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Putting your money where your mouth is: An experimental test of pro-environmental spillover
from reducing meat consumption to monetary donations

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Policies promoting voluntary behavior change are one of several strategies (e.g., command and control tactics, price-based approaches) that can be used to mitigate human impacts on the environment. Now more than ever, in the wake of stalled efforts to enact climate change policy in the United States, individual behavior change is as an opportunity to reduce greenhouse gas emissions (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Sovacool, 2014; Vandenbergh, Barkenbus, & Gilligan, 2008). As such, members of the general public are routinely asked to take steps to reduce their impact on the environment. Despite this, we know relatively little about the consistency of environmentally significant behaviors over time and under what conditions individuals are willing to engage in persistent efforts to limit their impact on the environment. When we successfully “nudge” an individual to adopt a green behavior, can we view this as a win for the environment? Or are there secondary effects of behavior change campaigns that may impact the ultimate success or failure of these efforts?

Researchers interested in environmental spillover have speculated on whether the effects of behavioral interventions may extend beyond the immediately targeted behavior (Poortinga, Whitmarsh, & Suffolk, 2013; Thøgersen, 1999; Truelove, Carrico, Weber, Raimi, & Vandenbergh, 2014). The impacts on secondary behaviors can be positive or negative. Positive spillover occurs when the adoption of an initial action increases the likelihood that an individual will adopt a subsequent action; for example, a homeowner who purchases an electric vehicle and then becomes more willing to invest in solar panels. On the other hand, negative spillover occurs when the adoption of a green behavior renders an individual less likely to adopt a subsequent

PEB. In this case, a person who purchased an electric vehicle would be less likely to invest in solar panels, possibly feeling as though she has already ‘done her part’ for the environment.

The presence of positive or negative spillover could have profound impacts on the effectiveness of policies that seek to achieve environmental conservation through voluntary behavior change. Negative spillover, if prevalent, has the potential to undermine the effectiveness of these approaches, and complicate their evaluation, measurement, and verification (Carrico, Vandenbergh, Stern, & Dietz, 2015). If negative spillover is common, it may be that behavior change programs should be redesigned or alternatives should be selected that do not rely so heavily on voluntary participation, such as supply-side measures or product-efficiency standards. On the other hand, if positive spillover is common, decision makers may be under-valuing these approaches by failing to consider benefits outside of the targeted behavior. A third possible conclusion is that spillover of any type is rare or so minimal as to be a trivial factor in policy decisions, in which case these concerns could be put to rest.

This paper describes an experimental test of spillover that prioritizes external validity by asking respondents to engage in behavior that involved a measure of both effort and sacrifice. Drawing on theorized mechanisms of spillover, we also examined the extent to which two variables—moral self-image and environmental concern—mediate the effect of an initial pro-environmental action on a subsequent green behavior. Prior to describing this study and its results, we provide a brief overview of theoretical explanations and empirical evidence related to spillover, followed by a discussion of research gaps that the present study addresses.

Empirical Evidence for spillover

Discussions of spillover and related phenomena have appeared in literature across many disciplines and sub-fields and under a variety of labels (e.g., rebound effects, moral licensing, and consistency effects). Yet, each term carries with it unique predictions about when and why spillover is likely to occur, and in which direction (i.e., positive vs. negative). In this paper, we adopt the terminology of Thøgersen, Truelove, and others (Lanzini & Thøgersen, 2014; Thøgersen, 1999; Thøgersen & Noblet, 2012; Thøgersen & Ölander, 2003; Truelove et al., 2014; Truelove, Yeung, Carrico, Gillis, & Raimi, 2016) who have attempted to apply these various theories to the context of pro-environmental action.

The most closely related literature to negative spillover is the work on moral licensing. Moral licensing theory suggests that individuals who engage in a moral good deed experience an improved moral self-image that, in some cases, may license an individual to engage in a morally dubious act thereafter (Merritt, Effron, & Monin, 2010). A recent meta-analysis of the moral licensing literature found evidence for a small to medium average effect size ($d = 0.31$) of one prosocial behavior reducing the likelihood of a second prosocial behavior (Blanken, van de Ven, & Zeelenberg, 2015). For example, Monin and Miller found that participants who had the opportunity to express their disapproval to sexist statements were subsequently less likely to favor a woman for a traditional male occupation, presumably because they had already established themselves as moral (non-sexist) via the earlier task (Monin & Miller, 2001).

Although most moral licensing research does not directly examine pro-environmental behavior, there is reason to believe that these findings are relevant. Environmentally significant behavior is widely regarded as having moral implications and green behaviors are perceived by the public to be ethical (e.g., Gardiner, 2010; Mazar & Zhong, 2010; Nordlund & Garvill, 2002). Some studies have measured or elicited green actions to examine more fundamental processes

associated with moral behavior (Blanken et al., 2015). For example, Mazar and Zhong (2010) found that people were more likely to lie and steal after participating in a simulated shopping task where they purchased green products compared to a task in which they purchased conventional versions of the same products.

Research on single-action bias has also been cited as an explanation of negative spillover (Wagner, 2011a). Whereas moral licensing effects are presumed to stem from perceptions of one's moral self-worth, single action bias is believed to be mediated by risk perceptions. In her original discussion on the topic, Weber (1997) theorized that after adopting an initial action to reduce a perceived threat, individuals will experience a reduction in perceived risk that will reduce motivation for future additional preventive action. The consequence is that individuals will often engage in a single, often insufficient step to resolve the problem. In her empirical work, Weber (1997) found that a set of discrete actions taken by farmers to adapt to climate change were negatively correlated. She also found a negative correlation between having adopted a behavior to adapt to climate change and the farmer's level of support for government intervention to address climate change, providing some evidence that risk reducing behaviors may undermine the perceived need for policy intervention.

The concern that voluntary greenhouse-gas reducing behaviors could undermine support for more robust policy interventions has been expressed by others (Wagner, 2011a, 2011b). Recently, Truelove and colleagues (2016) found evidence of negative spillover from recycling to support of a campus green fund, but only among self-identified Democrats. This pattern is consistent with Weber's explanation of single action bias, given that Democrats tend to be more concerned about the risks of environmental degradation (McCright, Xiao, & Dunlap, 2014) and may, therefore, be more impacted by the risk-reducing impact of engaging in a pro-

environmental action. On the other hand, Truelove et al. (2016) also found evidence that Republicans who recycled were more supportive of a campus green fund, suggesting that there may be important moderating variables that condition spillover processes.

Like negative spillover, positive spillover also has some basis in psychological theory and empirical evidence. Self-perception theory (Bem, 1972) argues that we at least partially infer information about our attitudes by observing our own behaviors. Therefore, a person who adopts a pro-environmental action may, as a result, begin to develop a stronger concern for the environment. Consistent with this theory, empirical work has found that reminding an individual of his or her past pro-environmental actions is associated with an increase in pro-environmental identity and, to some degree, pro-environmental behavior (Van der Werff, Steg, & Keizer, 2014). Similarly, cognitive dissonance theory (Festinger, 1962) argues that people desire consistency and may, therefore, feel a sense of discomfort from engaging in an environmentally protective act in one setting but not in another. This experience of anxiety or “dissonance” should, in theory, motivate people to align their actions and beliefs. By engaging in a pro-environmental action, a person may also acquire useful knowledge and skills that empower him/her to adopt other actions in the future (De Young, 2000; Thøgersen, 1999). In this way, nudging a person towards the adoption of a new PEB may be a valuable learning experience for that individual that facilitates further PEBs.

There has been much correlational research demonstrating a positive relationship between PEBs (Harland, Staats, & Wilke, 1999; Thøgersen, 1999; Whitmarsh & O’Neill, 2010; Willis & Schor, 2012). However, correlational methods are limited in their ability to establish causality. Thøgersen and Ölander (2003) improved upon this work by conducting a three-wave longitudinal survey among Danish consumers, finding positive spillover effects for some

behaviors, though not all. Baca-Motes and colleagues (2013) also found evidence of positive spillover using a field experiment. Their results suggested that, in response to an effective intervention, hotel guests adopted both targeted and non-targeted PEBs in greater numbers than did those who did not receive the intervention (or who received a less effective intervention). Finally, Lanzini and Thøgersen (2014) recently demonstrated that a six-week intervention promoting green purchasing resulted in positive spillover, particularly for behaviors that were relatively easy to perform (e.g., reading documents on a screen, recycling).

Research Gaps. As discussed above, there is theoretical precedent for both positive and negative spillover effects, as well as conflicting empirical support for both. As such, there is a need for additional research that attempts to reconcile these mixed findings. Based on the literatures reviewed above, we see three important goals for future research.

First, a heavy reliance on correlational designs has left many unanswered questions about whether there is a causal link between behaviors as opposed to a third variable that drives multiple related behaviors, such as environmental concern or values (Lanzini & Thøgersen, 2014; Truelove et al., 2014). Spillover is inherently a causal process regarding the effect of a pro-environmental action on subsequent behaviors. Therefore, experimental designs are necessary and the use of correlational data to examine spillover processes may be partially to blame for inconsistent findings (Truelove et al., 2014).

