



Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework



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ARTICLE INFO

Article history:

Received 28 February 2014

Received in revised form 7 August 2014

Accepted 13 September 2014

Available online 6 October 2014

Keywords:

Pro-environmental behavior
Behavioral spillover
Rebound effects
Moral licensing
Environmental identity
Decision modes

ABSTRACT

A recent surge of research has investigated the potential of pro-environmental behavior interventions to affect other pro-environmental behaviors not initially targeted by the intervention. The evidence evaluating these spillover effects has been mixed, with some studies finding evidence for positive spillover (i.e., one pro-environmental behavior increases the likelihood of performing additional pro-environmental behaviors) and others finding negative spillover (i.e., one pro-environmental behavior decreases the likelihood of additional pro-environmental behaviors). Different academic disciplines have investigated this question, employing different methodologies and arriving at divergent findings. This paper provides a unifying theoretical framework and uses the framework to review the existing research on pro-environmental behavior spillover. Our framework identifies different decision modes as competing mechanisms that drive adoption of initial pro-environmental behaviors, with different consequences for subsequent pro-environmental behaviors, leading to positive, negative, or no spillover. Attribution of the initial pro-environmental behavior to either an external motivator (e.g., a price signal) or internal motivator (e.g., self-identity) also matters. In addition, the characteristics of and similarity between initial and subsequent pro-environmental behaviors can be expected to moderate predicted spillover effects. We explore the implications of our model for policymakers and practitioners, and suggest key areas where future research on the topic would be most beneficial.

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Examination of behavioral interventions to promote energy efficiency and other pro-environmental behaviors has revealed our limited understanding of *behavioral spillover*, that is, the effects of an intervention on subsequent behaviors not directly targeted by it (Poortinga et al., 2013). Knowledge of spillover effects is important for energy and environmental policy, as growing concern over anthropogenic climate change and the limited success of comprehensive national and international policy measures have generated a renewed interest in strategies that promote efficiency

and conservation through behavior modification (Dietz et al., 2009; Kunreuther and Weber, 2014; Steg and Vlek, 2009). Many scholars have advocated for consideration of research on behavioral interventions in the design of climate policies (AAAS, 2011; Allcott and Mullainathan, 2010; Vandenbergh et al., 2011). If promotion of one pro-environmental behavior (PEB) raises the likelihood that individuals will adopt other PEBs (i.e., *positive spillover*), increased investments in such policies may be warranted. If, on the other hand, successful interventions induce individuals to reduce other PEBs (i.e., *negative spillover*), such interventions may be less desirable or may need to be redesigned.

Unfortunately, to date research on spillover effects has generated mixed and at times conflicting results, and studies are spread across disconnected literatures from diverse disciplines. The purpose of this paper is to provide a comprehensive, interdisciplinary review to clarify the conditions under which

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positive or negative spillover might be expected and to serve as a resource for both researchers and policymakers. We synthesize findings that address the question of whether and under what conditions positive and negative spillover occurs, as well as the magnitude of spillover effects. We also propose a theoretical framework that predicts and organizes these findings, and we discuss policy implications. Finally, we conclude with a proposed research agenda to address critical gaps within the spillover literature.

1. Spillover defined

We define spillover as an effect of an intervention on subsequent behaviors not targeted by the intervention. Intervention here is used in its broadest sense to include any attempt to encourage behavior change such as: a request to perform a new behavior, public education campaign, tax incentive, provision of “green” infrastructure such as curbside recycling, and regulatory policy. For example, spillover occurs when implementation of a local plastic bag tax not only affects plastic bag consumption, but also recycling behavior. Spillover effects can be both negative and positive. Negative spillover occurs when the successful increase in one PEB is associated with a reduction in another PEB (Thøgersen and Crompton, 2009), for example, a drop in participation in a recycling program in response to the introduction of a bag tax. Positive spillover occurs when an increase in one PEB is associated with an increase in another PEB (Austin et al., 2011; DEFRA, 2008), for example, an increase in recycling products in response to the introduction of a bag tax.

Although a number of different labels have been used to reference spillover effects and related phenomena (e.g., rebound effects, moral licensing, gateway effects, identity effects, and single action bias), we intentionally use the more general term “spillover” to avoid tying this phenomenon to a specific set of behaviors (e.g., energy use) and to acknowledge that these effects can be both positive and negative. Furthermore, although spillover is most commonly discussed in terms of actual behaviors, in this review we also consider spillover from behavior to policy support. Recently, some scholars have raised pertinent questions as to whether the widespread promotion of “green” behaviors that have little impact on environmental outcomes on their own could actually undermine public support for more effective policy measures (Thøgersen and Crompton, 2009; Wagner, 2011a, 2011b). We also discuss this potential negative byproduct of pro-environmental interventions below.

2. Implications for law and policy

Our interest in this paper is in spillover as it manifests at the level of the individual consumer or household in response to an environmental intervention, rather than purely economy-wide rebound effects such as the widely cited Jevons paradox (Alcott, 2005; Jevons, 1866)—the idea that as energy production becomes more efficient, the relative cost of per unit of energy drops, therefore leading to a rise in overall usage. Economy-wide rebound effects are a reflection of behavior in the aggregate in response to market fluctuations of the price of energy and other goods. Our goal in this review is to characterize behavioral patterns in response to programs or policies that target individuals or households. We do this to open up the “black box” of the individual to develop a theory of what generates spillover and under what conditions positive or negative spillover is likely to be observed. A deeper understanding of the psychological mechanisms and personal and situational triggers of spillover effects can then be used to improve program and policy design.

The design of successful laws and policies often requires insights that are generalizable across a sufficiently large population to allow scalable, widespread application (Posner, 2000; Scott, 2000). This is particularly true for energy and environmental policies, which may require behavior change by thousands or millions of individuals or households to achieve meaningful effects (Dietz et al., 2009). In the absence of a robust research base, isolated studies and intuitions about likely spillover effects from adoption of PEB often play a large role in energy and environmental policy debates (e.g., Jenkins et al., 2011; Tierney, 2011). Spillover research can better inform energy and environmental policy if it accounts for insights from relevant social science disciplines and examines spillover effects in realistic settings. This should enable development of generalizable insights about when negative or positive spillover effects may occur, the magnitude of such effects, and how to reduce negative spillover and increase positive spillover.

In addition, the existing literature often focuses on identifying spillover effects, but policymakers need to know not just that spillover effects occur, but also the net effects of an intervention after accounting for negative or positive spillover. For example, an effective information campaign that increases purchases of carbon offsets for electricity use will reduce carbon emissions (e.g., Jacobsen et al., 2012). Some purchasers of offsets may, however, also increase electricity use, resulting in additional carbon emissions (Jacobsen et al., 2012). Although the negative spillover (in the form of increased electricity consumption) is important, the issue of most concern to policymakers is the net effect of the intervention after accounting for the emissions reduction associated with the offsets and the emissions increase associated with the negative spillover. Concluding that a policy is ineffective because it results in some negative spillover without taking into account the net effects of the policy is problematic (Gillingham et al., 2013; Jacobsen et al., 2012).

