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The Conservative Case for Climate Change Belief: Effects of Theme and Source Characteristics

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Abstract

While belief in climate change continues to increase (Ballew et al., 2019), it is well-known that this growth isn't evenly distributed across political parties. Conservatives continue to be less likely than liberals to believe in climate change, and as a result they often oppose policies that are intended to mitigate its effects. Several studies (Wolsko et al., 2017; Kahan et al., 2015) have examined how appeals to values such as patriotism and stewardship can have modest effects on conservative beliefs, but few have examined whether the source of the message affects belief and whether peripheral arguments about how climate change affects other areas of life can affect beliefs. With this in mind, we conducted a survey experiment to examine the effects of source and theme on the climate change beliefs of climate skeptics. The experiment consisted of 7 conditions: a 2 (source: academic or scientist vs. practitioner) x 3 (message theme: immigration vs. national security vs. science of climate change) factorial design with a "no message" comparison group. Our results suggest that the source of the message has a significant influence on belief and that practitioners are significantly more likely to persuade climate skeptics to believe in and express concern about climate change than academics or scientists. Additionally, though no significant theme effect was observed, descriptive findings suggest that the immigration theme shows promise as a persuasive frame.

During the 1988 Presidential election cycle, Republican candidate George H.W. Bush made a campaign stop in Michigan, where he delivered a speech on environmental issues. While the focus was hot button issues like acid rain and deforestation, the speech was unique in its recognition of the risks posed by global warming and the need for bipartisan action. He told supporters: "These issues know no ideology, no political boundaries. It's not a liberal or conservative thing we're talking about" (Worland, 2017).

Thirty-one years later, climate acceptance is a far cry from the bipartisan consensus that the 41st President envisioned, having grown to be an issue of intractable partisan division. Between 2000 and 2019, the difference between Republican and Democratic belief in climate change grew from 17% (Norman, 2017) to 61% (Saad, 2019), with Democrats becoming increasingly alarmed and Republicans becoming increasingly skeptical.

While conservative skepticism toward climate change is very well documented, the reasons for this discrepancy aren't well understood. Several studies (Hart & Nisbet, 2011; Newman et al., 2018) have noted a correlation between media preferences and climate change beliefs, finding that conservatives who consume media that is characterized as conservative are more likely to be skeptical of climate change, while conservatives who consume a wide range of media, particularly that which is considered to lean moderate to liberal in its coverage, are more likely to believe in climate change. Other studies (Merkley & Stecula, 2018; Meyer, 2018) have suggested that conservative voters take both positive and negative cues from political elites, taking the relative lack of a clear position among conservative politicians and the consistent messaging from liberal ones as a cue to dismiss climate science.

Although this is not an exhaustive list of causes, it is not necessary to understand the full suite of causes to study potential solutions. For instance, several studies (Jylha & Akrami, 2015;

Wolsko et al., 2017; Kahan et al., 2015) have examined the effects of framing climate messages with conservative values such as patriotism and stewardship on climate change acceptance and have found that these can have a modest impact on climate acceptance. Other studies (Hart & Nisbet, 2012; Feinberg & Willer, 2012; Whitmarsh & Corner, 2017) have identified elements of mainstream climate arguments that intensify polarization, such as emphases on harm or justice or appeals for the wellbeing of remote or unrelatable populations.

While previous work has demonstrated the promise of value-framing, very little research has been done on the interplay between value-framing and the use of different messengers. In their study of how different messengers and message-frames affect consumer uptake of energy-efficient heating technologies, Hafner et al. (2019) found that the messenger (either a neighbor, a government agency, a utility company, an industry expert) had little impact on consumers' decisions to invest in a heat pump versus a traditional boiler, while the messaging frame (an economic message versus an environmental message) had a significant impact on consumers' decisions. However, the relevance of this research is somewhat limited by its use of hypothetical scenarios (e.g. *imagine you are talking to your neighbor),* which can serve to mute the messenger effect.

Outside of the discipline of scientific communication, Ahn et al. (2019) found that the efficacy of different messengers was contingent upon the consistency between the message and the ascribed messenger. That is, in order to observe meaningful changes in the attitudes of the message's recipients, the message needs to be something that the messenger would plausibly say. Building on prior research, the present study examines the effects of source characteristics, message themes, and the interaction between sources and themes on beliefs about climate change.

