

Self-Confrontation via a Carbon Footprint Calculator Increases Guilt and Support for a Proenvironmental Group

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Abstract

Guilt occurs when people realize they have violated personal or social standards for behavior. For example, past research found that confronting Whites for racist behavior created guilt, which motivated behavior change. Carbon footprint calculators provide a venue for self-confrontation about the impact of one's behavior on the environment. In Study 1, participants were randomly assigned to learn their carbon footprint was larger or smaller than the average United States' citizen. Participants confronted with a larger-than-average carbon footprint reported more personal guilt, but not shame or anger, than participants who learned they had a smaller-than-average carbon footprint. In Study 2, participants confronted with evidence that Americans had a larger carbon footprint than other industrialized nations reported more collective guilt, but no less collective pride, than participants who learned Americans had a smaller carbon footprint. Collective guilt then partially mediated the association between carbon footprint feedback and support for a proenvironmental group.

When people are confronted with evidence that they have not met personal or social standards for behavior, they often report negative self-directed emotions and attempt to make up for the indiscretion. For example, research on prejudice finds that confronting people with evidence that their behavior violates personal or social standards produces negative self-directed emotions and reduces future biased

behavior (Czopp et al., 2006; Monteith, 1993). The present research tests whether confronting people with feedback that their behavior has a greater negative impact on the environment than that of their peers produces more guilt, anger, or shame than when they learn their behavior has less of a harmful impact. We also test whether learning that one's environmental behaviors are better than average increases feelings of pride, relative to learning they are worse than average. Finally, we test whether emotions experienced after considering feedback about the impact of one's environmental behaviors partially explains the link between the content of the feedback (*better than peers* or *worse than peers*) and support for a proenvironmental group.

Rokeach's (1971) classic research on values found that when people were confronted with evidence that their behavior was inconsistent with their egalitarian standards, they were dissatisfied with themselves. These studies used a self-confrontation procedure, whereby participants first reported the extent to which various values were important guiding standards in their lives. Participants were then provided with information about how their peers ranked the same set of values. To induce self-dissatisfaction, participants were given negative feedback about the overall egalitarianism of their peer group. Specifically, they were told the research showed their peers were "more interested in their own freedom than in the freedom of other people" (p. 454). When contacted months later, participants who engaged in self-confrontation were more likely to support civil rights efforts (e.g., join the NAACP) than participants who had not engaged in self-confrontation.

Carbon footprint calculators, which are readily available on the Internet, provide people with the opportunity to engage in self-confrontation regarding their environmental behavior. People provide information about their behavior (e.g., energy consumption, travel habits) that the calculators use to tally the amount of climate-altering gaseous emissions produced by those behaviors (Wiedmann

Et Minx, 2007). Some Web sites go a step further by providing a vivid illustration of the meaning of one's carbon footprint, such as the number of planets we would need to sustain life if everyone had that large of a carbon footprint (e.g., myfootprint.org; Center for Sustainable Economy, 2012). By systematically varying whether people learn that their behavior falls short of or exceeds social standards, researchers can assess the effect that self-confrontation via a carbon footprint calculator has on emotions and behavioral intentions.

Providing people with information about how they compare to their peers either creates a feeling of dissonance or consonance (Rokeach, 1971). Dissonance occurs if the social comparison leads to dissatisfaction with the self, whereas consonance occurs if the social comparison leads people to remain satisfied with the self. More specifically, whether one underperforms or outperforms relative to a standard influences emotions and behavior (Festinger, 1954). Learning that one underperformed creates negative emotions and motivates one to change the behavior that contributed to the inferior performance (Collins, 1996). In contrast, learning that one has outperformed another creates positive emotions and reinforces the behavior that contributed to the superior performance (Bailis & Chipperfield, 2006).

