

**Environmental Management and Policy Decisions: Understanding the Influences on Public
Acceptance**

by

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Dedication

For Russel

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Abstract

Public acceptance shapes the implementation of technology, governance, and policy. Failure to achieve public acceptance has been expressed by the general public through lack of consumer acceptance, vilification in the media, and loss of political popularity. These actions can harm the realization of a sustainable product, renewable energies, or environmental policy. Conversely, achieving public acceptance can result in successes and support. In the face of global environmental change, innovating and working towards sustainability goals requires public acceptance and support as this is an issue that technology cannot address alone. When attempting to create change on a global scale the participation and acceptance of individuals, companies and governments is necessary. This dissertation contributes to both research and practice by addressing public acceptance in context of current events. I evaluate relevant and consequential activities conducted by individuals, companies, and governments for factors that affect public acceptance with the intent to improve understanding of barriers to acceptance. The first section helps to clarify the public acceptance of individual environmental behavior by addressing who is willing to take future action to address issues of global environmental change. The second section of this dissertation evaluates responses and acceptance of corporate sustainability behavior in response to controversy. The third section focuses on the outcome of federal policy changes and the impact on public acceptance.

Chapter 1

Executive Summary

Generally, acceptance means a positive opinion and approval of a certain technology, product, activity, or policy. When discussed in the literature, subcategories of acceptance have been introduced. Wüstenhagen, Wolsink, and Bürer (2007) delineate acceptance by the party who has given approval with socio-political acceptance referring to social acceptance on a broad level, community acceptance involving local authorities and residents, and market acceptance to indicate how well the market will adopt the product, activity, or policy (Bertsch, Hall, Weinhardt, & Fichtner, 2016). Schweizer-Ries (2008) classifies acceptance in four quadrants determined by two dimensions - a valuation dimension focuses on if a product or policy has been adopted or rejected and an action dimension refers to either passive or active adoption or rejection. In this dissertation, my interest in large-scale sustainability activities and policies excludes differentiation between active and passive action behavior and puts the focus on the valuation dimension (Schweizer-Ries, 2008). Overall, this dissertation will define acceptance as the passive or active socio-political acceptance of decisions by others.

Several factors are relevant to the formation of socio-political acceptance of decisions. Demographic characteristics such as age, gender (Nancarrow, Leviston, Po, Porter, & Tucker, 2008), education (Menegaki, Hanley, & Tsagarakis, 2006), and income (Bertsch et al., 2016) have been linked to acceptance of various sustainability products and activities. Prior research suggests, for example, that women are more concerned about sustainability issues—broadly

construed—than men (Dietz, Kalof, & Stern, 2002; McCright, 2010; Stern, Dietz, & Kalof, 1993); this, in turn, leads to higher levels of support and acceptance for business sustainability efforts among women than among their male counterparts (Jones, Reilly, Cox, & Cole, 2017). Likewise, it's women—more than men—that tend to exhibit more sustainability-conscious consumer behavior (Luchs & Mooradian, 2012; Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997).

Although these variables consistently have an effect – the nature of the association often varies. For instance, Dolnicar and Schäfer (2006) and Hurlimann (2007) found that increased age was associated with increased positive attitudes to recycled water. However, the opposite was observed by McKay and Hurlimann (2003) where younger individuals were more likely to have positive attitudes towards recycled water. For every example of greater concern on the part of younger people about the health of the environment—or the willingness to act on them—there is also evidence to the contrary. In the context of climate change, for example, a study of risk perceptions across six different countries (the United States, Canada, China, the United Kingdom, Germany, and Switzerland) found a significant effect of the age of participants in only one of them: Switzerland (Shi, Visschers, & Siegrist, 2015; Shi, Visschers, Siegrist, & Arvai, 2016). A multi-country follow-up study on support for measures aimed at mitigating climate change risk through geoengineering found that the age of participants was a non-factor (Visschers, Shi, Siegrist, & Arvai, 2017).

Studies of public acceptance have also highlighted the importance of knowledge or awareness to increase acceptance (Dolnicar, Hurlimann, & Grün, 2011; René Zimmer & Welke, 2012) – where increased knowledge of the policy or product corresponds with an increased acceptance. Similarly, there is a positive relationship between public acceptance and an increased understanding of the

risks and benefits (Bronfman, Jiménez, Arévalo, & Cifuentes, 2012; Chaudhuri, Micu, & Bose, 2014; R. Zimmer, Zschesche, & Hölzinger, 2009) and increased familiarity or experience with the product or policy (Assefa & Frostell, 2007; Shaheen, Martin, & Lipman, 2008).

In addition, the information presented about a sustainability technology or policy can act as an external cue. These kinds of cues activate judgmental heuristics (Gigerenzer, Hertwig, & Pachur, 2011; Gilovich, Griffin, & Kahneman, 2002), which facilitate the rapid—and often unconscious vs. rationally motivated—formation of judgments regarding public acceptance. Positive affect—i.e., the instinctive emotional response (Finucane, Alhakami, Slovic, & Johnson, 2000; Slovic, Finucane, Peters, & MacGregor, 2002)—can be used to influence public acceptance through halo effects (Imram, 1999; Wallquist, Seigo, Visschers, & Siegrist, 2012) that are associated with symbolically significant activities, outcomes, or behaviors (Wilson & Arvai, 2006, 2010). Halo effects describe the situation where, in a situation that requires multi-attribute evaluation, people's positive or negative reactions to certain salient attributes—i.e., attributes that cast a halo—“spill over” to effect their reactions to other attributes (Thorndike, 1920). For example, research by Sütterlin and Siegrist (2014) has shown that people rely on their instinctive emotional responses to code symbolically significant behaviors as statements about one's convictions. In other words, certain behaviors by individuals—and, by extension—companies or policy-makers become instinctively tagged with symbolic meaning, which in turn can be used by others to make inferences about their underlying values and motivations that will effect public acceptance.

An increasing number of studies have also begun to include perceived fairness and trust in authority as potential factors for public acceptance. Zoellner, Ittner, and Schweizer-Ries (2005) collected information regarding wind energy development and found that perception of fairness of the process was positively correlated with acceptance and positive attitude towards wind energy.

Upham and Shackley (2006) found a similar focus on procedural justice that also extended to who was making the decisions. Trust in regulatory institutions responsible for decision-making has been studied in multiple contexts including nanotechnology (Siegrist, Cousin, Kastenholz, & Wiek, 2007) and genetically modified food (Poortinga & Pidgeon, 2005). Trust in the scientist who is conveying the message has also been shown to be a predictive factor in the perceived benefits or risks associated with the technology or decision (Siegrist, Cvetkovich, & Roth, 2000). Trust has a direct positive effect on public acceptance, but also indirect effects as it influences the perception of risks and benefits (Bronfman et al., 2012; Ross, Fielding, & Louis, 2014).

Public acceptance shapes the implementation of technology, governance, and policy. Failure to achieve public acceptance has been expressed by the general public through lack of consumer acceptance, vilification in the media, and loss of political popularity (Carlman, 1984; Wüstenhagen et al., 2007). These actions can harm the realization of a sustainable product, renewable energies, or environmental policy (Bronfman et al., 2012; Dolnicar & Hurlimann, 2010). Conversely, achieving public acceptance can result in successes and support (Heras-Saizarbitoria, Cilleruelo, & Zamanillo, 2011). In the face of global environmental change, innovating and working towards sustainability goals requires public acceptance and support as this is an issue that technology cannot address alone. When attempting to create change on a global scale the participation and acceptance of individuals, companies and governments is necessary. Harnessing public acceptance (either positive or negative) can be an incredibly useful tool in the creation of support for individual environmental behavior (Chapter 2), social license to operate and the accountability of company behavior (Chapter 3), and the impact of federal policy in the context of current events (Chapter 4).

In Chapter 2, a study of what drives acceptance and satisfaction with environmental action and individual willingness to take future action started with this question: are younger people more

concerned about declines in environmental health when compared to their older counterparts within the United States and are younger generations more willing to support policy actions aimed at preventing future losses?

In spite of reporting by the U.S. popular press about the heightened environmental consciousness of Millennials, prior research offers conflicting answers. Scholarship focusing on age effects suggests that the answer to both questions is *yes* due to the dampening of environmental concern and action in older adults. In contrast, more recent applied research on climate related risks and risk management options suggest that there is no difference in climate concern and risk mitigation between younger and older adults.

In an attempt to disentangle these contradictory viewpoints, I undertook a study in which respondents in the United States characterized by age and generational cohort were presented with small and large hypothetical losses due to climate change. These same participants were then asked to indicate their support for future policy actions aimed at stemming these environmental losses. Overall, my data does not indicate that younger generations experience potential losses as more acute than older generations; neither age nor generational cohort correlated with the perceived severity of environmental losses nor support for future actions to prevent them. I found environmental value orientations (biospherism) and self-reported political orientation to be more robust predictors of both dependent variables.

Chapter 3 shifts from individual judgments about concern about environmental losses and the acceptability of policies aimed at curtailing them to consumers' judgments about the activities of corporate actors. Specifically, when confronted with concerns or backlash as a result of low public acceptance of their sustainability performance, companies can elect to address them head-

on by directly addressing and correcting their real or perceived misdeeds. However, it may also be the case that companies are unable or unwilling to address them; in these cases, they may elect to create benefits in other, unrelated domains.

In this study I sought to test the effect of these *indirect* and *direct* responses to sustainability challenges on two dependent variables: consumers' perception of company reputation, and their willingness to grant a company "social license" for future activities. Compared to a business-as-usual control condition, and across three company contexts, consumers provided favorable ratings of reputation, and were willing to grant social license, when companies responded indirectly to a sustainability challenge. my results highlight the importance of intuitive judgmental heuristics and individual value orientations when consumers decide on acceptance of corporate sustainability behavior.

Chapter 4 pivots to judgments about the acceptability of the science advisory process in policy-making. The context for this aspect of my dissertation was the depth and speed of the changes being made to the US Environmental Protection Agency (EPA) after the 2016 administration change. In 2017, the EPA was criticized by scientists and the media for two controversial directives that shifted the balance of industry and academic scientists serving on science advisory boards (SABs) and undermined public acceptance of the agency. One of them introduced new rules governing the eligibility of academic scientists to serve on the agency's key SABs; the other prematurely terminated the appointments of several EPA SAB members. Both directives were framed by the EPA as necessary to "ensure independence, geographic diversity & integrity in EPA science committees." However, critics portrayed the directives as a tactic by the agency to suppress mainstream science by increasing the number of positions held on the SAB by

scientists employed by industry, industry trade associations, and state agencies known for a right-of-center political stance on environmental and public health risks.

With this backdrop, my research examined SAB composition and its effect on the perceived legitimacy of risk management recommendations by the SAB. In an experiment with a nationally representative sample, I presented participants with hypothetical EPA SABs composed of different proportions of academic and industry scientists. I then asked participants to rate their satisfaction with, and the legitimacy of, these boards in light of their decisions in hypothetical scenarios based on actual EPA SAB deliberations about pesticides. Varying the composition of the hypothetical SABs alters the procedural fairness and prior research (van den Bos & Miedema, 2000; van den Bos, Vermunt, & Wilke, 1997) suggests that people rely on judgments about procedural fairness as a means of evaluating an outcome when the degree of “goodness” or “badness” associated with it is ambiguous. On the other hand, experimentally altering the decision of the SABs in hypothetical scenarios gives participants an opportunity to respond when the SAB finds in favor or against the desirable outcome (a more restrictive recommendation). This effect has been observed in research on people acting as jurors in legal matters (Skitka & Houston, 2001); it shows that normative positions—what the authors termed “moral mandates” such as punishing the guilty—act as determinants of how people make judgments about process. I found that participants perceived higher levels of satisfaction and legitimacy when SABs made more stringent recommendations about pesticide use. While participants exposed to SABs dominated by industry scientists (vs. academic scientists) judged them to be more strongly motivated to protect business interests, I found no effect of board composition on perceptions of satisfaction and legitimacy. These results are consistent with prior research on decision quality that suggests people use desirable outcomes as a heuristic for assessing the legitimacy of, and

their satisfaction with, a SAB. Moreover, my results suggest that members of the public are supportive of federal science advisory boards regardless of their composition but only if they take actions that are consistent with normative expectations.

This dissertation employed an experimental survey approach to determine the influence of factors that contribute to socio-political acceptance within three topical environmental contexts highlighting behaviors from distinct groups. Given the behavior of individuals, to companies, and finally, policy-makers my dissertation has reinforced that policy and behavior are iterative and anchor heavily from a starting point – this research focuses on public acceptance of current events that will influence future behavior.

Overall, I found that requirements of the general public to issue acceptance were low. I observed this to be true with company behavior – where any activity – even if it doesn't address the controversy, resulted in increased reputation and social license to operate. Similarly, in the case of federal policy, as long as the desired outcome is achieved the process is less important.

Ultimately, if the goal is to achieve progress in environmental action it is necessary to reserve public acceptance. Otherwise, the message being broadcast is that even placating behavior in the absence of true change is acceptable.

Chapter 2

Will Millennials Save the World? The Effect of Age and Generational Differences on Environmental Concern

1. Introduction

There is a popular narrative emerging about the importance of motivating and mobilizing younger voters in the U.S. because they are believed to care more about the environment. This response is in part due to actions by the current U.S. President, who in his first two years of office has made significant changes to existing environmental protections. In the past, failure to achieve public acceptance has previously been expressed by members of the general public through lack of consumer acceptance, vilification in the media, and loss of political popularity (Carlman, 1984; Wüstenhagen et al., 2007). These decisions by the Trump administration have failed to receive public acceptance and have prompted scientists, citizens, and some politicians to organize in opposition to further executive action that would place the environment at risk. One of the most prominent examples of protest during Trump's first year in the White House was the March for Science, which took place on Earth Day in 2017 and had an estimated global attendance of 1.07 million people.

Prominent during this, his third year, is the effort to continue to upset the current balance of power in the United States government during the next national election in 2020; key to this effort is the mobilization of younger voters¹—primarily Millennials—who are believed to be

¹ In 2016, younger voters strongly preferred the more liberal Hillary Clinton over Donald Trump. According to the Pew Research Center, 38% of voters between the ages of 18 and 29 preferred Clinton while only 27% preferred

more concerned about, and highly motivated, to protect the environment than their counterparts who were born earlier.

Given the popular narrative that is currently emerging about the importance of motivating and mobilizing younger voters in the United States, it is important to explore if the hope placed in younger people to be more concerned about—and to help protect—environmental health is appropriate. At the same time, I asked if individuals from younger generations could or should really be expected to care more about the declining health of the environment—and be more willing to act to safeguard it—than individuals from older generations.

1.1 Age-based differences

Prior research suggests that older people tend to express lower levels of relative concern for the environment—and a dampened willingness to act to protect it—than do younger people (Casey & Scott, 2006). In an influential review, Van Liere and Dunlap (1980) proposed that lower levels of concern about the environment among older people (relative to younger people) may be due to how individuals of different ages act to maintain or change their relative position within the dominant social order. Akin to the status quo bias (Kahneman, Knetsch, & Thaler, 1991) expressing concern about environmental quality, along with actions aimed at protecting it, may be viewed as disruptive to the existing social order. Thus, concern and action may be thought of as posing the greatest relative threat to those who stand to lose the most because their positions within society are most entrenched – namely, representatives of older generations. This, in turn,

Trump. However, among younger Americans who were eligible to vote, only 46% of them cast a ballot; this represented the lowest—by a wide margin—proportional turnout of voters by age in 2016. See: <https://goo.gl/Jfxq41> and <https://goo.gl/agjCX6>.

motivates older people—relative to younger people—to think and act in ways that protect their existing social status and identity.

For every example of greater concern on the part of younger people about the health of the environment—or the willingness to act on them—there is also evidence to the contrary. In the context of climate change, for example, a study of risk perceptions across six different countries (the United States, Canada, China, the United Kingdom, Germany, and Switzerland) found a significant effect of the age of participants in only one of them: Switzerland (Shi et al., 2015; Shi et al., 2016). A multi-country follow-up study on support for measures aimed at mitigating climate change risk through geoengineering found that the age of participants was a non-factor (Visschers et al., 2017).

1.2 Generational cohort-based differences

Beyond the absence of an age effect in the direction of younger people, a recent review by Gifford and Nilsson (2014) suggests that older individuals are the ones who are more concerned about the environment, and who report a greater affinity toward engaging in a broad array of smaller-scale pro-environmental behaviors (e.g., purchasing fair-trade goods and recycling). They hypothesize that this observation may be a function of generational cohort-level (vs. strictly age-related) differences; e.g., certain events such as the importance of being a frugal environmental steward during the Great Depression in the 1930s, and during wartime experiences of the 1940s, may have had a greater effect on the behaviors of people from older generations than they did on people from younger generations, the latter of which were not alive to experience these events. Alternatively, as environmental concern has been positively associated with education and income it may be that older individuals are more likely to have

increased dispensable income to engage with pro-environmental behaviors (Van Liere & Dunlap, 1980).

