

# Cognitive reappraisal and pro-environmental behavior: The role of global climate change perception

Angelo Panno\*, Giuseppe Carrus\*, Fridanna Maricchiolo\* & Lucia Mannetti‡

\* Department of Education, Experimental Psychology Laboratory, Roma Tre University, Rome, Italy

‡ Department of Social & Developmental Psychology, Sapienza University of Rome, Rome, Italy

## Correspondence

Angelo Panno, Department of Education,  
Experimental Psychology Laboratory, Roma  
Tre University, Via Milazzo, 11/B-00185,  
Rome, Italy.  
E-mail: angelopanno@yahoo.it

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## Abstract

Ecosystems are under pressure due to global climate change. Empirical evidence showing how people can reduce their ecological footprint is needed. It has been shown that a consequence of the perception of climate change is an increase in ecologically responsible behavior, but little is known about the antecedents of this relationship. In two field studies, we examined whether an emotion-regulation strategy (i.e., cognitive reappraisal) predicted both climate change perception and pro-environmental behavior. Undergraduate students at two university campuses participated in Study 1 ( $n = 299$ ). We found that individuals with a stronger tendency for habitual use of cognitive reappraisal showed both increased global climate change perception and a greater extent of pro-environmental behavior compared with individuals with a lower such tendency. As expected, our results also showed the mediating role of climate change perception in the relationship between people's habitual use of cognitive reappraisal and pro-environmental behavior. These findings were replicated in Study 2 ( $n = 81$ ) with a non-student sample. Implications for future studies and environmental risk communication strategies are discussed.

Global climate change represents one of the most relevant environmental issues in current times. Climate research suggests that many consequences of climate change such as the raising of sea levels and more frequent droughts could be imminent (e.g., Hansen, Sato, & Ruedy, 2012; Palmer, 2014). In the short term, it is commonly assumed that substantial reductions of greenhouse gases emissions are required to adequately tackle this trend (Intergovernmental Panel on Climate Change, 2013). While there is a growing consensus that a substantial portion of global climate change is due to human activity, still, relatively few individuals are willing to significantly adapt their lifestyle in order to reduce their ecological footprint. It has been shown that a consequence of the perception of climate change is an increase in ecologically responsible behavior (e.g., Doherty & Clayton, 2011; Gifford, 2011; Gifford & Comeau, 2011; Heath & Gifford, 2006; Swim, Markowitz, & Bloodhart, 2012; Swim et al., 2011), but little is known about antecedents of this phenomenon. It is therefore relevant to understand whether and how specific psychological factors may influence environmentally friendly behavior through more accurate perceptions of climate change.

We intend to outline some similarities between human perception of climate change and risk perception. The threat of climate change encompasses the concept of risk, although it represents a unique phenomenon because of its breadth and consequences. "Climate change is an

evolutionarily novel risk that does not represent a clearly observable physical danger" (van der Linden, 2014, p. 432). People can become more aware of the risks related to climate change when, for example, an adverse climatic event occurs near their place of residence or they detect changes in their local climate (Akerlof, Maibach, Fitzgerald, Cedeno, & Neuman, 2013; Howe, Markowitz, Lee, Ko, & Leiserowitz, 2013; Joireman, Truelove, & Duell, 2010; Zaval, Keenan, Johnson, & Weber, 2014).

Climate change is related to decision-making research as the threat of climate change represents a potential risk that individuals are required to deal with by making decisions under conditions of uncertainty (e.g., Leiserowitz, 2005; Patt & Weber, 2014; Zaval et al., 2014). Consistent with this connection, a growing number of scholars are pointing out that some antecedents of risk taking, emotions, for example, are also related to a perception of climate change (e.g., Doherty & Clayton, 2011; Leiserowitz, 2006; Myers, Nisbet, Maibach, & Leiserowitz, 2012; Roeser, 2012; Siegrist, Cousin, Kastenholz, & Wiek, 2007; Smith & Leiserowitz, 2014; van der Linden, 2014; Weber, 2006). Smith and Leiserowitz (2014) also found that some discrete emotions such as worry, interest, and hope have a large influence on how individuals support climate change policies. In this vein, a meta-analysis by Bamberg and Möser (2007) has pointed out that guilt feelings represent a key determinant of ecologically responsible behavior (also Carrus, Passafaro, & Bonnes,

2008; Kals & Maes, 2002; Kals, Schumacher, & Montada, 1999; Onwezen, Bartels, & Antonides, 2014). Interestingly, Bamberg and Möser (2007) focused on guilt feelings, which encompass a strong sense of individual responsibility, while Reese and Jacob (2015) extend these results focusing on moral anger, which is triggered when observing careless actions of others toward nature.