Second, existing work is also limited by a heavy use of self-reported behavior, behavioral intentions, and decision making in hypothetical scenarios as proxies for behavior. Prior research suggests that the relationship between these measures and actual behavior can be tenuous (Baumeister, Vohs, & Funder, 2007; Clements et al., 2015; Kormos & Gifford, 2014; List & Gallet, 2001). According to both self-perception and dissonance theories, the likelihood for

positive spillover may change depending on whether an individual attributes her behavior to an internal vs. external source (Aronson & Carlsmith, 1963; Schachter & Singer, 1962). Therefore, the extent to which a person ‘buys in’ to the idea or voluntarily puts forth effort to engage in a PEB may be an important factor in whether positive spillover occurs. Consistent with this explanation, Gneezy and colleagues’ (2012) found that negative spillover only occurred when the initial pro-social act involved little cost or effort, suggesting that by limiting research to low-effort behaviors that are easily studied in a laboratory setting, we may be biasing this body of work towards conditions that are more prone towards negative spillover.

Finally, competing theoretical explanations and mixed empirical results suggest a need for more research into the mechanisms of spillover. Moral licensing theory suggests a key role of moral self-image, whereas single action bias and self-perception theories hypothesize that environmental concern and risk perceptions are important mediating variables; although in opposite directions. More attention to the extent to which these variables mediate the relationship between initial and subsequent pro-environmental actions can help to provide clarity about when and why spillover may exist.

Overview of research and hypotheses

This study was designed to examine the presence of positive or negative spillover effects in response to an intervention targeting an effortful behavior—reducing red meat consumption over multiple days to limit GHG emissions (the initial pro-environmental behavior, PEB1). Adherence to the intervention was assessed via daily food diaries kept by participants. At the completion of the study, participants were given an opportunity to make a donation to an environmental cause (the secondary pro-environmental behavior; PEB2). We test our hypotheses

by comparing donation rates across experimental conditions in which participants reduced red meat consumption for environmental reasons (green behavior) or were not asked to reduce their red meat consumption (control). In addition to these two conditions, we also include a third condition (health behavior) so that we may gain insight into the extent to which any spillover effects that are observed are uniquely related to engaging in a PEB, versus any form of behavior change. Although we do not presume that the processes that may lead to spillover are unique to PEB, pro-environmental actions—like other common pool resource problems—are significant in that they involve a level of self-sacrifice to achieve a benefit that is enjoyed by others. It is this quality of pro-environmental actions that may make “green” behaviors vulnerable to moral licensing effects. On the other hand, it is possible that engaging in any form of effortful behavior or self-denial may undermine pro-social behavior for reasons other than moral licensing. For example, evidence for ego-depletion suggests that exerting effortful self-control can diminish people’s self-regulatory reserves and thus leave them unwilling to engage in additional behaviors that require self-control (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Muraven, 2012). If ego-depletion or similar processes lead to a reduction in pro-environmental action, we would expect donation rates to be lower in both the green behavior and health behavior conditions as compared to the control condition.

We hypothesize (H1a) that if negative spillover exists between reducing meat consumption and donations, those in the green behavior condition will donate less of their earnings to an environmental cause than will those in the control condition. On the other hand, if positive spillover exists, those in the green behavior condition will donate more of their earnings than will those in the control condition (H1b). Finally, if the null hypothesis is true and no spillover exists, we expect donation rates among those in the green behavior condition to be

equivalent to those in the control condition ($H1_{null}$). If donation rates of those in the health behavior condition mirror those of the green behavior condition, it would suggest that a process that is not tied to attitudes and motivations regarding pro-environmental behavior, and other phenomena (such as ego-depletion) should be investigated in subsequent research ($H2$).

In addition to the basic test of environmental spillover, we also examine two potential mediating variables. Drawing on moral licensing theory, we include a measure of moral self-image, which is predicted to mediate a negative spillover effect. According to this theory, a pro-social act leads to an increase in moral self-image, which then reduces the motivation to engage in subsequent pro-social acts because the individual no longer needs to establish his or her moral self-image. Based on this theory, we would expect moral self-image to be higher among those in the green behavior condition than the other two conditions (Khan & Dhar, 2006; Merritt et al., 2010). This variable should, in turn, be negatively related to donation behavior ($H3$). We also include a measure of environmental concern, which we predict will mediate positive spillover. Drawing from the work on self-perception theory, concern about the environment may increase for people who have taken an initial environmentally friendly action as they infer their attitudes based on that previous behavior (Bem, 1967; Poortinga et al., 2013). It is also possible that the green behavior manipulation will increase the participant's attention to environmental problems, resulting in an increase in environmental concern (Lanzini & Thøgersen, 2014). Regardless, an increase in environmental concern should be positively related to donation behavior ($H4$). Alternatively, work on single-action bias would suggest that an initial pro-environmental action would lead to a reduction in environmental concern, therefore reducing the likelihood of engaging in a subsequent pro-environmental act ($H5$).

Method

Respondents

Participants were adults aged 18 and over recruited through Mechanical Turk (MTurk) (Buhrmester, Kwang, & Gosling, 2011; Mason & Suri, 2012) to participate in an online study about dietary habits for up to \$5.00 in Amazon credit. All prospective participants were screened prior to enrollment in the study. Participants were eligible if they reported no health problems and reported consuming four or more servings of red meat in an average week (in this study red meat was defined as beef, pork, and lamb). Of the 709 participants who enrolled in the study, 481 completed at least three diaries and the follow-up survey, for a completion rate of 68%. Eighty-six participants were dropped from the analysis for failing a basic comprehension check after the final daily diary. These respondents could not correctly report whether they had been asked to change their diet and, if so, why. This left 396 participants in the final data set. These exclusion criteria were established prior to data collection. Table 1 summarizes the sample size and demographic characters for the sample and sub-samples. There was a disproportionately large number of male respondents in the health diet condition; therefore, the respondent's sex was entered as a control variable in all analyses that follow.

Procedure

During a screening survey, participants reported on the number of servings of red meat that they consume in an average week as well as the number of servings they consumed over the previous three days. Respondents who reported eating four or more servings of red meat in an average week were considered eligible for participation in the study. Red meat was defined as beef, pork, and lamb and a “serving” was defined as 2-3 oz. or “roughly the size of a computer

mouse or checkbook". These definitions were adapted from materials published by the American Heart Association (AHA, 2012) and the American Institute for Cancer Research (AICR, 2006).

Eligible participants were sent an invitation email via MTurk to participate in a study with the described objective of evaluating an online dietary change program. Those who agreed to participate first completed a baseline questionnaire and then received instructions about the diary program. Next, the 66% of the sample who were assigned to the experimental conditions received information about the dietary change task in which we introduced the experimental manipulation. These research participants were asked to limit their red meat consumption to one serving over a one-week period (experimental conditions), and were instructed to keep a daily food diary to track their progress. The remaining 33% of participants also kept a daily food diary, but were given no behavior change goal (control condition).

Among those in the experimental conditions, the stated purpose of the behavior change program randomly varied across participants. Half were told that we were investigating a method to lower greenhouse gas emissions (green behavior condition), the other half were told that we were investigating a method to reduce heart disease (health behavior condition). This design produced three comparisons: green behavior vs. control, health behavior vs. control, and green behavior vs. health behavior. Demographic statistics of the three groups is shown in Table 1. The manipulations are shown in Figure S1 (Online Supplementary Material).

After the initial introduction and study manipulation, participants were instructed to sign onto the study website each evening to complete their daily food diaries. To encourage truthful reporting of food consumption, participants were told (and reminded each day) that their payment for participating in the study was not based on what they ate, but purely on whether they completed the food diary itself each day. Participants were quizzed after each food diary to

make sure they understood the instructions and that those in the experimental conditions knew the reasons they had been given for why they should reduce their red meat consumption. Participants were then given feedback about their progress in the study and encouraged to stick with their assigned behavior. They were also shown reminders of the purpose of the study (e.g., their assigned condition). The instructions shown to participants and experimental manipulations are shown in Figure S1 of the Online Supplementary Material.

After completing the daily diary phase, respondents completed a follow-up survey in which they received a summary of their performance. Prior to starting this survey, those in the diet change conditions saw their consumption compared to the average red meat consumption they had reported before the start of the diet and were told how this translated into outcomes for climate change or heart disease (see Figure S3 in the Supplementary Material). Those in the control condition only received feedback about the number of daily diaries they had filled out. The respondents then answered a number of questions, including the hypothesized mediator variables: moral self-image and environmental concern. Finally, just before the completion of the study, respondents were asked if they would like to donate a portion of their earnings for participating in this research to an environmental organization (The Sierra Club). This donation served as the dependent variable. This method has been used successfully by other researchers and has been shown to be a valid measure of environmentally significant behavior (Clements et al., 2015).