A generation can be defined as a group of individuals who were born within a defined period of time and, importantly, have experienced consequential social and historical events at key developmental stages of their life histories (Smola & Sutton, 2002; Twenge, Campbell, Hoffman, & Lance, 2010). The lasting effects of these shared events remain relatively constant over an individuals' entire life and creates generational characteristics that those in the cohort share. These characteristics may include a shared world view, values, and attitudes (Kupperschmidt, 2000). Ultimately, this perspective “stays with the individuals throughout their lives and is the anchor against which later experiences are interpreted” (Scott, 2000, pg. 356).

When considering environmental concern from the perspective of generational cohort-level differences, there is evidence of lower levels of concern in older individuals. Among a series of traits and preferences—older generations within the U.S. are thought to be more conservative. Such an orientation leads to a tendency to focus on business and economic growth (McCright & Dunlap, 2010) when compared to younger generations (Egri & Ralston, 2004). The more conservative value orientations that are ascribed to older generations have not been associated with high levels of environmental concern (e.g., L'Orange Seigo, Arvai, Dohle, & Siegrist, 2014; Shi et al., 2016; Visschers et al., 2017). We're also led to believe that older individuals ascribe to hierarchical value orientations, whereas younger generations tend toward egalitarianism and seek situations that offer collaboration and a sense of purpose.

In support of this idea, younger generations prioritize contemporary policy issues related to sustainability and the environment ahead of issues like civil rights or economic reform, the latter

of which tend to be more prevalent among older generations (Benderev, 2014). Furthermore, younger generations—in contrast to their older counterparts—self-report that they would prefer products and policies that lessen humans' impact upon the environment, even if it means that the monetary cost of consumption will increase (Littrell, Ma, & Halepete, 2005). Indeed, it seems that Millennials are driving businesses and political leaders to make sustainability a primary concern (K. T. Smith & Brower, 2012). Overall, there is a belief that younger generations are poised to act to protect the environment (Timm, 2014).

1.3 Research aims

Overall, the effect of age and generational cohort on concern about environmental health is, at best, inconsistent (Malka, Krosnick Jon, & Langer, 2009; Wood & Vedlitz, 2007). There are several generational factors that are thought to influence people's concern about environmental health, and their willingness to support measures aimed at improving it: age, generational cohort, political orientation, and a series of prominent value orientations (e.g., egoism, altruism).

With this as backdrop, my research asked whether younger people (defined by age), or younger generations (defined by cohort-level measures), are more concerned about declines in environmental health, and if they would be more willing to support policy actions aimed at preventing future losses, when compared to older people or older generations. Alternatively, if age or generation do not impact perceived severity of the loss or future action, is there another pattern of decision-making that can be observed. In addition, because cohort-level differences across generations are frequently discussed alongside cultural and political differences, my research sought to clarify the effect of education, income, political and value orientations on these same dependent measures.

2. Methods

2.1 Participants

To answer these research questions, this research focused on age groups that make up the four current generations that are active voting members of the public:

1. *The Silent Generation*: This generation cohort is comprised of individuals born between 1925 and 1945. Representatives of this generation endured the Great Depression and World War II, and these two distinctive events are believed to have instilled generational characteristics of concern for security, frugality, caution, conformity, and hard work (Egri & Ralston, 2004; Lehto, Jang, Achana, & O'Leary, 2006).
2. *Baby Boomers*: Born between 1946 and 1964, this generation was influenced by the Vietnam war, the civil rights movement, the assassinations of prominent leaders like John F. Kennedy and Martin Luther King, and a period of rapid economic and educational expansion. Members of this generation are often referred to as results-driven, extrinsically motivated, and entitled (Jurkiewicz & Brown, 1998; Kupperschmidt, 2000; Twenge et al., 2010).
3. *Generation X*: Representatives of this generation were born between 1965 and 1981 and influenced by the AIDS epidemic, the end of the Cold War, a period of relative economic uncertainty, and rising divorce rates leaving many from this generation to be raised in lower-income homes by a single parent. Members of this generation are considered to be highly realistic, resourceful, and self-interested (Kupperschmidt, 2000; Murray, 1997; Smola & Sutton, 2002; Twenge et al., 2010).

4. *Millennials*: This generation is comprised of individuals who were born between 1982 and 1999. Sometimes referred to as Generation Y, or the Me Generation, individuals from this generation were influenced by the rise of the internet, mass shootings in primary and secondary schools, and prominent business and economic collapses and the associated insecurity that came with them. Members of this generation are typically referred to as being opinionated, distrustful of institutions, technologically savvy, quick to learn, and self-involved (Elam, Stratton, & Gibson, 2007; Smola & Sutton, 2002; Twenge & Campbell, 2008; Twenge et al., 2010).

Participants in this research were exclusively United States citizens and were recruited from an internet panel maintained by Survey Sampling International (SSI). I applied quasi-random quota sampling (whereby each participant was randomly drawn from a probability sample of active members in SSI's database) to fulfill age categories that coincided with the four generational cohorts outlined above. In total, 500 participants were recruited to participate in this research ($n = 125$ per generational cohort) as this exceeded the GPower calculated sample size for adequate statistical power (Faul, Erdfelder, Buchner, & Lang, 2009).

After data cleaning, the total sample was reduced to 469 participants; 31 participants were removed from the data set because they spent less than half the median time (8.9 minutes) on the instrument, because they failed a series of attention checks, or because they indicated (in response to a screening question) that they did not believe in climate change (because all of the scenarios in this experiment dealt with environmental losses due to climate change).

The overall sample consisted of 60% females ($n = 281$) and 39% males ($n = 181$), which was skewed in the direction of females relative to the national average (51%). Each of the

generational categories contained between 22% ($n = 104$) and 26% ($n = 124$) of all respondents. The majority (58%) of respondents went to college ($n = 274$); 19% ($n = 88$) of respondents reported a high school education or lower and 22% ($n = 102$) an education level beyond a bachelor's degree (Table 2-1).









Table 2-1. Sample details.

	<i>n</i>	Women	< High school	High school graduate	College or some college	> Bachelor's degree
Millennials	104	61%	0%	18%	58%	26%
Generation X	112	66%	2%	20%	65%	12%
Baby Boomers	122	60%	1%	13%	64%	22%
Silent Generation	124	57%	2%	20%	51%	27%

2.2 Experimental design

Participants in this research were asked to respond to questions in an extensively pretested survey about hypothetical declines in environmental health. These hypothetical declines were described as being brought on by climate change across four distinct, but recognizable contexts: the melting of arctic sea ice, species loss, the loss of protected forests, and drought leading to losses of surface water. The results from these four contexts were later combined during data analysis as there was no difference in perceived severity or future action by context (determined using a two-way Mixed ANOVA, $p > 0.05$). To study how the magnitude of losses might be perceived by different generations, participants responded to losses of both small (6% declines) and large (24% declines) magnitude (Table 2-2). Based on my pretests, environmental losses of 6% and 24% were selected such that they were deemed both plausible and clearly differentiated as being of small (6%) and large (24%) magnitude.

Table 2-2. Environmental loss scenarios.

Context and Description	6% loss image	24% loss image
<p>The cap of frozen seawater around the North Pole plays an important role in maintaining Earth's temperature. Its bright white surface reflects heat from the sun that the much darker ocean would otherwise absorb. Imagine if you learned that because of sudden changes to the Earth's climate, [6% or 24%] of the Arctic sea ice would be permanently lost over the next three years.</p>		
<p>Large animals such as whales, bears, and elephants play a vital role in ecosystems. Their presence in the food chain helps to maintain a balanced ecosystem. Imagine if you learned that because of sudden changes to the earth's climate, [6% or 24%] of all the large animal species would be permanently lost over the next three years.</p>		
<p>Yellowstone National Park in Wyoming is made up of a large forest. This forest serves as a wildlife habitat, prevents flooding and soil erosion, absorbs carbon dioxide from the atmosphere, and provides recreational benefits to visitors. Imagine if you learned that because of sudden changes to the Earth's climate, [6% or 24%] of the forest in Yellowstone National Park would be permanently lost over the next three years.</p>		
<p>Lake Mead in Nevada is the largest reservoir in the United States. This reservoir provides water for people and animals, helps to maintain a balanced ecosystem, and provides recreational benefits. Imagine if you learned that because of sudden changes to earth's climate, [6% or 24%] of the water stored in Lake Mead would be permanently lost over the next three years.</p>		

Participants were randomly assigned to one of the environmental health scenarios and were asked to respond to a small and large loss within the scenario. The presentation order of the small and large losses was counter-balanced to control for order effects. In addition, the written descriptions of the small and large loss scenarios were accompanied by infographics designed to address concerns about numeracy when respondents are asked to consider proportional losses (Table 2-2).

After reading the scenario, participants answered a series of questions. The first four questions assessed the perceived severity of the loss; responses were reported on bipolar 10-point sliders

for questions dealing with the magnitude of the loss (from very small to very large), feelings of worry (from not at all worried to very worried), and two questions about risk (risk to the environment and risk to people, from minimal to high). Responses to these questions were averaged across individuals to create an index of perceived severity (Cronbach's $\alpha = 0.96$ for the 6% loss and $\alpha = 0.92$ for the 24% loss); this scale served as the first of two main dependent variables.

Participants answered three questions about their support for international agreements, regulations aimed at companies and businesses, and personal actions intended to minimize future environmental losses of the type described in the scenario. Responses to these questions were collected on bipolar 10-point sliders that ranged from extremely opposed to extremely supportive; the midpoint was neither supportive or opposed. Responses to these questions were also averaged across individuals to create an index of support for future action aimed at stemming further losses (Cronbach's $\alpha = 0.91$ for the 6% loss and $\alpha = 0.91$ for the 24% loss); this scale served as the second main dependent variable. Once participants finished with their first version of the scenario (small or large loss), they followed an identical procedure for the second level of loss.

I also collected data from each respondent across a series of covariates. These included each respondent's gender, and political orientation (which was measured on a 7-point Likert scale from liberal to conservative; the midpoint was labeled neither liberal nor conservative).

In addition to participants' self-reported political orientation, I also collected data on their value orientations; here I adopted the scales (measured from 0, "opposed to my values", to 7, "extremely important") developed and validated by de Groot and Steg (2008) for measures of

egoistic (consideration of individual costs and benefits, 4 items), altruistic (consideration of the costs and benefits to others, 4 items), and biospheric value orientations (consideration of the costs and benefits to the whole ecosystem or biosphere, 4 items). These three scales were validated—to ensure convergent and discriminant validity—using the Oblique Multiple Group Method, which examines whether items correlate most strongly with dimensions they are intended to measure according to theory while also controlling for self-correlations (Bouman, Steg, & Kiers, 2018; Judith I M de Groot & Linda Steg, 2007; de Groot & Steg, 2008; Steg, Perlaviciute, van der Werff, & Lurvnik, 2014; Stuive, 2007).

I also included a series of questions aimed at determining the generational cohorts with which each participant identified. The most direct question asked respondents to self-report their age (according to their year of birth). This information was then used to sort participants into generational cohort: the Silent Generation (born between 1925 – 1945), Baby Boomers (born between 1946 – 1964), Generation X (born between 1965 – 1981), or Millennials (born between 1982 – 1999).

2.3 Data analysis

My first research question asked whether generation predicts perceived severity about losses—of small and large magnitude—in environmental health. To study the differences between small and large losses, I used paired t-tests and linear regression.

My second research question sought to clarify the effect of demographic characteristics (i.e., gender, year of birth, and political orientation, education, and income), value orientations, and generational characteristics (i.e., literature ascribed generational cohorts) on my dependent variables: perceived severity and future action. These variables were included in a total of four

linear regression analyses conducted for each dependent variable across the 6% and 24% loss scenarios. The relationship between the perceived severity and support for future action and the independent variables were compared between small and large loss scenarios using 95% confidence intervals. I used Cohen's guidelines for the interpretation of effect sizes; f^2 of .02 is considered a small effect, .15 a medium effect, and .35 a large effect (Cohen, 1988; Selya, Rose, Dierker, Hedeker, & Mermelstein, 2012). Given my relatively small sample size, I used the software package GPower (Faul et al., 2009) to determine what effect sizes I could expect to find. With a sample size of 469 and 19 predictors in my model, a potential effect size of $f^2 = .04$ could be found at 73% power and a f^2 of .045 at 80% power.

My final research question, to determine if there were patterns in participants' perceptions regarding the two main dependent variables beyond generational cohort, I performed a two-step cluster analysis without a predetermined number of clusters with square Euclidean differences and between-group linkages. Two cluster analyses were performed where I used SPSS to group data around perceived severity and future action, one on the small (6%) loss scenarios, and another on the large (24%) loss scenario.

To complement the cluster analyses, which focused on my main independent variables, I conducted a series of statistical tests to determine if there was a significant difference between the two clusters based on the covariates. For continuous variables such as year of birth I ran independent samples t-tests. For ordinal variables, such as participant values, Mann-Whitney U tests were used. To compare multinomial variables, including political orientation, I ran a chi-square test of homogeneity and multiple z-tests of two proportions.

3. Results

3.1 Descriptive statistics and t-tests

3.1.1 Perceived severity

Within the 6% loss scenario, participants demonstrated a mean perceived severity of 6.857 ($SD = 2.284$) on a 10 point scale where a 10 indicated higher perceived severity. By comparison, the mean perceived severity of the 24% loss scenario was 8.149 ($SD = 1.774$). On average, the 24% environmental loss was perceived to be 1.292 more severe, a significant difference ($t(468) = -18.686, p < .001$).

3.1.2 Future action

On average, participants in the 6% loss scenario ($M = 6.142, SD = 3.857$) were less willing to commit to future action than those in the 24% loss scenario ($M = 6.717, SD = 3.751$). A significant difference of ($t(468) = -6.755, p < .001$) .58 between the loss scenarios was observed.

3.2 Regression analyses

3.2.1 Perceived severity

For the 6% loss scenario, I found that biospherism, gender, and an interaction between age and gender were significant predictors of the perceived severity of the loss (Table 2-3). Perceived severity of the 6% loss was greater for males and explained 2% of the variance in perceived severity. For participants with stronger biospherism values, perceived severity was increased with 8.4% of the variance explained. Biospheric value orientation had a stronger effect than gender, but both produced small effect sizes ($f^2 = .115$ and $f^2 = .027$, respectively). The effect

size of biospheric value orientation, while small to medium, exceeds 90% power to detect a true effect. By comparison, the effect of gender on perceived severity has just over 50% power and may indicate that the small sample size has resulted in an overestimation of significance.

Previous studies parallel my observed relationship between biospheric value orientation and environmental concern. de Groot and Steg (2008) observed a positive relationship between the New Environmental Paradigm (NEP), their measure for environmental concern, and a biospheric value orientation at a calculated medium to large effect size². In addition, although there is no overall effect of age, there is a significant crossover interaction between age and gender, a small effect. As men age, their perceived severity of the loss decreases at a much quicker rate in comparison to females who have a more gradual reduction in perceived severity as they age. The overall model explained 27.1% of the variance.

For the 24% loss scenario, I again found that high levels of biospherism predicted an increase in perceived severity and explained 8.8% of the variance. In addition, perceived severity was significantly negative for those who identify as more conservative (those who self-reported their political orientation as 4, 5, 6, or 7) in comparison to those who identify as 'Liberal' or a '1' on the political orientation scale. A political orientation of 4, 6, and 7 explained less than 1% of the overall variance and a political orientation of 5 accounted for 1.5%. The overall model accounted for 29.2% of the variance in perceived severity (Table 2-3). The effect size of biospheric value orientation ($f^2 = .124$) and political orientation (4: $f^2 = .011$; 5: $f^2 = .021$; 6: $f^2 = .011$; and 7: $f^2 = .013$) was small. The small to medium effect size of the biospheric value orientation exceeds 98% power to detect a true effect and is similar to the relationship observed in the literature (de

² Calculated Cohen's d using reported standardized regression coefficients, standard deviation of the DV, and sample size. This was then compared to Cohen's (1988) guidelines for interpretation of effect size where $d = .20$ is a small effect size, $d = .50$ is medium, and $d = .80$ is a large effect size.

Groot & Steg, 2008). For self-reported political orientation values of 4 or larger, there was less than 40% power. A small to medium effect size was also estimated² for the negative relationship between conservative political ideology and climate change concern observed by McCright (2010).