Rokeach (1971) found that a critical factor in creating long-term behavioral change in the direction of the egalitarian standard was negative self-directed emotions created by comparing the self with one's peers during self-confrontation. Recent research similarly demonstrates that negative self-directed emotions resulting from dissatisfaction with one's personal behavior motivate people to regulate their behavior (Monteith, 1993). For example, when confronted by another person for stereotypic behavior, people experienced negative self-directed emotions, including feeling "guilty," "angry at myself," and "shameful." To reduce the experience of negative self-directed emotions, people made fewer stereotypic responses in the future (Czopp et al., 2006). Moreover, eco-guilt increases willingness to engage in both personal (e.g., conserving electricity at home) and collective (e.g., paying green taxes) reparative behaviors (Ferguson & Branscombe, 2010).

Although most research has focused on negative self-directed emotions, there is reason to believe that positive self-directed emotions could motivate proenvironmental behavior. For example, De Young (1985, 1986) found that personal satisfaction and positive emotions were the most important reasons people gave for recycling. The positive emotion of pride could be particularly relevant to promoting proenvironmental behavior. Pride occurs when people perceive that they have caused a positive outcome (Ellsworth & Smith, 1988; Smith & Lazarus, 1993), and pride also reinforces altruistic behaviors (Weiner, 1985).

The present research tests how self-confrontation that occurs when people consider feedback provided by a carbon footprint calculator affects emotions and behavioral intentions. Study 1 tests whether people report more self-directed negative emotions when the feedback indicates they are doing worse, compared to better, than their peers. Study 2 tests whether we find a similar pattern for positive and negative emotions when the feedback is about a social group to which one belongs. Study 2 also tests whether self-directed emotions partially explain the association between the type of feedback (*better than peers* or *worse than peers*) and support for a proenvironmental group.

Study 1

Study 1 tests whether three types of self-directed negative emotions (guilt, anger, shame) emerge in response to social comparison feedback about one's environmental behavior. Guilt, anger, and shame all may occur when people believe they have engaged in harmful behavior (Ellsworth & Tong, 2006). Guilt and shame occur when people perceive their behavior as conflicting with a moral or social standard (Estrada-Hollenbeck & Heatherton, 1998; Kugler & Jones, 1992). Unlike guilt, shame typically results from behavior that occurs in a public setting (Ellsworth & Tong, 2006). In comparison, self-directed anger occurs when people perceive they did something wrong but do *not* see their behavior as violating a moral standard (Ellsworth & Tong, 2006).

We predict that learning one has done worse than one's peers via feedback from a carbon footprint calculator will produce more negative self-directed emotions than learning one has done better than one's peers (Collins, 1996). We expect that learning one has done *worse than peers* will affect guilt more than shame or anger because guilt results from a private determination that one's behavior has violated a moral code of conduct (Ellsworth & Tong, 2006)—an assessment that most closely resembles the nature of the carbon footprint feedback.

Study 1 Method

Participants

Forty-four students (41 women, 3 men) at an urban Midwestern university participated in exchange for course credit. Participants were White ($n = 39$), Asian ($n = 4$), and Hispanic ($n = 1$).

Materials and procedure

Participants used a computer to answer carbon footprint calculator questions, receive false feedback about their carbon footprint, and report emotions.

Carbon footprint calculator. Participants read,

Virtually everything we do contributes to the creation of climate-warming gases that are released into the atmosphere. You are about to estimate the amount of greenhouse gas related to your consumption. This calculator uses your input to estimate your carbon footprint and then it compares your carbon footprint to that of the average U.S. citizen.

Participants then provided information about their consumption behaviors including transportation (car, air travel, public transportation), housing (home size, energy usage), and spending habits (food, personal goods, entertainment, other services) to allegedly calculate a carbon footprint. We did not calculate a carbon footprint score for each participant; instead, we randomly assigned participants to receive false feedback about the size of their carbon footprint so that we could vary the type of social comparison.

Social comparison feedback. Participants were randomly assigned to learn their carbon footprint was larger or smaller than that of the average U.S. citizen. Participants either read that “According to the calculator, your carbon footprint is larger than that of the average U.S. citizen” (*worse-than-peers* condition) or that “According to the calculator, your carbon footprint is smaller than that of the average U.S. citizen” (*better-than-peers* condition).

