale scores.

H2 predicted that cultural cognition worldviews would significantly explain barrier perception. Multiple regression analysis revealed that the two cultural worldview dimensions significantly predict barrier perception, accounting for 16% of the variance ($F = 13.8$, $p < .001$, $R^2 = .16$). However, only hierarchy-egalitarianism contributed significantly ($\beta = .39$, $p < .001$; for individualism-communitarianism, $\beta = .04$, $p = .65$). More hierarchical participants perceived stronger barriers to pro-environmental behavior. Therefore, H2 was partially supported.

Building from H2, we also conducted exploratory analyses to unveil more subtle nuances in barrier perception, that is, to learn whether subsets of barriers might be related to cultural worldviews. First, principal components analyses (PCAs) were conducted to determine the underlying dimensions of the barriers. Oblique rotation was deemed appropriate because we chose to allow the factors to correlate (Field, 2013). Components with eigenvalues greater than one were retained (H. F. Kaiser, 1960). A cutoff loading of .4 was used to determine which items to retain for component interpretation (Field, 2013; Stevens, 2002).

The PCA resulted in the following six barrier components: (a) Mission Impossible (e.g., "Even if most people made this change, it wouldn't help enough"), (b) Interpersonal Influences (e.g., "Making this change would be criticized by those around me"), (c) Conflicting Goals and Aspirations (e.g., "Other things are more important to me right now than making this change"), (d) Technosalvation (e.g., "Large-scale technological changes are only part of the solution—It's also necessary that individuals make changes such as this in their personal lives," reversed), (e) Ignorance (e.g., "I don't understand many of the details about how to make this change"), and (f) Denial (e.g., "Honestly, I don't think that the 'problem' that this would solve is actually a problem"). Barrier items, factor loadings, and alphas are listed in Table 2.

Next, to gain better knowledge about how different individuals experience psychological barriers, we examined the relation between each barrier component and cultural worldviews (Table 3). The pattern of relations between cultural worldviews and the barrier components was very similar to the overall perception of barriers. For all six barrier components, more hierarchical participants perceived more barriers. As with overall perception of barriers, the individualism-communitarianism worldview was not correlated with the barrier components, except for Denial. The cultural worldviews are most strongly correlated with Denial ($r = .44$, $p < .001$, for hierarchy-egalitarianism, $r = .19$, $p = .02$, for individualism-communitarianism) and least strongly correlated with Mission Impossible ($r = .22$, $p = .01$, for Hierarchy-Egalitarian scale).

**Table 2.** Barrier Items and Factor Loadings.

| | Rotated factor loadings | | | | | |
|---|---|---|---|---|---|---|
| Item | Mission impossible | Interpersonal influences | Conflicting goals and aspirations | Technosalvation | Ignorance | Denial |
| Unfortunately, I don't think one person changing will make much difference | **.715** | −.082 | .123 | .115 | −.240 | .121 |
| Even if most people made this change, it wouldn't help enough | **.690** | .111 | .058 | −.045 | .336 | −.146 |
| It's not fair for me to have to change when really it's industry that's causing the majority of environmental problems | **.620** | .084 | .199 | −.167 | .092 | −.135 |
| I doubt that making this change would have a positive impact on the environmental situation | **.572** | −.047 | .238 | .122 | .129 | −.226 |
| I'm not sure whether or not making this change would help the environment | **.545** | −.172 | .260 | .232 | .088 | −.214 |
| It wouldn't be fair for me to change, because others are not changing | **.494** | .354 | .042 | .095 | −.235 | −.052 |
| This change is simply not under my control | **.466** | .422 | −.161 | −.078 | −.162 | −.012 |
| It wouldn't be equitable for me to put more effort into this than others around me | **.408** | .166 | .123 | .012 | −.372 | −.114 |
| I'm worried that my friends will criticize me for making this change | −.002 | **.838** | .045 | .043 | .015 | −.029 |