Participants could earn up to \$5 for completing the full study. They were compensated for each individual component of the study that they completed (e.g., the individual food diaries and the follow-up survey). To incentivize complete participation, those who completed all diaries and the follow-up survey were entered into a lottery for a 1/20 chance to win \$15. If a respondent

failed to complete a component of the study, he/she was not paid for that component and was not entered into the lottery. Those who failed the comprehension check were compensated using the procedure described above, but were omitted from data analysis.

Approximately halfway through this study the research protocol was revised to reduce cost and the time demands on the participants. Therefore, for $N=182$ participants, the protocol described above took place over the course of three days rather than the full seven. These participants were told to consume no red meat during those three days. No differences were found between participants in the 3-day diet and those in the 7-day diet; therefore, the two samples are combined in the analyses that follow. We include a variable for the study duration (3 vs. 7 day) as a control variable in all models.

Measures

Moral self-image. We adapted Khan and Dhar's (2006) five-item measure of moral self-concept and some of the moral traits outlined by Aquino and Reed (2002). Participants rated their level of agreement (from 1 = *strongly disagree* to 7 = *strongly agree*) that they were: *compassionate, fair, selfish, moral, and immoral*. The *selfish* and *immoral* items were reverse-coded before a composite score was created. Cronbach's alpha was .76.

Environmental concern. Environmental concern was measured with three items. Respondents were asked how concerned they are about: *environmental damage, global warming, and loss of wildlife*. The stem, 'How concerned are you about...' is a commonly used a measure of issue concern; similar items have been used by Leiserowitz and colleagues (Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Rosenthal, 2016) to assess concern about global warming. These items were embedded within a longer list of contemporary social and political issues (e.g., terrorism, the economy, etc.) to mask the environmental focus of this research. Answers were

made on a 5-point scale ranging from *not at all* to *very much*. Cronbach's alpha was .87. The three items were averaged to create a composite score.

Donation measure. At the end of the follow-up survey respondents were shown the following, "We offer all research participants the opportunity to donate any amount of their earnings (up to \$5.00) to a non-profit organization that is being sponsored by the research team. The sponsored non-profit rotates from month to month. The current organization is: The Sierra Club, an environmental organization. More information can be found here: <http://www.sierraclub.org/>." Respondents could enter any value between \$0 and \$5.00 (the maximum amount earned in this study). The amount entered was deducted from the participant's payment. A donation equivalent to the amount donated by the research participants was made to the Sierra Club by a member of the research team.

Behavioral difficulty. Three items were used to assess how difficult it was for respondents to comply with the daily diary/dietary change task: *How difficult was it for you to comply with this program?*, *How much effort did it require*, and *"How much sacrifice did it require?"* Answers were made on an 11-point scale ranging from 0 = *not at all* to 10 = *very much*. The three items were highly correlated (Cronbach's Alpha = .94) and were, therefore, averaged to create a single score. Because these questions were added to the follow-up survey after data collection had started, these data are only available on $n = 161$ cases.

Analysis and Results

Manipulation Check

A one-way repeated measures analysis of variance (ANOVA) was used to assess whether the dietary change manipulation in the two experimental groups was successful, leading to a

change in the number of red meat servings per day from baseline to follow-up. Due to fact that there was an unequal distribution of male participants across the experimental groups, the respondent's sex was controlled for in the analysis, as was the duration of the study (3 vs. 7 days). As expected, results indicated significant main effects of time (baseline vs. follow-up), $F(1, 391) = 18.77, p < .001$, condition, $F(2, 391) = 33.81, p < .001$, and a time x condition interaction effect, $F(2, 391) = 61.44, p < .001$. A simple effects analysis revealed that, as expected, there was a significant reduction in red meat consumption over the course of the week in both the green behavior ($t = 6.67, p < .001, n = 134, \text{mean change} = -1.00$) and health behavior ($t = 14.20, p < .001, n = 123, \text{mean change} = -0.91$) conditions. Those in the control condition increased consumption by 0.50 servings per day ($t = 5.75, p < .001, n = 138$). There was no effect of study duration, $F(1, 391) = 0.05, p = .82$.

Next, we examined the perceived difficulty of engaging in this study to assess whether we effectively engaged those in the experimental groups in an effortful behavior change. Results from a one-way ANOVA indicated a significant effect of condition, $F(2, 159) = 70.51, p < .001$. Perceived difficulty was lower among those in the control condition ($M = 0.37, SD = 0.26$; Scale = 0 to 10) relative to those in the green behavior condition ($M = 3.83, SD = 0.28$), Welch $t(56.38) = -9.54, p < .001$, and those in the health behavior condition ($M = 4.56, SD = 0.28$), Welch $t(57.55) = -11.58, p < .001$. The difference between the green behavior and health behavior conditions was not significant, $t(99) = -1.78, p = .14$.

Behavioral Spillover

We assessed the impact of the experimental manipulation on donation behavior in two ways. First, we conducted a logistic regression with bootstrapped standard errors to examine the effect of condition on a dichotomously coded outcome variable of whether or not the respondent

made a donation to the environmental group. Because spillover is relevant only for those who adopt an initial PEB, those in the green behavior and health behavior conditions who did not reduce their red meat consumption ($n = 12$) were removed from the analysis. (However, the analysis was conducted with and without these participants included, and there was no substantive difference in the results.) We controlled for the respondent's sex and the duration of the study in the analyses. Dummy coded variables for experimental group were entered with the control condition as the reference group.

The results (Table 2) indicated a significant effect of the respondent's sex, whereby significantly fewer men made a donation ($M = 10\%$) than women ($M = 17\%$). There was also a significant effect of experimental condition, such that those in the health behavior condition were significantly less likely to make a donation (9%) compared to those in the control condition (19%). Those in the green behavior condition were no more or less likely to make a donation than those in the control condition. In a follow-up analysis, we switched the reference group to the health behavior group to test for differences between the health behavior and green behavior conditions and the effect was not significant. Adjusted means are presented in Figure 1. The effect of study duration was not significant.

Next, we examined the effect of experimental group on the amount of money donated. As is common with monetary data, this variable was highly positively skewed. Approximately 14% of the sample made a donation, resulting in a high frequency of zero data points. The donations that were made ranged from \$0.01 to \$5.00 with a median donation of \$0.75 ($M = \0.92). Therefore, we modeled these data using a negative binomial regression. The respondent's sex and the duration of the study were entered as controls. The experimental condition variable was dummy coded, with the control condition entered as the reference group. Model results are

shown in the right column of Table 2. There was a significant effect of the respondent's gender. Male respondents donated less (\$0.07), on average, than female respondents (\$0.17). However, there was no difference between the two behavior change conditions and the control condition. In a follow-up analysis, we switched the reference group to the health behavior condition; yet, there was no difference between the health behavior and green behavior conditions. Estimated marginal means are also shown in Figure 1.

Mechanisms of Spillover

Although the results reported above provide no evidence for environmental spillover, there was evidence that the health behavior condition reduced donation rates, suggesting the possibility of negative spillover across behavioral domains. To further explore this and to examine the effect of the experimental manipulation on theorized mechanisms of spillover, we conducted a mediation analysis to predict the binary outcome variable of whether the respondent made a donation or not. In this analysis we estimated a parallel multiple mediation logit model with bias-corrected asymmetric bootstrapping of the 95% confidence interval (CI) based on 10,000 bootstrap samples (PROCESS, Model 4 v. 2.13). We utilized the technique proposed by Hayes and Preacher (2014) to accommodate a multi-categorical independent variable. The experimental factor was dummy coded with the control condition as the reference category. The mediator variables were moral self-image and environmental concern. This model controls for the effects of the respondent's sex and the duration of the study.

The model results are presented in Figure 2. The model including the mediators improved the *pseudo R²* from 0.05 to 0.15 (based on the *Nagelkerke R²*). The total indirect effect estimates suggest that moral self-image did not mediate either the green or health behavior conditions compared to the control (Green: -0.01 (0.04), 95% CI = -0.12 to 0.04; Health: 0.01 (0.04), 95%

$CI = -0.03$ to 0.13). Environmental concern partially mediated the effect of the green behavior and, to a lesser extent, the health behavior conditions on donation behavior (Green: 0.20 (0.11), $95\% CI = 0.02$ to 0.44 ; Health: 0.18 (0.10), $95\% CI = 0.00$ to 0.42).

Both experimental groups led to a significant increase in environmental concern and, in turn, environmental concern was positively related to making a donation. Therefore, these results provide some evidence for a route to positive spillover via environmental concern: Those who engaged in an initial PEB (i.e., those in the green behavior condition) demonstrated higher levels of environmental concern than did those in the control condition. Surprisingly, those in the health behavior condition also demonstrated a greater concern for the environment than did those in the control condition. After accounting for the mediators, the direct effect of the health behavior condition on donation rates remained negative and significant and, in fact, increased in magnitude, suggesting a suppression effect. After including the mediators, there was also a marginally significant negative effect of the green behavior condition on donation rates.