3.1.2 Future action

For the 6% loss scenario, significant predictors included political orientations that leaned conservative (those who self-reported their political orientation as 4, 5, 6, or 7 where 7 was “conservative”); these respondents were significantly less likely to support future action aimed at stemming climate losses. A political orientation of 4 accounted for 1.8% of the variance, a 5 accounted for 3.3%, a 6 accounted for 2.1%, and a 7 accounted for 3.5%. Conservative political orientation had a small to medium effect size (4: $f^2 = .032$; 5: $f^2 = .058$; 6: $f^2 = .037$; and 7: $f^2 = .062$). When evaluating future action, political orientation ranged from 60% (associated with a 4 out of 7 on the political orientation scale) to over 90% (associated with a 7 out of 7 on the political orientation, where 7 was “conservative”) power to detect a true effect. Raimi, Stern, and Maki (2017) also reported small to medium effect sizes for elements of their study that suggest policy preferences that promote actions to mitigate climate change given conservative political ideology. However, a stronger identification with a biospheric value orientation was a significant and positive predictor of support for future action, accounted for 11.6% of the variance and had a medium to large effect size ($f^2 = .203$). Given the medium to large effect size associated with biospheric value orientation, I had over 99% power to detect a true effect. de Groot and Steg (2010) also observed a significant positive correlation between biospherism and their measures of pro-environmental intentions with a calculated medium to large effect size².

In the 24% loss scenario, support for future action to stem climate losses was significantly negative for some of the most conservative participants (those who self-reported their political orientation as 4, 5, 6, or 7 where 7 was “conservative”). A 4 on the political orientation scale accounts for 0.8% of the variance, a 5 accounts for 2.1%, a 6 accounts for 1%, and a 7 accounts for 2.3%. Conservative political orientation has a small effect size (4: $f^2 = .014$; 5: $f^2 = .036$; 6: $f^2 = .017$; and 7: $f^2 = .039$). The power associated with conservative political orientation ranges from 25% to over 70%. In the 24% loss scenario, the effect size of conservative political orientation was smaller than that observed in the literature (Raimi et al., 2017). Identification with a biospheric value orientation was also a highly significant and a positive predictor of willingness to take action. A biospheric value orientation accounted for 11% of the variance and had a medium to large effect ($f^2 = .188$). The effect size of the biospheric value orientation exceeds 99% power to detect a true effect. This mirrors the effect size calculated² from de Groot and Steg (2010). Overall, the model fit was accounted for 41.6% of the variance.

Table 2-3. Regression analyses for perceived magnitude of loss and future action in light of the loss in the 6% and 24% loss scenarios.

	Small (6%) Loss				Large (24%) Loss			
	Perceived Severity		Future Action		Perceived Severity		Future Action	
	<i>B (SE)</i>	<i>sr²</i>	<i>B (SE)</i>	<i>sr²</i>	<i>B (SE)</i>	<i>sr²</i>	<i>B (SE)</i>	<i>sr²</i>
Constant	2.024 (0.917)		-1.884 (1.359)		3.363 (0.704)		-2.901 (1.338)	
Age	-0.006 (0.020)	0.000	-0.027 (0.030)	0.001	0.025 (0.016)	0.004	-0.010 (0.030)	0.000
Generation								
Silent Gen.	0.337 (0.983)	0.000	1.001 (1.456)	0.001	-1.160 (0.754)	0.004	0.483 (1.433)	0.000
Baby Boomers	0.782 (0.715)	0.002	0.958 (1.061)	0.001	-0.514 (0.548)	0.001	0.539 (1.045)	0.000
Generation X	0.042 (0.423)	0.000	0.282 (0.625)	0.000	-0.426 (0.325)	0.003	0.283 (0.616)	0.000
Political 2	0.287 (0.388)	0.001	-0.296 (0.576)	0.000	-0.050 (0.298)	0.000	-0.064 (0.567)	0.000
Political 3	0.004 (0.410)	0.000	-0.434 (0.604)	0.001	0.104 (0.313)	0.000	-0.090 (0.595)	0.000
Political 4	-0.466 (0.327)	0.003	-1.799*** (0.483)	0.018	-0.555* (0.250)	0.008	-1.193* (0.475)	0.008

Political 5	-0.810 (0.432)	0.006	-3.243*** (0.641)	0.033	-0.979** (0.330)	0.015	-2.507*** (0.631)	0.021
Political 6	-0.770 (0.402)	0.006	-2.409*** (0.592)	0.021	-0.687* (0.307)	0.008	-1.637*** (0.583)	0.010
Political 7 (conservative)	-0.652 (0.420)	0.004	-3.216*** (0.620)	0.035	-0.741* (0.319)	0.009	-2.519*** (0.610)	0.023
Egoism	0.142 (0.077)	0.006	0.007 (0.114)	0.000	0.066 (0.059)	0.002	0.038 (0.113)	0.000
Altruism	-0.084 (0.127)	0.001	0.160 (0.185)	0.001	0.042 (0.096)	0.000	0.308 (0.182)	0.004
Biospherism	0.832*** (0.118)	0.084	1.606*** (0.170)	0.116	0.648*** (0.089)	0.088	1.524*** (0.167)	0.110
Education	-0.244 (0.417)	0.001	-0.649 (0.617)	0.001	-0.207 (0.320)	0.001	-0.091 (0.608)	0.000
Income	0.017 (0.043)	0.000	0.110 (.064)	0.004	0.045 (0.033)	0.003	0.055 (0.063)	0.001
Gender	0.713** (0.210)	0.020	0.268 (0.311)	0.001	0.226 (0.162)	0.003	0.075 (0.306)	0.000
Age* Education	0.002 (0.007)	0.000	0.013 (0.011)	0.002	0.003 (0.006)	0.000	0.007 (0.010)	0.001
Age* Income	0.002 (0.002)	0.002	-0.003 (0.003)	0.001	0.001 (0.002)	0.000	-0.003 (0.003)	0.001
Age* Gender	-0.032*** (0.011)	0.014	-0.022 (0.016)	0.002	-0.009 (0.009)	0.002	-0.019 (0.016)	0.002
R^2	0.271		0.431		0.292		0.416	
<i>Number of observations</i>	469		469		469		469	
<i>df</i>	19,449		19,449		19,449		19,449	

* $p < .05$; ** $p < .01$; *** $p < .001$

B is the unstandardized regression coefficient

VIF was below three for all non-dummy variables.

3.2 Cluster analyses

3.2.1 Small (6%) losses

To determine if there was an observable profile of participants whose perceptions of perceived severity and future action were similar according to variables other than generational cohort, a two-step cluster analysis for perceived severity and future action in the small (6%) loss scenario was run. The cluster analysis was run without a predetermined number of clusters and was instead designed to group the data set around the dependent variables of perceived severity and future action. The cluster analysis produced two distinct clusters (Figure 2-1A). Figure 1A

illustrates the distinction between clusters 1 (the “cautious”) and 2 (the “concerned”). Relative to cluster 2, cluster 1 was characterized by participants whose judgments about perceived severity and future action were lower. By comparison, cluster 2 includes participants who perceived higher levels of loss and increased willingness to take future action.

An independent t-test was run to determine if there were differences in age between clusters 1 and 2 of the 6% loss. However, there was no significant difference in age between participants of each cluster, $t_{(454)} = 1.044, p = .297$. Mann-Whitney U tests were used to determine if the ordinal variables I used differed according to cluster. There was no significant difference between the cautious and the concerned for the egoism value orientation ($U = 21257, z = -1.449, p = .147$). However, “the cautious” ($M_{Altruism} = 5.5; M_{Biospherism} = 5$) also scored significantly lower on the scales for the altruistic and biospheric value orientations than “the concerned” ($M_{Altruism} = 6.5; M_{Biospherism} = 6.5; U = 11631, z = -8.806, p < .001$ and $U = 19442, z = -3.051, p = .002$, respectively).

In terms of self-reported political orientation, a chi-square test of homogeneity determined that there was a statistically significant difference ($p < .001$) between the proportions of political categories across the two clusters. *Post hoc* analyses involved pairwise comparisons using the z-test of two proportions with a Bonferroni correction. The proportion of participants who identified as more liberal (i.e., self-ratings of 1, 2, or 3) on the political orientation scale was significantly higher in the concerned than the cautious ($p < .05$). By comparison, the proportion of participants who identified as more conservative (i.e., self-ratings of 5 and 6 only) was significantly higher in the cautious than the concerned ($p < .05$). There was no significant difference between clusters for those who identified as neither liberal nor conservative (4) or strongly conservative (7). In summary, the cautious had a larger proportion of participants who

leaned conservative whereas the concerned had a larger proportion of participants who leaned liberal.

3.2.2 Large (24 %) losses

A two-step cluster analysis was also run on the large (24%) loss scenario for perceived severity and future action. This cluster analysis once again determined that there were two distinct groups (Figure 2-1B); participants in cluster 1 perceived the severity of the loss to be lower than those in cluster 2. In addition, participants in cluster 1 were less willing to commit to future action to address the loss. Following the cluster analysis, a series of statistical tests were run to determine if clusters 1 and 2 differed by independent variables. Once again, I refer to cluster 1 as cautious and cluster 2 as concerned.

To determine if there were differences in age between the cautious and the concerned of the 24% loss an independent t-test was run. There was no significant difference in age between participants of each cluster, $t_{(452)} = -1.312, p = .190$. To test if the clusters from the 24% loss scenario differ on ordinal independent variables, Mann-Whitney U tests were performed. There was no significant difference between the cautious and the concerned with regards to the egoism value orientation ($U = 23401.5, z = -.139, p = .890$). By comparison, participants in the cautious ($M_{Altruism} = 5.5; M_{Biospherism} = 5.25$) also scored significantly lower on the scales for the altruistic and biospheric value orientations than the concerned ($M_{Altruism} = 6.5; M_{Biospherism} = 6.5; U = 11504.5, z = -9.157, p < .001$ and $U = 10875.5, z = -9.652, p < .001$, respectively).

For self-reported political orientation, a chi-square test of homogeneity demonstrated a significant difference between clusters ($p < .001$). A post-hoc tests of pairwise comparisons

using the z-test of two proportions with a Bonferroni correction mirrored the patterns observed in the 6% loss scenario.

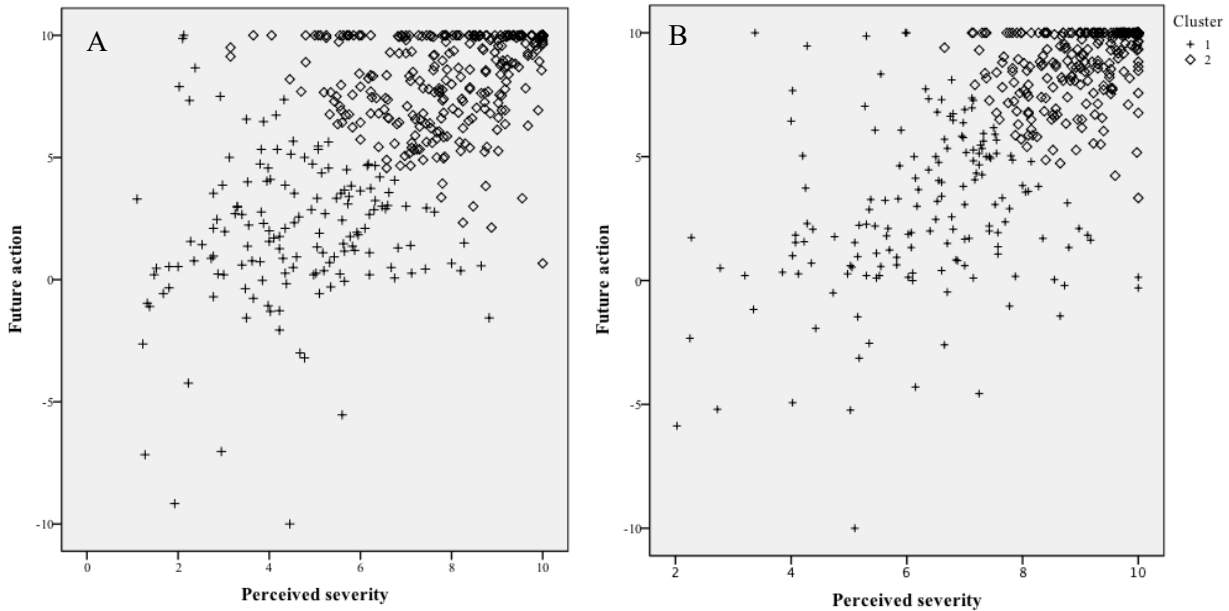


Table 2-4. Two-step cluster analysis grouped around the two dependent variables used in this research (perceived severity and future action) in the 6% (A) and 24% (B) loss scenarios.

4. Discussion

This research asked whether younger people—defined by age or generational cohort—are more concerned about declining environmental health as a result of climate change, and whether they are more willing to support future actions aimed at stemming future losses, when compared to older people. In this study, I did not find evidence of increased concern or support of future action amongst younger people.

I compared environmental losses of relatively small and large magnitude. In addition to including age and generational cohort as my primary independent variables, I also included a series of covariates; these were a series of dominant value orientations (as stand-ins for “culture”, which is notoriously challenging to measure; see van der Linden et al. (2017)) and

political orientation. My research was motivated by the suggestion, popularized by corporations and the media, that the generational cohort to which an individual belongs may influence their response to environmental change. According to recent reports (World Economic Forum 2017), for example, representatives of younger generations tend to highlight environmental risks related to climate change (and associated habitat loss) as being among the world’s most significant problems; likewise, recent media reporting (e.g., see recent reporting by NBC News³ and The Huffington Post⁴) has suggested that this heightened level of concern among younger people will lead to changing consumption habits and higher levels of support for actions—policy and otherwise—aimed at stemming these losses.

In contrast to the reports of popular media, there has been a persistent lack of agreement observed between environmental attitudes and pro-environmental behavior. For example, air travel is known to have a significant environmental impact due to the production of greenhouse gas emissions from combustion of aviation fuel (Gössling et al., 2007). However, there is little sign of air travel behavior change even amongst the most environmentally aware and “greenest” travelers (Barr, Shaw, Coles, & Prillwitz, 2010; Böhler, Grischkat, Haustein, & Hunecke, 2006). The same pattern holds for many other attitude-behavior combinations.

The disconnect between attitudes and behavior has been attributed to both external and internal factors that can act as barriers (Kollmuss & Agyeman, 2002). External factors can include institutional, economic, or social and cultural factors. Internal factors that can impair behavior change include motivation, knowledge, values, attitudes, emotions, and responsibilities and priorities (Ajzen & Fishbein, 1980; Hines, Hungerford, & Tomera, 1987; Kollmuss & Agyeman,

³ <https://goo.gl/aEYFD>

⁴ <https://goo.gl/hPWXd9>

2002; Padel & Foster, 2005). The factors that shape behavior often conflict and compete, and they demonstrate that—despite increased concern about the environment amongst younger people—it is not safe to assume that concern will translate into action.

Additionally, in the past it has been difficult to determine if age and generational cohorts influence an individual's response to environmental change, as people—regardless of their age or generational cohort—are asked for their opinions about environmental losses, and questions are often posed in a context-free manner. In other words, respondents are often asked to respond to broadly characterized challenges (like climate change or habitat loss), but not to specific magnitudes of these losses. In addition, it has been my observation that measures of generational differences tend to be rather simplistic. For example, though much of the discourse around generational differences centers on cohorts (i.e., Millennials vs. Generation X and Baby Boomers), these differences are based on the age of participants and not on cohort-level measures (Dimock, 2018). Thus, the term “generation” is instead used as a way to conveniently—but, ultimately, imprecisely—categorize individuals of a certain age.

For these reasons, my research sought to describe generational cohort in a manner that went beyond self-reported age and age-based assignment to generational cohorts; I also asked participants for their reactions to specific levels of environmental loss across a series of specific climate change contexts, and to use strength-of-preference measures for policies and actions aimed at ameliorating them.

Returning to my primary research question, I found little evidence that younger people—defined by age and generational cohort—are more concerned about declining environmental health (Table 3). Similarly, I found no evidence for a greater willingness on the part of younger

people—and younger generations—to support future actions aimed at stemming future losses when compared to older people and older generations.

Specifically, I could detect no consistent and significant difference between generations and ages in terms of their response to the small (6%) and large (24%) losses associated with climate change. Only responses to the small (6%) loss pointed to an age and gender interaction effect for perceptions of severity. Here, as age increased male participants reflected a much steeper decrease in perceived severity than females. However, this pattern in perceived severity for age and generation in the 6% loss was not consistent with the large magnitude loss (Table 3).