*(continued)*

**Table 2. (continued)**

| Item | Rotated factor loadings | | | | | |
|---|---|---|---|---|---|---|
| | Mission impossible | Interpersonal influences | Conflicting goals and aspirations | Technosalvation | Ignorance | Denial |
| If I made this change, I probably would be embarrassed when others noticed what I was doing | .020 | **.743** | .276 | .141 | −.104 | .121 |
| Making this change would be criticized by those around me | .023 | **.707** | .003 | −.056 | .105 | −.244 |
| This change would be inconsistent with my political views | −.144 | **.403** | .178 | .305 | −.139 | −.210 |
| I've put a lot of time and effort into my current lifestyle, and so I don't want to change | −.159 | .211 | **.840** | −.043 | −.133 | .007 |
| I prefer doing things that I enjoy rather than make this change | .040 | .047 | **.795** | .044 | .136 | −.112 |
| I can't change because I'm invested in my current lifestyle | .070 | .060 | **.781** | −.116 | −.075 | .105 |
| Other things are more important to me right now than making this change | .229 | −.213 | **.661** | −.059 | .014 | −.048 |
| Making this change would interfere too much with my other goals in life | .049 | .090 | **.643** | .071 | −.021 | −.062 |
| I don't see why I should inconvenience myself when others are not making this change | .245 | .212 | **.459** | .096 | −.179 | −.035 |

*(continued)*

**Table 2. (continued)**

| Item | Rotated factor loadings | | | | | |
|---|---|---|---|---|---|---|
| | Mission impossible | Interpersonal influences | Conflicting goals and aspirations | Technosalvation | Ignorance | Denial |
| There's no need to change because I'm not convinced that a serious environmental problem even exists[a] | .248 | −.074 | .379 | .246 | −.191 | −.233 |
| Large-scale technological changes are only part of the solution—It's also necessary that individuals make changes such as this in their personal lives (reversed) | .036 | .073 | −.153 | **.848** | −.025 | .208 |
| It's necessary for individuals to make changes, such as this, to help mitigate climate change because other technological solutions will not be sufficient to solve environmental problems (reversed) | −.097 | .045 | .044 | **.689** | .211 | −.211 |
| My political understanding makes me realize that changes like this are not necessary | .065 | −.130 | .158 | **.398** | −.273 | −.331 |
| I don't understand many of the details about how to make this change | −.148 | .011 | .092 | −.046 | **−.801** | −.012 |
| There's so much information out there that I'm confused about how to make this change | .029 | .061 | −.033 | −.118 | **−.698** | −.308 |
| I don't understand the reasons why this change is important[a] | .285 | .056 | .276 | .176 | −.358 | −.075 |

*(continued)*

**Table 2. (continued)**

| Item | Rotated factor loadings | | | | | |
|---|---|---|---|---|---|---|
| | Mission impossible | Interpersonal influences | Conflicting goals and aspirations | Technosalvation | Ignorance | Denial |
| I don't believe that the news media have honest intentions when they encourage this change | −.049 | .147 | .017 | −.242 | −.056 | **−.818** |
| I don't trust the supposedly scientific models that are used to call for this change | .057 | .077 | .017 | .034 | −.065 | **−.807** |
| I think that "climate scientists" have a hidden motive for promoting this change | .032 | .040 | −.017 | .081 | −.058 | **−.802** |
| There's no need to change because the current "environmental crisis" has been exaggerated | .090 | −.012 | .227 | .228 | −.035 | **−.654** |
| I don't trust the companies that are promoting this change because it's probably just another example of greenwashing | .321 | .151 | −.279 | .156 | −.252 | **−.497** |
| Honestly I don't think that the "problem" that this would solve is actually a problem | .227 | −.035 | .320 | .213 | −.029 | **−.454** |
| I don't see why I should make this change when even experts are uncertain about what's going to happen with the environment[a] | .231 | −.044 | .315 | .314 | −.121 | −.376 |
| Eigen values | 13.02 | 2.52 | 1.91 | 1.56 | 1.34 | 1.21 |
| % of variance | 40.70 | 7.86 | 5.96 | 4.89 | 4.17 | 3.79 |
| α | .87 | .79 | .87 | .56 | .70 | .91 |

*Note*. Principal components analysis using oblique rotation. Items above cutoff value are indicated in bold.
[a]Item not retained for component interpretation because it is below cutoff value (<0.4).