Discussion

The results from this study provide several insights regarding environmental spillover processes. First, in a direct test of spillover, there was no evidence for positive or negative spillover, providing no support for Hypotheses 1a or 1b. Those who received the green behavior manipulation were just as likely to make a donation to an environmental organization, and donated an approximately equivalent amount, as those in the health behavior and control conditions. This finding is consistent with Hypothesis 1_{null} predicting no spillover, and replicates a small set of studies that have employed an experimental design and have found no evidence of spillover within the environmental domain (Poortinga et al., 2013; Reams, Geaghan, & Gendron, 1996). This finding offers some evidence that the concern that policies and programs designed to

promote voluntary pro-environmental action will de-motivate subsequent actions may be unfounded. Contrary to Hypothesis 3, there was no effect of the green behavior manipulation on moral self-image, and moral self-image was unrelated to donation behavior. This is surprising given numerous studies theorizing that moral licensing effects result from changes to moral self-image (Jordan, Mullen, & Murnighan, 2011; Merritt et al., 2010; Nisan, 2013; Sachdeva, Iliev, & Medin, 2009). However, few studies have actually measured moral self-worth to confirm that this variable is driving moral licensing effects (Kahn & Dhar, 2006). Thus, this study adds significantly to this literature despite the fact that we did not find evidence to support the theory.

On the other hand, consistent with Hypothesis 4 (and inconsistent with Hypothesis 5), the green behavior condition led to a small but significant increase in concern about the environment. Environmental concern was also associated with a greater likelihood of making a donation, and was shown to partially mediate the green behavior manipulation on positive spillover. This result suggests that those who developed a greater concern for the environment by virtue of participating in this behavior change program were more likely to make a donation to an environmental cause, indicating a possible route to positive spillover. Again, this finding contradicts the assumptions made by some that programs to encourage individual pro-environmental behavior may distract support from more robust government action to address environmental problems (Tidwell, 2009; Wagner, 2011a). Rather, it is consistent with self-perception theory (Bem, 1967) and dissonance theory (Abelson, 1959; Festinger, 1962), which would expect a strengthening of attitudes and perceptions that are consistent with one's recent actions. This also reinforces the importance of mediation processes in spillover. Mediation can occur even when direct spillover effects are either non-existent or in the opposite direction as direct effects (Thøgersen, 1999; Truelove et al., 2016). Whereas previous work has shown the

importance of personal norms (Thøgersen, 1999), and environmental self-identity (Truelove et al., 2016) as a mediator of spillover, our work contributes to the literature by highlighting the role of environmental concern.

It is important to note that the health behavior condition also resulted in a marginally significant increase in environmental concern relative to the control condition, suggesting that this impact on attitudes was not isolated to those who participated in a PEB. This does raise the question of whether it was engaging in a pro-environmental action that prompted greater concern for the environment, or simply the act of changing a behavior at all. Despite the fact that we manipulated the justification offered for this behavior change, dissonance theories offer precedent for the expectation that individuals will develop a diverse set of reasons for why they engage in an action, particularly one that is effortful (Abelson, 1959; Festinger, 1962). Within the environmental domain, Thøgersen (2011) has theorized that this process often operates in the direction of adopting beliefs about the self-serving aspects of one's decision, even when a decision was made for primarily unselfish reasons. This is presumably to protect their self-image as competent and rational individuals. Like Thøgersen, we find evidence that individuals adopted attitudes that are consistent with their recent behavior change, but that were unique from the initial reason why they adopted the behavior. However, in contrast to Thøgersen, we observed that those who engaged in a behavior change for self-serving reasons (to lower their own risk of heart disease) demonstrated more unselfish attitudes (concern for the environment) as a result.

Surprisingly, these results also indicated that those in the health behavior condition were less likely to make a donation to an environmental cause than those in the control condition. Although this finding is not indicative of a spillover effect, it does suggest a relationship between the behavior change task and subsequent behavior. There are a number of possible explanations

for this pattern. First, in accordance with Hypothesis 2, it may be that both the green and health behavior conditions involved a measure of self-denial that undermined the respondent's willingness to engage in an additional form of self-denial. This explanation is consistent with the ego-depletion theory of limited "reserves" of self-regulatory control (Baumeister et al., 1998). If this explanation were true within the context of the current study, we would expect to see significantly lower donations in both of the experimental conditions relative to the control, which was not observed. However, the pattern of means is consistent with this explanation. Nineteen percent of participants in the control condition made a donation, compared to 9% in the health behavior condition and 13% in the green behavior condition. Only the health behavior condition was significantly different than the control at the $p < .05$ level, whereas the p -value for the difference between the green behavior and control was $p = .17$. Clearly, this p -value suggests that this mean difference may not be reliable; however, we encourage others in the field to consider ego-depletion when designing studies to examine spillover effects. Few studies are designed in such a way to delineate between spillover that results from engaging in a pro-environmental behavior specifically versus any behavior at all.

An alternative explanation is that the health behavior condition, which explicitly mentioned heart disease, provoked anxiety among participants to a greater degree than the green behavior or control conditions. Mortality salience, i.e., when an individual is primed to contemplate his or her own death, is known to promote self-protective behavior (Burke, Martens, & Faucher, 2010) and to inhibit behavior that perpetuates anxiety (Hirschberger, Ein-Dor, & Almakias, 2008). For example, Kasser and Sheldon (2000) found that, following a mortality salience manipulation, participants played more competitively in a simulated resource management game. If the above hypothesis were true, we may expect participants who received the health behavior manipulation

to demonstrate higher levels of anxiety than those in the green behavior condition, and that anxiety would be negatively associated with donation behavior. Although we did not measure anxiety per se, we did ask respondents to report their concern about a variety of non-environmental issues (e.g., heart disease, terrorism) in addition to the three environmental issues (global warming, environmental degradation, and loss of wildlife) that were used in the environmental concern scale. In a series of follow-up analyses, we examined whether average levels of concern across the non-environmental items in this scale mediated the effect of the health behavior condition on making a donation. As in earlier analyses, environmental concern was again entered as a second potential mediator to compare the relative importance of the two concern measures. This approach of creating two subscales (environmental and general) was supported by a factor analysis (described in Online Appendix A within the supplementary material). The results (Online Appendix B) suggested that, relative to the control, the health behavior condition increased general concern; however, general concern did not impact donation behavior. There are questions about the validity of this measure of general concern as a proxy for anxiety, as well as the extent to which we would expect an affective response to mortality salience (Landau et al., 2004). However, taken at face value, these results are not consistent with the explanation that mortality salience accounted for the lower rate of donations in the health behavior condition.

Finally, a third explanation is that the health behavior condition, which prompted individuals to change their diet to protect their own health, primed respondents with a self-protective or self-interested value orientation that affected donation behavior. Prior work has found a number of priming effects on pro-social behavior. For example, priming individuals with images of money led to more self-regarding behavior (Kouchaki, Smith-Crowe, Brief, & Sousa,

2013; Vohs, Mead, & Goode, 2006), priming with concepts of god or secular moral institutions led to more pro-social behavior (Shariff & Norenzayan, 2007), and individuals who were primed with rude- or polite-related stimuli were more and less likely to interrupt an experimenter, respectively (Bargh, Chen, & Burrows, 1996). It is possible that focusing the participants' attention on their own health, as compared to an environmental or neutral task, may have suppressed donation behavior among those in the health behavior condition.

This study does have a number of limitations that should be discussed. First, red-meat consumption was self-reported. Although efforts were made to promote honest reporting (for example, paying participants based on frequency, not content of the daily diaries), participants may not have been totally honest about their diets or may have misestimated portion sizes. However, we believe that this paradigm offers an important (if not perfect) tool for assessing real PEBs (red meat consumption and environmental donations) rather than behavioral intentions that are so often utilized with online samples. Online samples have limitations as well, and it is possible that the MTurk participants reacted differently to the health and environmental interventions than would those in the general population due to demographic differences or familiarity with online studies. For example, they may have been more comfortable with an online daily diary intervention than people who are less technologically savvy, and thus more likely to reduce their red-meat consumption thanks to the daily reminders of study goals. Further, it is important to note that this study examined only two behaviors. It may be that spillover processes are contingent upon particular characteristics of behaviors, or the combination of behaviors. For example, others have speculated that similarity between behaviors may amplify spillover effects (Thøgersen, 2004; Truelove et al., 2014).