Manipulation checks. To verify participants understood the feedback, they answered, “According to the carbon footprint calculator, how much greenhouse gas do you produce relative to the average American citizen?” Responses ranged from 1 *much less* to 7 *much more*. To assess the extent to which participants believed the feedback, participants answered the item, “Do you feel that feedback by carbon footprint calculator was an accurate reflection of your consumption habits?” using a scale from 1 *very inaccurate* to 7 *very accurate*.

Eco-guilt, eco-anger, and eco-shame. Participants rated their feelings of guilt, anger, and shame in response to the following statements: consume non-renewable natural resources; contribute to global warming; know that I can do more to minimize the environmental impact that I have on the earth; do not always recycle items like cans or paper; and waste natural resources. Participants answered items on a scale of 1 *not at all guilty [angry, ashamed]* to 7 *extremely guilty [angry, ashamed]*.

The eco-guilt ($M=3.98$, $SD=1.30$, $\alpha=.92$), eco-anger ($M=3.24$, $SD=1.51$, $\alpha=.93$), and eco-shame ($M=4.73$, $SD=1.66$, $\alpha=.90$) scale

items were always presented together, but their order of presentation was random (e.g., sometimes eco-guilt came first; other times eco-anger or eco-shame came first). Eco-guilt was positively correlated with eco-anger ($r=.61$, $p<.001$) and eco-shame ($r=.68$, $p<.001$). Eco-anger and eco-shame were positively correlated ($r=.65$, $p<.001$).

Study 1 Results

Manipulation checks

An independent samples *t* test showed that participants correctly reported having a larger carbon footprint in the *worse-than-peers* condition ($M=5.67$, $SD=1.49$) than in the *better-than-peers* condition ($M=2.22$, $SD=0.79$), $t(42)=-9.68$, $p<.001$. Perceived accuracy of the feedback did not differ significantly across condition, though there was a trend toward perceiving the *worse-than-peers* feedback ($M=3.05$, $SD=1.60$) as slightly less accurate than the *better-than-peers* feedback ($M=3.87$, $SD=1.49$), $t(42)=1.77$, $p=.08$.

Eco-guilt, eco-anger, and eco-shame

A repeated-measures ANOVA with social comparison feedback as the between-subjects factor and type of emotion as the repeated factor showed no main effect of feedback, $F(1, 42)=.32$, $p=.58$, $\eta_p^2=.008$. There was a main effect of type of emotion such that people reported higher eco-guilt than eco-shame and eco-anger, $F(1, 42)=8.60$, $p<.01$, $\eta_p^2=.17$. This was qualified by an interaction (see Fig. 1), $F(1, 42)=19.43$, $p<.001$, $\eta_p^2=.32$. Simple effects tests showed that in response to *worse-than-peers* feedback, participants reported more eco-guilt than eco-shame and eco-anger, $F(2, 41)=23.46$, $p<.001$, $\eta_p^2=.53$. Moreover, as predicted, eco-guilt was also higher in the *worse-than-peers*, compared to *better-than-peers*, feedback condition, $F(1, 42)=7.51$, $p<.01$, $\eta_p^2=.15$. None of the other simple effects tests were significant, $ps>.39$.

Study 1 Discussion

Confronting individuals with evidence that their personal consumption behavior created a larger-than-average carbon footprint increased reports of eco-guilt more so than reports of eco-anger and eco-shame. This may have occurred if participants perceived they were responsible for the behaviors used to calculate their carbon footprint and believed that having a larger-than-average carbon footprint violated a social standard for behavior. The specific combination of perceiving the self as responsible for violating a social standard should affect guilt more than anger. Finding no difference in levels of shame across condition was potentially due to the fact that we used self-confrontation, so the discovery of one's failure was private rather than public.