When looking specifically at willingness to support future environmental action, the political orientation of participants was a significant predictor and demonstrated a small to medium effect size with a range of probabilities to detect a true effect. Previous studies have demonstrated that the self-identified conservatives report beliefs that are less consistent with scientific consensus and express less concern (R. E. Dunlap, McCright, & Yarosh, 2016; McCright, 2011; Van Liere & Dunlap, 1980). Within this study, participants who do not believe that climate change is occurring were screened out, leaving only those participants who accept the reality of climate change. Even amongst self-identified conservatives who believe that climate change is occurring, willingness to support future environmental action was lower in comparison to liberals. As participants' self-reported political orientation increased in the direction of conservatism, their commitment to future action decreased in comparison to liberals (Table 3). It is noteworthy, however, that the differentiation amongst those of different political orientations was less strongly demonstrated in the 24% loss scenario and did not extend to evaluations of the perceived severity of loss in the 6% scenario. This result suggests that the divide in terms of how people with different political orientations respond occurs not in how the loss is perceived (i.e.,

as small or large in magnitude), but instead when people are asked to act on them. In addition, the small to medium effect sizes and varying power calculations may in part be due to my treatment of the variable as ordinal instead of continuous as is commonly practiced within the literature.

How a participant perceives the severity of losses in the 6% and 24% loss scenarios, as well as the strength of their support for future environmental action, were consistently explained by the how strongly participants identified with biospheric value orientations. Identifying strongly with biospheric values led to a corresponding increase in judgments about the perceived severity of the loss, and a corresponding increase in participants' willingness to commit to future action.

Overall, a biospheric value orientation was a more robust predictor of perceived severity and the willingness to take future action than was age and generation. Those with a biospheric value orientation will consider the costs and benefits of their actions on the whole ecosystem or biosphere instead of the individual costs and benefits—i.e., egoism)—or the costs and benefits to other people—i.e., altruism (de Groot & Steg, 2008; Stern & Dietz, 1994). In my study, pro-environmental beliefs such as perceived magnitude of the loss and commitment to environmental action have been positively correlated with biospheric values. Value orientations have been shown to be a consistent and strong predictor of environmental attitudes, specifically the positive relationship between biospherism and pro-environmental attitudes (Schultz & Zelezny, 1999).

The cluster analysis then determined that there were two distinct ways in which participants responded to the loss scenarios: There were participants who perceived the severity of losses to be low coupled with a low strength-of-preference for taking future action to stem losses; and, there were participants who tended toward the higher ends of the scales for both of these items.

Exploring the characteristics of the clusters, altruistic and biospheric value orientations were consistently and significantly different between clusters. Lower scores on the biospherism and altruism scales correlated with “the cautious” cluster that reported low perceived severity and future action. Higher biospheric and altruistic values correlated with “the concerned” cluster that reported higher perceived severity and future action.

Overall, my research suggests that political and value orientations are better predictors of environmental concern and action than generation and age, which had inconsistent or non-existent effects. Based on this finding, I suggest a sharper focus—especially by the media and business—on other variables that more accurately distinguish who people really are. At a time when diversity in terms of worldview and culture is receiving frontline attention from researchers and practitioners, it may be impractical to continue with the idea that labels based on generational cohort will suffice to differentiate individuals.

In the end, it’s my view that if we are truly interested in stemming environmental losses due to climate change, then simply waiting for people from younger generations to “save the world” is not a safe strategy. Instead, by actively engaging with members of the general public who already share a biospheric value orientation and a more liberal political orientation we can encourage their predisposition to environmental concern and action. In addition, policy and business leaders—along with the public—will have to redouble their efforts.

To address those who self-report a more conservative political orientation or who do not value biospherism, we may need to change the morality and value-laden language that we use around environmental issues. Dominant value orientations such as biospherism and ideologies such as political ideology tend to be relatively stable over extended periods of time and are difficult to

alter (MCright, 2011; S. H. Schwartz, 1992, 1994). Thus, we may do better by framing environmental discourse in terms of the morals and values that people already hold.

For example, research on moral foundations has shown that some moral concerns, such as purity, are more prominent among conservatives than liberals (Haidt & Graham, 2007; Markowitz & Shariff, 2012). Therefore, framing environmental discourse purity can increase environmental attitudes in conservatives, and thus reduce the difference in environmental concern between liberals and conservatives (Feinberg & Willer, 2013). This communication strategy may be useful in encouraging support for concern and future action. Similarly, it may be beneficial to use altruism- or egoism-based appeals for environmental action to audiences who value those orientations more highly than biospherism (Schultz & Zelezny, 2003).

This study was not without limitations. For example, this study is related to how the climate-related environmental losses evaluated in this study were framed. Climate change is a highly polarizing topic (Feinberg & Willer, 2013) that divides liberals and conservatives; indeed, the differential reaction of liberals and conservatives was central to my findings regarding the perceived severity of the losses and support for future actions. However, because I was also interested in generational differences, it would have been useful to also characterize small and large environmental losses without drawing attention to climate change. Doing so could have led to the appearance of more pronounced generational differences.

A second limitation of this study, is that the overall effect sizes I observed were fairly small according to traditional guidelines (Cohen, 1988) especially for political orientation. This may be due to the granularity of the political orientation question. In the future, a question that provides participants with fewer alternatives may be beneficial.

A third limitation of this study is that my survey was hosted on an online platform with a sample that encompassed a wide variety of ages (from ages 18 – 90). In the past, older adults have expressed their discomfort with going online and while this is slowly changing (A. Smith, 2014) those who currently participate in online surveys may not accurately reflect the perspective of the average older adult.

In spite of these limitations, however, my results suggest that age and generational cohort may not be among the most robust predictors of climate concern and willingness to act as I found no evidence of effect. This conclusion may be disheartening to those—especially people in the media and in government—who had hoped to rely on the perceptions, values, and actions of younger people as a firewall to the worsening of many of the environmental problems currently faced by society (e.g., see recent reporting by National Public Radio⁵). As an alternative, this study does demonstrate that perhaps the best place to focus messaging is instead upon the divide of political orientation and value orientations.

⁵ <https://goo.gl/bqbSy1>

Chapter 3

The Mechanics of Greenwash and Virtue Signaling: How Direct and Indirect Responses to Emergent Sustainability Challenges Affect Social License to Operate

1. Introduction

When it comes to advancing global sustainability⁶ goals - consumers' and regulators' expectations of companies have been shifting over the past several decades. While it used to be the case that the success of a company was tied almost exclusively to its profitability based on the quality of its products and services, they are now judged by their ability to deliver on quality, while at the same time making environmental and social progress. This shift in expectations is perhaps best exemplified by the evolution of Ford Motor Company's consumer-facing identity from "Quality is Job 1" (the company's tagline introduced in 1982) to marketing materials highlighting customers' ability to choose "any color you want, as long as it's green" (a theme of Ford's marketing strategy introduced in 1998); today, Ford's corporate mission is aligned with mobility to "make people's lives better".

A company's ability to achieve consumer and market acceptance regarding the protection of social and environmental wellbeing depends, to a significant degree, upon its approach to business sustainability (Bertsch et al., 2016; Bronfman et al., 2012). Business sustainability (interchangeably referred to as corporate social responsibility) encompasses a suite of activities by corporations that go beyond the financial bottom-line. These activities—which include

⁶ Framed according to United Nations 2030 Agenda for Sustainable Development (United Nations 2015), which includes social, environmental, and economic performance linked to seventeen "Sustainable Development Goals".

stakeholder engagement, environmental protection, creating social value, etc.—are generally geared toward achieving social or environmental goods (or counteracting social or environmental harms), and are viewed as being worthwhile even if some marginal level of profit must be sacrificed in the process (Carroll & Shabana, 2010; Steenkamp, 2017).

Business sustainability as a core component of company operations has moved from the fringes to the mainstream; it has gone from merely being a nice thing to do to a function of corporate governance that is essential to a firm’s long-term strategy, profitability, and survival. This transition is evident from the fact that nearly 80% of Fortune 500 companies—from manufacturing and consumer goods to banking and financial services—now issue sustainability reports in addition to, and often in concert with, financial reporting. Overall, many firms view their business sustainability activities as central to their being granted a “social license to operate” from their stakeholders, and from the communities within which they operate (Wilburn & Wilburn, 2011).

Social license in the context of corporate sustainability has proven to be a rather nebulous concept (Rooney, Leach, & Ashworth, 2014), that lacks a clear and widely agreed-upon definition. At its core, it is akin to the amalgamation of several factors (e.g., the overall level of public or consumer trust in a company and its leadership, stakeholders’ judgments about procedural fairness, the level of transparency of a company’s practices, a company’s compliance with social norms and expectations, etc.) that together lead to generally positive disposition toward a company and its approach to doing business; this, in turn, leads to relatively broad acceptance of its current and proposed future activities (Wilburn & Wilburn, 2011). Social license may be limited to the communities that surround a company’s operations (e.g., as is the case with extractive activities like mining or oil and gas extraction), or it may be granted on a

broader societal level (e.g., by consumers in the case of high-profile products and services like foods and beverages, consumer electronics, and apparel).

Of particular interest to us is the observation that social license may be gained through both “direct” and “indirect” means. For example, it may be gained directly—and proactively—by complying with regulatory and social norms surrounding informed consent before a company’s operations begin; e.g., relationship building and co-production of services with neighboring communities, maintaining a high level of transparency about company operations, and timely and fulsome compliance with regulatory reviews like environmental impact assessments (Rooney et al., 2014). It can also be gained by directly and meaningfully addressing concerns about a company’s activities after they have been initiated; e.g., going beyond compliance (Gunningham, Kagan, & Thornton, 2006) and altering or even ceasing business operations that are shown to be deleterious for public or environmental health (Hall, Lacey, Carr-Cornish, & Dowd, 2015).

But, because of its linkages to perceptions of reputation and judgments regarding trust, social license may also be gained *indirectly* as companies attract stakeholder and customer support by being good corporate citizens in areas that are distal to where their primary operations unfold. These kinds of activities—which some scholars refer to as virtue signaling (Orlitzky, 2018; Wallace, Buil, & de Chernatony, 2018)—help companies to enhance their reputations, and to build trust and goodwill within communities and among stakeholders and consumers (Moffat & Zhang, 2014). Taking the United Nations’ Goals for Sustainable Development (United Nations, 2015) as a guide, for example, a company in the oil and gas business may opt to invest in research on a ghastly disease (which is in line with *Goal 3: Good Health and Well-Being*), or they may opt to donate equipment and human resources for a sanitation project in a developing

country (in response to *Goal 6: Clean Water and Sanitation*), in lieu of progress on the goals most closely related to their core business (namely, *Goal 7: Affordable and Clean Energy*, and *Goal 13: Climate Action*).

While effective in garnering goodwill and social license, many researchers and practitioners have argued that these kinds of indirect efforts designed to garner social license are in fact smokescreens that have more to do with impression management than they do with a genuine interest in corporate social responsibility (Pomeroy, 2017). For example, Banerjee (2008) has argued that the rhetoric of social benefits and environmental protection notwithstanding, corporate social responsibility and the quest for social license to operate is really defined by sharply-focused economic goals, which come at the expense of society and the environment. Prasad and Holzinger (2013) adopt a similar perspective, arguing that indirect efforts to garner social license to operate are really an attempt to engender a positive but ultimately false consciousness among customers and stakeholders surrounding much darker business realities.

Research on human perception, judgment, and decision-making supports this assertion; specifically, companies may be attempting to capitalize on the halo effects (Thorndike, 1920) associated with doing certain good deeds. Halo effects are a form of context-dependent judgment borne from the fact that people find it difficult to treat stimuli—e.g., events, companies, products, etc.—as a compound of separate attributes that require independent prioritization. Instead, I observe that the relationship between the priorities assigned to attributes tends to be highly correlated; specifically, substantially *positive* (or, in the case of stigma—see Gregory et al. (1995)—*negative*) feelings about certain salient attributes “spill over” to affect their feelings about other attributes. So, it’s easy to imagine that a company that is valued by stakeholders for being socially conscious, may also be viewed as being environmentally friendly.

I know from experience that firms and organizations routinely attempt to capitalize on these effects in an attempt to influence the perceptions and preferences of consumers and stakeholders. At one extreme are legitimate efforts by firms to highlight sustainability in their behaviors, products, and services through so-called “green marketing” efforts (Dangelico & Vocalelli, 2017); green marketing refers to the process of drawing attention to—and ultimately selling—products and services based on their environmental benefits, or because they stem from environmentally friendly supply chains or manufacturing processes. The same can be said of legitimate social marketing initiatives whose goal is to showcase or sell services that are equitable and sustainable (Andreason, 1995).

At the other extreme is greenwashing (Lyon & Maxwell, 2011), which can be considered according to different perspectives. Firms may, on the one hand, highlight symbolically significant sustainability-focused *programs* in order to deflect attention from a firm’s environmentally unfriendly or less wholesome activities. Likewise, firms may selectively highlight specific, carefully selected sustainability *attributes*—e.g., certain behaviors, products, services, or even the corporate ethos (regardless of whether it’s authentic or fabricated)—without drawing attention to potentially more important and relevant attributes or externalities.

When evaluating the effects of companies’ behaviors, or their strategies aimed at reputation enhancement and the earning of social license, it is important to recognize that not all observers of these behaviors will arrive at their judgments in a similar fashion. Prior research suggests, for example, that women are more concerned about sustainability issues—broadly construed—than men (Dietz et al., 2002; McCright, 2010; Stern et al., 1993); this, in turn, leads to higher levels of support for business sustainability efforts among women than among their male counterparts (Jones et al., 2017). Likewise, it’s women—more than men—that tend to exhibit more

sustainability-conscious consumer behavior (Luchs & Mooradian, 2012; Mainieri et al., 1997). Extending these findings to the granting of social license, it stands to reason that women may hold companies to a higher standard than men.

In addition to demographic categories, other factors have also been found to influence people's concerns about sustainability, and their support of activities or policies. For example, several studies have shown that psychographics such as worldviews and value orientations are associated with concern about sustainability and support for efforts that promote it. Some of this work falls under the umbrella of “cultural cognition” (Kahan, Jenkins-Smith, & Braman, 2011), which suggests that cultural drivers—more than demographic differences or domain-specific knowledge (e.g., about sustainability)—are the primary predictors of both public concern about a wide range of environmental and human health risks, and generalized public support—i.e., social license—for strategies or behaviors which address them. However, this research has been criticized for not addressing cultural variables at all; others suggest that cultural cognition is little more than a proxy for psychological variables like motivated reasoning driven by one's political orientation (van der Linden, 2016; van der Linden et al., 2017).

Academic arguments about culture notwithstanding, it is true that identity-protective (i.e., motivated) reasoning based on political beliefs is an important facet of risk and benefit perceptions in the domain of sustainability. But, so too is measuring the value orientations that provide the scaffolding for cultural drivers. To this end, Shi et al. (2016) explored the interaction of domain-specific knowledge and individual value orientations—e.g., egoism, altruism, and biospherism—as drivers of public concern about climate risks. Related studies by Visschers et al. (2017) and L'Orange Seigo et al. (2014) took this work a step further and modeled the relationship between these variables to better understand the factors that predict public risk and

benefit perceptions and support for strategies like geoengineering and carbon capture and sequestration (both of which may mitigate the effects of rising industrial CO₂ emissions).

But, in spite of a wide range of studies that explore the constellation predictors of risk and benefit perceptions in the realm of environment and sustainability, no study (to the best of my knowledge) offers a systematic exploration of predictors of public support for business sustainability activities and, in particular, direct and indirect attempts aimed at obtaining social license. The research reported here was undertaken to address this gap.

To this end, I was interested in studying the influence of direct and indirect responses by companies to emergent sustainability challenges on individual judgments about company reputation and the willingness to grant social license. In addition, I sought to explore how influential common demographic characteristics (such as gender, age, education, and income), political orientation, individual value orientations (egoism, altruism, and biospherism), and environmental concern might drive judgments about social license.

Because the sector in which a company operates may be influential in guiding judgments about reputation and social license, I conducted this research in three different company contexts: oil and gas, consumer electronics, and food and beverages. These contexts were selected because each has been the locus of recent controversies regarding the sustainability practices of companies doing business within them. Indeed, the scenarios developed for my research (see below) were based on actual sustainability controversies experienced by the Coca-Cola Company, Apple, and Enbridge (a Canadian oil and gas pipelines company).

2. Methods

2.1 Design and Hypotheses

Participants in this research responded to an online survey instrument, with an embedded experimental design, to address the research questions noted above. After obtaining informed consent, participants were asked to read a brief scenario that described an emergent sustainability challenge faced by a company. Each scenario was comprised of two parts: (1) a description of an emergent corporate sustainability challenge and (2) an explanation of how the company responded to it. A company's response was further segmented such that it (a) directly addressed the sustainability challenge by changing its behavior or business practices (labeled a *direct response*), (b) indirectly addressed the sustainability challenge by taking positive action in an unrelated area (labeled an *indirect response*), or (c) ignored the challenge and proceeded with business-as-usual (labeled *BAU*); see Table 3-1.

Table 3-1. Scenarios describing sustainability challenges and company responses that were presented to participants. A between-subjects design was adopted such that each participant responded to only one company context and only one company response.