One advantage of this study is that it is among the first to examine an initial behavior that requires a substantial investment over time rather than a one-off behavior (see Lanzini and Thøgersen, 2014 for another example). Theoretically, the repeated reminders that participants received to cut back on meat consumption coupled with the fact that most participants did make some progress toward that goal and received praise for doing so, should have strengthened environmental self-identity, leading to positive spillover. Yet, we did not observe a direct effect of positive spillover. It could be that the reminders and feedback participants received each night as they completed their diaries actually served more as a reminder of progress toward the goal of reducing meat consumption than a signal of commitment to the cause. Framing past moral behavior in terms of goal progress has been shown to lead to negative spillover between prosocial behaviors as it frees up motivation to be switched to other relevant goals (Susewind & Hoelzl, 2014). However, framing past moral behavior in terms of commitment toward a goal has been shown to lead to positive spillover (Susewind & Hoelzl, 2014). Future research should consider asking participants to make a commitment to change their initial behavior (in line with Baca-Motes et al., 2013) and ask them to reaffirm that commitment each day as they reflect on their behavior performance. Additionally, future research should consider allowing participants the option to choose a charity to donate to, with an environmental charity as one of the options listed. In the present study, this design was not economically feasible. Providing multiple donation options would likely reduce the rate of environmental donations, requiring a much larger sample to detect significant effects. However, with sufficient resources, a design where participants are encouraged to perform an initial, difficult pro-environmental behavior and then given an option to donate to the charity of their choice could better mirror real world conditions.

Overall, this research extends the existing literature on PEB spillover by manipulating an effortful pro-environmental action using a novel experimental design to assess its impact on subsequent actions, while simultaneously examining the extent to which environmental concern and moral self-image explain the spillover relationship. Our study provided no direct evidence of spillover, though the pattern of results provides some evidence that interventions targeting one PEB may positively spill over to other PEBs by increasing environmental concern. We found no evidence that moral self-image increases following the performance of a PEB, opening the door to questions about the theoretical vs. empirical support for moral licensing effects in PEB spillover. Additional work is clearly needed before we can make recommendations to campaign designers interested in maximizing positive spillover and avoiding negative spillover.

References

- Abelson, R. P. (1959). Modes of resolution in belief dilemmas. *The Journal of Conflict Resolution*, 3(4) 343 – 352. doi: 10.1177/002200275900300403
- AHA. (2012, June). Eat more chicken, fish and beans than red meat. American Heart Association: Learn and Live. Retrieved April 4, 2017 from
http://www.heart.org/HEARTORG/HealthyLiving/HealthyEating/Nutrition/Eat-More-Chicken-Fish-and-Beans_UCM_320278_Article.jsp#.WOQeI9LyuUk
- AICR. (2006). Questions about portion sizes, Lycopene, and red meat. Retrieved February 5, 2013, from
<http://www.aicr.org/press/health-features/nutrition-wise/questions-about-portion-sizes-lycopene-and-red-meat.html?referrer=https://www.google.com/>
- Aquino, K., & Reed, A. (2002). The self-importance of moral identity. *Journal of Personality and Social Psychology*, 83(6), 1423–1440. doi:10.1037/0022-3514.83.6.1423
- Aronson, E., & Carlsmith, J. M. (1963). Effect of the severity of threat on the devaluation of forbidden

- behavior. *The Journal of Abnormal and Social Psychology*, 66(6), 584–588. doi:10.1037/h0039901
- Baca-Motes, K., Brown, A., Gneezy, A., Keenan, E. A., & Nelson, L. D. (2013). Commitment and behavior change: Evidence from the field. *Journal of Consumer Research*, 39(5), 1070–1084. doi:10.1086/667226
- Bargh, J. a, Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype-activation on action. *Journal of Personality and Social Psychology*, 71(2), 230–244. doi:10.1037/0022-3514.71.2.230
- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, 74(5), 1252–1265. doi:10.1037/0022-3514.74.5.1252
- Baumeister, R. F., Vohs, K. D., & Funder, D. C. (2007). Psychology as the science of self-reports and finger movements: Whatever happened to actual behavior? *Perspectives on Psychological Science*, 2(4), 396–403. doi:10.1111/j.1745-6916.2007.00051.
- Bem, D. J. (1967). Self-perception: An alternative interpretation of cognitive dissonance phenomena. *Psychological Review*, 74(3), 183–200. doi:10.1037/h0024835
- Bem, D. J. (1972). Self-perception theory. *Advances in Experimental Social Psychology*, 6(C), 1–62. doi:10.1016/S0065-2601(08)60024-6
- Blanken, I., van de Ven, N., & Zeelenberg, M. (2015). A meta-analytic review of moral licensing. *Personality and Social Psychology Bulletin*, 41(4), 540–588. doi:10.1177/0146167215572134
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science*, 6(1), 3–5. doi:10.1177/1745691610393980
- Burke, B. L., Martens, A., & Faucher, E. H. (2010). Two decades of terror management theory: A meta-analysis of mortality salience research. *Personality and Social Psychology Review*, 14(2), 155–195. doi:10.1177/1088868309352321
- Carrico, A., Vandenberghe, M. P., Stern, P. C., & Dietz, T. (2015). US climate policy needs behavioural

- science. *Nature Climate Change*, 5(3), 177–179. doi:10.1038/nclimate2518
- Clements, J. M., McCright, A. M., Dietz, T., & Marquart-Pyatt, S. T. (2015). A behavioural measure of environmental decision-making for social surveys. *Environmental Sociology*, 1(1), 27–37. doi:10.1080/23251042.2015.1020466
- De Young, R. (2000). Expanding and evaluating motives for environmentally responsible behavior. *Journal of Social Issues*, 56(3), 509–526. doi:10.1111/0022-4537.00181
- Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Vandenbergh, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences*, 106(44), 18452–6. doi:10.1073/pnas.0908738106
- Festinger, L. (1962). *A theory of cognitive dissonance* (2nd ed.). Stanford: Stanford University Press.
- Gardiner, S. M. (2010). Ethics and global climate change. *Ethics*, 114(3), 555–600. doi: 10.1086/382247
- Gneezy, A., Imas, A., Brown, A., Nelson, L. D., & Norton, M. I. (2012). Paying to be nice: Consistency and costly prosocial behavior. *Management Science*, 58(1), 179–187. doi:10.1287/mnsc.1110.1437
- Harland, P., Staats, H., & Wilke, H. A. M. (1999). Explaining proenvironmental intention and behavior by personal norms and the Theory of Planned Behavior. *Journal of Applied Social Psychology*, 29(12), 2505–2528. doi:10.1111/j.1559-1816.1999.tb00123.x
- Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology*, 67, 451–470. doi:10.1111/bmsp.12028
- Hirschberger, G., Ein-Dor, T., & Almakias, S. (2008). The self-protective altruist: Terror management and the ambivalent nature of prosocial behavior. *Personality and Social Psychology Bulletin*, 34(5), 666–678. doi:10.1177/0146167207313933
- Jordan, J., Mullen, E., & Murnighan, J. K. (2011). Striving for the moral self: The effects of recalling past moral actions on future moral behavior. *Personality and Social Psychology Bulletin*, 37(5), 701–713. doi:10.1177/0146167211400208
- Kasser, T., & Sheldon, K. M. (2000). Of wealth and death: Materialism, mortality salience, and

- consumption behavior. *Psychological Science*, 11(4), 348–351. doi:10.1111/1467-9280.00269
- Khan, U., & Dhar, R. (2006). Licensing effect in consumer choice. *Journal of Marketing*, 43(2), 259–266. doi: <http://dx.doi.org/10.1509/jmkr.43.2.259>
- Kormos, C., & Gifford, R. (2014). Validity of self-report measures of pro-environmental behavior: A meta-analytic review. *Journal of Environmental Psychology*, 40, 1–38. doi:10.1016/j.jenvp.2014.09.003
- Kouchaki, M., Smith-Crowe, K., Brief, A. P., & Sousa, C. (2013). Seeing green: Mere exposure to money triggers a business decision frame and unethical outcomes. *Organizational Behavior and Human Decision Processes*, 121(1), 53–61. doi:10.1016/j.obhdp.2012.12.002
- Landau, M. J., Solomon, S., Greenberg, J., Coen, F., Pyszczynski, T., Arndt, J., ... Cook, A. (2004). Deliver us from evil: The effects of mortality salience and reminders of 9/11 on support for President George W. Bush. *Personality and Social Psychology Bulletin*, 30(9), 1136–1150. doi:10.1177/0146167204267988
- Lanzini, P., & Thøgersen, J. (2014). Behavioural spillover in the environmental domain: An intervention study. *Journal of Environmental Psychology*, 40, 381–390. doi:10.1016/j.jenvp.2014.09.006
- Leiserowitz, A. A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (2016). Climate change in the American mind: March, 2016. New Haven, CT: Yale Program on Climate Change Communication. Retrieved from <http://climatecommunication.yale.edu/publications/climate-change-american-mind-march-2016/>
- List, J. a., & Gallet, C. a. (2001). What experimental protocol influence disparities between actual and hypothetical stated values? *Environmental and Resource Economics*, 20(3), 241–254. doi:10.1023/A:1012791822804
- Mason, W., & Suri, S. (2012). Conducting behavioral research on Amazon's Mechanical Turk. *Behavior Research Methods*, 44(1), 1–23. doi:10.3758/s13428-011-0124-6
- Mazar, N., & Zhong, C.-B. (2010). Do green products make us better people? *Psychological Science*, 21(4), 494–8. doi:10.1177/0956797610363538