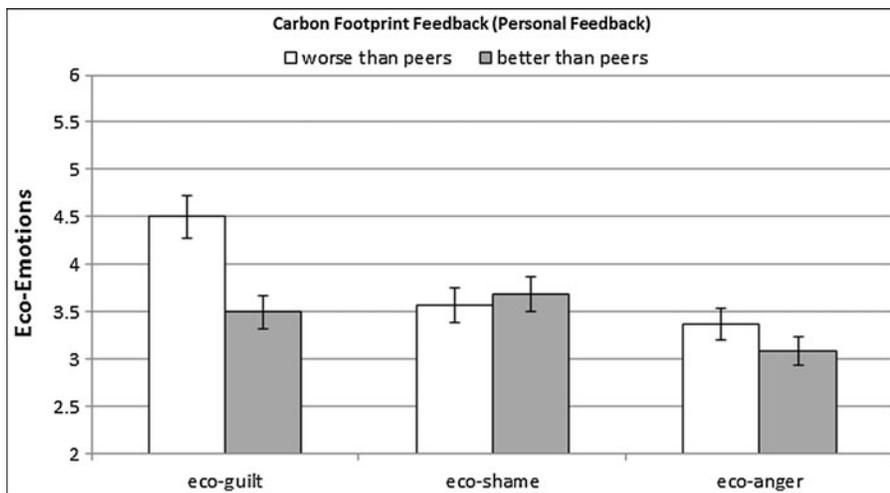


Fig. 1. The interaction between carbon footprint calculator feedback and reports of personal eco-guilt, eco-anger, and eco-shame (Study 1).

Providing individuals with feedback that their personal consumption behavior created a smaller-than-average carbon footprint did not affect negative eco-emotions. This was expected because negative self-directed emotions arise when individuals perceive they are responsible for negative, rather than positive, behavior. Study 2 measures both guilt and pride to further investigate emotional responses to both types of feedback.

Study 2

Study 2 builds on Study 1 in three ways. First, it examines self-directed positive and negative emotions in response to self-confrontation. We measure guilt because it was the only negative eco-emotion that differed in response to carbon footprint feedback in Study 1. We add a measure of pride to test whether receiving positive feedback about environmental behavior increases pride relative to receiving negative feedback.

Second, Study 2 tests whether we find similar results for eco-emotions when the carbon footprint feedback concerns how a social group to which one belongs compares to another social group. People experience emotions as a result of considering positive and negative acts committed by the social groups to which they belong (Cialdini, 1976). For example, individuals feel collective eco-guilt when they perceive that humans are responsible for global warming (Ferguson & Branscombe, 2010). Additionally, focusing on the fact that one's group has performed better than another group causes collective pride (Cialdini, 1976; Harth et al., 2008).

Third, Study 2 tests whether self-directed emotions partially explain the association between the nature of the feedback (*better than peers* or *worse than peers*) and support for a proenvironmental group. We hypothesize that carbon footprint feedback indicating that one's group, in this case one's nation (America), performs worse than its international peers will increase eco-guilt and that eco-guilt will increase support for a proenvironmental group. We test whether eco-pride serves a similar function. Carbon footprint feedback that one's nation performs better than its peers could increase eco-pride, and eco-pride may increase support for a proenvironmental group.

Study 2 Method

Participants

One-hundred fifty-two students (111 women, 41 men) at an urban Midwestern university participated in exchange for course credit. Participants were White ($n = 148$) and Asian ($n = 4$).

Materials and procedure

Participants used a computer to answer carbon footprint calculator questions, receive false feedback about their carbon footprint, and report their emotions and support for a proenvironmental group.

Social comparison feedback. Participants answered the same consumption questions used in Study 1, but the feedback targeted U.S. citizens as a group rather than participants as individuals. Participants then read, "This calculator will use your input to estimate what the average carbon footprint of U.S. citizens would look like if everyone shared your habits. It will then compare the average U.S. carbon footprint to that of other industrialized nations."

Participants were randomly assigned to learn that, on average, the United States' carbon footprint was larger or smaller than that of other industrialized nations. Participants either read "According to the carbon footprint calculator, the average U.S. citizen's footprint is larger than that of the average citizen of other industrialized nations" (*worse-than-peers* condition) or "According to the carbon footprint calculator, the average U.S. citizen's footprint is smaller than that of the average citizen of other industrialized nations" (*better-than-peers* condition).