Several authors (e.g., Damasio, 1994; Izard, 2002; Kahneman, 2003; LeDoux, 2012; Levine & Leven, 2014) have given emotion a primary role in motivating human behavior. According to information-processing theories (e.g., Deci & Ryan, 1985; Dykas & Cassidy, 2011; Evans, 2008), the prerequisite behind these ideas is that emotion is taken into account when one is deciding to act and consequently is used as information. Keller and colleagues suggested that the way in which individuals appraise climate change-related events is a powerful means of understanding mechanisms underlying global warming risk perception (Keller *et al.*, 2012). We are interested in understanding whether, and how, individual differences in regulating emotions can enhance perceptions of climate change and, in turn, be related to pro-environmental behavior.

From a different line of research, pioneered by Gross and John (2003), we know that people feeling an emotion may use some specific strategies to regulate it. It has been demonstrated that a specific emotion-regulation strategy (i.e., cognitive reappraisal) provides an array of benefits enhancing people's daily life across various domains, such as academic achievement, functional attitudes, job performance, career success and mood management behavior, and decision making (e.g., Finkel, Slotter, Luchies, Walton, & Gross, 2013; Gross, 2011; Gross & John, 2003; Leroy, Grégoire, Magen, Gross, & Mikolajczak, 2012; John & Gross, 2004; Panno, Lauriola, & Figner, 2013). Cognitive reappraisal represents one's ability to reframe a situation in order to understand how environmental cues may trigger some emotions (e.g., Aldao, Jazaieri, Goldin, & Gross, 2014; Aldao, 2013; Gross & John, 2003; John & Gross, 2004). Accordingly, some authors have shown that people who habitually use a cognitive reappraisal strategy use the information conveyed by emotion as a source for motivating their behavior (Aldao, 2013; Carstensen, Fung, & Charles, 2003; Gross, 2011; Gross & John, 2003; Martin Braunstein, Herrera, & Delgado, 2014).

Empirical research has shown that cognitive reappraisal is strongly related to a high capacity of working memory during information processing, and, consequently, this may influence the appraisal of risk (e.g., Gross, 2011; Richards & Gross, 2000; Schmeichel, Volokhov, & Demaree, 2008). In this vein, some authors have also shown that this emotion-regulation strategy is related to risk perception. Specifically, some studies have shown that it is positively related to a greater perception of risk and a more accurate appraisal of the consequences of risk behavior (Kober, Kross, Mischel, Hart, & Ochsner, 2010; Magar, Phillips, & Hosie, 2008; Martin & Delgado, 2011). In our study, we argue that cognitive reappraisal can be taken into account in order to deal with emotions associated with climate change phenomena. For instance,

people habitually using cognitive reappraisal strategy may use the global climate change-related emotions (e.g., fears and concerns with regard to local flooding and abnormal daily temperatures) as information to avoid environmentally damaging behavior. By contrast, their inability to process these emotions may lead people to maintain an unsustainable lifestyle.

## THE PRESENT STUDY

Previous environmental research has demonstrated that some antecedents of risk perception, such as emotion, are also related to climate change perception (e.g., Leiserowitz, 2006; Smith & Leiserowitz, 2014; van der Linden, 2014). Other studies have shown that people's cognitive reappraisal is associated with a more accurate appraisal of risk as well as with the consequences of risk behavior (e.g., Kober *et al.*, 2010; Magar *et al.*, 2008; Martin & Delgado, 2011). The theoretical account behind our hypotheses is that people's cognitive reappraisal determines how individuals appraise climate change-related stimuli (e.g., a rise in temperature, a change in weather patterns, and emotions concerning these phenomena) and the type of goals they pursue (e.g., reducing their ecological footprint). Thus, drawing on environmental and emotion studies, in this research, we present two studies testing three hypotheses: First, we predicted that individuals with a stronger tendency for habitual use of cognitive reappraisal would show increased global climate change perception compared with individuals with a lower such tendency. Second, we predicted that such individuals would show more pro-environmental behavior compared with individuals with a lower such tendency. Third, we expected that habitual use of cognitive reappraisal is related to ecologically responsible behavior through global climate change perception. Specifically, we expected that individuals with a stronger tendency for habitual use of cognitive reappraisal would show increased climate change perception, which, in turn, is related to ecologically responsible behavior.