3. Review of existing literature

In our review of the literature, we searched for articles that related to the broad topic of spillover based on searches in Google Scholar for “spillover,” “gateway effects,” “rebound effects,” “moral licensing,” “single action bias,” etc. We do not claim that every article written on the topic is included, but we have made a concerted effort to include the most relevant literature and believe we have accomplished this goal.

In general, evidence of spillover can be found in two types of studies. The most commonly cited research in the psychological literature on spillover investigates cross-sectional correlations among multiple PEBs (e.g., Berger, 1997; Weber, 1997). Although this research typically does not examine behavior in response to an intervention (and therefore does not necessarily meet our definition of spillover), the findings from this body of work are highly relevant to this discussion. More direct evidence comes from research that experimentally manipulates whether someone performs an initial behavior and then observes the effect on a subsequent behavior. Such studies are more difficult to carry out, but some initial forays into experimental and longitudinal work have been conducted (e.g., Baca-Motes et al., 2013; Thøgersen and Ölander, 2003; Tiefenbeck et al., 2013). This work has shown mixed results, with some studies demonstrating negative spillover, others finding positive spillover, and still others showing no effects (e.g., Reams et al., 1996). It should be noted that much of this work was conducted by researchers examining related phenomena such as rebound effects, moral licensing, single action bias, consistency, and identity effects rather than spillover per se. Nevertheless these studies provide suggestions about possible mechanisms (mediators as well as moderators) behind spillover effects.

Sections 3.1 and 3.2 provide a review of existing research on the existence of negative and positive spillover, respectively. Additionally, research in closely related fields is reviewed as it pertains to spillover, with a focus on the potential mechanisms and moderators that underlie and influence spillover effects. Finally, the theoretical implications of these study results are discussed in Section 4.

3.1. Negative spillover

Relatively little research has been conducted to directly test for negative spillover effects. Of the studies that have been conducted, researchers using both qualitative and quantitative research methods have found evidence that, though not conclusive, is consistent with an explanation of negative spillover.

Research on people's environmentally relevant vacation decisions has found that often the most environmentally inclined participants at home are also the most likely to use carbon-intensive modes of transportation on holidays (Barr et al., 2010), providing some correlational evidence for negative spillover. Further, focus group participants have reported that they did not feel a need to be environmentally friendly on vacation if they performed PEBs at home (Miller et al., 2007), which suggests that performing an initial PEB (e.g., performing PEBs at home) may reduce feelings of moral obligation to perform a subsequent PEB (e.g., performing PEBs on vacation). It is worth noting that this latter study measured a perceived obligation to engage in PEB, rather than measuring actual or self-reported behavior. A previous study found that engagement in an initial PEB led to a reduction in the perception that one is obligated to perform a PEB; however, the behavioral effect among the same participants was that of positive spillover (Thøgersen, 1999).

In a recent field experiment, residents were exposed to a water conservation campaign that provided water usage feedback while residents living in an identical apartment building served as a control group. The campaign was successful at reducing water use, and the authors argue that they found evidence for negative spillover in that residents in the treatment group significantly increased their energy use over baseline while those in the control showed no change (Tiefenbeck et al., 2013). However, a closer inspection of the results shows that the difference between the treatment and control groups is only significant in a one-tailed test, when, with a priori competing hypotheses for negative vs. positive spillover, a two-tailed test is more appropriate. Additionally, the apparent difference between the control and treatment groups during the feedback phase of the intervention seems to only be different for one of the six weeks investigated (J. Thøgersen, personal communication, June 2014). This study illustrates the difficulties in conducting and analyzing data from field experiments that investigate spillover and underlines the need for more research in this area.

3.1.1. Rebound effects

Research in economics, psychology, and other fields has explored rebound effects (sometimes also called "take-back effects"), which refer to the increase in energy usage that sometimes follows efficiency improvements (Binswanger, 2001; Herring, 2006). For example, households that weatherize their homes tend to increase their thermostat settings during the winter that follows, resulting in a decrease in energy savings relative to what is technologically achievable (Hirst et al., 1985). This line of work has examined both direct and indirect rebound effects at the individual level (for a review, see Gillingham et al., 2013). Direct rebound effects occur when lower energy costs (e.g., from improved motor vehicle fuel economy or more efficient household appliances) increase the use of and thus energy consumption from

those same goods. Indirect rebound effects occur when saving money, such as from a more efficient motor vehicle or appliance, leads to increases in energy use from other activities, such as the purchase of additional appliances or other goods.

We view rebound effects as a closely related phenomenon to spillover effects. Rebound effects as identified by economists (e.g., the Jevons' (1866) paradox) are often explained as a price effect at a more macro level, where technological progress brings increased efficiency but also lower prices, thus leading to an increase (rather than decrease) in the rate of consumption. In contrast, spillover effects are generally conceived of as the result of changes in motivation or preferences at the level of the individual decision maker. Economics and psychology agree, of course, on the fact that prices can be expected to change behavior, an observation that lies at the basis of calls for a carbon tax to change energy-related behavior at the individual, corporate, and government levels. Economists have noted that rebound effects in energy use may occur at the individual level because the cost of a behavior decreased (direct rebound) or because disposable income increased (indirect rebound) (e.g., Gillingham et al., 2013). Obviously, price mechanisms can only be at play in situations where price changes (reductions) are present. But even in situations where this is true, not all negative spillover effects labeled rebound effects are necessarily just due to changes in energy price, but also may be related to changes in motivation or preferences. The existing rebound effect literature is correlational and has not examined these potential non-fiscal drivers of behavior change, so we cannot rule out these alternative explanations.

Recently, Jacobsen et al. (2012) presented evidence of a "buy-in" effect on behavior whereby the voluntary participation in a green power program increased subsequent household electricity consumption. The authors described this as a "buy-in" effect because it only occurred among those who participated in the program at the minimum level, by purchasing one \$4 block of green power, not among those who bought two or more units. Energy use was measured in the months following a household's voluntary purchase of "green" electricity. Those who participated at the minimum level were found to increase their energy use by 2.5% during the months following the purchase. Conversely, households that bought more than the minimum did not significantly change their electricity consumption after this purchase. One potential explanation for this finding is that those who display a high level of motivation or commitment to an initial behavior may be less likely to display negative spillover effects, suggesting that motivation and commitment may be important moderating variables that influence the emergence or direction of spillover. Alternatively, this pattern of findings could be explained by moral cleansing theory (Sachdeva et al., 2009), such that households who had just purchased a new energy-consuming product or anticipated some other increase in energy consumption in the coming months felt guilty for behaving wastefully, thus motivating them to alleviate this negative emotion by purchasing a minimum block of green power. Although we deem it unlikely that a large proportion of those who bought green power simultaneously anticipated a jump in energy usage as an explanation for their purchase of the minimum level, this inability to firmly identify the reasons why negative spillover occurs points to a larger problem in the field, where the mechanisms for the effect are often assumed without being directly tested (cf., Khan and Dhar, 2007).