**Table 3.** Barrier Components and Correlations.

| | Hierarchy-egalitarianism | Individualism-communitarian | Climate change risk | 1 | 2 | 3 | 4 | 5 | 6 | Barriers overall |
|---|---|---|---|---|---|---|---|---|---|---|
| Hierarchy-egalitarianism | 1 | | | | | | | | | |
| Individualism-communitarian | .10 (.20) | 1 | | | | | | | | |
| Climate change risk perception | −.34 (<.001) | −.19 (.02) | 1 | | | | | | | |
| Component 1: Mission impossible | .22 (.01) | .02 (.82) | −.49 (<.001) | 1 | | | | | | |
| Component 2: Interpersonal influences | .31 (<.001) | .09 (.25) | −.25 (<.001) | .49 (<.001) | 1 | | | | | |
| Component 3: Conflicting goals and aspirations | .28 (<.001) | −.04 (.62) | −.56 (<.001) | .65 (<.001) | .43 (<.001) | 1 | | | | |
| Component 4: Technosalvation | .28 (<.001) | .03 (.69) | −.37 (<.001) | .35 (<.001) | .29 (<.001) | .28 (<.001) | 1 | | | |
| Component 5: Ignorance | .26 (<.001) | −.02 (.82) | −.22 (.01) | .46 (<.001) | .50 (<.001) | .46 (<.001) | .23 (<.001) | 1 | | |
| Component 6: Denial | .44 (<.001) | .19 (.02) | −.51 (<.001) | .71 (<.001) | .57 (<.001) | .54 (<.001) | .46 (<.001) | .54 (<.001) | 1 | |
| Overall perception of barriers | .39 (<.001) | .08 (.36) | −.58 (<.001) | .88 (<.001) | .67 (<.001) | .78 (<.001) | .54 (<.001) | .65 (<.001) | .88 (<.001) | 1 |
| Energy conservation behavior | −.07 (.38) | −.02 (.78) | .42 (<.001) | −.23 (<.01) | −.17 (.03) | −.46 (<.001) | −.19 (.02) | −.14 (.10) | −.22 (.01) | −.32 (<.001) |

*Note.* Listed are correlation coefficients (*r*) and significance levels (*p* values).

**Table 4.** Barrier Perception Predicted ($n$ = 152).

| Predictors | β | $p$ | $sr^2$ |
|---|---|---|---|
| Hierarchy-egalitarianism | .22 | <.01 | .04 |
| Individualism-communitarianism | −.07 | .34 | .00 |
| Risk perception | −.56 | <.01 | .21 |
| Knowledge | −.04 | .61 | .00 |
| Age | −.03 | .66 | .00 |
| Gender | .02 | .74 | .00 |
| Education | −.07 | .37 | .00 |
| $F$ | 13.04 | <.001 | |
| $R^2$ | .39 | | |

*Note.* Higher scores indicate a more hierarchical orientation and a more individualist orientation. The semipartial correlation squared ($sr^2$) indicates the unique proportion of variance explained by each predictor (Field, 2013). Gender is scored 1 = male, 2 = female.

H3 predicted that the relation between cultural cognition worldviews and perceived barriers would be mediated through climate change risk perception. Recall that our conceptual model suggests that (a) perceived barriers should be explained by cultural worldviews and climate change risk perception (confirmed in Table 4) and that (b) part of the variance in perceived barriers that is explained by cultural worldviews should be mediated by risk perception. To test H3, PROCESS (Hayes, 2015) was used. All variables were standardized prior to conducting the analyses.