As people's political orientation could be related to global climate change as well as pro-environmental behavior (e.g., Fransson & Garling, 1999; Neumayer, 2004, see also Swim *et al.*, 2012), we also included a political orientation measure to test whether the relationships investigated in our studies are perhaps less likely to be moderated as outcomes of this factor. Because Study 1 is based on undergraduate student sample, three items of social desirability were included in order to control for the possibility that socially desirable responses explained significant correlations (Crowne & Marlowe, 1960).

## STUDY 1

### Method

#### Participants

Two hundred and ninety-nine undergraduate students at two university campuses of Rome, Italy (Roma Tre

and Sapienza Universities) participated in the study ( $M_{\text{age}}=23$ ;  $SD=2.66$ ; range 19 to 40 years; 61% women).

### Procedure and Measures

The aim of collecting data across two different university campuses including several faculties was twofold. First, in Italy, some faculties (e.g., Psychology) have a higher percentage of students with a liberal orientation than others (e.g., Engineering). This procedure allowed us to recruit participants with political orientations ranging between liberal and conservative. Second, recruiting participants across different faculties of these two university campuses helped to better balance gender.

Data were collected through an online questionnaire administered by trained interviewers. Participants individually filled in the questionnaire on a laptop. They were assured anonymity about their responses. Data were collected from May to July 2014.

Because this first study was part of a larger survey that aims to investigate a wide range of attitudes and behavior related to climate change, we measured some constructs with abbreviated scales (i.e., three items for cognitive reappraisal and climate change perception). In Study 2, we used the full measures of these constructs (six and five items, respectively).

**Social Desirability.** To assess social desirability, we used three items of the Marlowe–Crowne Social Desirability Scale: “I have never deliberately said something that hurt someone’s feelings”; “I have never intensely disliked anyone”; and “I never hesitate to go out of my way to help someone in trouble” (Crowne & Marlowe, 1960). Ratings were made on a 5-point Likert-type scale, with the response anchored at the ends with 1 (*strongly disagree*) and 5 (*strongly agree*).

**Political Orientation.** Self-placement on the left–right (liberal–conservative) dimension was measured with the following item: “Considering the current political context in Italy, how would you describe your political orientation?” A 5-point response scale was used (1 = *left*, 2 = *center-left*, 3 = *center*, 4 = *center-right*, and 5 = *right*).

**Cognitive Reappraisal.** We assessed people’s cognitive reappraisal strategy through three items of the Italian version of the emotion-regulation questionnaire (Balzarotti, John, & Gross, 2010). Respondents rated the extent to which they agree with self-descriptive statements reflecting cognitive reappraisal: “When I’m faced with a stressful situation, I make myself think about it in a way that helps me stay calm”; “I control my emotions by changing the way I think about the situation I’m in”; and “When I want to feel more positive emotion, I change the way I’m thinking about the situation”;  $\alpha=.70$ . Ratings were made on a 5-point Likert-type scale, with the response anchored at the ends with 1 (*strongly disagree*) and 5 (*strongly agree*).

**Global Climate Change Perception.** To assess people’s global climate change perception, we used three items from Heath and Gifford (2006): “I have already noticed some signs of global warming”; “It seems to me that temperature is warmer now than in years before”; and “It seems to me that weather patterns have changed compared to when I was a child”;  $\alpha=.80$ . Respondents rated the extent to which they agree with these statements, on a 5-point Likert-type scale, with the response anchored at the ends with 1 (*strongly disagree*) and 5 (*strongly agree*).