Manipulation checks. To verify participants understood the feedback, they answered, "According to the carbon footprint calculator,

how much carbon emission does the average American produce relative to the average citizen of other industrialized nations?" Responses ranged from 1 *much less* to 7 *much more*. To assess the extent to which participants believed the feedback, participants answered the item, "Do you feel that the feedback provided by the carbon footprint calculator was an accurate reflection of Americans' overall consumption habits?" using a scale from 1 *very inaccurate* to 7 *very accurate*.

Eco-guilt and eco-pride. To measure eco-guilt, participants read, "Think about the behavior of Americans as a group. To what extent do you feel guilty that Americans ..." Then participants used a scale from 1 *not at all guilty* to 7 *extremely guilty* to rate the statements: consume non-renewable natural resources; contribute to global warming; know that we can do more to minimize the environmental impact that we have on the earth; do not always recycle items like cans or paper; and waste natural resources.

To measure eco-pride, participants read, "Think about the behavior of Americans as a group. To what extent do you feel proud that Americans ..." Then participants used a scale from 1 *not at all proud* to 7 *extremely proud* to rate the statements: conserve non-renewable natural resources; recycle cans or paper; reuse materials (writing paper, plastic bags); conserve energy at home (turn off lights, regulate heating and cooling); make daily efforts to minimize the impact we have on the environment.

The order of presentation of eco-guilt ($M=4.95$, $SD=.80$, $\alpha=.89$) and eco-pride ($M=5.10$, $SD=1.14$, $\alpha=.78$) scale items was counterbalanced. Eco-guilt was positively correlated with eco-pride ($r=.31$, $p<.001$).

Support for proenvironmental group. Participants indicated their desired level of involvement with a group described as calling "for U.S. corporations and nonprofits to fund projects aimed at repairing the environment." The measure was modeled after Iyer, Schmader, and Lickel's (2007) Political Action Intentions. Participants used a scale from 1 *not at all willing* to 7 *completely willing* to rate eight actions including, "Volunteer with this group" and "Recruit others to become involved with this group" (see Appendix).

Study 2 Results

Manipulation checks

An independent samples *t* test showed participants correctly reported Americans had a larger carbon footprint in the *worse-than-peers* condition ($M=6.28$, $SD=.70$) than in the *better-than-peers* condition ($M=2.70$, $SD=1.13$), $t(150)=23.58$, $p<.001$. Perceptions of the accuracy of the carbon footprint feedback differed across condition, $t(150)=8.57$, $p<.001$. Although ratings of accuracy were above the scale midpoint in both conditions, participants who learned that Americans did *worse than peers* ($M=5.51$, $SD=.99$) rated the feedback as more accurate than participants who learned that Americans did *better than peers* ($M=4.01$, $SD=1.16$).

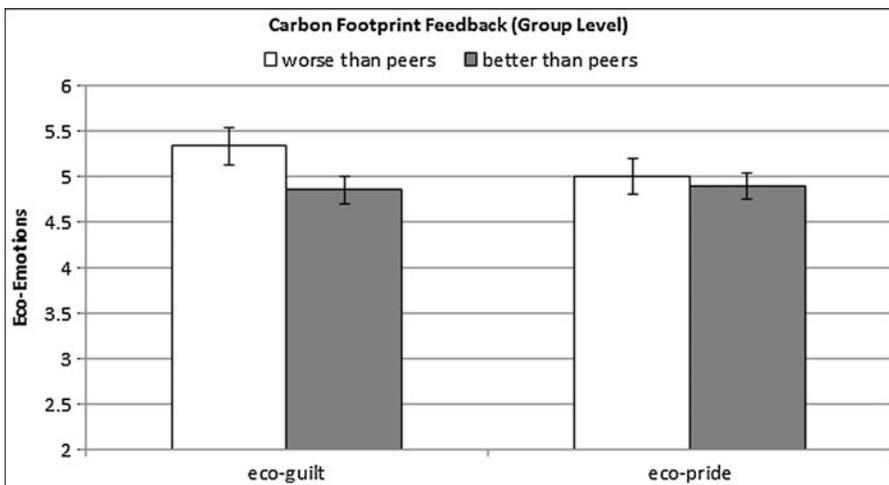


Fig. 2. The interaction between carbon footprint calculator feedback and reports of collective eco-guilt and eco-pride (Study 2).