	Food and Beverage	Oil and Gas Pipelines	Consumer Electronics
Sustainability Challenge	A well-known food and beverage company manufactures various products including sodas, energy drinks, bottled water, juices, and iced tea. Recently, concerns have been raised about the company’s use and treatment of the water that they require to produce these beverages. Specifically, the company has been criticized for withdrawing too much water from certain sensitive ecosystems. They have also been criticized for polluting the water resources they use to make their beverages.	A well-known oil and gas pipeline company is proposing to build a large pipeline designed to carry oil from Alberta’s oil sands to a port in northern British Columbia. Recently, concerns have been raised about the environmental risks associated with the pipeline project. The company has also been criticized for its handling of concerns from First Nations people who live near the proposed pipeline route.	A well-known consumer electronics and software company manufactures products such as smartphones, digital tablets, computers, watches, and various accessories in Chinese factories. Recently, reports have emerged that workers at these factories had been treated unfairly. Specifically, concerns had been raised about unfair working conditions, including: long working hours without breaks provided, or overtime paid; and low wages.
Company Response			
<i>Direct</i>	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. In order to protect their reputation, the company took steps to reduce the amount of water they use during beverage production. For example, they invested in new manufacturing systems that make more efficient use of water. And, they have taken steps to make their business practices more environmentally friendly in order to minimize pollution.	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. In order to protect their reputation, the company took steps to change the way in which they make pipeline-siting decisions. For example, they now consult more meaningfully with a diversity of stakeholders and have shown a willingness to alter plans – or even cancel projects altogether – if they fail to meet stakeholders’ expectations about environmental protection, and respect for First Nations people.	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. In order to protect their reputation, the company took steps at improving working conditions in their Chinese factories. Monitors are now present in the factories, and surprise inspections take place, to ensure that workers receive higher wages, breaks, and receive overtime pay when required.
<i>Indirect</i>	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. In order to protect their reputation, the company took steps to promote the empowerment of women in the workplace; this included providing training opportunities for women so that they could develop business skills, offering them financial advice and resources and providing them with business connections.	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. In order to protect their reputation, the company took steps to invest in the wellbeing of communities all across Canada. For example, they sponsored cultural events such as art exhibits. And, they sponsored a cycling event intended to raise funds for cancer research.	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. In order to protect their reputation, the company took steps aimed at making their manufacturing processes more environmentally friendly; this included obtaining more energy from renewable sources and reducing the amount of waste generated in their supply chain.
<i>BAU</i>	The company recognized that these concerns could damage their reputation amongst consumers and could negatively affect the profitability of their business in the future. However, the company ignored these concerns and continued with business-as-usual.		

For the purposes of this research, the emergent sustainability challenges and company responses (with the exception of *BAU*) were defined according to the United Nations’ Goals for Sustainable Development (United Nations, 2015), which include an array of environmental, social, and economic dimensions. The scenarios—which as I note above were based on real-world

companies, and their sustainability challenges and responses—were developed for each of the three company contexts: oil and gas pipelines, consumer electronics, and food and beverages. In the experiment, the companies were not named so as to not bias the results because of either company recognition or brand (or company) loyalty. A between-subjects design was adopted such that each participant responded to only one company context and only one kind of company response to an emergent corporate sustainability challenge.

After reading their assigned scenario, participants responded to a question included as a manipulation check; it asked if the company's response *directly* addressed the concerns raised about their business practices. Responses were collected using a 7-point Likert scale where 1 = "The response did not directly address the concerns" and 7 = "The response did directly address the concerns."

Next, participants were asked to respond to two questions, which were combined to form a scale (Cronbach's $\alpha = 0.87$), regarding their judgments about the company's reputation. The first question asked about the effect of the company's response to the sustainability challenge on its reputation; responses were collected using a 7-point Likert scale where -3 = "Negative effect on their reputation" and +3 = "Positive effect on their reputation" (midpoint (0) = "No effect on their reputation"). For analysis these responses were recoded on 1 – 7 scales. The second question, also linked to a 7-point Likert scale, asked how each participant would rate the company's reputation based on the information they received in the scenario; here, 1 = "Their reputation is poor" and 7 = "Their reputation is excellent" (midpoint = "Their reputation is average").

Finally, participants were asked to respond to two questions aimed at the concept of social license; once again these questions were combined to form a scale (Cronbach's $\alpha = 0.86$). The first question asked if the company's response to the concerns raised about their business would make them less or more likely to support the company in the future. Responses were provided on a 7-point Likert scale where -3 = "I'd be much less likely to support them" and +3 = "I'd be much more likely to support them" (midpoint (0) = "This would have no effect on my support for them"). The second question asked participants to assume the company's response outlined in the scenario reflected "business as usual" for the company; they were then asked to offer a judgment about whether the company should be allowed to continue taking this kind of approach in their future corporate activities. Responses were provided on a 7-point Likert scale where -3 = "No" and +3 = "Yes" (midpoint (0) = "I'm not sure"). As above, these responses were recoded on 1 – 7 scales for the statistical analyses.

After answering these questions, participants were asked a series of questions aimed at the covariates in this study. First, they were asked to indicate their level of trust in each of the three company types featured in this study; trust was measured on a single item, which asked: "Generally speaking, how much do you trust the following companies and organizations to conduct business in a socially responsible manner?" Responses were collected on a 7-point Likert scale where 1 = "Low trust" and 7 = "High trust" (midpoint = "Medium trust").

Next, participants were asked to indicate their level of concern about climate change; four climate concern questions, which formed a scale (Cronbach's $\alpha = .94$) were taken from previous studies used by the authors (e.g., see Shi et al., 2016; Tobler, Visschers, & Siegrist, 2012). These questions were asked because concerns about oil and gas in particular are often tied to concerns about climate change, and also because previous studies have shown that concern about climate

change is closely related to (and may be a proxy for) broader concerns about sustainability and the environment (Hornsey, Harris, Bain, & Fielding, 2016; National Science Board, 2018).

Participants were then asked to self-report their political orientation; responses were collected on a 7-point Likert scale where 1 = “Extreme left” and 7 = “Extreme right” (midpoint = “Centrist: Neither left nor right”). For analysis these responses were recoded on 1 – 7 scales. In addition, I used the 12-item value orientations scale developed by de Groot and Steg (2007) to measure participants’ *egoistic*, *altruistic*, and *biospheric value orientations*. Respondents were asked to indicate the importance of each value as a guiding principle in their lives on an 8-point Likert scale where 1 = “Not important” and 7 = “Extremely important”; the eighth point (labelled as -1) was in place so respondents could indicate if a particular item was opposed to their values. The internal reliability of each value scale was found to be high (Cronbach’s $\alpha_{\text{Egoism}} = .78, n = 4$; Cronbach’s $\alpha_{\text{Altruism}} = .89, n = 4$; and Cronbach’s $\alpha_{\text{Biospherism}} = .96, n = 4$). Finally, respondents reported their gender, income, and education level.

I hypothesized that participants would offer the lowest ratings for company reputation and their willingness to grant social license in the *BAU* conditions for all three company contexts.

Similarly, I hypothesized that the highest ratings would be given for reputation and social license in the *direct* response conditions for all three company contexts. Finally, I hypothesized that ratings for reputation and social license in the *indirect* response conditions would be significantly higher than in the *BAU* conditions, approaching those in the *direct* response conditions. In terms of my exploratory regression, I anticipated that lower levels of self-rated concern about climate change and biospherism, and higher ratings of trust in companies and egoism would contribute to more favorable ratings—for reputation and social license—when considering *indirect* company responses.

2.2 Sample

Participants in this research were recruited in Canada from a representative internet panel maintained by Insightrix Research LLC. A total of 750 participants were randomly assigned to the *BAU* ($n = 250$), *indirect response* ($n = 250$), and *direct response* ($n = 250$) conditions for each of the three company contexts: oil and gas, consumer electronics, and food and beverage; thus, the total sample was $n = 2,250$ (i.e., 3×750).

After data cleaning, the total sample was reduced to $n = 1,753$. Cleaning the data consisted of removing participants because they spent less than half the median time (7 minutes) on the instrument, or because they failed a series of attention checks.

The overall sample was 52% female ($n = 912$) and 48% male ($n = 841$); the average age of participants was 40 to 49, and the mean response for education levels was the completion of some technical school or college. Within the consumer electronics context, 199 participants responded to the *BAU* condition, 192 participants responded to the *indirect response* condition, and 184 participants responded to the *direct response* condition. Within the oil and gas pipelines context, 206 participants responded to the *BAU* condition, 183 participants responded to the indirect response condition, and 208 participants responded to the direct response condition. And, within the food and beverage context, 188 participants responded to the *BAU* condition, 198 participants responded to the indirect response condition, and 195 participants responded to the direct response condition.

2.3 Analysis

I conducted analyses of variance with Tukey's post-hoc tests to detect differences across *BAU*, *indirect*, and *direct* company responses for each context. ANOVAs and post-hoc tests were carried out for the manipulation check, and for the dependent measures regarding reputation and social license. To lower the rate of Type II errors due to multiple (3) comparisons per context, I applied a Bonferroni correction; thus, the *p*-value required for significance in the ANOVAs was set at 0.0167.

I also conducted exploratory linear regressions to improve my understanding about the extent to which demographic characteristics (i.e., gender, income, and education level), trust in participants' assigned company type, concern about climate change, and value orientations explained participants' judgments about company reputation and their willingness to grant social license.

3. Results

Considering the manipulation check questions for the food and beverage, and the oil and gas pipelines contexts, my ANOVA detected a significant main effect ($F_{(2, 578)} = 192.87$; $p < 0.001$ for the food and beverage context and $F_{(2, 594)} = 93.49$; $p < 0.001$ for the oil and gas pipelines context). Thus, both contexts passed the manipulation check (Table 3-2). Post-hoc testing revealed that, in both contexts, participants provided higher average ratings for the companies' *direct* responses to sustainability challenges than they did for *indirect* responses and *BAU*. Neither the *indirect* responses nor the *BAU* responses were significantly different from one another ($p < 0.001$ for both contexts); thus, in both contexts, the *indirect* response and *BAU* were judged, on average, to be equally "indirect".

The ANOVA also detected a significant main effect ($F_{(2, 572)} = 147.78$; $p < 0.001$) in the consumer electronics context, meaning it too passed the manipulation check (Table 3-2). However, post-hoc testing revealed a significant one-tailed difference across all scenarios such that the *direct* response outperformed the *indirect* response, and the *indirect* response outperformed *BAU*; thus, the *indirect* response was judged, on average, to be more “direct” than *BAU*.

Table 3-2. ANOVA comparing manipulation check results by context and response (Direct, Indirect, and BAU).

<i>Context</i>	<i>Direct (D)</i>		<i>Indirect (I)</i>		<i>BAU (B)</i>		<i>F</i>	<i>p</i>	<i>Tukey Results</i>
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>			
Food & Beverage	4.83 (n = 195)	1.28	2.29 (n = 198)	1.69	2.20 (n = 188)	1.48	192.87 (2, 578)	< 0.001	D vs. I*** D vs. B*** I vs. B ^{ns}
Oil & Gas Pipelines	4.55 (n = 208)	1.43	2.81 (n = 183)	1.60	2.66 (n = 206)	1.62	93.49 (2, 594)	< 0.001	D vs. I*** D vs. B*** I vs. B ^{ns}
Consumer Electronics	4.81 (n = 184)	1.29	3.14 (n = 192)	1.75	2.21 (n = 199)	1.40	147.78 (2, 572)	< 0.001	D vs. I*** D vs. B*** I vs. B***

Significance level for Tukey’s post-hoc comparisons: * $p \leq 0.0167$; ** $p \leq 0.01$; *** $p \leq 0.001$; ns = no significant difference.

For participants judgments about companies’ reputation following different responses to a sustainability challenge, the ANOVA detected a significant main effect for all three company contexts ($F_{(2, 578)} = 201.68$; $p < 0.001$ for the food and beverage context, $F_{(2, 594)} = 87.94$; $p < 0.001$ for the oil and gas pipelines context, and $F_{(2, 572)} = 141.80$; $p < 0.001$ for the consumer electronics context). Post-hoc testing showed a significant one-tailed difference across all scenarios such that *direct* responses outperformed *indirect* responses, and *indirect* responses outperformed *BAU* (Table 3-3).

Table 3-3. ANOVA comparing participants judgments about company reputation by context and sustainability response (Direct, Indirect, and BAU).

<i>Context</i>	<i>Direct (D)</i>		<i>Indirect (I)</i>		<i>BAU (B)</i>		<i>F</i>	<i>p</i>	<i>Tukey Results</i>
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>			
Food & Beverage	4.94 (n = 195)	1.17	3.20 (n = 198)	1.38	2.32 (n = 188)	1.34	201.68 (2, 578)	< 0.001	D vs. I*** D vs. B*** I vs. B***
Oil & Gas Pipelines	4.64 (n = 208)	1.41	3.75 (n = 183)	1.34	2.79 (n = 206)	1.49	87.94 (2, 594)	< 0.001	D vs. I*** D vs. B*** I vs. B***
Consumer Electronics	4.76 (n = 184)	1.28	3.83 (n = 192)	1.39	2.53 (n = 199)	1.24	141.80 (2, 572)	< 0.001	D vs. I*** D vs. B*** I vs. B***

Significance level for Tukey’s post-hoc comparisons: * $p \leq 0.0167$; ** $p \leq 0.01$; *** $p \leq 0.001$; ns = no significant difference.

My results were very similar when considering participants judgments about social license. An ANOVA detected a significant main effect for all three company contexts ($F_{(2, 578)} = 123.35$; $p < 0.001$ for the food and beverage context, $F_{(2, 594)} = 85.57$; $p < 0.001$ for the oil and gas pipelines context, and $F_{(2, 572)} = 105.73$; $p < 0.001$ for the consumer electronics context). Post-hoc testing showed a significant one-tailed difference across all scenarios such that *direct* responses outperformed *indirect* responses, and *indirect* responses outperformed *BAU* (Table 3-4).

Table 3-4. ANOVA comparing participants judgments about social license by context and sustainability response (Direct, Indirect, and BAU).

<i>Context</i>	<i>Direct (D)</i>		<i>Indirect (I)</i>		<i>BAU (B)</i>		<i>F</i>	<i>p</i>	<i>Tukey Results</i>
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>			
Food & Beverage	4.45 (n = 195)	1.32	2.77 (n = 198)	1.52	2.31 (n = 188)	1.37	123.35 (2, 578)	< 0.001	D vs. I*** D vs. B*** I vs. B***
Oil & Gas Pipelines	4.62 (n = 208)	1.29	3.33 (n = 183)	1.46	2.83 (n = 206)	1.55	85.57 (2, 594)	< 0.001	D vs. I*** D vs. B*** I vs. B***
Consumer Electronics	4.49 (n = 184)	1.17	3.35 (n = 192)	1.43	2.57 (n = 199)	1.29	105.73 (2, 572)	< 0.001	D vs. I*** D vs. B*** I vs. B***

Significance level for Tukey’s post-hoc comparisons: * $p \leq 0.0167$; ** $p \leq 0.01$; *** $p \leq 0.001$; ns = no significant difference.

In terms of my exploratory regression for *indirect* responses and the willingness to grant social license (Table 3-5), trust in the type of company that participants were exposed to was a significant predictor of the willingness to grant social license in the case of *indirect* responses to

sustainability challenges. Ascribing to an egoistic value orientation—which is related to the pursuit of personal interests, such as power and achievement—was also a significant predictor of the willingness to grant social license for *indirect* responses. Income, political orientation, and ascribing to a biospheric value orientation—which is a self-transcendent value orientation that emphasizes the importance of harmony between people and the environment—were also shown to be significant predictors, though none of them were robust across all three company contexts. Concern about climate change did not significantly predict social license.

Table 3-5. Linear regression results describing the extent to which demographic characteristics (i.e., gender, income, education level, political orientation), value orientations (egoism, altruism, biospherism), trust in companies, and climate change concern explained participants' judgments about social license assigned to a company *indirectly* responding to sustainability challenges by context.