**Pro-Environmental Behavior.** To assess pro-environmental behavior, we used 16 items<sup>1</sup> of the Student Environmental Behavior Scale (Markowitz, Goldberg, Ashton, & Lee, 2012; see Supporting Information). It is a self-report measure assessing environmentally responsible behavior that people adopt in order to reduce their ecological footprint. In addition, we measured participants’ habitual consumption of vegetables with the following item: “I usually prefer to eat vegetables than meat.” A composite score of these items indicated participants’ pro-environmental behavior;  $\alpha=.77$ . Ratings were made on a 5-point Likert-type scale, with the response anchored at the ends with 1 (*strongly disagree*) and 5 (*strongly agree*).

### Results

To investigate our hypotheses of the relationships between cognitive reappraisal, global climate change perception, and pro-environmental behavior, we computed zero-order correlations among these variables (Table 1). As predicted, cognitive reappraisal and climate change perception were both significantly positively correlated with pro-environmental behavior. Our results also showed that cognitive reappraisal was significantly positively correlated with climate change perception. The effect sizes of these relationships were around the small effect size threshold as they range from  $r=.12$  to  $r=.22$  (Cohen, 1988). Participants’ political orientation was significantly associated with pro-environmental behavior (Table 1).

As expected, the associations of cognitive reappraisal with global climate change perception and pro-environmental behavior were supported by two multiple regression models, where global climate change perception and pro-environmental behavior scores were regressed on participants’ reappraisal and social desirability scores (global climate change perception, reappraisal  $\beta=.12$ ,  $p=.050$ ; pro-environmental behavior, reappraisal  $\beta=.14$ ,  $p<.05$ ). An insignificant effect of social desirability was found ( $p>.10$ ).

To understand the mechanisms underlying the relationships between cognitive reappraisal strategy, global

<sup>1</sup>We have excluded some items from the classical version of the Student Environmental Behavior Scale because either they appeared not suitable to the Italian context (e.g., “Warm your car in the morning before driving”) or the wording was duplicating another item of the scale (e.g., “Throw recyclables, e.g., plastic bottle, in the trash can”).

**Table 1.** Means, standard deviations, and intercorrelations among variables investigated in Study 1

	1	2	3	4
1. Cognitive reappraisal	1			
2. Global climate change	.12*	1		
3. Pro-environmental behavior	.14*	.22**	1	
4. Political orientation	-.07	-.10	-.20**	1
<i>M (SD)</i>	3.21 (0.74)	4.04 (0.83)	2.83 (0.53)	2.72 (1.32)

Note:

\* $p < .05$ ;

\*\* $p < .01$ ;

\*\*\* $p < .001$ .

climate change perception, and pro-environmental behavior, we used the PROCESS macro for SPSS (IBM Corporation, Armonk, NY, USA; Hayes, 2013), which tested our mediation hypothesis. The mediation model was estimated to derive the total, direct, and indirect associations of cognitive reappraisal strategy with pro-environmental behavior through global climate change perception. We estimated the indirect effect of cognitive reappraisal on pro-environmental behavior, quantified as the product of the ordinary least-squares (OLS) regression coefficient estimating global climate change perception from cognitive reappraisal strategy (path *a* in Figure 1), and the OLS regression coefficient estimating pro-environmental behavior from global climate change perception, controlling for cognitive reappraisal (path *b* in Figure 1). A bias-corrected bootstrap confidence interval (CI) for the product of these paths that does not include zero provides evidence of a significant indirect effect (Preacher & Hayes, 2008). Using the PROCESS macro with 5000 bootstrap samples, our results revealed a significant positive indirect effect of cognitive reappraisal on pro-environmental behavior through global climate change perception (point estimate = 0.10; 95% CI = 0.011 to 0.263).

Preacher and Kelley (2011) suggested the use of kappa squared as a measure of effect size for the indirect effect. The kappa squared is the ratio of the

indirect effect to the maximum possible size the indirect effect could have been, given the variances. In this mediation model, the  $\kappa^2$  equaled 0.025 (95% CI = 0.003 to 0.061).