Theoretical Background

Source Effects

Message content is frequently purveyed by a spokesman or messenger, whose express purpose is to increase the likelihood of persuasion above and beyond the persuasiveness of the message itself. Empirical research has demonstrated that more so than the message construction, the medium of delivery, and the characteristics of the audience, the characteristics of the source exert a significant influence over the audience's attitudes and behavior (Wilson & Sherell, 1993). Broadly speaking, the most cogent messenger characteristics are credibility, which encompasses expertise and trustworthiness (Pornpitakpan, 2004; O'Keefe, 2015), and likability, which draws on factors such as personality traits, physical attractiveness, and similarity, the audience's ability to relate to the messenger in terms of shared demographics (age, race, gender, etc.), beliefs, and experiences (O'Keefe, 2015; Puckett et al., 1983; Phua, 2016).

Expertise refers to a source's "presumed knowledge and ability to provide accurate information" (Petty & Wegener, 1998). More practically, expertise can be thought of as the sum of the source's professional training, education, experience, knowledge, and skill related to a topic (McCroskey, 1997). The overwhelming consensus in the literature is that, all else being held equal, audiences are more likely to be persuaded by an expert than a non-expert (O'Keefe, 2015; Till & Busler, 2000; Pornpitakpan, 2004). Moreover, several studies have demonstrated that experts are able to produce better recall of information and more durable attitude changes than non-experts, both in the near and extended term (Johnson & Watkins, 1971). The reason for this, according to attribution theory (Heider, 1958; Kelley 1967), is that experts exert influence due to the responsibility, authority, and power that individuals attribute to them. This effect is

further explained by the perception that experts are likely to provide accurate information, make strong arguments, and successfully preempt common counterarguments.

While credibility is generally regarded as the strongest source effect (Wilson & Sherell, 1993; O'Keefe, 2015), likability, physical attractiveness, and similarity can increase persuasion both independently and by increasing the perceived credibility of the source (Meijenders et al., 2009; Patzer, 1983). For example, Meijenders and his colleagues found that journalists are perceived as more trustworthy when they share beliefs with the reader on other issues, and Silvia (2005) found that perceived similarity can make messages that would otherwise be perceived as threatening seem less threatening.

Each of these persuasive effects can better be understood through the Elaboration-Likelihood Model (Petty & Cacioppo, 1984) and the Heuristic-Systematic Model (Chaiken, 1987), which draw a distinction between systematic (or central) processing of information and heuristic (or peripheral) processing. Systematic processing of information can be described as a thoughtful evaluation of information of the merits, with a great deal of cognitive effort being expended on the part of the recipient. Heuristic processing, by contrast, involves the use of cognitive shortcuts, such as assessments of the speaker's credibility and attractiveness, to make judgements, rather than careful consideration.

The differentiating factor between systematic and heuristic processing is the motivation and ability of the audience to process the message. If the audience is uninterested in the topic or the message does not seem relevant, the low-elaboration pathway of persuasion would be expected. In this case, the initial assessment of credibility or similarity is a frequent shortcut to a judgement (DeBono & Harnish, 1988; Fleming & Petty, 2000). By contrast, if the audience is very involved in a topic and has a high motivation and ability to process the argument, the use of

a credible and similar messenger can be an argument in itself and directly affect judgement about the content of the message (Hogg & Smith, 2007). Finally, in cases of moderate involvement and interest, the use of a credible or similar messenger can motivate the audience to commit more thought to the argument by signaling that the message is accurate or relevant (Turner, 1991; Mackie et al. 1992; Tobin & Raymundo, 2009).

While source expertise and similarity are known to improve the persuasiveness of a message over the baseline, there is a paucity of research about the interplay between the two and the conditions under which one might be more effective than the other. Thus, one of the primary objectives of this paper is to contribute a better understanding of which source characteristic is most compelling for individuals who are indifferent or antagonistic toward mainstream climate science. Additionally, this paper will explore the impact of perceived expertise from messengers with a significant amount of relevant vocational knowledge rather than formal education. Based on previous research on source effects and the expected characteristics of participants, we expect the following:

H1:The practitioner will be more persuasive to this population than the academic.

Message Effects

While the source of a message can often amplify or undermine its persuasiveness, the content of the message itself is often the most instrumental element of a persuasion attempt. Thus, it is important to understand how various message features influence the efficacy of a persuasion attempt.