In addition, this work suggests the importance of examining the net effects of behavior, accounting for spillover, rather than focusing exclusively on the spillover effect. In this case, the "buy-in" effect among those who purchased only one green power block accounted for an increase of 35 kWh/month of electricity. One

green power block accounted for 150 kWh/month of green energy, resulting in a net effect of approximately 115 kWh/month of reduced electricity generation per household among those who exhibited negative spillover. When combined with reduced generation associated with households that bought more than the minimum and that did not significantly change energy consumption, the net environmental benefits were even larger.

Although sometimes used as a rationale against promoting energy efficiency (Jenkins et al., 2011; Tierney, 2011), the preponderance of evidence suggests that rebound effects, in most cases measured as direct rebound, displace only a small to moderate fraction of technologically-achieved savings (Berkhout et al., 2000; Gillingham et al., 2013; Greening et al., 2000). In a comprehensive literature review, Ehrhardt-Martinez and Laitner (2010) estimated this proportion to be approximately 10–30%, suggesting that rebound effects negate at most less than one-third of the benefits of efficiency upgrades.

3.1.2. *Single action bias*

A possible mechanism for negative spillover is the perception that a risk is reduced after a single ameliorative action is taken, even when multiple actions would be more beneficial. This phenomenon is called single-action bias (Weber, 1997). The consequence is that complementary or superior problem-solving strategies are overlooked. Weber (1997) found evidence for single-action bias in a sample of American farmers. Those who had adapted their production practices in response to climate change (e.g., through crop selection or tillage practices) were less likely to adopt a price-based adaptation action (e.g. using futures contracts). Weber also found that farmers who had engaged in either of these classes of adaptation behaviors were less supportive of government interventions to curb climate change, a pattern that is consistent with negative spillover. These data also provide evidence for spillover from behavior to policy support. However, because these data are correlational, causation cannot be determined.

Similar effects were found with farmers in Argentina (Hansen et al., 2004). Weber hypothesized that when an individual adopts an initial action to cope with a problem, it reduces feelings of fear or concern and, therefore, the perceived necessity of engaging in subsequent risk reduction strategies (Weber, 2006). This would be true whether or not the initial action taken is the most effective option for managing the risk in question or whether multiple risk reduction strategies are warranted.

Single action bias has been given as a reason for negative spillover, followed by proposals to abandon efforts to change individual voluntary behavior for fear that these actions will undermine policy support (Wagner, 2011b). However, the extent to which this work applies to PEB within the general public is unclear. Weber's work dealt with self-protective actions among farmers exposed to environmental stressors. Nevertheless, PEBs directed at the collective good also may suffer from the single action bias, as risk perceptions and efficacy beliefs are related to intentions to engage in actions to mitigate climate change (Heath and Gifford, 2006; Leiserowitz, 2006; Lubell, 2002).

3.1.3. *Moral licensing effects*

Other research suggests that people's regulation of their moral self-image is a mechanism underlying negative spillover. Work within social psychology on moral self-regulation suggests that moral behavior is, in part, motivated by self-perceptions of an individual's own moral image (Zhong et al., 2009). Not surprisingly, individuals experience a heightened sense of morality after engaging in what is considered to be a moral behavior and a compromised moral self-image after engaging in an ethically dubious action. More importantly, individuals are more likely to

behave "morally" when their moral self-image is threatened (i.e., moral cleansing) and less likely when it is heightened by a recent moral action (i.e., moral licensing). PEBs are considered by many to be an instance of moral or ethical behavior (Steg et al., 2005; Stern, 2000) and guilt is related to pro-environmental intention (Bamberg and Möser, 2007; O'Keefe and Shepard, 2002), suggesting that PEBs may be subject to moral balance sheets. In a similar vein, others have argued that pro-environmental behavior is often motivated by a "contribution ethic" (Kahneman et al., 1993; Thøgersen and Crompton, 2009). Therefore, people may feel justified in passing up an opportunity to engage in a PEB if they feel they have already done their part to uphold the contribution ethic (i.e., "resting on one's laurels").

There is some recent empirical evidence for moral licensing of PEBs. Calling attention to an individual's own prosocial actions reduced their subsequent support of local anti-pollution measures (Sachdeva et al., 2009). Similarly, Mazar and Zhong (2010) found that engaging individuals in green behaviors reduced subsequent cooperative actions and licensed individuals to lie and steal when subsequently tempted. Other research showed that Norwegian owners of electric cars felt less moral obligation to act in pro-environmental ways compared to owners of conventional cars (Klößner et al., 2013). This suggests that the act of purchasing an electric car might have made them feel off the hook for future environmental transgressions, in line with moral licensing theory or a contribution ethic.

Together this research seems to point toward strategic maintenance of one's moral self-image as a potential key mediator of negative spillover. However, only a few studies have directly tested whether moral self-worth changes mediate negative spillover. Khan and Dhar (2006) found that imagining performing a pro-social behavior increased people's sense of a positive self-concept (i.e., "I am compassionate, sympathetic, warm, and helpful"), which in turn was related to future frivolous purchases. Cornelissen and colleagues found that recalling performing an ethical (vs. unethical) act was related to cheating and that this relationship was mediated by moral self-image levels, conditional on an individual's ethical mind set (Cornelissen et al., 2013). However, moral self-image levels were measured after participants had the opportunity to cheat. Theoretically, moral self-image levels would have been expected to increase after remembering an ethical (vs. unethical) act and then decrease back to some moral equilibrium after cheating (vs. not cheating). Assessing the mediator after the second behavior and then using it to explain the relationship between behavior one and behavior two limits the ability to explain the relationship. Thus the implications of these results for moral licensing theory are unclear. Additional research is needed that directly assesses moral self-worth levels between behavior one and behavior two and tests the ability of moral self-worth to explain the observed negative spillover effects.

Further, most of the evidence for moral licensing in the PEB domain uses paradigms where initial behaviors are relatively easy or costless (Gneezy et al., 2012). When more costly initial behaviors are examined, positive spillover, as opposed to negative spillover via licensing, is more likely to occur (Gneezy et al., 2012). Therefore, participants' perceptions of the costs of behaviors are of primary importance to predicting whether or not negative spillover will occur.

3.2. *Positive spillover*

Several studies have found positive correlations among different PEBs that could indicate positive spillover. For example, recycling has been shown to positively correlate with avoidance of excess packaging (Thøgersen, 1999), as well as energy conservation, water

conservation, composting, and use of reusable bags (Berger, 1997). Other studies have found similar positive relationships between pro-social consumer behaviors and environmental policy support (Thøgersen and Noblet, 2012; Willis and Schor, 2012), between fuel-efficient driving styles and intentions to reduce meat consumption (Van der Werff et al., 2013), and between use of energy-saving light bulbs and use of unbleached paper (Harland et al., 1999). Additional research has found distinct PEB clusters using factor analysis (Bratt, 1999; Whitmarsh and O'Neill, 2010), suggesting that the likelihood of performing one behavior is positively related to the likelihood of performing other behaviors in that cluster, as well as correlations between clusters of PEBs and between PEBs and policy support (Tobler et al., 2012).