As participants' gender and political orientation could be related to pro-environmental behavior, we also tested a mediating model, which included gender (*men* coded as 1 and *women* coded as 2) and political orientation as covariates. We also included social desirability as covariate in this model. The relationships between cognitive reappraisal, global climate change perception, and pro-environmental behavior did not substantially change after controlling for the effect of these covariates (point estimate = 0.082; 95% CI = 0.006 to 0.217). Interestingly, we found a significant positive effect of gender on pro-environmental behavior ( $\beta = .14$ ,  $p < .05$ ;  $B_{unstandardized} = 2.53$ , 95% CI = 0.427 to 4.630), with women being more environmentally oriented than men. We also found a significant negative effect of political orientation on pro-environmental behavior ( $\beta = -.17$ ,  $p < .01$ ;  $B_{unstandardized} = -1.18$ , 95% CI = -1.966 to -0.385), with conservatives being less environmentally oriented than liberals. An insignificant effect of social desirability on pro-environmental behavior was found ( $p > .10$ ).

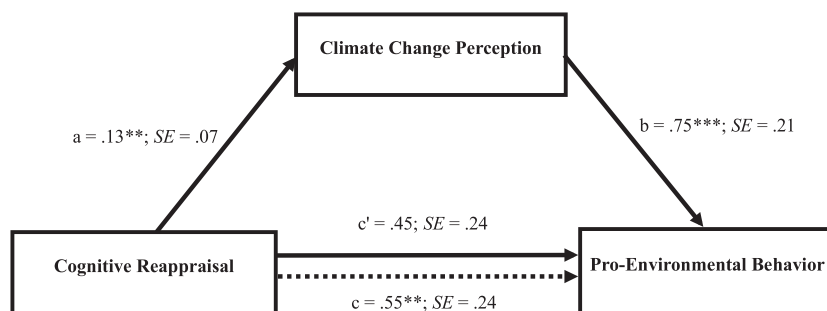
To investigate the potential interaction effect of political orientation in the relationship between cognitive reappraisal and global climate change perception, we then tested a further moderated mediation model, in which political orientation was considered as a moderator of this relationship. Using the PROCESS macro for SPSS (Hayes, 2013), we did not find a significant effect of the political orientation as a moderator of this model (point estimate = -0.010; 95% CI = -0.085 to 0.063). These results will be discussed together with the results from Study 2.

## STUDY 2

### Method

#### Participants

Study 1 clearly shows that cognitive reappraisal is related to pro-environmental behavior through global climate change perception. However, one might argue that cognitive reappraisal can also have "undesired"



**Fig. 1.** Path coefficients for mediation analysis in Study 1. Note. Dotted line denotes the effect of cognitive reappraisal strategy on pro-environmental behavior, when global climate change perception is not included as a mediator. *a*, *b*, *c*, and *c'* are unstandardized OLS regression coefficients. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$



consequences in terms of eco-friendly behavior and inhibit engagement in pro-environmental behavior. For example, cognitive reappraisal might not be related to climate change perception and pro-environmental behavior for those individuals who believe in government or technological solutions with regard to climate change. Indeed, these people are probably underrepresented in a college students' sample. Therefore, to rule out possible alternative explanations based on sampling artifacts, a second study was conducted using a non-student sample. Eighty-one participants living in the region of Rome were recruited for this purpose ( $M_{\text{age}} = 35$ ;  $SD = 14.96$ ; range 18 to 75 years; 55% women).

### Procedure and Measures

Data were collected through a paper-and-pencil questionnaire administered by trained interviewers. The questionnaires were administered in public areas and waiting rooms in Rome's main train station. Participants individually filled in the questionnaire. They were assured anonymity about their responses. The survey was administered from February to March 2015 and took about 15 minutes to complete.

**Political Orientation.** As in Study 1, the self-placement on the left–right (liberal–conservative) dimension was measured with the following item: “Considering the current political context in Italy, how would you describe your political orientation?” A 5-point response scale was used (1 = *left*, 2 = *center-left*, 3 = *center*, 4 = *center-right*, and 5 = *right*).

**Cognitive Reappraisal.** We assessed people's cognitive reappraisal strategy through all the six items of the Italian version of the emotion-regulation questionnaire (Balzarotti *et al.*, 2010). Respondents rated the extent to which they agree with self-descriptive statements reflecting cognitive reappraisal. Ratings were made on a 7-point Likert-type scale, with the response anchored at the ends with 1 (*strongly disagree*) and 7 (*strongly agree*);  $\alpha = .74$ .