As predicted, the relation between hierarchy-egalitarianism and barrier perception was partially mediated through risk perception (Figure 2). The total effect of hierarchy-egalitarianism on barriers decreased from $b = .39$, $p < .001$, to $b = .22$, $p < .01$, when climate change risk perception was taken into account, a significant indirect effect ($b = .17$, $Z = 3.8$, $p < .001$), representing an effect size of 18% (i.e., $k^2 = .18$, 95% confident interval [CI] = [.10, .28]), a medium effect (Cohen, 1988; Field, 2013). Furthermore, stepwise regression analyses showed that the proportion of variance in barriers explained by the Hierarchy-Egalitarianism scale decreased from 15% to 4% when climate change risk perception was included. Therefore, H3 was supported.

Finally, to examine the cumulative and relative importance of the psychological predictors and the demographic variables in predicting psychological barriers, multiple regression analyses were conducted. These analyses revealed that seven predictors (i.e., hierarchy-egalitarianism, individualism-communitarianism, climate change risk perception, level of knowledge, age,

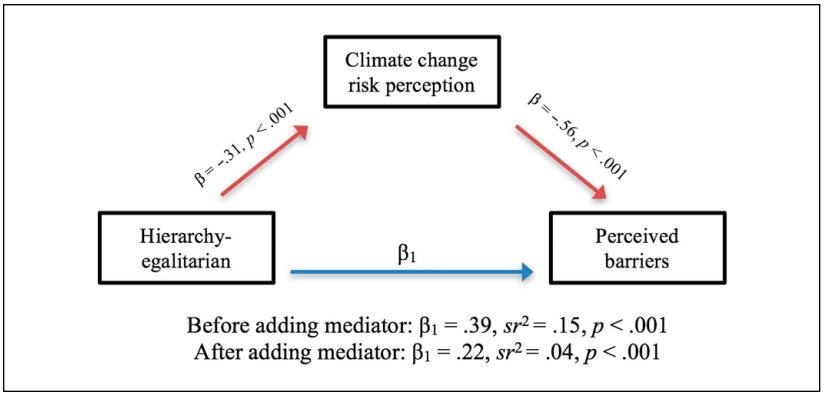


**Figure 2.** Climate change risk perception as mediator.
*Note.* Sobel test for indirect effect: $b = .17$, $SE = .05$, $Z = 3.80$, $p < .001$, $R^2$ mediation effect size = .11, 95% BCa CI = [.05, .21], $k^2$ effect size = .18, 95% BCa CI = [.10, .28], full model $R^2 = .38$, $p < .001$. 95% BCa CI = 95% bootstrap confidence interval; $sr^2$ = semipartial correlation squared.

gender, and education) significantly explained 39% of the variance in perceived barriers ($F = 13.04$, $R^2 = .39$, $p < .001$; Table 4). Climate change risk perception was the most important predictor ($\beta = -.56$, $p < .001$), a large effect size, followed by hierarchy-egalitarianism ($\beta = .22$, $p < .01$). Perceived barriers decreased as individuals perceived greater climate change risk and were more egalitarian. No other predictor significantly contributed to the model. Income was excluded because so few answered ($n = 57$).

H4 predicted that stronger barrier perception would be correlated with less reported energy conservation behavior, and it was $r = -.32$, $p < .001$. We then dug deeper to tease out relations between reported energy conservation behavior and each barrier component. In sum, reported energy conservation behavior was correlated with all but one (i.e., Ignorance) barrier component. Reported behavior was most strongly correlated with stronger Conflicting Goals and Aspirations ($r = -.46$, $p < .001$) and least strongly correlated with Interpersonal Influences ($r = -.17$, $p = .03$; Table 3). Therefore, H4 is partially supported.