As an improvement over cross-sectional and qualitative designs, though still limited by self-report and correlational analyses, Thøgersen and Ölander (2003) conducted a three-wave longitudinal survey of the Danish public. The evidence was mixed. Recycling behavior measured at wave 1 correlated positively with purchasing organic products at wave 2, and pro-environmental transportation decisions at wave 3. On the other hand, purchasing organic products correlated negatively with later recycling behaviors (Thøgersen and Ölander, 2003).

This body of work suggests at least two factors—consistency and identity—may account for positive spillover effects. An explanation of and evidence for each is offered below.

3.2.1. Consistency effects

Research on people's desire to be consistent (and look consistent to others) suggests one potential explanation for positive spillover. Multiple theories in psychology focus on people's desire to think and act in consistent ways (Bem, 1967; Cialdini et al., 1995; Festinger, 1957). The classic work of Freedman and Fraser (1966) on the foot-in-the-door (FITD) effect found that eliciting a commitment to a small request (i.e., placing a small sign carrying a public service announcement in one's yard) made individuals more likely to comply with a later larger request (i.e., agreeing to locate a billboard-sized sign in one's yard). Public commitments are commonly used in environmental interventions, and meta-analytic analyses suggest that they can be an effective strategy for motivating behavior change (Abrahamse et al., 2005; Lokhorst et al., 2013). A recent study of hotel guests' towel reuse found limited evidence for positive spillover following a commitment (Baca-Motes et al., 2013). Guests who made a specific commitment to reuse their towels and guests given a pin upon check-in showing their commitment to reuse their towels were less likely to leave their lights on in an unoccupied room compared to guests in two of three control groups.

People have social motivations for acting consistently. When people are inconsistent in their views or behaviors, they risk social sanctions from spectators who see them as hypocritical or two-faced (Abrahamse et al., 2005; Cialdini, 2008; Maslow, 1968; Suh, 2002). Therefore, it is not surprising that people are often motivated to present a consistent image of themselves to others, including in situations in which they want to maintain an image of moral integrity (Tedeschi and Rosenfield, 1981; Tedeschi et al., 1971). To the extent that PEBs are witnessed by others, the desire to project a positive, moral, and consistent image could motivate additional pro-environmental actions. However, other research has found that consistency in commitments to cooperate in social dilemmas occurs even when behaviors are anonymous (Kerr and Kaufman-Gilliland, 1994), suggesting that mechanisms other than the motivation to make a positive impression on others must be in play. Identity has been implicated as a key explanation for consistency effects (Burger and Caldwell, 2003; Freedman and Fraser, 1966).

3.2.2. Identity effects

Social identity is defined as the part of a person's self-concept that is based on a membership in a group or category of people (Tajfel and Turner, 1979). Empirical evidence for social identity theory (e.g., Tajfel and Turner, 1979; Turner, 1991) suggests that when a social identity is salient, individuals report the feeling of an "inner obligation to act" to uphold the relevant group's goals (Stürmer et al., 2003). This extends to the environmental realm, in which an individual's identity as an environmentalist has been shown to influence PEB (De Groot and Steg, 2007; Joireman et al., 2010; Whitmarsh and O'Neill, 2010). Perceived norms of what is typical or desirable in a given situation are also known to be powerful motivators of behavior (Cialdini et al., 1990; Schultz et al., 2007), and this influence is heightened when the individual identifies with a reference group.

Freedman and Fraser (1966) speculated that consistency in behavior emerges because engaging in an initial behavior changes one's self-perception as a certain type of person (i.e., identity), and this self-perception leads people to act in accordance with how such a person might behave (see also Ariely and Norton, 2008; Bem, 1972). Empirical research has supported this explanation. Burger and Caldwell (2003) found evidence that individuals who were initially paid to sign a petition to support the homeless subsequently were less likely to volunteer for a food drive. In comparison, those who were labeled by research confederates as "helpful individuals" were more likely to volunteer.

Additional work has shown that environmental identity mediates positive PEB spillover effects. Cueing people about the positive environmental outcomes of their behavior leads them to see themselves as the type of person who is concerned about environmental issues, essentially establishing an environmental identity and corresponding rules of conduct (Cornelissen et al., 2008). This identity makes them more likely to engage in subsequent PEBs. Additionally, a recent field experiment found that after a fee was implemented for plastic bag use in Wales, residents demonstrated stronger environmental identities than their counterparts in England, where no bag tax was implemented (Poortinga et al., 2013). However, participants in Wales did not perform more PEBs than those in England, providing evidence only that the intervention increased residents' environmental identities. The authors hypothesize that over time these identities would lead to increased behavior performance (Poortinga et al., 2013). In another line of research, Van der Werff et al. (2013) found that people who had been reminded of their previous performance of a range of PEBs were more likely to make "green" product decisions, as compared to those who were reminded of environmentally unfriendly actions (Van der Werff et al., 2013). Furthermore, the researchers found that this positive spillover was mediated by environmental identity such that reminding people of previous PEBs increased identity, which led people to choose green products and make more pro-environmental judgments in social dilemmas. This set of findings was corroborated by a panel study where the frequency with which participants reported driving in an eco-friendly manner predicted their intention to reduce meat consumption one year later (Van der Werff et al., 2013). This relationship was also mediated by environmental self-identity such that ecofriendly driving style at Time 1 predicted self-identity at Time 2, which in turn related to intention to reduce meat consumption in Time 2 (Van der Werff et al., 2013). The implications of these findings are that the adoption of an initial PEB may act as a gateway to the adoption of more challenging and potentially impactful behaviors, that is, a "virtuous escalator" (Thøgersen and Crompton, 2009) by reinforcing an emerging or pre-existing environmental identity. However, there is some evidence that this process may be moderated by the difficulty of the initial behavior. Gneezy et al. (2012) have shown that

pro-social identity is amplified only when the initial behavior is difficult or costly. Specifically, [Gneezy et al. \(2012\)](#) found that participants who donated to a charity with their own money (costly behavior) were more truthful in a subsequent interdependent game than controls (i.e., positive spillover), while those who donated to a charity with house money (costless behavior) were less truthful in the game than controls (i.e., negative spillover). Furthermore, the effect of cost on truthfulness was mediated by prosocial identity. Easy or costless actions require less effort and are therefore less reflective of strongly held beliefs or motivations. On the other hand, costly behaviors require some explanation as to why an individual put forth the effort, and this self-examination may make salient an environmental identity, thereby influencing subsequent behaviors.