**Global Climate Change Perception.** To assess people's global climate change perception, we used all of the five items from Heath and Gifford (2006). Respondents rated the extent to which they agree with statements reflecting the human perception of global climate change (Heath & Gifford, 2006). Ratings were made on a 7-point Likert-type scale with the response anchored at the ends with 1 (*strongly disagree*) and 7 (*strongly agree*);  $\alpha = .74$ .

**Pro-Environmental Behavior.** Participants' pro-environmental behavior was measured as in Study 1 (also Supporting Information);  $\alpha = .75$ .

## Results

To test our hypotheses of the relationships between cognitive reappraisal, global climate change perception, and

**Table 2.** Means, standard deviations, and intercorrelations among variables investigated in Study 2

	1	2	3	4
1. Cognitive reappraisal	1			
2. Global climate change	.35**	1		
3. Pro-environmental behavior	.21 <sup>†</sup>	.33**	1	
4. Political orientation	-.01	-.09	-.21 <sup>†</sup>	1
<i>M</i> ( <i>SD</i> )	4.75 (0.93)	4.96 (1.03)	3.21 (0.54)	2.96 (1.27)

Note:

<sup>†</sup> $p < .058$ ;

\* $p < .05$ ;

\*\* $p < .01$ ;

\*\*\* $p < .001$ .

pro-environmental behavior, we computed zero-order correlations among these variables (Table 2). Participants' cognitive reappraisal and global climate change perception were both positively correlated with pro-environmental behavior. Our results also showed that cognitive reappraisal was significantly positively correlated with global climate change perception. According to Cohen's (1988) guidelines, the effect sizes of these relationships range from small ( $r = .21$ ) to medium ( $r = .35$ ).

The associations of cognitive reappraisal with global climate change perception and pro-environmental behavior were supported by two regression models, in which global climate change perception and pro-environmental behavior scores were regressed on participants' reappraisal scores (global climate change perception, reappraisal  $\beta = .35$ ,  $p < .01$ ; pro-environmental behavior, reappraisal  $\beta = .21$ ,  $p = .058^2$ ).

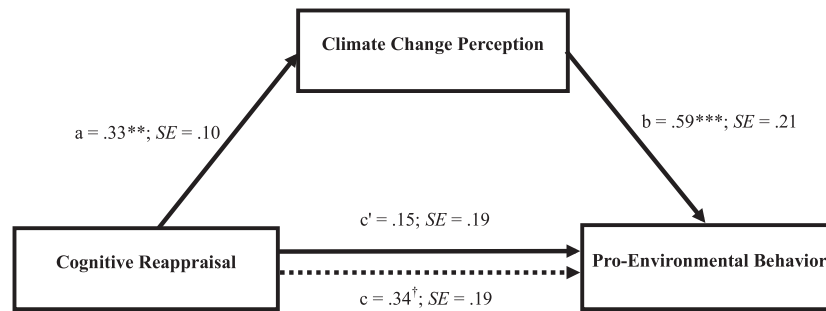
To better understand the mechanisms underlying these relationships, we used the PROCESS macro for SPSS (Hayes, 2013) testing the same mediation models of Study 1. As shown in Figure 2, mediation analysis with 5000 bootstrap samples revealed a significant positive indirect effect of cognitive reappraisal on pro-environmental behavior through global climate change perception (point estimate = 0.19; 95% CI = 0.058 to 0.403).

In this mediation model, the  $\kappa^2$  equaled 0.11 (95% CI = 0.032 to 0.233). According to Cohen's (1988) guidelines, this can be considered as a medium effect size.

We also tested a mediating model that included gender (coded as in Study 1) as covariate. The relationships

<sup>2</sup>Hayes and other authors (e.g., MacKinnon, Krull, & Lockwood, 2000) recommend that

‘Researchers not require a significant total effect before proceeding with tests of indirect effects. A failure to test for indirect effects in the absence of a total effect can lead to you miss some potentially interesting, important, or useful mechanisms by which X exerts some kind of effect on Y’— (Hayes, 2009, p. 414).