Last, to examine the relative importance of our reported energy conservation predictors, multiple regression analyses were conducted. These analyses revealed that our predictors (i.e., hierarchy-egalitarianism, individualism-communitarianism, climate change risk perception, barrier components, climate change knowledge, and demographics) explained 31% of the variance in reported energy conservation behavior (Table 5). Of these, however, only

**Table 5.** Energy Conservation Behavior Frequency Predicted ($n$ = 150).

| Predictors | β | $p$ | $sr^2$ |
|---|---|---|---|
| Hierarchy-egalitarian | .07 | .21 | .00 |
| Individualism-communitarianism | .02 | .77 | .00 |
| Risk perception | .20 | .01 | .04 |
| Barrier Component 1 | .08 | .17 | .00 |
| Barrier Component 2 | −.04 | .47 | .00 |
| Barrier Component 3 | −.19 | .001 | .04 |
| Barrier Component 4 | −.02 | .62 | .00 |
| Barrier Component 5 | .03 | .58 | .00 |
| Barrier Component 6 | .004 | .94 | .00 |
| Knowledge | .01 | .53 | .00 |
| Age | .004 | .10 | .00 |
| Gender | −.01 | .87 | .00 |
| Education | .05 | .24 | .00 |
| $F$ | 4.58 | <.001 | |
| $R^2$ | .31 | | |

*Note.* Higher scores indicate a more hierarchical orientation and a more individualist orientation. The semipartial correlation squared ($sr^2$) indicates the unique proportion of variance explained by each predictor (Field, 2013). Component 1 = Mission Impossible; Component 2 = Interpersonal Influences; Component 3 = Conflicting Goals and Aspirations; Component 4 = Technosalvation; Component 5 = Ignorance; Component 6 = Denial. Gender is scored 1 for male, 2 for female.

climate change risk perception and Conflicting Goals and Aspiration contributed significantly (β = .20, $p$ = .01, and β = −.19, $p$ = .001).

## Discussion

We proposed a model in which cultural cognition worldviews would predict psychological barriers to pro-environmental behavior, mediated by climate change risk perception, and psychological barriers would predict self-reported energy conservation behavior. All four hypotheses were at least partially supported. This study examined correlations rather than causal relations; the directionality of our conceptual model should be verified in future studies.

Cultural worldviews are correlated with the perception of climate change risk and perceived psychological barriers to pro-environmental behavior. Furthermore, the relation between cultural worldviews and perceived barriers is mediated by climate change risk perception. Psychological barriers to pro-environmental behavior are associated with self-reported energy conservation

behavior. Climate change risk perception is the strongest predictor of barriers to pro-environmental behavior and of self-reported energy conservation behavior frequency, at least of the constructs examined in this study. Finally, the study demonstrated that hierarchy-egalitarianism is a stronger predictor of climate change risk perception and perceived barriers to pro-environmental behavior than is individualism-communitarianism.

### *Psychological Barriers*

The results show that cultural worldviews are most strongly correlated with climate change beliefs (i.e., Denial) as psychological barriers to energy conservation. Denial was the only barrier that was correlated with both cultural worldview dimensions (i.e., hierarchy-egalitarian and individualism-communitarianism). This is not surprising, considering cultural cognition theory's predictions about the role of worldviews on climate change skepticism (e.g., Kahan et al., 2011).

On the contrary, Mission Impossible was the barrier least strongly correlated with cultural worldviews, suggesting that some internal justifications (i.e., psychological barriers) for not behaving in a pro-environmental manner might be more ideologically motivated than others. For example, agreeing with the statement "There's no need to change because the current 'environmental crisis' has been exaggerated" appears to be more ideologically motivated than "Even if most people make this change, it wouldn't help enough." However, because we did not examine the mechanisms underlying cultural cognition or ideologically motivated cognition, this hypothesis needs to be tested further.