4. Theoretical framework

Inconsistent findings in the literature suggest the need for a deeper understanding of the reasons why positive or negative spillover may occur and the conditions that increase or decrease its likelihood ([Whitmarsh and O'Neill, 2010](#)). We propose a framework that accounts for the mixed set of results and provides testable hypotheses for additional research in this area. Our theoretical framework assumes that two major factors influence the extent to which an initial behavior guides subsequent behaviors: (1) the mode by which the initial decision is made, and (2) the attribution of one's behavior. We also predict an important moderating effect of the characteristics and interrelationships of the behaviors.

4.1. Decision mode

People make decisions in qualitatively different ways ([Cornelissen et al., 2013](#); [Weber et al., 2005](#); [Weber and Lindemann, 2007](#)). We propose that the mode by which the decision to adopt an initial PEB is made affects the likelihood of adopting a second PEB. In particular, *calculation-based* decisions involve analytic processing (e.g., the consideration of pros and cons or costs and benefits). Because calculation-based actions are based on the cost-benefit ratio of available action alternatives and evaluation of these alternatives are person-specific, overall, we expect no consistently positive or negative spillover effects, though we do anticipate that spillover can occur. Specifically, to the extent that performance of an initial behavior changes the perceived resources the individual has at his or her disposal when evaluating the costs and benefits of the subsequent behavior, spillover effects can be expected. Consider, for example, carpooling, which has, among a host of possible costs and benefits, the benefits of saving money on fuel and saving time by using HOV lanes to bypass traffic, and its potential influence on shutting down one's home computer at night, a behavior for which time (to reboot the computer each morning) is a significant barrier and monetary savings on energy bills is a significant benefit. For those who heavily weight the time costs associated with shutting down the computer in their cost-benefit calculus, carpooling would be expected to remove this barrier by providing more time to the individual, thus swaying the calculus in favor of performing the behavior, resulting in positive spillover. For those who more heavily weight monetary savings as a benefit of shutting down the computer, carpooling would be expected to negatively spill over to this behavior as the desired monetary savings are already achieved via carpooling. This could be one explanation of the classic rebound effects. The key here is that we do not expect positive or negative spillover as a rule when initial PEBs are performed according to the calculation-based mode. Instead we expect that the instances of positive and negative spillover will average out over time, within and across

people, such that we anticipate no net positive or negative spillover effects after calculation-based decisions. We also expect that calculation-based processes may drive the moderating effect of PEB difficulty, described below.

Affect-based decisions are less deliberative reactions that are laden with positive or negative emotions elicited by the decision context ([Damasio, 2000](#)). This includes protective action in the face of risk and fear, or some amending action in the face of guilt. Because negative mood states are aversive, negative mood flags tend to go down after a single responsive action has been taken, giving rise to the single-action bias—an instance of negative spillover ([Weber, 2006](#)). This suggests that inducing a negative emotion such as fear in an effort to promote initial PEBs could result in negative spillover because engaging in the initial PEB reduces the negative emotion and, as a consequence, eliminates the motivation for adopting a subsequent PEB.

Affect-based decisions may also help to explain some effects found in the moral licensing literature. This literature argues that one's moral self-image changes after performing an initial behavior, which decreases the propensity for additional moral behaviors ([Khan and Dhar, 2006](#)). In our framework, we propose that a person who is motivated to perform an initial PEB by the discomfort or guilt that accompanies a negative moral self-image will experience a boost in moral self-image, and a reduction in discomfort or guilt, lessening the motivating emotions that lead one to engage in a PEB. In this application of the moral licensing literature, we assume moral licensing effects are most relevant for those who are motivated to engage in PEB by negative emotions.

When an individual engages in a *rule- and role-based* decision, the decision context elicits a rule of conduct derived from a social role held by the decision-maker. The role is reinforced each time a decision is made in this way, and the reminder of a valued group membership is reinforcing ([March and Heath, 1994](#)). Roles may include positions of responsibility within society (role of parent) or may be prescribed by a social identity (role of an environmentalist). Each role has associated obligations; rules of conduct are often acquired through observational learning and imitation, and they are recalled and executed when a triggering situation is encountered. The findings that environmental-identity can be invoked experimentally and can lead to positive spillover suggests that this role-based approach to decision making may be one way to encourage multiple PEBs (e.g., [Van der Werff et al., 2013](#)). Social and internal pressure to live up to an assumed role by acting consistently may help to maintain positive spillover over time (e.g., [Baca-Motes et al., 2013](#); [Cornelissen et al., 2008](#)).

This research suggests that those who engage in a PEB because their environmental identity has been activated will be likely to exhibit positive spillover because the participants' role will get reinforced and strengthened as the result of the initial decision ([March and Heath, 1994](#)). Although public commitment and consistency research suggests that positive spillover can occur even when no pre-existing environmental identity is triggered, there is extensive research to suggest that making an environmental identity salient could encourage positive spillover. This could either take the form of priming existing environmental identities or by framing initial behaviors in a way to encourage the development or recognition of an environmental identity.

It is important to note that although we articulate these predictions specifically around *environmental* identity, we also predict that positive PEB spillover may follow from identities that are not explicitly pro-environmental. Thus, promoting PEBs with messages that appeal to multiple relevant social identities, for example, patriotism, religiousness, or community activism, could invoke positive spillover among segments of the population that do not necessarily identify as environmentalists. Our model suggests that the identity activated in the initial PEB request

should be reactivated in subsequent requests to maximize the potential for positive spillover to occur.

In the domain of moral decisions, research has shown that moral considerations (similar to rule- and role-based decisions) are often based on affective reactions that occur automatically (Greene et al., 2001). It is important to note that these affective reactions tend to be focused on the object of the moral judgment or action (e.g., “I am disgusted by some behavior”) rather than on the decision maker, as they are in our decision mode framework (e.g., “I feel guilty about my carbon footprint”), and, more importantly, do not change as a result of the judgment or action (e.g., “I will still be disgusted when I see a subsequent similar behavior, but will no longer feel guilty when I contemplate the next PEB, because I alleviated my guilt by the prior PEB”).

Different decision modes can be executed in parallel and differ in their time course, with the more automatic ones (rule- and role-based and affect-based) turning in their verdict earlier, while the more conscious and effortful ones require more time to completion. People report using between two or three modes for any given decision (Krosch et al., 2012; Weber and Lindemann, 2007). When the choice option selected by different decision modes is the same, cross-modal consensus on best action contributes to decision confidence. When the indicated best choice option differs between decision modes, the relative weight given to the output of the different modes will determine which one gets selected (Engel and Weber, 2007) and decision confidence will be low(er) (Weber et al., 2000).