	Food & Beverage			Oil & Gas Pipelines			Consumer Electronics		
	B	SD	95% CI (LL, UL)	B	SD	95% CI (LL, UL)	B	SD	95% CI (LL, UL)
Gender	-0.23	0.50	-0.62, 0.16	-0.05	0.50	-0.43, 0.32	-0.03	0.50	-0.43, 0.36
Income	-0.50***	0.94	-0.71, -0.29	-0.01	0.91	-0.22, 0.20	-0.08	0.98	-0.29, 0.13
Education	0.07	1.51	-0.06, 0.20	-0.03	1.52	-0.15, 0.10	-0.03	1.59	-0.16, 0.10
Political Orientation	-0.01	1.08	-0.20, 0.17	0.22*	1.16	0.05, 0.38	0.15	1.08	-0.06, 0.36
Egoism	0.14*	1.38	0.00, 0.28	0.18**	1.42	0.05, 0.31	0.18*	1.21	0.00, 0.36
Altruism	-0.15	1.28	-0.35, 0.05	-0.02	1.38	-0.23, 0.19	-0.08	1.17	-0.32, 0.17
Biospherism	-0.20*	1.46	-0.40, -0.01	-0.01	1.45	-0.23, 0.20	0.04	1.38	-0.21, 0.29
Trust	0.50***	1.12	0.33, 0.67	0.47***	1.28	0.30, 0.63	0.31**	1.03	0.10, 0.52
Climate Concern	0.02	1.35	-0.16, -0.19	-0.04	1.25	-0.23, 0.15	-0.03	1.27	-0.26, 0.19
R ²	0.32			0.39			0.14		
F	9.64***			9.82***			3.36**		
(df1, df2)	(9, 188)			(9, 173)			(9, 182)		

*p < .05, **p < .01, ***p < .001

4. Discussion

Results from this study show that *direct* responses by companies that are aimed at addressing sustainability challenges significantly outperform business as usual across dependent variables; reputation and social license. However, my results also show that *indirect* responses by companies also have a significant and positive impact (relative to business as usual) on

judgments about reputation (Table 3-3) and social license (Table 3-4) even though they—with the exception of the consumer electronics scenario (Table 3-2)—were not viewed by participants as directly addressing the sustainability challenge as described in the scenarios (Table 1). These findings are in line with my hypotheses.

These results illustrate that there's more to what drives judgments about stakeholders' satisfaction with companies—in terms of company reputation and the willingness to grant social license—than the “directness” of a company's response to a sustainability challenge alone. It is clear that people are responding to other signals—beyond the type and appropriateness of a company's response—when formulating these judgments.

A commonly accepted assumption amongst pollsters, policy analysts, and many behavioral scientists is that, when it comes to judgments such as the ones studied here, those forming them simply draw upon a pool of consistent, preexisting priorities and experiences. Preexisting priorities and past experiences can be identified in a variety of contexts. For example, when an individual's or groups' behavior reinforces or violates a strongly held social norm, people are able to draw on their priorities and experiences in labeling the behavior in question as “good” or “bad”. But the question that inevitably follows—namely, how good or bad?—cannot be answered by drawing on preexisting priorities and experiences alone.

In these situations, consistent preexisting priorities or past experiences upon which to base judgments about the magnitude of benefit or harm are largely absent. The same is true of contexts that require the opposite kind of judgment; e.g., judgments about the degree of “goodness” associated with an event or behavior, or the magnitude of support for actors that would be indicated in response to their good behaviors. Under these circumstances, people must

construct their judgments in response to cues that are available to them at the time when the judgments are made or elicited (Payne, Bettman, & Johnson, 1992; Slovic, 1995). Some of these cues will be external, in the sense that they are associated with information that accompanies judgmental context. And some cues will be internal, reflecting the worldview or ideology of the people making the judgments.

For example, external cues may take the form of information presented—as was the case with my research—about sustainability challenges or a firm’s responses to them. These kinds of cues activate judgmental heuristics (Gigerenzer et al., 2011; Gilovich et al., 2002), which facilitate the rapid—and often unconscious *vs.* rationally motivated—formation of judgments. In particular, my results suggest that heuristic judgments based on halo effects (Thorndike, 1920) are a powerful force in driving consumer and stakeholder responses to indirect responses by companies to sustainability challenges. Halo effects describe the situation where, in a situation that requires multi-attribute evaluation, people’s positive or negative reactions to certain salient attributes—i.e., attributes that cast a halo—“spill over” to effect their reactions to other attributes.

In my research, there are at least two external cues that can could have lead to the formation of positive halo effects for participants. One is the positive nature of the *indirect* response to the sustainability challenges as described in the scenarios; though they do not directly address the sustainability challenges raised by a company’s behavior, indirect responses are likely to create an influential warm glow for observers. The other is the positive halo that is imparted by a trusted organization; the effect of trust in a company in driving judgments about social license (Table 3-5) was highly significant. The importance of trust is in line with prior work in business on crisis management. Crisis managers often believe that if a company’s pre-crisis reputation is

strongly positive, it will create a positive halo that protects the firm against reputational damages (Coombs & Holladay, 2006).

Recent research suggests that the psychological mechanism behind these halo effects is linked to the level of positive affect—i.e., the instinctive emotional response (Finucane et al., 2000; Slovic et al., 2002)—that is associated with symbolically significant activities, outcomes, or behaviors (Wilson & Arvai, 2006, 2010). For example, research by Sütterlin and Siegrist (2014) has shown that people rely on their instinctive emotional responses to code symbolically significant behaviors as statements about one’s convictions. In other words, certain behaviors by individuals—and, by extension—firms become instinctively tagged with symbolic meaning, which in turn can be used by others to make inferences about their underlying values and motivations.

Building upon research by Mead (1934) and Blumer (1969) on symbolic interactionism, the symbolic meaning attributed to a person’s or firm’s action and whether it is perceived as either positive or negative is ultimately the product of the social interactions that unfold between organizations and the people they serve. The end result is that, what is viewed from outside the firm as contributing positively to the society and the environment—and thus, creating social license—is socially constructed rather than being objectively linked to the firm’s achievement of specific outcomes or impacts. Thus, engaging in certain symbolically meaningful behaviors—even if these behaviors deflect attention away from an emerging sustainability crisis—a firm may be more easily and more directly associated with the positive *symbolic* meaning of those behaviors rather than with the behaviors that address—or do not address—the underlying sustainability crisis.

In research by Sütterlin and Siegrist (2014), for example, judgments about the degree to which people were perceived as behaving “sustainably” were more strongly tied to external evaluations of symbolically significant attributes of their behaviors (e.g., driving hybrid-electric vehicles *vs.* a SUV) rather than on more “objective” and informative behavioral attributes of sustainability (e.g., the annual distance covered and the fuel consumption of the car—that is, the amount of energy a driver actually consumed).

My results suggest that, consistent with research on halo effects, affect, and symbolic significance, positive intuitive reactions to indirect responses by companies to sustainability challenges spill over to influence ratings on corporate reputation and—ultimately—social license. Indeed, participants ratings of how directly the indirect responses addressed the concerns (see manipulation check in Table 3-2) may provide further support for this assertion. In the food and beverage, and the oil and gas pipelines contexts, participants viewed *indirect* and *BAU* responses as the same. In the consumer electronics context, *indirect* responses were viewed more favorably than *BAU*. I believe this to be the case because this was the only context in which an indirect response to a sustainability challenge involved an improvement in environmental performance. Because environmental performance is so closely linked to concerns about sustainability, I believe that the positive halo created by a commitment to environmental improvements led to the significant increase in ratings of “directness”.

My results also highlight the importance of other variables (Table 3-5) that may influence people’s ratings of reputation and social license. Controlling for other covariates, my results suggest that people who identify strongly with an egoistic value orientation—which is often associated with a free-market ideology (Halali, Dorfman, Jun, & Halevy, 2017)—were more

likely to positively rate indirect responses than participants who did not identify with this value orientation.

On the flipside, my results did not support my hypotheses that ascribing to a biospheric value orientation (except for the context food and beverages) or being concerned about climate change, would lead to an increased willingness to grant social license. Specifically, higher levels of concern about climate change—which I included as a covariate in my regression—did not reduce social license when considering indirect responses to sustainability challenges. This finding came as a surprise as it has been previously shown that those who care most deeply about the health of the environment are much more demanding of the private sector for meaningful action on this front (M. Schwartz & Cragg, 2009).

Even though judgments about corporate reputation and social license appear to be strongly influenced by *indirect* responses, I take it as a positive that these responses did not score as highly as *direct* responses. These results suggest that company stakeholders and consumers would strongly prefer *direct* responses to sustainability challenges, and they would reward companies for them.

On the other hand, these results also suggest that companies are likely to receive significant upticks in stakeholder and consumer support—including the willingness to grant social license—for sustainability efforts that neither address directly areas where they may be deficient, nor areas that are core to their business activities. In addition to the reality-based contexts that I studied in my research, there are countless other examples of corporate misdirection that yield positive halo effects; e.g., the prominent case of the oil and gas giants who made relatively small but high-profile investments in renewable energy or biodiversity protection while bankrolling and

lobbying misinformation campaigns aimed at weakening policies and public perceptions about climate change (R. Dunlap & McCright, 2011).

I doubt that the influence of indirect responses to sustainability challenges is lost on companies. Many of today's companies possess increasingly sophisticated marketing and communications divisions that often portray their products and services such that they serve as signals that can help to define consumers' personalities and priorities (Belk, 1988; Galinsky, Dubois, & Rucker, 2011; Griskevicius & Wang, 2013). I expect that companies equally understand the importance of creating diversions by highlighting indirect but highly symbolic behaviors that help outwardly signal their values regardless of whether these values are authentic or manufactured.

Chapter 4

Industry-Dominated Science Advisory Boards are Perceived to be Legitimate...but Only If they Recommend More Stringent Health and Environmental Policies

1. Introduction

Of the 1,004 advisory bodies assembled under Federal Advisory Committee Act (FACA) in 2018, 220 were designated as “scientific and technical” (General Services Administration, 2019). Scientists who serve on these federal science advisory boards (SABs) offer guidance to policy-makers about pre-existing or proposed policies and about research to support them. Until recently, members of federal SABs were typically drawn primarily from academia.⁷ However, scientists from industry (and industry trade associations), private consulting, tribal and state agencies, and the non-profit sector have also been invited to serve.⁸ Service on a SAB represents one of the few formal channels through which non-governmental scientists may formally participate in the policy-making process (Stuessy, 2016).

Far from a feather in the cap of non-governmental scientists, service on a federal SAB serves an important, practical purpose. These scientists help government agencies to identify relevant studies in the early stages of problem identification and policy formulation, they offer guidance on best practices—in research design, data collection, and analysis—across a wide spectrum of

⁷For example, the proportion of EPA SAB members representing industry rose from 5% in 2008 to 11% in 2016; this period of time reflected EPA leadership under Presidents George W. Bush (2001 – 2008) and Barack Obama (2009 – 2016). The proportion of EPA SAB members representing industry rose from 11% in 2017 to 34% in 2019, reflecting the first three years of the Donald Trump Administration. In this same period (2017 – 2019), representation on the EPA SAB from academic scientists fell from 78% to 50%.

⁸Scientists from tribal and state agencies may also serve on federal SABs.

scientific disciplines, and they help to set expectations about the ethical and scientific norms (e.g., regarding replication and data transparency) that underlie the conduct and use of science for policy-making. In effect, a federal SAB serves a critical peer review role for the science underlying policy (Wagner, Fisher, & Pascual, 2018).

One of the most high-profile examples of a federal SAB is the Chartered Science Advisory Board assembled by the United States Environmental Protection Agency (EPA). The EPA SAB was created in 1978 and works under a congressional mandate codified under section 8(b) of the Environmental Research, Development, and Demonstration Authorization Act (ERDDAA). Its objective is to provide independent advice and peer review to the EPA Administrator on scientific and technical matters that are relevant to agency rulemaking. While the SAB reports to the EPA Administrator, congressional committees may also ask for guidance from the SAB on scientific and technical matters (95th Congress of the United States of America, 1978).

Recently, the EPA SAB has come under public and political scrutiny because of a directive⁹ issued by former EPA Administrator, Scott Pruitt, and upheld by the agency's current Administrator, Andrew Wheeler. This directive introduced more restrictive rules governing the eligibility of academic scientists to serve on the EPA SAB¹⁰ by barring those who received research grant support from the EPA from serving on the SAB. These rules did not restrict the service on SABs of scientists from EPA-regulated industry, or from state agencies that receive

⁹Administrator Pruitt's directive, dated 31 October 2017, was entitled Strengthening and Improving Membership on EPA Federal Advisory Committees.

¹⁰This same directive affected the eligibility of academic scientists to serve on the EPA's Clean Air Scientific Advisory Committee (CASAC) and the EPA's Board of Scientific Councillors (which is managed by the EPA Office of Research and Development).

EPA funds. The second directive, tied to the first, prematurely terminated the appointments of several EPA SAB members.

These directives were framed by the EPA as necessary for ensuring the “independence, geographic diversity & integrity in EPA science committees.” However, critics have portrayed the directive as a tactic by the agency to advance a deregulatory policy agenda—and to suppress mainstream science—by increasing the influence of scientists employed by regulated industry (and industry trade associations) and state agencies known for a right-of-center political stance on environmental and public health risks (Cornwall, 2017; Union of Concerned Scientists, 2018).

That, in today’s political climate, a conservative leaning EPA and a largely liberal leaning block of academic scientists (Nisbet, 2011) and their supporters disagree about the intent behind this directive is not surprising. However, an open question remains as to whether members of the American public—to whom the agencies like EPA ultimately answer—still trust the outcomes of EPA SABs given these changes. I know for example that public trust in the scientific community has remained both high and stable since the 1970s (Pew Research Center, 2019). Recent research also demonstrates that industry scientists are viewed with greater skepticism by members of the public than are academic scientists (Besley et al., 2017). Trust has also been shown to have direct positive effect on public acceptance, but also indirect effects as it influences the perception of risks and benefits (Bronfman et al., 2012; Ross et al., 2014). Taken together, these data may suggest little public acceptance for the EPA’s current stance on the composition of its SAB.

At the same time, however, polling reveals significant partisan divide between members of the public regarding their concern about safeguarding the environment as a priority for policy.

Approximately one-third (31%) of Republicans think the environment should be a top priority

for policy-makers; this number jumps to 74% for Democrats. The partisan divide on the public's highest public policy priority is much smaller: a large majority of both Republicans (79%) and Democrats (64%) view the economy as the most important issue facing policy makers (Pew Research Center, 2019). It is reasonable to assume that industry scientists could be expected to place a higher priority on the economic priorities of their firms. Thus, the Pew data on public views of policy priorities points to the possibility of broader public support for the EPA's opening of its SAB to more scientists representing the business interests of private industry (while restricting membership by academic scientists).

In the remainder of this paper, I present and discuss the results from an experiment aimed at improving my understanding of how the composition of the EPA's SAB is perceived by the public. Specifically, I was interested in the question of how SAB composition effects people's satisfaction with, and their ratings of the perceived legitimacy of recommendations made to policy-makers. This research was informed by prior work on procedural justice which has shown that deliberative processes that are seen by outsiders as being free of bias from conflicts of interest receive higher ratings of satisfaction and legitimacy (McComas, Tuite, Waks, & Sherman, 2007; Thibaut & Walker, 1975). The mechanism behind this effect is thought to be the use of the presence (or absence) of conflict of interest as a heuristic for evaluating the legitimacy of a process or satisfaction with the outcome that results from it (Tyler, 2000).

I presented a nationally representative sample of participants with hypothetical EPA SABs composed of varying proportions of academic and industry scientists. I then asked participants to rate their satisfaction with, and the legitimacy of, these boards in light of their recommendations in the context of two hypothetical scenarios based on actual EPA SAB deliberations about

pesticides. One scenario focused on protecting environmental health and the other focused on safeguarding human health.

Participants were asked to consider a recommendation from the SAB to either relax or strengthen an existing EPA rule about pesticide use. I hypothesized that SABs dominated by industry scientists would be perceived to be more motivated to make decisions to protect business interests (H1) while SABs dominated by academic scientists would be perceived to be more motivated to make decisions to protect the interests of human (H2) and environmental health (H3). Finally, I hypothesized that participants would be more satisfied with more restrictive regulations (H4); I also hypothesized that advisory boards composed of a higher proportion of academic scientists (relative to industry scientists) would be viewed as making more legitimate recommendations (H5).

2. Methods

2.1 Participants

Participants in this research were citizens of the United States over the age of 18, and recruited from an online panel maintained by Dynata™ ; participants were randomly drawn from a probability sample of active panel members in the Dynata™ database (Table S1).

For a desired sample of 2,400 participants, a total of 3,180 participants were initially recruited to participate in this study. The desired sample exceeded the sample size recommended for 95% statistical power (Faul et al., 2009). A total of 227 participants were removed from the dataset because they failed to complete the experiment. An additional 453 participants were removed from the dataset for spending less than half of the median time (4.6 minutes) reading their

assigned scenario and answering the accompanying questions. After data cleaning, the total sample size was reduced to 2,500.

Overall, the sample was 56% female ($n = 1,383$) and 43% male ($n = 1,082$); 1% of the sample ($n = 29$) self-identified as neither female nor male. The average age of the participants was 46 (SD = 15.5). The majority (60%) of participants attended some college ($n = 1490$); 21% ($n = 527$) of participants reported a high school education or lower and 19% ($n = 477$) an education level beyond a bachelor's degree (Table S1).