- McCright, A. M., Xiao, C., & Dunlap, R. E. (2014). Political polarization on support for government spending on environmental protection in the USA, 1974-2012. *Social Science Research*, 48, 251–260. doi:10.1016/j.ssresearch.2014.06.008
- Merritt, A. C., Effron, D. a., & Monin, B. (2010). Moral self-licensing: When being good frees us to be bad. *Social and Personality Psychology Compass*, 4(5), 344–357. doi:10.1111/j.1751-9004.2010.00263.x
- Monin, B., & Miller, D. T. (2001). Moral credentials and the expression of prejudice. *Journal of Personality and Social Psychology*, 81(1), 33–43. doi:10.1037//0022-3514.81.1.33
- Muraven, M. (2012). Ego depletion: Theory and evidence. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* (pp. 111–126). Oxford University Press.
- Nisan, M. (2013). The moral balance model: Theory and research extending our understanding of moral choice and deviation. In W. M. Kurtines, J. Gewirtz, & J. L. Lamb (Eds.), *Handbook of moral behavior and development* (pp. 213– 249). Hillsdale, NJ: Erlbaum.
- Nordlund, A. M., & Garvill, J. (2002). Value structures behind proenvironmental behavior. *Environment & Behavior*, 34(6), 740–756. doi:10.1177/001391602237244
- Poortinga, W., Whitmarsh, L., & Suffolk, C. (2013). The introduction of a single-use carrier bag charge in Wales: Attitude change and behavioural spillover effects. *Journal of Environmental Psychology*, 36, 240–247. doi:10.1016/j.jenvp.2013.09.001
- Reams, M. A., Geaghan, J. P., & Gendron, R. C. (1996). The link between recycling and litter: A field study. *Environment & Behavior*, 28(1), 92–110. doi:10.1177/0013916596281005
- Sachdeva, S., Iliev, R., & Medin, D. L. (2009). Sinning saints and saintly sinners: The paradox of moral self-regulation. *Psychological Science*, 20(4), 523–8. doi:10.1111/j.1467-9280.2009.02326.x
- Schachter, S., & Singer, J. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review*, 69(5). doi:10.1037/h0021465
- Shariff, A. F., & Norenzayan, A. (2007). God is watching you. *Psychological Science*, 18(9), 803–809. doi:10.1111/j.1467-9280.2007.01983.x

- Sovacool, B. K. (2014). Energy studies need social science. *Nature*, 511, 529–530. doi: 10.1038/511529a
- Susewind, M., & Hoelzl, E. (2014). A matter of perspective: Why past moral behavior can sometimes encourage and other times discourage future moral striving. *Journal of Applied Social Psychology*, 44(3), 201–209. doi:10.1111/jasp.12214
- Thøgersen, J. (1999). Spillover processes in the development of a sustainable consumption pattern. *Journal of Economic Psychology*, 20(1), 53–81. doi:10.1016/S0167-4870(98)00043-9
- Thøgersen, J. (2004). A cognitive dissonance interpretation of consistencies and inconsistencies in environmentally responsible behavior. *Journal of Environmental Psychology*, 24(1), 93–103. Doi:10.1016/S0272-4944(03)00039-2
- Thøgersen, J. (2011). Green shopping: For selfish reasons or the common good? *American Behavioral Scientist*, 55(8), 1052–1076. doi:10.1177/0002764211407903
- Thøgersen, J., & Noblet, C. (2012). Does green consumerism increase the acceptance of wind power? *Energy Policy*, 51, 854–862. doi:10.1016/j.enpol.2012.09.044
- Thøgersen, J., & Ölander, F. (2003). Spillover of environment-friendly consumer behaviour. *Journal of Environmental Psychology*, 23(3), 225–236. doi:10.1016/S0272-4944(03)00018-5
- Tidwell, M. (2009, December 9). To fix climate change, stop going green all alone. *Washington Post*. Retrieved from <http://www.washingtonpost.com/wp-dyn/content/article/2009/12/04/AR2009120402605.html>
- Truelove, H., Carrico, A., Weber, E., Raimi, K. T., & Vandenberghe, M. P. (2014). Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework. *Global Environmental Change-Human and Policy Dimensions*, 29, 127–138. doi:10.1016/j.gloenvcha.2014.09.004
- Truelove, H., Yeung, K. Y., Carrico, A., Gillis, A. J., & Raimi, K. T. (2016). From plastic bottles to policy support: An experimental test of pro-environmental spillover. *Journal of Environmental Psychology*, 46, 55–66. doi:10.1016/j.jenvp.2016.03.004
- Van der Werff, E., Steg, L., Keizer, K. (2014). I am what I am, by looking past the present: The influence

- of biospheric values and past behavior on environmental self-identity. *Environment and Behavior*, 46, 626 – 657. doi: 10.1177/0013916512475209
- Vandenbergh, M., Barkenbus, J., & Gilligan, J. (2008). Individual carbon emissions: The low-hanging fruit. *UCLA Law Review*, 55, 1701.
- Vohs, K. D., Mead, N. L., & Goode, M. R. (2006). The psychological consequences of money. *Science*, 314(5802), 1154–1156. doi:10.1126/science.1132491
- Wagner, G. (2011a). But will the planet notice? How smart economics can save the world. New York: Hill and Wang.
- Wagner, G. (2011b, September 7). Going green but getting nowhere. *The New York Times*. Retrieved from <http://www.nytimes.com/2011/09/08/opinion/going-green-but-getting-nowhere.html>
- Weber, E. (1997). Perception and expectation of climate change: Precondition for economic and technological adaptation. In M. H. Bazerman, D. M. Messick, A. Tensbrunsel, & K. Wade-Benzoni (Eds.), *Environment, ethics, and behavior: The psychology of environmental valuation and degradation*. (pp. 314–341). San Francisco, CA: The New Lexington Press/Jossey-Bass Publishers. Retrieved from <http://doi.apa.org/?uid=1997-08936-012>
- Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30(3), 305–314. doi:10.1016/j.jenvp.2010.01.003
- Willis, M. M., & Schor, J. B. (2012). Does changing a light bulb lead to changing the world? Political action and the conscious consumer. *The ANNALS of the American Academy of Political and Social Science*, 644(1), 160 - 190. doi:10.1177/0002716212454831

Tables & Figures

Table 1. Demographic information and red meat consumption by experimental group

	Green		Health	
	Behavior		Behavior	Control
	Group	Group	Group	Full Sample
N	134	124	138	396
% Male	41.05	52.42	39.13	43.93
Age (mean)	36.98	37.00	36.71	36.89
Education (median)	Bachelor's	Bachelor's	Bachelor's	Bachelor's
Income (median)	\$35 - 50k	\$35 - 50k	\$35 - 50k	\$35 - 50k
Made a donation (%)	13	9	19	14
Donation amount (mean)	\$0.10	\$0.08	\$0.19	\$0.13
Baseline red meat consumption ¹ (mean)	1.19	1.15	1.01	1.12
Intervention red meat consumption ¹ (mean)	0.20	0.23	1.51	0.67

Table 2. Summary of model results examining the effect of experimental condition on donation behavior.

	Made Donation ¹					Donation Amount ²							
	B	SE(B)	W	p(W)	OR	B	SE(B)	W	p				
Constant/Intercept	-1.13	0.27	17.76	<.01	0.32	20.85	4.59	20.68	<.01				
Male	-0.53	0.34	2.80	.09	0.59	-9.80	4.15	5.58	.02				
Duration (3 day vs. 7 day)	-0.22	0.32	0.52	.50	0.81	-1.13	3.27	0.12	.73				
Condition													
Green Behavior (vs. Control)	-0.46	0.35	1.88	.18	0.63	-4.22	4.81	0.77	.38				
Health Behavior (vs. Control)	-0.90	0.43	5.19	.02	0.41	-6.51	4.56	2.04	.15				
Green Behavior(vs. Health) [^]	0.44	0.46	1.08	.30	1.55	-2.30	3.33	0.47	.49				
Likelihood ratio test	10.26, p = .04					114.46, p < .01							
Nagelkerke R ²	0.05												
Correct Classification	85.9%												

¹Logistic regression analysis²Negative binomial regression

B = Unstandardized beta weight; SE(B) = Standard Error of the beta weight; OR = Odds Ratio; W = Wald Chi-square statistic. [^]Contrast was estimated in a second model.