There is some evidence that people differ in their likelihood to use a calculation-based, rule and role-based, or affect-based decision mode, though the domain of the decision (i.e., the “situation” rather than the “person”) tends to play a larger role than individual differences (Weber et al., 2005). In the domain of moral decisions, Cornelissen et al. (2013) report that people appear to have different dominant mind-sets, making such decisions either based on consideration of the outcomes of different options (i.e., a consequentialist mode that maps onto calculation-based decisions) or based on rules about what is moral in a given situation (i.e., a deontological mode that maps onto rule- and role-based decisions). Cornelissen et al. (2013) found that those who had an outcome-based ethical mindset (either by individual predisposition or by experimental manipulation to think of a previous behavior in terms of outcomes to others) were more likely to display negative spillover (i.e., more likely to act selfishly in a dictator game or to cheat after recalling instance of previous ethical versus unethical behavior). In contrast, those who had a rule-based ethical mindset (either by individual predisposition or by experimental manipulation to think of a previous behavior in terms of agreement with an ethical norm) were more likely to display positive spillover (i.e., less likely to act selfishly in a dictator game or to cheat after recalling instance of previous ethical versus unethical behavior), which was not associated with any change in moral self-image (Cornelissen et al., 2013). These results thus provide additional validation for our proposed framework in that their rule-based ethical mindset that maps onto our rule- and role-based decision mode, although our mode directly implicates pro-environmental or a related social identity, as opposed to their more general moral norm, as the driver of the effect.

The conceptualization of PEBs as concrete or abstract also affects people’s decisions. Further supporting our theoretical framework, research on self-regulation has demonstrated that when people think about goals abstractly, they tend to act consistently with past behavior, whereas thinking about goals in concrete terms results in less behavioral consistency (Fishbach et al., 2006; Trope and Liberman, 2003). In line with research showing the correspondence between temporal distance and abstract vs. concrete construal level (Liberman et al., 2002; Trope

and Liberman, 2003), Conway and Peetz (2012) argue that temporally close behaviors tend to be thought of more concretely as subgoals and are thus more prone to negative spillover, whereas distant behaviors are thought of abstractly and thus more likely to have positive spillover. In a series of experimental studies, Conway and Peetz (2012) found that only people who recalled concrete (i.e., recently performed) moral behaviors displayed negative spillover, while those who recalled more abstract (i.e., distantly performed) moral behaviors displayed positive spillover. Reminding people of concrete moral behaviors they have performed in the past may provide them with evidence that they have already satisfied their moral obligations (Conway and Peetz, 2012). This in turn, would lead to less feelings of negative emotions, particularly guilt, resulting in negative spillover, in line with our affective decision mode. On the other hand, reminding people of abstract moral behaviors leads them to focus on their self-concept, which activates identity and consistency effects, leading to positive spillover (Conway and Peetz, 2012). This is in line with our rule- and role-based decision mode.

4.2. Causal attribution

There is also reason to believe that the post-decision process of attributing a cause for one’s action to either an internal or external source will influence adoption of subsequent actions. Work on counter-attitudinal advocacy demonstrates that the motivation to achieve consistency between behaviors relaxes when an individual can attribute an initial behavior to an external cause, such as being coerced, forced, or paid to do something (Pittman, 1975; Zanna and Cooper, 1974). Other work on motivational crowding finds that external enforcement of a behavior can undermine intrinsic motivation, particularly when the magnitude of the incentive or punishment is disproportionate to the cost of engaging in the behavior (Deci et al., 1999; Frey, 1993). Within the context of spillover effects, we expect that an external attribution for an initial PEB will reduce intrinsic motivation, therefore reducing the likelihood of adoption of a subsequent PEB when the external motivator is no longer present (negative spillover). On the other hand, we expect that an internal attribution will lead to positive spillover by triggering an environmental identity or the need for consistency. The potential implication of both of these lines of work is that traditional environmental policy mechanisms such as price-based measures or command and control tactics that are insufficiently calibrated or inadequately enforced may, in fact, lead to negative spillover effects rather than positive spillover.

4.3. Characteristics and interrelationships of the behaviors

There is a broad range of PEBs, and we use this term to include both direct actions (e.g., household energy conservation actions, energy efficient appliance purchases, and volunteering) and behavioral intentions (e.g., expressions of willingness to pay for environmental protection and policy support). This conceptualization is in line with previous research in the field (Dietz et al., 1998; Stern, 1992) and allows for a more comprehensive theory of spillover processes. Not all environmental behaviors are equivalent however, and the characteristics of the initial and subsequent behaviors will have profound implications for whether or not spillover is observed. Surprisingly, relatively little work has been done to sort environmental behaviors into classes. Most scholars differentiate among PEBs based on their frequency (repetitive curtailment actions vs. one-time efficiency upgrades), cost (low cost vs. high cost), and location (household vs. travel) (Gardner and Stern, 2008; Laitner et al., 2009). However, for our purposes we argue that laypeople’s, not experts’, perception of the characteristics of the behavior is the relevant factor in determining

behavioral spillover. Research has shown the importance of perceptions of the similarity between PEBs (Thøgersen, 2004) and behavioral difficulty (Fujii, 2006) in influencing decisions to perform PEBs. Thus, we propose that these two dimensions of PEB, difficulty and similarity, are especially germane to the discussion of spillover.

4.3.1. Behavioral difficulty

PEBs vary in terms of their difficulty (Kaiser and Keller, 2001). Difficult behaviors can require monetary investments, significant effort, physical exertion, or foregone comfort or convenience. Not surprisingly, evidence has shown that people favor easy behaviors for themselves, even as they favor hard behaviors for others (Attari, 2011). Of course, easy behaviors are not always the most effective (Gardner and Stern, 2008). Even when people understand that easy policies are not particularly effective, they still seem to support them over difficult alternatives (Rosentrater et al., 2013). Furthermore, there is reason to believe that the order of behaviors matters for spillover: following an easy behavior with a difficult one may have different results than the reverse order.

We anticipate that the difficulty of an initial behavior will affect the likelihood of spillover effects. In general, when facing the decision of whether or not to perform a PEB, people will look to their past behavior as an indication of their attitudes and self-concept (Bem, 1972). If they have recently performed a difficult PEB (as opposed to an easier one), they may be more likely to infer that they are a pro-environmental person and their environmental self-identity will become salient (Gneezy et al., 2012). They would then be expected to be more likely to act in line with this salient identity and follow through with further environmental actions (Cialdini et al., 1995; Festinger, 1957). This effect is expected to be particularly strong among individuals who take on initial PEBs as a result of a role-based decision.

However, a highly difficult secondary behavior might result in a greater likelihood of negative spillover than positive spillover. Especially when individuals engage in affect-based decisions, we anticipate that a high effort secondary behavior will increase the likelihood of negative spillover. A person facing a difficult (vs. easy) subsequent PEB is expected to be more likely to use their initial behavior as justification for not performing the second behavior, in line with moral licensing effects. After all, the second behavior is costly and people have an easy example to point to (their initial behavior) as evidence of their moral standing and thus avoid feelings of guilt.