2.2 Experimental Design and Data Analysis

The experiment utilized a 2 (board composition) \times 2 (scenario) \times 2 (recommendation) between-subjects design. Participants read a short introduction to the EPA's SAB and then were randomly assigned to read about one of two 40-member board compositions: one was composed of 80% academic scientists and 20% industry scientists (i.e., academic-heavy), and the other was composed of 20% academic scientists and 80% industry scientists (i.e., industry-heavy); see Table S2 for the specific wording of these scenarios. A pie chart depicting the ratio of academic scientists to industry scientists was included to help participants visualize these differences.

Next, participants were randomly assigned to one of two EPA policy scenarios. In the first scenario, participants were told about an unnamed pesticide that kills insect pests, but that may also kill non-pest insects such as pollinators (bees, butterflies) that are beneficial for environmental health. In the second scenario, participants read about the same unnamed pesticide; however, rather than being harmful to non-pest insects, participants were told that the chemical may cause cancer in humans.

Participants were then randomly assigned to one of two different SAB recommendations. In one, the SAB recommended that the regulation of the pesticide be made *more* restrictive (e.g., allowing the pesticide to be used less frequently and at lower concentrations); in the second, the SAB recommended that the regulation of the pesticide be made *less* restrictive (e.g., allowing the pesticide to be used more frequently and at higher concentrations).

Participants were asked to indicate their perceptions of the assigned SAB's underlying motivations: to support policies that promote *business interests*, to support policies that promote *human health*, and to support policies that promote the *natural environment*. These responses were collected on 7-point Likert scales from “not at all motivated” to “completely motivated”. Participants were also asked how *satisfied* they were with the board's recommendation, on a 7-point Likert scale from “not at all satisfied” to “completely satisfied”. Participants were also asked to provide ratings of the SAB's recommendations themselves: they indicated the extent to which they thought the SAB made its decision based on the best available science and to what extent they trusted the SAB to make an unbiased recommendation. Responses were collected on 7-point Likert scales from “not at all science-based” to “completely science-based” for the first question, and from “very low trust” to “very high trust” for the second question. Participants' responses to these two items were highly correlated ($r = .75, p < .001$) so they were combined to form a single measure I termed “decision legitimacy” ($\alpha = .86$).

I performed three-way analyses of variance to measure the effect of SAB composition, scenario, and recommendation on the dependent variables (satisfaction, underlying motivations, and legitimacy).

3. Results

3.1 Perceived motivation to protect business interests

I did not observe a significant two- or three-way interaction between composition, scenario, and recommendation on judgments about a SAB's motivation to protect business interests (Table 4-1). Likewise, I did not detect a main effect of scenario on the perceived motivation to protect business interests. However, both recommendation and board composition exhibited significant main effects. Supporting H1, participants thought that protecting business interests was a stronger motive for the industry-heavy SAB ($n = 1,263$, $M = 4.55$, $SD = 1.92$) than the academic-heavy SAB ($n = 1,244$, $M = 4.34$, $SD = 1.97$). Participants also judged the motivation to protect business interests as greater when the SAB recommended a less restrictive regulation ($n = 1,252$, $M = 5.19$, $SD = 1.76$) vs. when it recommended a more restrictive regulation ($n = 1,255$, $M = 3.70$, $SD = 1.83$).

Table 4-1. Three-way ANOVA for perceived motivation to protect business interests, human health, and environmental health as a function of board composition, scenario, and recommendation.

Variables		Motivation: Business			Motivation: Human Health			Motivation: Environment		
		<i>F</i>	<i>p</i>	<i>Part. η²</i>	<i>F</i>	<i>p</i>	<i>Part. η²</i>	<i>F</i>	<i>p</i>	<i>Part. η²</i>
Main Effects	<i>Board composition (C)</i>	4.77	.029	.002	1.45	.228	.001	3.81	.051	.002
	<i>Scenario (S)</i>	0.34	.563	.000	3.16	.075	.001	12.08	.001	.005
	<i>Recommendation (R)</i>	422.09	<.001	.144	1174.93	<.001	.320	1201.89	<.001	.325
Interaction Effects	<i>C × S</i>	0.08	.780	.000	1.07	.300	.000	0.23	.629	.000
	<i>C × R</i>	0.58	.447	.000	0.81	.370	.000	1.80	.180	.001
	<i>S × R</i>	0.01	.915	.000	15.63	<.001	.006	3.42	.064	.001
	<i>C × S × R</i>	2.14	.144	.001	6.38	.012	.003	2.83	.092	.001

df = (1, 2499)

3.2 Perceived motivation to protect human health

I observed a significant three-way interaction between board composition, scenario, and recommendation for judgments about the SAB’s motivation to protect human health (Table 4-1, Figure 4-1). Statistical significance was accepted at the Bonferroni corrected $p < .025$ level for simple two-way interactions and simple-simple main effects. There was a statistically significant simple two-way interaction between board composition and recommendation for the environmental health scenario ($F_{(1, 2499)} = 5.89, p = .015$) but not the human health scenario ($F_{(1, 2499)} = 1.32, p = .251$).

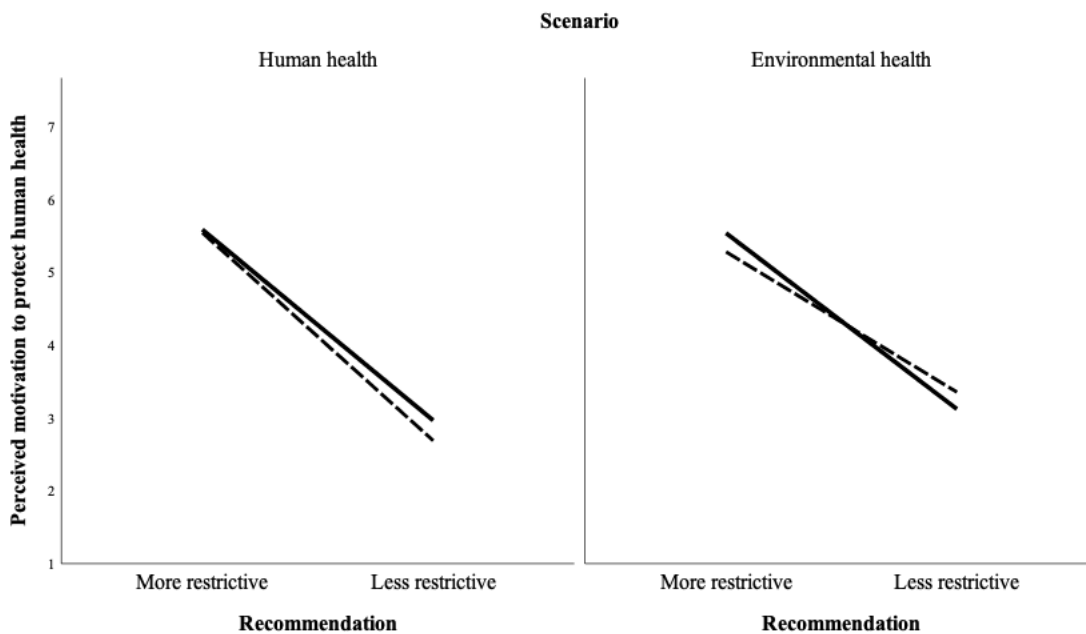


Figure 4-1. Estimated marginal means of the extent to which the SAB was perceived to be motivated to protect human health as a function of board composition, scenario, and recommendation. The solid line represents the academic-heavy SAB and the hatched line represents the industry-heavy SAB. For the non-significant three-way interactions, see Figures S1 to S3.

Exploring this simple two-way interaction further, I observed a significant simple-simple main effect for the environmental health scenario in both the academic-heavy ($F_{(1, 2499)} = 284.41, p < .001$) and industry-heavy SAB conditions ($F_{(1, 2499)} = 183.18, p < .001$). Simple-simple pairwise comparisons were carried out for those in the environmental health scenario with an academic-

heavy and industry-heavy SAB using a Bonferroni adjustment. The pattern was the same for both SAB compositions: participants perceived the SABs to be more motivated to protect human health ($p < .001$) when the SAB made a more restrictive recommendation (academic-heavy: $M = 5.54$, $SD = 1.52$; industry-heavy: $M = 5.28$, $SD = 1.62$) than when it made a less restrictive recommendation (academic-heavy: $M = 3.12$, $SD = 1.97$; industry-heavy: $M = 3.35$, $SD = 2.00$). However, H2 was not supported as there was no significant difference in perceived motivation to protect human health between academic-heavy and industry-heavy SAB compositions ($F_{(1, 2499)} = 1.45$, $p = .228$).

3.3 Perceived motivation to protect environmental health

I did not observe any significant two- or three-way interactions between composition, scenario, and recommendation for judgments about the SAB's motivation to protect environmental health (Table 4-1). Significant main effects were observed for scenario and recommendation only. Participants thought the SAB was more motivated to protect environmental health when it issued a more restrictive ($n = 1,252$, $M = 5.49$, $SD = 1.54$) vs. less restrictive recommendation ($n = 1,255$, $M = 3.00$, $SD = 2.01$). Participants also indicated that protecting environmental health was a more powerful motive within the environmental health context ($n = 1,262$, $M = 4.45$, $SD = 2.18$) than the human health context ($n = 1,245$, $M = 4.04$, $SD = 1.12$). H3, predicting that perceived motivations to protect environmental health would differ by SAB composition, was not supported ($F_{(1, 2499)} = 3.81$, $p = .051$).

3.4 Satisfaction with the SAB's recommendation

I did not detect any significant two- or three-way interactions between composition, scenario, and recommendation on participants' satisfaction with the recommendation made by the SAB

(Table 4-2). Neither board composition nor scenario exhibited a main effect for participants' satisfaction with the SAB's recommendation. However, satisfaction was significantly different between the two recommendation types. Supporting H4, satisfaction was significantly higher for participants who were informed of a recommendation in the direction of a more restrictive regulation ($n = 1,252, M = 5.70, SD = 1.62$) vs. a less restrictive regulation ($n = 1,255, M = 2.74, SD = 1.98$).

Table 4-2. Three-way ANOVAs for participant satisfaction with the SAB's recommendation and perceived legitimacy as a function of board composition, scenario, and recommendation.

	Variables	Satisfaction			Legitimacy		
		<i>F</i>	<i>p</i>	<i>Part. η²</i>	<i>F</i>	<i>p</i>	<i>Part. η²</i>
Main Effects	Board composition (<i>C</i>)	3.10	.078	.001	1.36	.243	.001
	Scenario (<i>S</i>)	3.14	.076	.001	1.66	.198	.001
	Recommendation (<i>R</i>)	1653.68	<.001	.398	898.75	<.001	.265
Interaction Effects	<i>C</i> × <i>S</i>	0.37	.545	.000	1.96	.162	.001
	<i>C</i> × <i>R</i>	0.01	.946	.000	3.32	.069	.001
	<i>S</i> × <i>R</i>	0.20	.652	.000	0.60	.439	.000
	<i>C</i> × <i>S</i> × <i>R</i>	1.38	.241	.001	4.60	.032*	.002

df = (1, 2499)

3.5 Perceived decision legitimacy

I observed a significant three-way interaction between composition, scenario, and recommendation for participants' judgments about the SAB's legitimacy (Table 4-2, Figure 4-2). Specially, significant effects were observed at the Bonferroni corrected level of $p < .025$ for simple two-way interactions and simple-simple main effects. I detected a significant simple two-way interaction between composition and recommendation in the environmental health scenario ($F_{(1, 2499)} = 7.91, p = .005$), but not the human health scenario ($F_{(1, 2499)} = 0.05, p = .819$).

Looking more closely at the simple two-way interaction, I detected a significant simple-simple main effect of environmental health scenario with an academic-heavy ($F_{(1, 2499)} = 274.8, p < .001$) and an industry-heavy SAB ($F_{(1, 2499)} = 161.25, p < .001$). However, H5 was unsupported as there was no significant difference in perceived decision legitimacy by board composition ($F_{(1, 2499)} = 1.36, p = .243$). Simple-simple pairwise comparisons were carried out for the environmental health scenario combined with an academic-heavy and industry-heavy SAB; a Bonferroni adjustment was once again applied. The perceived legitimacy of the academic-heavy SAB was significantly higher ($p < .001$) when it made a more restrictive recommendation ($M = 5.25, SD = 1.37$) compared to when it made a less restrictive recommendation ($M = 3.18, SD = 1.69$). The perceived legitimacy of the industry-heavy SAB was also significantly higher ($p < .001$) when it made a more restrictive recommendation ($M = 5.01, SD = 1.43$) when compared to a less restrictive recommendation ($M = 3.44, SD = 1.75$).

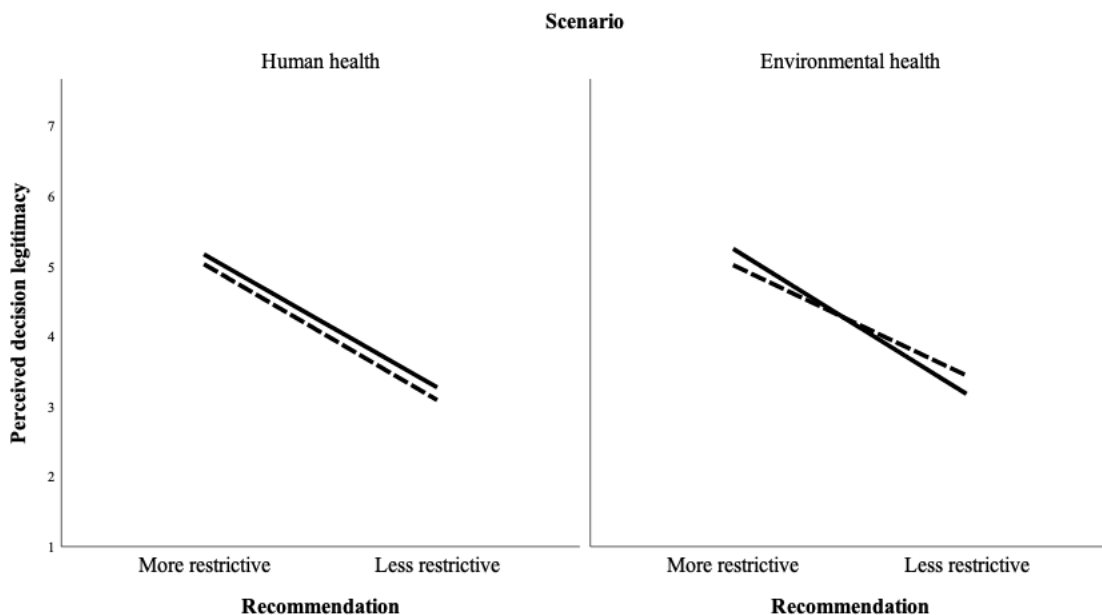


Figure 4-2. Estimated marginal means of the perception that the SAB made a legitimate decision as a function of board composition, scenario, and recommendation. The solid line represents the academic-heavy SAB and the hatched line represents the industry-heavy SAB. For the non-significant three-way interactions, see Figures S1 to S3.

4. Discussion

I examined public judgments about their satisfaction with, the motivations behind, and the legitimacy of recommendations made by a federal science advisory board (namely, the EPA's SAB) as a function of its composition (i.e., dominated by academic vs. industry scientists), the scenario it was addressing (i.e., human or environmental health), and the type of recommendation made (i.e., suggesting a less or more stringent regulation).

I found that, independent of SAB composition and scenario, people demonstrated higher levels of satisfaction with more restrictive recommendations; this finding was in line with my hypothesis (H4). More restrictive recommendations also led people to believe that a SAB was strongly motivated to safeguard environmental health, and less motivated to protect the interests of businesses regardless of SAB composition; this finding did not support my hypotheses (H3). Similarly, people exposed to a SAB making a more restrictive recommendation believed it was more motivated to protect human health and judged the legitimacy of the recommendation to be higher; these findings did not depend on SAB composition and, therefore, did not support my hypotheses (H2 and H5). Unsurprisingly, participants exposed to an industry-heavy SAB judged it to be more strongly motivated to protect business interests when compared to an academic-heavy SAB; this finding was in line with my hypothesis (H1).

Consistent with research on procedural justice (McComas et al., 2007), I hypothesized that a SAB composed mainly of academic scientists —vs. industry scientists who are often perceived as having conflicts of interest (Besley et al., 2017)—would be perceived as making more legitimate recommendations (i.e., recommendations that were perceived to be unbiased and science-based). Zoellner et al. (2005) found that perception of fairness of the process was

positively correlated with acceptance and positive attitude towards wind energy. Upham and Shackley (2006) found a similar focus on procedural justice that also extended to who was making the decisions. However, my results suggest that board composition is not the determining factor in judgments about legitimacy. Rather, it was the stringency of the SAB's recommendation that determined legitimacy in this study; recommendations by a SAB for *more* stringent regulations were viewed as more legitimate when compared to recommendations that regulations be *less* stringent. Similarly, SAB composition was not related to participants' satisfaction; once again, recommendations by a SAB for *more* (*vs. less*) stringent regulations were met with higher levels of participant satisfaction.