Eco-emotions

A repeated-measures ANOVA with social comparison feedback as the between-subjects factor and type of emotion as the repeated factor showed a main effect of feedback, $F(1, 150)=5.52$, $p=.02$, $\eta_p^2=.04$. Participants reported stronger feelings in the *worse-than-peers* condition ($M=5.17$, $SE=.09$) than in the *better-than-peers* condition ($M=4.87$, $SE=.09$). There was no main effect of type of emotion, $F(1, 150)=2.50$, $p=.12$. There was an interaction between type of feedback and emotion (see Fig. 2), $F(1, 150)=3.82$, $p=.05$, $\eta_p^2=.03$. Simple effects tests showed that in the *worse-than-peers* condition, participants reported stronger eco-guilt than eco-pride, $F(1, 150)=6.43$, $p=.01$. As in Study 1, eco-guilt was stronger in the *worse-than-peers*, compared to *better-than-peers*, condition, $F(1, 150)=7.04$,

Table 1. Results of Bootstrapping Analyses Testing for an Indirect Effect of Social Comparison Feedback on Support for an Environmental Group That Operates Through Eco-Guilt or Eco-Pride (Study 2)

DESCRIPTION OF ESTIMATED PATH (TRADITIONAL BARON AND KENNY PATHS)	POINT ESTIMATE (SE)	<i>t</i>	<i>p</i>	BIAS CORRECTED 95% CONFIDENCE INTERVALS
Support for Environmental Group				
Social Comparison Feedback to Eco-Guilt (a path)	0.24 (0.09)	2.65	0.009	
Social Comparison Feedback to Eco-Pride (a path)	0.06 (0.06)	0.87	0.38	
Direct Effect of Eco-Guilt on Support for Environmental Group (b path)	0.55 (.07)	7.97	0.0001	
Direct Effect of Eco-Pride on Support for Environmental Group (b path)	0.09 (0.09)	0.93	0.35	
Total Effect of Social Comparison Feedback on Support for Environmental Group (c path)	0.23 (0.09)	2.61	0.01	
Bootstrap Results for Indirect Effects	Data	Boot	Bias (SE)	
Indirect Effect of Social Comparison Feedback on Support for Environmental Group Through Eco-Guilt (c' path)	0.13	0.13	0.003 (0.06)	Lower = 0.03 Upper = 0.27
Indirect Effect of Social Comparison Feedback on Support for Environmental Group Through Eco-Pride (c' path)	0.01	0.01	0.001 (0.01)	Lower = -0.01 Upper = 0.04

$p < .01$, $\eta_p^2 = .05$. None of the other simple effects tests were significant, $ps > .38$.

We calculated the indirect effect of social comparison feedback on support for an environmental group through eco-guilt and eco-pride using the Preacher and Hayes (2004) bootstrapping method. Bootstrapping is a powerful method for testing indirect effects because it has greater power to detect effects in small samples while maintaining control over the Type I error rate (MacKinnon et al., 2002; Williams & MacKinnon, 2008). We used Preacher and Hayes' (2008) macro for SPSS to generate 5,000 samples from the original data set (using sampling with replacement). Social comparison feedback was coded so that -1 = *better than peers* and 1 = *worse than peers*. Table 1 shows that social comparison feedback and eco-guilt are both positively associated with support for an environmental group. That is, participants report greater eco-guilt after receiving feedback that they are doing *worse than peers*, compared to *better than peers*, in terms of their carbon footprint; and as eco-guilt increases, so does support for the environmental group. The confidence intervals for the indirect effect do not include zero; therefore, we conclude that the indirect effect of social comparison feedback on support for an environmental group through eco-guilt was reliable. Pride was unrelated to social comparison feedback and was therefore not a viable pathway for the indirect effect.