This is not to say that all except those applying a role-based decision mode are susceptible to negative spillover in the face of a difficult secondary behavior; however, we do expect negative spillover to be less prevalent when people make role-based decisions. Indeed, even among people who are concerned about the environment, the strength of that concern on environmental behaviors diminishes as behaviors become more difficult or costly (Diekmann and Preisendörfer, 2003). In the face of a particularly onerous secondary PEB, we expect that even those who hold a strong identity may feel some relief from the guilt associated with acting inconsistently with their identity, by virtue of having engaged in an initial action. Thus, although we would expect highly identified people to still be more likely to perform the difficult secondary PEB than those who were not guided by a role-based decision mode, we would still expect that likelihood to diminish in the face of an arduous new task.

4.3.2. Behavioral similarity

Second, pro-environmental actions vary in terms of the behavioral domain. Although all PEBs benefit the natural environment, people conduct specific PEBs to achieve diverse

goals, ranging from energy conservation to reducing waste. People tend to be more likely to co-perform behaviors in similar categories (Gatersleben et al., 2002), and we expect that both positive and negative spillover will be more likely across similar behaviors. Drawing on the consistency theories outlined earlier (e.g., Bem, 1972; Cialdini et al., 1995; Festinger, 1957; Freedman and Fraser, 1966), we predict that positive spillover may be more likely between two similar PEBs, than between dissimilar PEBs, out of a preference for consistency. Behavioral similarity may also amplify the desire to prevent dissonance associated with inconsistent behaviors among individuals who hold a pro-environmental identity. For example, someone who recycles and wishes to maintain a self-image of being consistent would be more likely to engage in other behaviors she sees as similar to recycling (e.g., composting) than different (e.g., reducing meat consumption). Even though both secondary behaviors are considered PEBs in the broad sense, their similarity in accomplishing specific goals influences the extent to which consistency preferences are seen as relevant. Composting, which is similar to recycling in its goal of landfill reduction, would activate consistency preferences more so than reducing meat consumption. Thus positive spillover would be more likely to be expected between recycling and composting than recycling and meat consumption.

Behavioral similarity may also influence the likelihood of negative spillover among those with a weak or no pro-environmental identity. Single action bias suggests that people perform behaviors to reduce risks and when two behaviors are expected to reduce the same risk, only one protective behavior is likely to be performed. Along these lines, people who perform a behavior (i.e., recycling) to reduce a risk (i.e., landfill shortages) will be less likely to perform another behavior that will meet the same goal (i.e., composting) than a behavior (i.e., water conservation) that will reduce a different risk (i.e., water shortages).

Of course, the degree to which two behaviors are similar in one person's mind may differ from the way they are perceived as similar in another's mind (Thøgersen, 2004). Those with more environmental knowledge may think of behaviors as similar (e.g., for example that both eating meat and maintaining correct tire pressure fall under the pro-environmental umbrella) whereas those with low knowledge may not see the same behaviors as connected. Thus, those with high environmental identity and high knowledge might be more likely to engage in positive spillover simply because they recognize the behaviors as related. Alternatively, those with high knowledge and low identity might be more likely to engage in negative spillover because they recognize the second behavior as part of the same risk they have already reduced through their single action. Therefore, researchers wishing to study the effects of behavioral similarity on spillover will have to take care to find out how their participants conceive of the similarity between measured behaviors.

5. Conclusions and research agenda

Our proposed theoretical framework, shown in its entirety in Fig. 1, unifies the fragmented literature on behavioral spillover under an overarching model and identifies many of the key variables that policymakers should consider when designing behavioral programs. We have drawn on literature from diverse fields to pull together the most compelling explanations for why spillover occurs and under what conditions spillover will be most and least likely to occur. We argue that whether people are more, less, or equally likely to perform a PEB following an initial PEB depends on three elements: (1) the decision-mode people use to take their initial PEB, (2) the attribution people give for why they performed the initial behavior, and (3) the characteristics of the behaviors themselves. The application of decision mode theory to

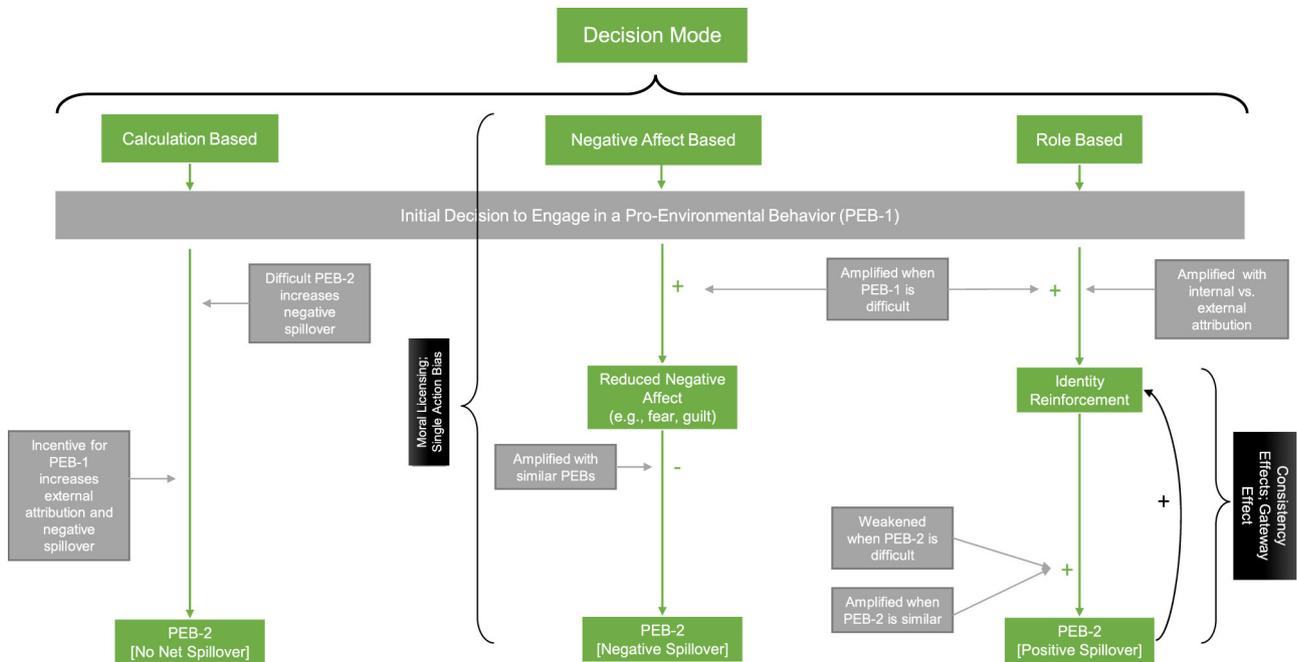


Fig. 1. Theoretical framework illustrating the hypothesized relationships between decision mode (green) and behavioral characteristics (gray). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

spillover research is among the most novel aspects of our framework and lends the field much-needed structure.

In addition to organizing the factors we believe to be critical in influencing positive or negative spillover, our proposed framework provides the basis for a future research agenda in the domain of environmental spillover. In this spirit, we have used our framework to identify a number of gaps in the literature that future research should address. These research priority areas are discussed below.