Some barrier components were not correlated with energy conservation behavior frequency. Perhaps this is because the energy conservation behaviors included in the study were low-cost, relatively easy, convenient behaviors. We speculate that the role of psychological barriers differs for low- and high-cost behaviors, and likely across environmental domains. For example, Ignorance (i.e., not knowing how to change) might not be a barrier for easier behaviors such as taking shorter showers, but it may apply to some high-cost behaviors such as installing solar panels. Similarly, structural barriers might be more important for high-cost behaviors (e.g., not owning one's residence or purchasing expensive energy-efficient appliances). This should be investigated for different types of pro-environmental behaviors.

The results provide support for the important role played by the "dragons of inaction." The barrier components resulting from the PCA fit the general barrier categories identified by Gifford (2011). However, the Perceived Behavioral Control and Social Norms barrier categories from Gifford are more closely linked than originally suggested, at least when examined in

relation to energy conservation behavior. The structure of barrier components should be examined further while including more items, to measure as many of the theorized specific manifestations of the psychological barriers as possible.

## Cultural Cognition Theory

The study also provides support for cultural cognition theory. Most previous studies of it were conducted in the United States, although one was conducted in Switzerland (Shi, Visschers, & Siegrist, 2015), one in Australia (Xue et al., 2014), one in the United Kingdom (Kahan, Jenkins-Smith, Tarantola, Silva, & Braman, 2015), and one in China (Xue, Hine, Marks, Phillips, & Zhao, 2016). To the best of our knowledge, this study is the first to examine it in Canada. Our finding that cultural worldviews have a small but significant relation with climate change risk perception is consistent with previous research (e.g., Kahan, Braman, Gastil, et al., 2007; Kahan, Braman, Slovic, et al., 2007; Overdevest & Christiansen, 2013).

However, the results also raise some concerns about the cultural cognition worldview scales. They point to an imbalance between the two cultural dimensions in their ability to predict climate change risk perception. This is consistent with previous results investigating three types of risks (Kahan, Braman, Gastil, et al., 2007), although this imbalance was never explicitly mentioned by those authors. Individualism-communitarianism and hierarchy-egalitarianism were almost equally important for nonenvironmental risks in that study (i.e., gun-risk perception and abortion risks), but hierarchy-egalitarianism had more than twice the predictive ability of individualism-communitarianism for environmental risks (Kahan, Braman, Gastil, et al., 2007). The present results for climate change risk perception also suggest a similar imbalance between the two scales.

Taken together, these results may constitute cause for concern about the individualism-communitarianism worldview measurement. Alternatively, the Individualism-Communitarianism Worldview scale may simply be less relevant for predicting environmental or climate change risk perception than for other types of risks. More specifically, beliefs about social equality (i.e., hierarchy-egalitarianism) might be more informative than beliefs about government regulation (i.e., individualism-communitarianism) for climate change risk perception, as opposed to other types of risks. Future research should further critically examine how each cultural cognition worldview dimension relates to climate change risk perception.

The present results indicate that cultural worldviews are significantly related to perceived climate change risk and perceived barriers, but not to

reported energy conservation behavior. This is consistent with the results in a previous study that reported a significant relation between cultural worldviews (i.e., cultural theory and myths of nature), environmental beliefs, and attitudes, but none between cultural worldviews and pro-environmental behavior (i.e., car use; Steg & Sievers, 2000). In contrast, a study of "cultural environmental biases" showed that these directly predicted pro-environmental behavior (Price, Walker, & Boschetti, 2014). However, the cultural *environmental* biases measured in that study are arguably more proximal to one's pro-environmental behavior than one's cultural worldviews. Nevertheless, all these studies fit the proposed domain-context-behavior model (van der Linden, 2016b), in which broader orientation (e.g., values) do not directly influence specific behavior, but do so indirectly *through* their influence on context variables and general behavioral intentions.