It is also noteworthy from my results that people judged both academic- and industry-heavy SABs as equally motivated to protect human and environmental health. As I note above, these results ran contrary to my hypothesis. SAB composition had a significant main effect only when participants were asked to evaluate the SABs motivation to protect business interests; specifically, a SAB with a high proportion of industry scientists was judged by participants to be more motivated to protect business interests.

These results are surprising on two levels. On the one hand, they unfold in sharp contrast to the concerns raised by academic scientists and members of the general public about the inclusion of more industry scientists on federal science advisory boards (such as the EPA's Chartered SAB). In spite of recent criticism of the EPA for terminating the service of academic scientists and replacing them with more industry scientists (e.g., see Boyle & Kotchen, 2018; Malakoff, 2017; Tonko, 2017), members of the public don't seem to see these changes as problematic from the standpoint of their satisfaction with a SAB or the legitimacy of its recommendations. But, on the other hand, these results also point to expectations from the public that SABs—the EPA's

Chartered SAB in this study—will protect human and environmental health when they are at risk. That these expectations are prevalent even when a SAB dominated by industry scientists is seen as being motivated to protect business interests may be telling.

However, there is an alternative explanation for my results, which is that participants in this study are basing their judgments about satisfaction, underlying motivations, and legitimacy on their negative or positive perceptions of the SAB's recommendation. Specifically, these findings are also consistent with prior experimental work (Arvai & Froschauer, 2010) that demonstrated that people judged the quality of decision-making processes (and their satisfaction with those who made them) as either positive or negative based on the whether the outcomes resulting from them were either positive or negative. Here, decisions were coded as “high quality” based on the realization of positive outcomes even if they were the result of substandard decision-making processes.

Thus, participants in this study may have been willing to abandon any preconceived notions about SAB bias when the board made a recommendation in the direction of more restrictive regulation. In this sense, the halo effect (Thorndike, 1920) associated with a more or less stringent recommendation may be “spilling over” to influence participants' judgments about other attributes of a SAB.

Taken together, my results suggest that people may be relying on desirable outcomes as a heuristic for assessing the legitimacy of, and their satisfaction with a SAB. Prior research (van den Bos & Miedema, 2000; van den Bos et al., 1997) suggests that people rely on judgments about procedural fairness as a means of evaluating an outcome when the degree of “goodness” or “badness” associated with it is ambiguous. In the case of the study reported here, the reverse

appears to also be true. Research on people acting as jurors in legal matters (Skitka & Houston, 2001) supports this suggestion; it shows that normative positions—what the authors termed “moral mandates” such as punishing the guilty—act as determinants of how people make judgments about process.

Applied to the research reported in this paper, the normative response to a pesticide that causes harm to either environmental or human health is to regulate it more stringently, even if would be advantageous to industry to relax the rules governing its use. The perspective aligns with the growing number of Americans—63% in 2019, which is up from 59% in 2017—who believe that stricter environmental regulations are “worth the cost” (Pew Research Center, 2019). It stands to reason, therefore, that any (academic-heavy or industry-heavy) SAB that takes such an action will be rewarded with positive ratings of both satisfaction with and legitimacy based on it.

From a practical perspective, the results from this research suggest that members of the public are supportive of federal science advisory boards regardless of their composition, *but only if they take actions (e.g., make policy recommendations) that are consistent with normative expectations*. This is both good and bad news from the perspective of the EPA’s recent agency directive aimed at, the agency’s words, “ensuring the integrity” of the EPA’s chartered SAB.

It is good news because people seem willing to accept SAB compositions that alter the historic balance that strongly favored academic scientists in the direction of greater representation by scientists from regulated industry. However, it is bad news if one accepts the criticisms leveled against the EPA that the ulterior motive of this directive is to weaken regulations that safeguard environmental and human health; my results, suggest that people look to SABs for

recommendations that uphold normative standards exemplified by the mission of the agency that they serve. In the case of the EPA, it is to protect environmental and human health.

The research reported here was not without some limitations which, taken together, open the doors to future studies. My study design did not provide information about hypothetical SAB members or their qualifications. This is an important omission because not all scientists—whether they work for industry or in the academy—are equal in terms of their qualifications and motivations. As of this writing, for example, some members of the current iteration of the EPA’s Chartered SAB are climate change skeptics, while others are known for their previous efforts aimed at rolling back human and environmental health safeguards. I intentionally withheld information about the qualifications and past work of individual SAB members so that I may better understand participant perceptions of SAB composition as a whole. However, members of the public have access to information about individual SAB members, and this may strongly influence their perceptions in a real-world setting.

I also limited both the number and types of scenarios shown to participants. Future studies may wish to consider a broader range of scenarios where the normatively “correct” recommendation is less clear to participants. Results from my research lead us to believe that SABs that acted to protect human and environmental health were rewarded with more positive ratings of satisfaction and legitimacy. In the absence of a normatively correct recommendation, participants would be required to look more closely at other contextual cues—such as board composition or member qualifications—to evaluate these variables. This in turn would add important detail to my understanding of how members of the public feel about changes to federal SABs like those enacted by the EPA.

In spite of these limitations, my research sheds light on the importance of the activities and the recommendations of SABs as variables that influence the public's ratings of satisfaction and legitimacy. my research is both important and timely because it demonstrates that SAB composition may not be as important as SAB behavior. Science advisory boards, such as the EPA's Chartered SAB, are assembled to offer science-based advice to policy-makers in a manner that is consistent with an agency's mission and mandate. Changing the rules by which SABs are structured to either satisfy a temporary political agenda or as a vehicle for enacting regulatory rollbacks is likely to be met with continued resistance.

Appendix

Supplemental Materials for Chapter 4

Industry-dominated science advisory boards are perceived to be legitimate...but only if they recommend more stringent health and environmental policies.

Table A-1. Comparison table of U.S. census data and demographic responses of participants.

Demographic variables	U.S. Census Data 2017		Online Dynata study	
Gender	Male	49.2%	Male	43.4%
	Female	50.8%	Female	55.5%
Education	Less than high school	12.6%	Less than high school	2.7%
	High school graduate	27.3%	High school graduate	18.4%
	Some college	20.8%	Some college	22.6%
	2 year degree	8.3%	2 year degree	10.7%
	4 year degree	19.1%	4 year degree	26.5%
	Graduate or Professional degree	11.8%	Graduate or Professional degree	19%
Race/ethnicity	White	75.7%	White	71.1%
	Black or African American	13.9%	Black or African American	9.9%
	American Indian and Alaska Native	1.7%	American Indian and Alaska Native	2.3%
	Asian	6.3%	Asian	7.7%
	Some other race	5.8%	Some other race	10.5%

Table A-2. Vignette components participants were asked to read.

<p>Short introduction to the EPA's SAB</p>	<p>The United States Environmental Protection Agency ("EPA") is an agency of the federal government. It's mission is to protect human and environmental health. The primary way it does this is to make and enforce environmental regulations.</p> <p>To help make sure the regulations are appropriate and work as intended, the EPA brings together up to 40 American scientists from universities, companies, and</p>
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	<p>other organizations to serve on its Science Advisory Board.</p> <p>The group of scientists from which the EPA selects its advisors are all experts in fields and disciplines that are in line with the scientific issues facing the EPA. After they are selected, Science Advisory Board members advise the EPA for three years.</p>
Board composition text	<p>Imagine that the Science Advisory Board that was asked to provide advice about the chemical had the following composition:</p> <p>20% of the EPA's Science Advisory Board is made up of scientists from nationally recognized universities 80% of the EPA's Science Advisory Board is made up of industry scientists that work for reputable companies</p> <p>OR</p> <p>Imagine that the Science Advisory Board that was asked to provide advice about the chemical had the following composition:</p> <p>80% of the EPA's Science Advisory Board is made up of scientists from nationally recognized universities 20% of the EPA's Science Advisory Board is made up of industry scientists that work for reputable companies</p>
EPA policy scenarios	<p>Now, imagine that this Science Advisory Board has been asked by the EPA for advice about a regulation that limits the amount of a certain chemical that can be used in pesticides to kill weeds and insect pests.</p> <p>The chemical in question is very good at killing weeds and insect pests. However, new research suggests that <u>the chemical may also be very poisonous to non-pest insects like bees and butterflies that are important for overall environmental health.</u></p> <p>The Science Advisory Board has been asked if the existing regulations about the chemical should be: <u>More restrictive</u>, meaning only smaller amounts of the chemical will be allowable for use in the future. <u>Less restrictive</u>, meaning larger amounts of this chemical will be allowable for use in the future. <u>Kept the same</u>, meaning that there will be no changes to the existing regulations dealing with the use of this chemical.</p>

	<p>OR</p> <p>Now, Imagine that this Science Advisory Board has been asked by the EPA for advice about a regulation that limits the amount of a certain chemical that can be used in pesticides to kill weeds and insect pests.</p> <p>The chemical in question is very good at killing weeds and insect pests. However, new research suggests that <u>the chemical may also be very poisonous to people and may cause cancer.</u></p> <p>The Science Advisory Board has been asked if the existing regulations about the chemical should be: <u>More restrictive</u>, meaning only smaller amounts of the chemical will be allowable for use in the future. <u>Less restrictive</u>, meaning larger amounts of this chemical will be allowable for use in the future. <u>Kept the same</u>, meaning that there will be no changes to the existing regulations dealing with the use of this chemical.</p>
SAB recommendations	<p>Now, imagine this is what the Science Advisory Board ACTUALLY DID:</p> <p>The Science Advisory Board recommends that the regulations about the chemical should be more restrictive.</p> <p>OR</p> <p>Now, imagine this is what the Science Advisory Board ACTUALLY DID:</p> <p>The Science Advisory Board recommends that the regulations about the chemical should be less restrictive.</p>

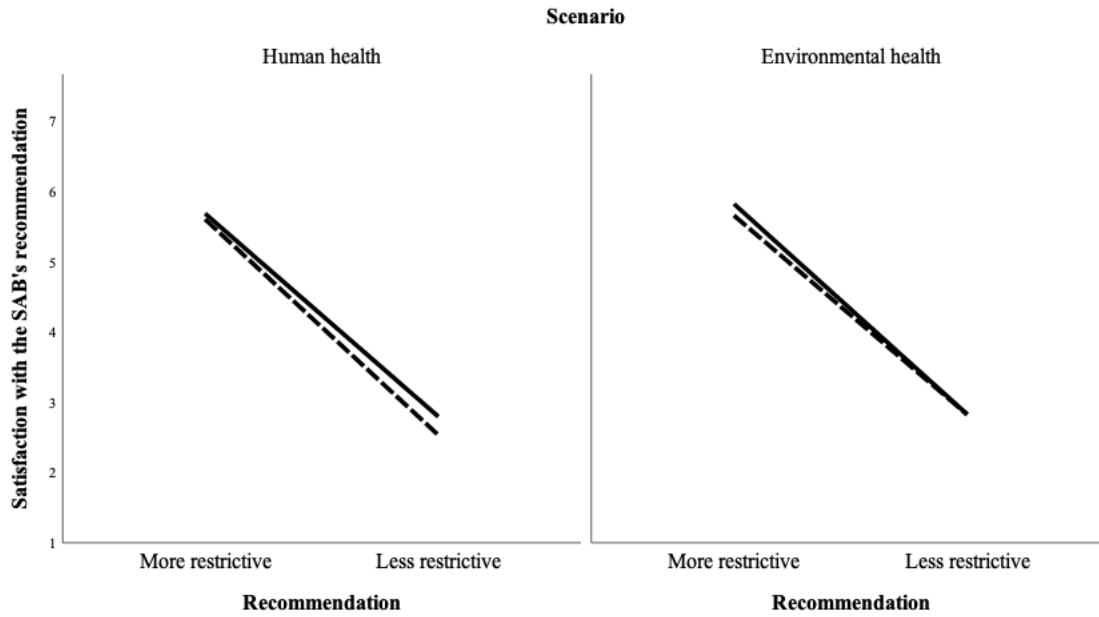


Figure A-1. Estimated marginal means for participant satisfaction with the SAB’s recommendation as a function of board composition, scenario, and recommendation. The solid line represents the academic-heavy SAB and the hatched line represents the industry-heavy SAB.

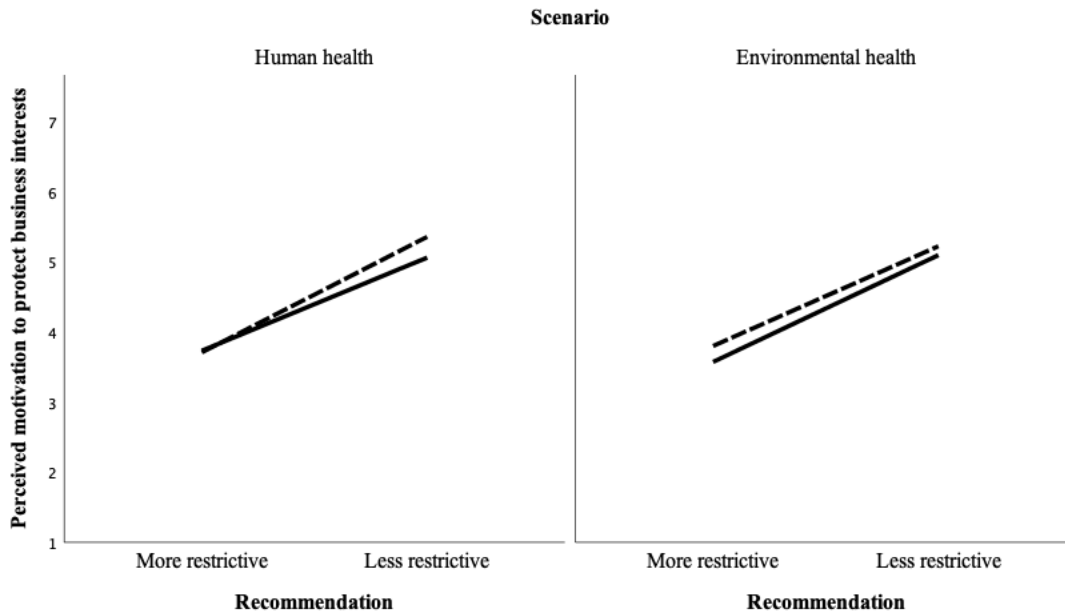


Figure A-2. Estimated marginal means of the extent to which the SAB was perceived to be motivated to protect business interests as a function of board composition, scenario, and recommendation. The solid line represents the academic-heavy SAB and the hatched line represents the industry-heavy SAB.

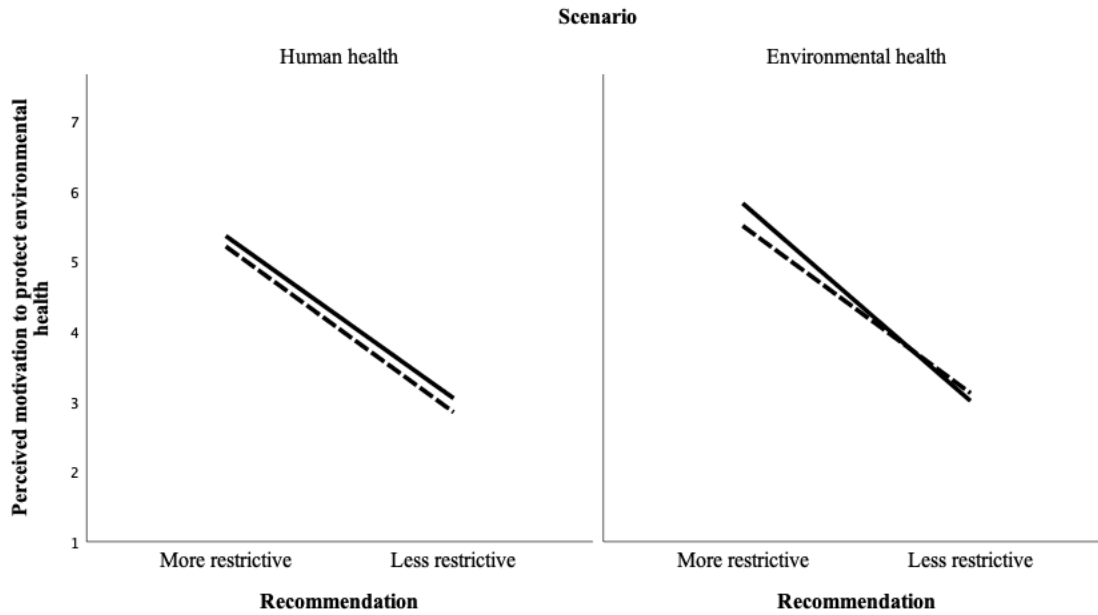


Figure A-3. Estimated marginal means of the extent to which the SAB was perceived to be motivated to protect environmental health as a function of board composition, scenario, and recommendation. The solid line represents the academic-heavy SAB and the hatched line represents the industry-heavy SAB.

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