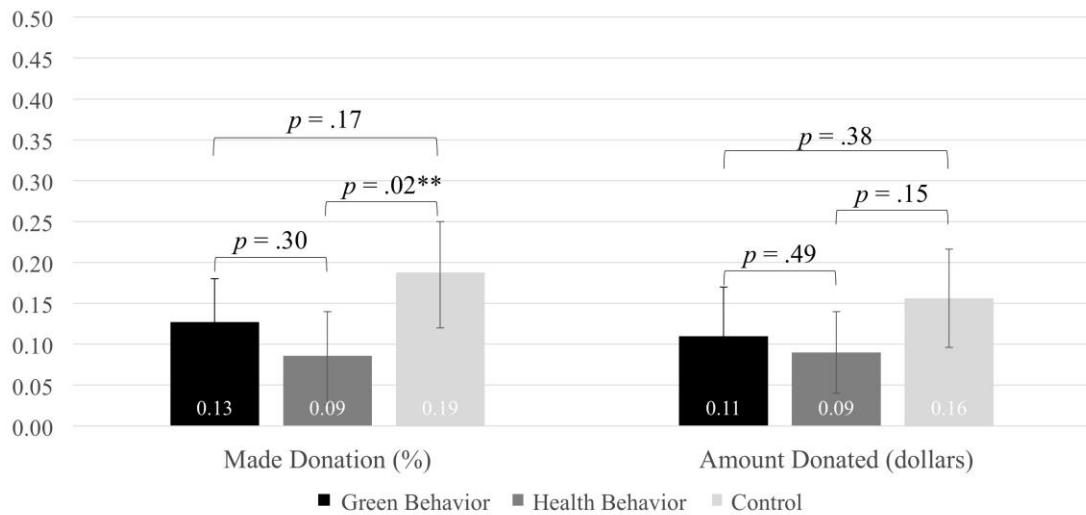


Figure 1. Adjusted marginal means for the proportion of respondents who made a donation to an environmental cause and the average amount donated (US dollars) by experimental condition. Error bars represent the 95% confidence interval.

Supplementary Material

Control	Health Behavior	Green Behavior
<p>This is a research study to evaluate an online dietary change program. A lot of diet change programs require people to show up in person to participate. This isn't always convenient for people who lead busy lives or live far away from diet centers. Therefore, we are trying out an online system as an alternative.</p> <p><u>We won't ask you to change your diet, but we do want you to record what you eat in the daily food diary.</u></p> <p>We ask that you sign into this website using your MTURK ID every day to complete a daily food diary. You will have until 3 am EST each night to complete your diary. At the end of the 7 days, we will give you a summary of how you did and ask you to fill out a follow-up questionnaire.</p>	<p>This is a research study to evaluate an online dietary change program. A lot of diet change programs require people to show up in person to participate. This isn't always convenient for people who lead busy lives or live far away from diet centers. Therefore, we are trying out an online system as an alternative.</p> <p><u>For the next 7 days, we will ask that you eat no more than 1 serving of red meat (total, over the course of the week). By red meat, we mean beef, pork, and lamb. A serving of red meat is 2-3 oz. or roughly the size of a computer mouse or checkbook.</u></p> <p>We also ask that you sign into this website using your MTURK ID every day to complete a daily food diary. You will have until 3 am EST each night to complete your diary. At the end of the 7 days, we will give you a summary of how you did and ask you to fill out a follow-up questionnaire.</p> <p><u>The purpose of this study is to explore opportunities for reducing the risk of heart disease by reducing red meat consumption. Eating red meat puts people at greater risk of developing heart-related problems, such as high cholesterol, high blood pressure, and greater risk of heart attacks and strokes. Health organizations, such as the American Heart Association, have recommended that people limit their consumption of red meat as a way to reduce the risk of heart disease.</u></p>	<p>This is a research study to evaluate an online dietary change program. A lot of diet change programs require people to show up in person to participate. This isn't always convenient for people who lead busy lives or live far away from diet centers. Therefore, we are trying out an online system as an alternative.</p> <p><u>For the next 7 days, we will ask that you eat no more than 1 serving of red meat (total, over the course of the week). By red meat, we mean beef, pork, and lamb. A serving of red meat is 2-3 oz. or roughly the size of a computer mouse or checkbook.</u></p> <p>We also ask that you sign into this website using your MTURK ID every day to complete a daily food diary. You will have until 3 am EST each night to complete your diary. At the end of the 7 days, we will give you a summary of how you did and ask you to fill out a follow-up questionnaire.</p> <p><u>The purpose of this study is to explore opportunities for lowering greenhouse gas emissions by reducing red meat consumption. Greenhouse gases, such as carbon dioxide, cause climate change. Meat, and especially red meat, generates a lot of climate-changing greenhouse gases. Environmental groups, such as the World Wildlife Fund, have recommended that people limit their consumption of red meat as a way to reduce climate change. They endorse this as a particularly effective way of making a personal contribution to solving this social issue that will threaten our well-being and that of future generations.</u></p>

Figure S1. Experimental manipulation that introduces the dietary change task. Underlined text varies between the three conditions.

Health Behavior

Green Behavior

No Servings	1 Serving; Below Average	> 1 serving; above average
<p><u>Great job, you didn't eat any red meat today!</u></p> <p>In addition to meeting your daily goal for the dietary change study, this means that your contribution to heart disease risk today was lower than your average of <u> servings of red meat per day!</u></p> <p>Remember, your aim in this study is to only eat 1 serving of red meat all week. Red meat consumption is a major source of heart disease. Scientists estimate that Americans could significantly reduce their rates of heart disease if they stopped eating red meat completely. <u>Keep up the great work!</u></p>	<p><u>Ok, you ate some red meat today.</u></p> <p>This is less than your average of <u>servings of red meat per day</u>, but this will make it harder to meet your goal of eating only 1 serving of red meat all week. The good news is that your contribution to heart disease risk today was lower than your average!</p> <p>Remember, your aim in this study is to only eat 1 serving of red meat all week. Red meat consumption is a major source of heart disease. Scientists estimate that Americans could significantly reduce their rates of heart disease if they stopped eating red meat completely. <u>Keep up the effort, tomorrow is a new day!</u></p>	<p><u>Ouch, you ate a lot of red meat today!</u></p> <p>This is more than your average of <u> servings of red meat per day</u>, and it means that you have failed to meet your goal of eating only 1 serving of red meat all week. In addition, this means that your contribution to heart disease risk today was higher than your average!</p> <p>Remember, your aim in this study was to only eat 1 serving of red meat all week. <u>Even though you have missed this goal, you can still try to reduce your red meat consumption for the rest of the week.</u> Red meat consumption is a major source of heart disease. Scientists estimate that Americans could significantly reduce their rates of heart disease if they stopped eating red meat completely. <u>Keep up the effort, tomorrow is a new day!</u></p>
<p><u>Great job, you didn't eat any red meat today!</u></p> <p>In addition to meeting your daily goal for the dietary change study, this means that your contribution to climate change today was lower than your average of <u> servings of red meat per day!</u></p> <p>Remember, your aim in this study is to only eat 1 serving of red meat all week. Red meat consumption is a major source of greenhouse gas emissions. Scientists estimate that Americans could significantly reduce their greenhouse gas emissions if they stopped eating red meat completely. <u>Keep up the great work!</u></p>	<p><u>Ok, you ate some red meat today.</u></p> <p>This is less than your average of <u> servings of red meat per day</u>, but this will make it harder to meet your goal of eating only 1 serving of red meat all week. The good news is that your contribution to climate change today was lower than your average!</p> <p>Remember, your aim in this study is to only eat 1 serving of red meat all week. Red meat consumption is a major source of greenhouse gas emissions. Scientists estimate that Americans could significantly reduce their greenhouse gas emissions if they stopped eating red meat completely. <u>Keep up the effort, tomorrow is a new day!</u></p>	<p><u>Ouch, you ate a lot of red meat today!</u></p> <p>This is more than your average of <u> servings of red meat per day</u>, and it means that you have failed to meet your goal of eating only 1 serving of red meat all week. In addition, this means that your contribution to climate change today was higher than your average!</p> <p>Remember, your aim in this study was to only eat 1 serving of red meat all week. <u>Even though you have missed this goal, you can still try to reduce your red meat consumption for the rest of the week.</u> Red meat consumption is a major source of greenhouse gas emissions. Scientists estimate that Americans could significantly reduce their greenhouse gas emissions if they stopped eating red meat completely. <u>Keep up the effort, tomorrow is a new day!</u></p>

Figure S2. Examples of feedback given at the completion of a daily diary. The content of feedback was contingent upon multiple factors: experimental condition, # of servings of red meat, if goal had been exceeded, if daily consumption was above, below or equal to the respondent's weekly average. Respondents in the control condition received no feedback.