5.1. Need for sound experimental field studies and randomized control trials

Much of the work conducted in this area has been correlational in nature or conducted in small one-off laboratory studies. This has made it difficult to draw causal inferences regarding the effect of one action on another. Furthermore, the nature of the problem at hand requires an understanding of the consequences of large scale behavior change campaigns and the results of these campaigns on targeted and non-targeted behaviors. It is difficult enough to get one behavior to change through a campaign and to evaluate that change; measuring effects on multiple behaviors is a significant challenge. However, experimental field research methods (i.e., randomized control trials) are essential if the goal is to achieve a comprehensive understanding of spillover effects and properly understand the net effects of pro-environmental interventions.

5.2. Need to consider net environmental impacts

As discussed above, although identification of a particular positive or negative spillover effect may be of greatest interest to researchers and may receive the most media attention, the design of successful laws and policies often requires research that not only identifies spillover effects, but also examines net effects after accounting for positive and negative spillover. Focusing largely or exclusively on a negative spillover effect while ignoring net effects can mislead researchers or policy makers into abandoning approaches that may be effective, albeit to a lesser degree than originally expected. An intervention may result in an overall

reduction in GHG emissions by effectively altering the initial behavior targeted, even though there is a small negative spillover to a behavior that is not specifically targeted (e.g., Jacobsen et al., 2012). In these instances, some level of negative spillover may need to be anticipated in the design of programs and policies, and efforts can be taken to minimize it. For example, interventions that are at risk of having negative spillover effects could include elements known to lead to positive spillover, such as commitment techniques. In cases where negative spillover overwhelms the positive benefits of a behavior change, the intervention may need to be abandoned or modified. This may be most likely to occur with programs that target easy behaviors, but negatively spill over to more difficult and important environmental behaviors. Furthermore, the existence of positive spillover may suggest that some programs and policies that focus on household behavior produce a greater return on investment than originally anticipated.

5.3. Need for policy-relevant research

Insights about when spillover effects occur and the magnitude of the effects can have important implications for the design of environmental policy. Current assumptions about spillover have led to suggestions for laws and policies that may lead to counterproductive results or missed opportunities. For example, critics of government energy efficiency programs have pointed to the existence of negative spillover as a reason to question the value of these programs in climate mitigation strategies (Jenkins et al., 2011). Research is needed to understand the types of behaviors that may be valuable targets for policy interventions after accounting for spillover effects, particularly those behaviors that have high behavioral plasticity and technical potential (Dietz et al., 2009), and that present opportunities for law and policy to intervene.

Subject to further empirical testing, and holding other considerations constant, our framework provides policymakers with rough guidance or rules of thumb for the design of PEB interventions. It suggests, for example, that to reduce negative spillover policymakers should prefer interventions that induce rule- and role-based decision-making modes (e.g., by reinforcing

environmental identity), rather than by relying on affect-based decision-making (e.g., by shaming campaigns that motivate by guilt or fear). In addition, policymakers should prefer interventions that create intrinsic rather than extrinsic motivations to engage in a PEB. As to the type of target behavior, they should select PEBs that are similar to one another, but they should stage interventions so that more difficult PEBs precede easier PEBs. Other considerations may outweigh concerns about spillover effects, and these rules of thumb do not provide simple answers, but they provide a means of informing policy decisions to account for spillover.

As an in-depth example, consider the case of a state energy official who wants to develop a campaign to reduce household energy use. The official wants to avoid negative spillover and promote positive spillover as much as possible. To do so, she decides to avoid the use of fear campaigns about threats to energy security or messages designed to make people feel guilty about their overconsumption of electricity in order to avoid negative spillover. To promote positive spillover, she decides that the intervention materials will be addressed to “The good and responsible citizens of this state, such as yourself” with information about how responsibility includes being responsible about energy efficiency—thus helping to promote a role-based decision mode. She’ll also be cautious about including language about the price benefits of energy savings to avoid promoting a calculation based mindset and to prevent people from making external attributions for their behavior. To maximize the effects of behavioral difficulty, the official decides that she will start the campaign by first focusing on relatively difficult or costly behavior changes (e.g., replacing appliances, installing insulation), and only later introducing relatively easy behaviors such as changing thermostat settings and replacing light bulbs. To help promote feelings of internal motivation and desires for consistency, those who perform behaviors in the first wave of the campaign will receive notices thanking them for their commitment to energy efficiency and for making the choice to save energy. This is just one example of the many possible applications of spillover to policy decisions, but we hope it helps illustrate the need (and ability) to consider spillover in PEB interventions.

5.4. Need to further test and refine the theoretical model proposed here

Research on PEB spillover has been multidisciplinary and, therefore, benefited from multiple methodologies. While such diversity can be a strength, it has also resulted in a set of disconnected literatures. The framework proposed here is an attempt to organize the existing literature and explain and integrate its seemingly contradictory results, while providing a unifying theoretical model that can be tested and explored.

We specify hypotheses about the roles of decision mode, causal attribution, and behavioral characteristics. We also examine mediating factors, specifically, identity as among the most important mediators of positive spillover, and guilt and fear as among the most important for negative spillover. We leave the door open to future research on if, when, and why rule- and role-based decisions lead to positive spillover and affect-based decisions lead to negative spillover. We are particularly interested in the role of positive affect on spillover and see this as an obvious avenue for future research and theorizing. Additionally, we encourage future research on the role of social norms (e.g., Cialdini et al., 1990; Schultz et al., 2007) in spillover, as social pressures to engage in PEBs among those who do not hold a pro-environmental identity may promote affect-based decision making by inducing feelings of guilt, therefore leading to negative spillover. Alternatively, given that individuals tend to underreport or fail to detect

the effect of peer behavior on their own actions (Nolan et al., 2008), a PEB that is triggered by a descriptive behavioral norm may lead to the development or reinforcement of a PEB as predicted by self-perception theory (e.g., consistency or gateway effects). Finally, we recognize that our proposed decision modes may interact and encourage future researchers to examine these potential interactions. For example, to the extent that people include emotions into their cost-benefit calculus (Bell, 1982; Mellers et al., 1997), calculation-based decisions can have affective components that lead to negative spillover.

Likewise, we have proposed ideas about several moderator variables that we expect will increase or decrease the likelihood of positive and negative spillover. Although we include the variables we think will be most influential for spillover, we recognize that other variables may be shown to influence the propensity for spillover. For example, the factors that influence the performance of PEBs differ for public vs. private behaviors (Stern, 2000), habitual vs. planned behaviors (Steg and Vlek, 2009), and home vs. transport behaviors (Whitmarsh, 2009). We hope that future researchers will examine these variables and other potential moderators to determine their effect on PEB spillover. The goal of this paper has been to organize the existing research into a unifying theoretical structure and to set the stage for additional work to fill out current gaps in the model.

Acknowledgements

Support for this project was provided by grants from NSF (SES-1325660) and NSF RCN (DBI-049179401). We would like to thank Michael Gerrard for helpful comments on this manuscript.

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