**Fig. 2:** Path coefficients for mediation analysis in Study 2. Note. Dotted line denotes the effect of cognitive reappraisal strategy on pro-environmental behavior, when global climate change perception is not included as a mediator.  $a$ ,  $b$ ,  $c$ , and  $c'$  are unstandardized OLS regression coefficients.  $^\dagger p = .058$ ;  $*p < .05$ ;  $**p < .01$ ;  $***p < .001$

between cognitive reappraisal, global climate change perception, and pro-environmental behavior did not substantially change after controlling for the effect of this covariate (point estimate = 0.175; 95% CI = 0.044 to 0.378). Again, we found a significant positive association between gender and pro-environmental behavior ( $\beta = .26$ ,  $p < .05$ ;  $B_{\text{unstandardized}} = 4.93$ , 95% CI = 0.951 to 8.914).

As in Study 1, we tested a moderated mediation model in which participants' political orientation was considered a moderator of the relationship between cognitive reappraisal and global climate change perception. Using the PROCESS macro for SPSS (Hayes, 2013), we did not find a significant moderation effect of political orientation (point estimate =  $-0.005$ ; 95% CI =  $-0.023$  to 0.007).

## GENERAL DISCUSSION

Taken together, the results of the two studies suggest that habitual use of cognitive reappraisal is associated with both global climate change perception and self-reported pro-environmental behavior. Furthermore, we show that people's habitual use of cognitive reappraisal is related to pro-environmental behavior through global climate change perception. In line with our hypotheses, our results show that people who habitually use cognitive reappraisal as a strategy to regulate their emotions also display a greater sensitivity with regard to climate change issues, and, in turn, this awareness could motivate their behavior toward reducing their ecological footprint.

In comparison with earlier studies (e.g., Doherty & Clayton, 2011; Leiserowitz, 2006; Myers et al., 2012; Smith & Leiserowitz, 2014; van der Linden, 2014), current research expands our knowledge in three ways. First, we show that people's habitual use of cognitive reappraisal is associated with global climate change perception. Second, we show that habitual use of cognitive reappraisal also predicts people's pro-environmental behavior. Third, our results detect global climate change perception as a key factor in the relationship between habitual use of cognitive reappraisal and pro-environmental behavior. Moreover, the present study supports previous research that shows that women—compared with men—are more engaged with pro-environmental behavior, pointing out, thus, the

relevant role of gender within this domain (Kollmuss & Agyeman, 2002; Swim et al., 2011).

Recently, Van der Linden (2014) claimed that "the interactive engagement of both cognitive and emotional processing mechanisms is key to fostering more public involvement with climate change" (p. 438). In a similar vein, almost two decades ago, Damasio (1998) had explicitly suggested that the interplay between emotion and reasoned processes in decision making could be a key to understanding human concern for the environment. Consistent with this view, Bamberg and Möser's (2007) model has also shown that environmental problem awareness is indirectly related to pro-environmental behavior through feelings of guilt (also Kals & Maes, 2002). In line with these suggestions, we point out that a specific cognitive strategy that people use to regulate their emotions may be associated with a proximal predictor of environmentally friendly behavior (i.e., the perception of climate change). These results are also consistent with the Keller et al. (2012) proposal that suggests that the way in which individuals appraise signs of climate change can foster ecologically responsible behavior. Indeed, the results of the current study are consistent with the idea that reappraisers might take more accurately into account climate change-related signs (e.g., a rise in temperature and a change in weather patterns) and consequently adjust their ecological footprint. In other words, the cognitive reappraisal strategy may influence how individuals appraise their physical environment and the type of goals they pursue therein. The results of the present research support Bamberg and Möser's (2007) model as they outline the role of the cognitive reappraisal of emotion in enhancing environmental problem awareness, which is recognized as a key determinant of ecologically responsible behavior (Bamberg & Möser, 2007).