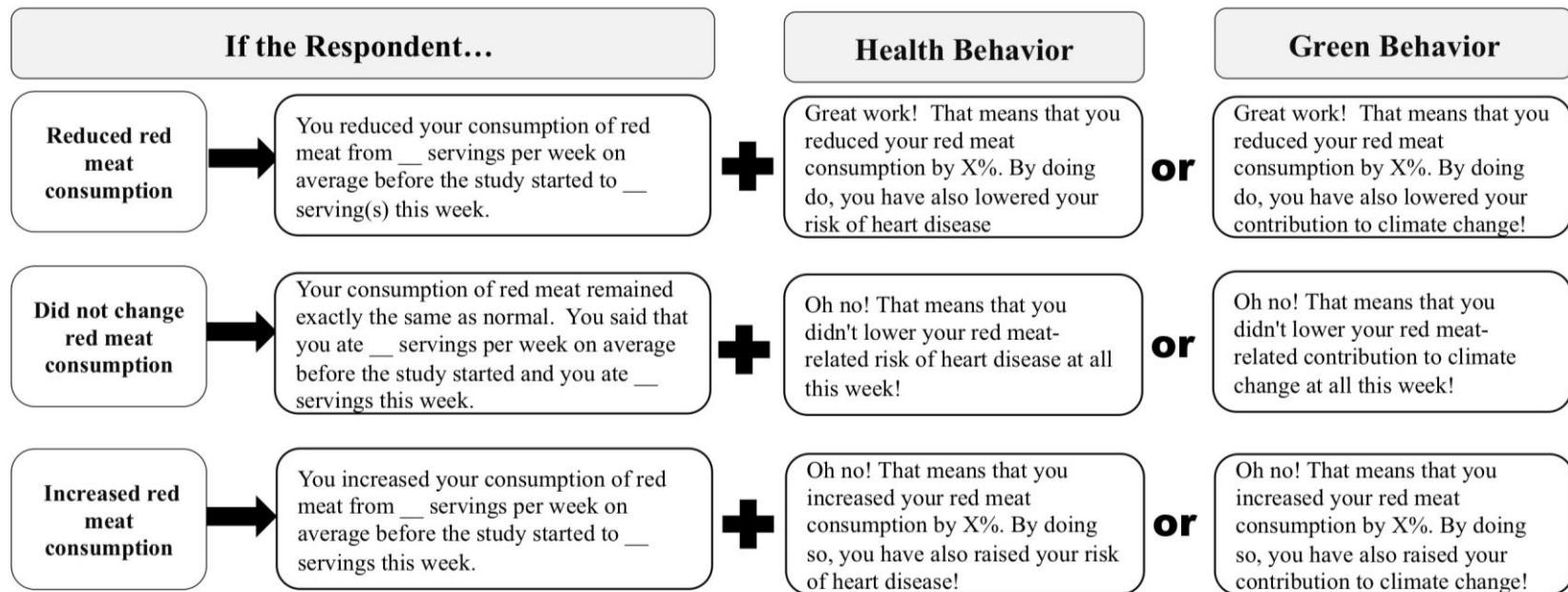


Figure S3. Summary of feedback given at the completion of the dietary change task but prior to the follow-up survey. Feedback was conditional upon the respondent's change in red meat consumption and experimental condition. Respondents in the control condition received no feedback.

Appendix A - Principal components analysis of concern items

The nine items shown in Table S1 were subjected to a principal components analysis (PCA). The initial PCA revealed two components with eigenvalues > 1.00 accounting for 58.50% of the total variance. The Scree plot was consistent with this conclusion. Next, we used an orthogonal varimax rotation with Kaiser normalization to estimate a rotated solution. The rotated factor loadings (Table S2) show an unambiguous pattern in which the three environmental items cleanly loaded on Component 2 and the remaining items, which measured concern about health and economic and political events, cleanly loaded onto Component 1. This analysis was repeated using an alternative orthogonal rotation (promax) as well as an oblique rotation (oblimin). The results were substantively identical; therefore, only the results of the varimax rotation are presented here.

Table S1. Nine items used to measure environmental concern and general concern

	Mean	SD
<i>How personally worried are you about the following?</i>		
Heart Disease	2.85	1.00
Global Warming [^]	3.01	1.14
Car Accidents	2.80	1.00
Nuclear war	2.31	0.99
Cancer	3.24	1.01
Environmental Damage [^]	3.14	1.08
Economic Collapse	3.18	1.04
Terrorism	2.63	1.10
Loss of Wildlife [^]	3.06	1.10

Note. N = 396. Responses were made on a 5-point scale ranging from 1=No at all worried to 5 = Very worried. [^]Indicates that the item was included in the environmental concern subscale.

Table S2. Component loadings resulting from rotation with Kaiser normalization

	Components	
	1	2
Heart Disease	0.65	--
Global Warming	--	0.90
Car Accidents	0.61	--
Nuclear war	0.68	--
Cancer	0.78	--
Environmental Damage	--	0.91
Economic Collapse	0.58	--
Terrorism	0.75	--
Loss of Wildlife	--	0.82

Note. Factor loadings of less than 0.30 are omitted.

Appendix B – Mediation Analysis of General and Environmental Concern

We conducted a parallel multiple mediation logit model with bias-corrected asymmetric bootstrapping of the 95% confidence interval (CI) based on 10,000 bootstrap samples (PROCESS, Model 4 v. 2.13). The dependent variable whether or not the respondent made a donation (0=No, 1=Yes). We utilized the technique proposed by Hayes and Preacher (2014) to accommodate a multi-categorical independent variable. The experimental factor was dummy coded with the control condition as the reference category. The mediator variables were environmental concern and general concern. Like in earlier analyses, this model controls for the effects of the respondent's sex and the duration of the study, and respondents who failed to reduce red meat consumption ($n=12$) were dropped from the analysis. After running the initial model, the analysis was replicated but with the green behavior condition as the reference group, allowing us to compare the green and health behavior conditions. Parameter estimates from both models are shown in Figure S4.

The results showed that the inclusion of the mediator variables improved the variance explained from 5% to 14% (based on the *Negelkrk R-Square*). The health behavior manipulation was associated with a significant increase in general concern relative to the control condition ($B = 0.24, p = .001$), but not relative to the green behavior condition ($B = 0.13, p = .14$). However, general concern had no direct effect on donation behavior ($B = 0.05, SE = 0.23, p = .83$), and did not mediate the relationship between the health manipulation and donation behavior (Health vs. Control: *effect* = .01, *SE* = .06, 95% *CI* = -.00 to .42; Health vs. Green: *effect* = .01, *SE* = 0.03, 95% *CI* = -0.05 to 0.11).

This model was estimated again using a two-item measure of health concern (concern about heart disease and cancer, see Table S2) in place of the general concern measure. In this case, the health behavior manipulation increased health concern over both the green behavior manipulation ($B = .22, SE = .11, p = .05$) and the control ($B = .33, SE = .11, p = .003$); however, health concern had no direct effect on donation behavior ($B = .10, SE = .18, p = .58$).

$N = 377$
 $^{\wedge}p < .10, *p < .05, **p < .01$

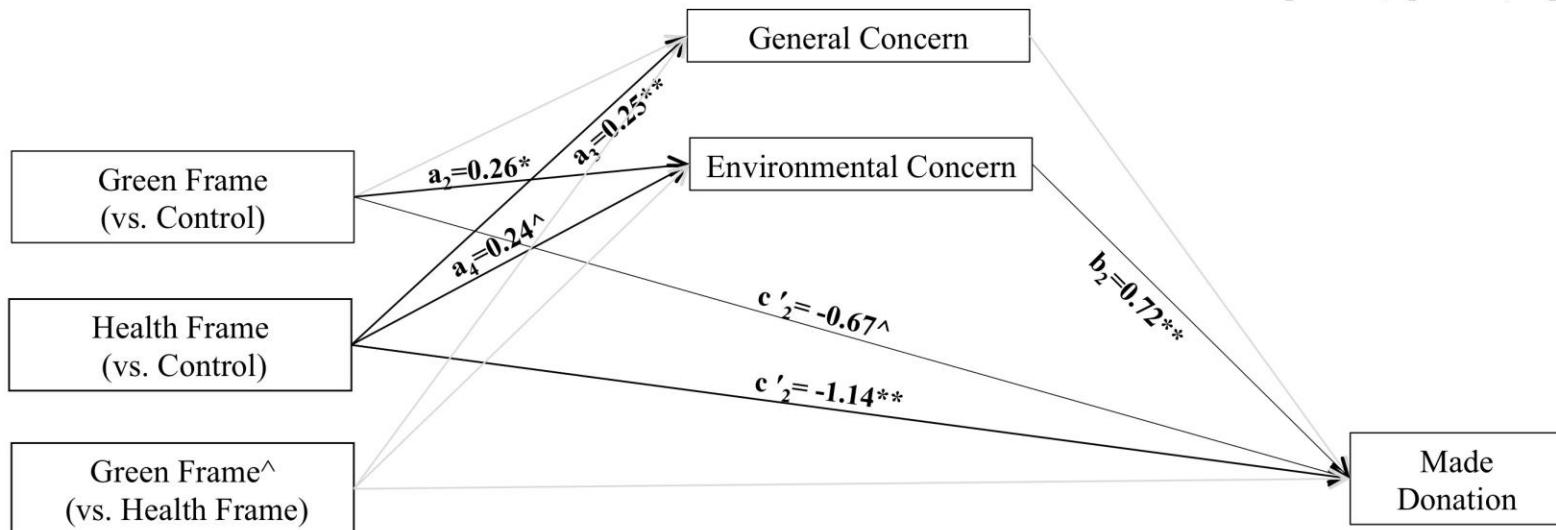


Figure S4. Results of a parallel multiple mediation analysis. Parameter estimates and p values are only shown for significant pathways. Non-significant pathways are indicated in grey. The parameters associated with the Green Frame vs. Health Frame contrast were estimated in a second model.