Study 2 Discussion

When confronted with evidence that Americans had a larger-than-average carbon footprint, compared to other industrialized nations, participants reported more collective eco-guilt than when they learned Americans had a smaller-than-average carbon footprint. This replicates the results of Study 1 in that feedback indicating a carbon footprint that was *worse than peers* increased eco-guilt in comparison to feedback indicating a carbon footprint that was *better than peers*.

Carbon footprint feedback did not affect pride. This may be due to the extent to which participants believed the carbon footprint feedback was accurate. Perceived accuracy of the feedback differed across condition such that people rated the feedback as more accurate when the U.S. was depicted as having a larger, compared to smaller, carbon footprint than other industrialized nations. It could be that participants were unconvinced that their country performed well and therefore did not use the feedback as a source of pride.

Importantly, conceptually replicating past research (e.g., Ferguson & Branscombe, 2010), collective eco-guilt partially mediated the association between the type of feedback and support for a proenvironmental group. More specifically, learning the U.S. had a larger carbon footprint than other industrialized nations increased collective eco-guilt, which increased support for joining and working on behalf of a proenvironmental group.

General Discussion

Negative self-directed emotions that result from self-confrontation are essential to changing future behavior (Rokeach, 1971). We found that self-confrontation (via carbon footprint feedback) about the impact of one's behavior on the environment increased eco-guilt when people learned that they, or a group to which they belong, created more carbon emissions than their peers. Specifically, participants reported more eco-guilt when confronted with evidence that they had a larger, compared to smaller, carbon footprint than their peers. Collective eco-guilt then partially mediated the association between carbon footprint feedback and support for a proenvironmental group. Environmentally related shame, anger, and pride did not change in response to carbon footprint feedback.

Our participants believed feedback indicating that their nation had a larger carbon footprint than other industrialized nations was more accurate than feedback indicating their nation had a smaller carbon footprint. Interestingly, we found a trend in the opposite direction for feedback about one's personal behavior. That is, participants in Study 1 were slightly more likely to rate feedback indicating they personally had a smaller carbon footprint than their fellow U.S. citizens as more accurate than feedback indicating their carbon footprint was larger than that of their peers. Perhaps this difference is due to personal efforts at protecting the environment being more salient to individuals than efforts taken by their nation. Overall, participants rated the accuracy of feedback from the carbon footprint calculator as above the scale midpoint, suggesting that they generally thought the feedback was accurate.

Our studies highlight the potentially positive implications of carbon footprint calculators. To maximize the potential for a positive impact, Web sites that provide carbon footprint calculators should also provide social comparison information and highlight ways that people can improve their proenvironmental behaviors or donate to proenvironmental causes. It would be particularly useful to track whether feedback about the size of one's carbon footprint is positively related to clicking on another site to donate money to an environmental cause. Furthermore, local groups—such as schools or community groups—may be able to use similar tools to increase proenvironmental behavior. For example, to induce collective eco-guilt, a proenvironmental student group could provide their fellow students with information about the school's performance compared to other schools. Providing students with negative social comparison feedback may motivate students to engage in proenvironmental behaviors such as signing a petition or using recycling bins on campus.

Appendix

Instructions: Rate your willingness to engage in each behavior using a scale from 1 *not at all willing* to 7 *completely willing*.

Some Americans are taking action to express their opinions about what should be done about the environmental crisis (e.g., excess waste in landfills, depletion of natural resources, increase in carbon emissions). To make up for the damages that have already been done, one group has called for U.S. corporations and nonprofits to fund projects aimed at repairing the environment. Using the scale below, indicate how willing you would be to engage in various activities to support this group and its strategy.

- (1) Volunteer with this group
- (2) Vote for a candidate who agrees with this group
- (3) Sign a petition
- (4) Wear a button supporting this group
- (5) Attend a rally
- (6) Join the group's e-mail list
- (7) Recruit others to become involved with this group
- (8) Go to a meeting of local representatives of this group

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