Some limitations in our study need to be acknowledged. First, it is possible that people can also use maladaptive emotion-regulation strategies, such as inhibition, denial, attentional deployment, and avoidance (Gross & John, 2003; Lazarus & Folkman, 1984). It was beyond the scope of this study to investigate all of these, but further studies should point out the relationships between these strategies and climate change perception. Second, although we shed light on the relationships between people's habitual use of cognitive reappraisal, global climate change perception,

and environmentally friendly behavior, the mediating role of climate change perception needs to be supported by further empirical evidence. For instance, future studies should be designed in order to experimentally manipulate cognitive reappraisal before people rate their perception of climate change as well as pro-environmental intentions, thus providing more robust indications on the causal processes underlying these relationships. Future studies could also experimentally manipulate the perception of climate change (Zaval *et al.*, 2014) and then test whether cognitive reappraisal strengthens this perception. Moreover, further investigations could experimentally manipulate cognitive reappraisal in order to test whether the effect of some emotions, such as moral anger, on pro-environmental behavior would be greater under these circumstances (Reese & Jacob, 2015). In this vein, future studies investigating the interactions between cognitive reappraisal and integral emotions triggered by a climate change phenomenon (e.g., a hurricane) may provide fruitful insights into mechanisms underlying people's climate change perception. Interestingly, it has been shown that guilt feelings mediate the relationship between environmental problem awareness and pro-environmental behavior (Bamberg & Möser, 2007). Thus, future research could also investigate whether cognitive reappraisal plays a key role in accounting for these guilt feelings, when people make decisions involving an ecologically friendly option. One might argue that habitual reappraisers are more strongly affected by guilt feelings for acting in an environmentally irresponsible way, and this could motivate their actions toward ecologically responsible behavior.

As emotion regulation, climate change perception, and pro-environmental behavior are topics with great relevance to social-psychological research and its applications (e.g., environmental research and decision science), the current study may represent the beginning of a fruitful avenue of research. The present findings could have important applied implications. Indeed, to design effective social-psychological interventions, environmental friendly campaigns (e.g., risk communication messages) should take into account that people's cognitive reappraisal strategy may foster pro-environmental behavior, because it is related to more accurate perceptions of and beliefs in climate change. As Gross and John (2003) showed that cognitive reappraisal can also be induced by specific situations, then environmental risk communication campaigns can improve people's awareness about climate change focusing their messages on specific contents or cues that situationally trigger the cognitive reappraisal of the severity of climate change phenomena. Moreover, psychological interventions enhancing people's cognitive reappraisal may increase individuals' sensitivity to phenomena related to global climate change and environmentally friendly activities (see Denny & Ochsner, 2014, for more details about training in cognitive reappraisal). For example, social-psychological interventions in schools

focusing on training in cognitive reappraisal could foster environmentally friendly behavior in children as well as adolescents. Interestingly, in a field study, Halperin and colleagues have shown that cognitive reappraisal could foster conciliatory attitudes in situations of intractable conflicts, such as the Israeli–Palestinian conflict (see Halperin, Porat, Tamir, & Gross, 2013, for more details). To some extent, global climate change and the risk related to it might represent a form of “intractable” situation for many people in current society; therefore, it is likely that also in this domain cognitive reappraisal might represent an emotion-regulation strategy leading to more appropriate individual actions. Future studies are needed to shed light on these potential applications. Finally, as research is showing a consistent pattern of results regarding the relationship between gender and pro-environmental behavior, then the inclusion of women in groups of policy makers making environmental decisions should be strongly supported. As a consequence, this inclusion could promote greater engagement in environmentally friendly activities among men (e.g., Swim, 2015).

In conclusion, the results of the current study increase our knowledge of emotion research (e.g., Gross, 2011; Gross & John, 2003) and are also relevant to lines of research that rely on climate change-related risk perception to foster ecologically responsible behavior in society at large (e.g., Doherty & Clayton, 2011; Heath & Gifford, 2006; Swim *et al.*, 2012). More broadly speaking, future studies investigating people's emotion-regulation strategy (e.g., cognitive reappraisal) promise novel insights into the connections between emotion and environmental research. Thus, if recent studies (Leiserowitz, 2006; Myers *et al.*, 2012; Roeser, 2012; Smith & Leiserowitz, 2014; van der Linden, 2014) are pointing out the relationship between emotion and global climate change perception, perhaps emotion regulation is bound to play an increasingly prominent role in the near future.

## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher's web-site.

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