## *Implications and Directions for Future Research*

The role of climate change risk perception as a psychological barrier to climate-relevant behavior itself should be investigated further. More research is needed about the *sequence* of known psychological barriers (e.g., Does Denial come before Conflicting Goals and Aspirations?), the possible interaction or amplification effects of experiencing multiple barriers, and the possible feedback loops between climate change risk perception and other "dragons of inaction" (Gifford, 2011) such as Social Norms, Denial, Optimism Bias, and Judgmental Discounting. Are some barriers less stable through time and therefore more malleable than others? Can some psychological barriers be eliminated? If a barrier is eliminated, do spillover or, alternatively, rebound effects occur? Advancing theoretical knowledge of the psychological barriers will allow for better targeting of influential barriers with climate policies and programs.

This study demonstrates that climate change risk perception negatively predicts psychological barriers and positively predicts energy conservation behavior. The link between climate change risk perception and other types of pro-environmental behaviors has been demonstrated in previous research (e.g., Dietz, Stern, & Guagnano, 1998; McCright, Dunlap, & Xiao, 2013) and is recognized in theory (e.g., awareness of consequences in value-belief-norm theory; Stern et al., 1999). Similarly, previous research indicated that belief in anthropogenic climate change is correlated with risk perception (Safi et al., 2012) and that increasing the perception of scientific consensus on climate change is a gateway to increasing the belief in anthropogenic climate change and, in turn, for more climate change risk perception and more support for public action on climate change (van der Linden, Leiserowitz,

Feinberg, & Maibach, 2015). Together, these findings suggest that a key starting point for climate policy support or pro-environmental behavior lies in increasing the public perception of scientific consensus on climate change.

### Limitations

Several limitations should be considered when interpreting the results of this study. We focused on psychological barriers. Had we included structural barriers (e.g., no access to public transportation), a more complete picture of the relations between climate change risk, psychological barriers, structural barriers, and energy conservation behavior might have emerged.

Although climate change risk perception had the strongest relation to reported energy conservation behavior, it is not a situation-specific variable (van der Linden, 2016b). Therefore, it might not have been the strongest predictor if we had measured other variables that may be causally closer to the measured behavior, such as energy conservation behavioral intentions or habits (Klöckner, 2013; van der Linden, 2016b).

We also conducted exploratory analyses of the relative importance of our predictor variables to perceived barriers and reported energy conservation behavior, and exploratory analyses of the psychological barrier components. Exploratory analyses can result in Type I errors, so they should be confirmed in future studies. Finally, we conducted horizontal mean imputation for energy conservation behavior frequency, which is the preferred method for handling missing data in multiple-item scales (Hawthorne & Elliott, 2005). However, it can sometimes lead to reduced variances.

## Conclusion

The present study demonstrated that climate change risk perception partly mediates the relation between cultural worldviews and perceived barriers. The results point to differences in the perception of psychological barriers for individuals with different worldviews. We speculate that the perception of psychological barriers also varies depending on the pro-environmental behavior domain, and perhaps whether the behavior is low- or high cost.

Furthermore, we demonstrated that climate change risk perception is an important predictor of both perceived barriers to and self-reported energy conservation behavior. Given that communicating the scientific consensus on climate change can increase the belief in anthropogenic climate change and climate change risk perception, one avenue for future efforts is to focus on effectively communicating this consensus (e.g., van der Linden, Leiserowitz, Feinberg, & Maibach, 2014). Climate change risk perception is negatively

related to other significant barriers to energy conservation behavior and, thus, such efforts may also help reduce the perception of psychological barriers. Other approaches should focus on directly reducing those barriers to energy conservation behavior identified in this study.

Current climate change is largely accelerated by human behavior, and therefore, it needs to be mitigated by changes in behavior at both the individual and societal levels. Public acceptance of climate change is a necessary first step, but combinations of voluntary, regulatory, and structural approaches are also needed to reduce GHG emissions. More efficient climate change communication must be based on sound empirical research. This will require continued cooperation between climate scientists, social scientists, and policy makers.

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