Much of the foundational research in persuasive communication has been in the context of advertising, which has highlighted several important message factors that translate directly to political and scientific communication as well. One of these factors is the use of individualist or

collectivist appeals, which have been found to increase the efficacy of an advertisement when the appeal is consistent with the prevailing opinion of the audience. For instance, research has shown that individualistic appeals such as "this watch will make you stand out" are more effective for American audiences, while collectivist appeals such as "this watch will help you fit in" are more effective for Chinese audiences (Aaker & Schmitt, 2001). More recently, Xiang et al. (2019) found that individuals with more individualist orientations are more likely to view climate change as unpreventable and are therefore less inclined to take pro-environmental actions to prevent it. This finding is especially relevant to the present study because research has consistently shown that conservatives tend to possess a more individualist than collectivist orientation (Bourgeois, 2002).

As the differential impact of individualist versus collectivist appeals illustrates, the persuasiveness of a message is highly dependent on appealing to the values and interests of the audience. When trying to change an attitude or behavior, it seems intuitive to present the most devastating consequences of that attitude or behavior, but arguments including these consequences are not always the most persuasive. For instance, research has shown that arguments related to premature aging and other aesthetic consequences of sun exposure are more successful in convincing consumers to wear sunscreen than arguments relating to cancer risk (Thomas et al., 2011). Similarly, Krieger & Sarge (2013) found that arguments about the prevention of genital warts were more effective in persuading college students to receive the HPV vaccine than arguments about preventing cancer. These arguments may have been more effective because they were more closely aligned with the values and interests of the audience. Building on this finding, this study will explore whether arguments about national security and immigration will be more persuasive than more traditional arguments about deaths and disasters.

One reason that less consequential arguments can be more impactful than arguments featuring more serious consequences is that fear appeals can be ineffective when the audience does not feel vulnerable to the consequence or when they feel helpless to change the situation. For instance, O'Neill and Nicholson-Cole (2009) found that climate coverage about devastating weather events often leads listeners to perceive the problem as spatially and temporally distant. Similarly, apocalyptic descriptions of climate change can be especially ineffective when the end result is that listeners believe the problem is impossible to solve (Chen, 2016; Peters, Ruiger, & Kok, 2013). This is consistent with the Extended Parallel Process Model (Witte, 1992), which suggests that fear-based persuasion is only successful when both the threat and the ability to address the threat are perceived to be high. This finding is also consistent with the Protection Motivation Theory (Rogers & Prentice-Dunn, 1997), which suggests that fear based appeals are only effective when the severity of the threat and the listener's vulnerability to the threat are perceived to be high and the proffered solution is perceived to be both effective and reasonably pursued. The fourth criterion is perhaps the most important of the four to understanding climate skepticism and denialism, as evidenced by the consistent use of economic counterarguments against climate proposals. This is consistent with research that found that Republican rejection of climate change is driven more by fear of the proposed solutions than dismissal of the problem (Campbell & Kay, 2014). Thus, it stands to reason that successful climate messages will emphasize solution efficacy and highlight consequences that are more relevant and immediate to the individual than the actual changes in the climate.

Value Frames

While political ideology is often a salient predictor of attitudes toward climate change, an individual's values are perhaps even more telling than their party. Although there are many

theories and indices for human values, this section will focus on those derived by Schwartz &

Bilsky (1992) and Douglas & Wildavsky (1982), which are the basis for much of the

environmental-specific research on values and value frames. Schwartz and Bilsky's work

considers 56 "universal" human values, which can be subdivided into 4 categories along the two

intersecting dimensions of openness to change versus conservation of tradition and self-

transcendence versus self-enhancement. Similarly, Douglas and Wildavsky's work consists of 4

categories along the two intersecting dimensions of hierarchy versus egalitarianism and

individualism versus communitarianism. Under both frameworks, the dimension of most interest

is the distinction between self-promotion and social promotion, since climate change acceptance

and concern is positively correlated with a preference for egalitarianism and communitarianism

and negatively correlated with a preference for individualism and hierarchy (Kahan et al., 2012;

Kahan et al., 2011; Carlton et al. 2015). This is further confirmed by research that correlates high

Social Dominance Orientation (SDO) with climate skepticism (Hakkinen & Akrami, 2014;

Milfont et al., 2013), since SDO is merely a preference for group based hierarchies (Pratto et al.,

1994).

Beyond these broader values, research has demonstrated that responsiveness to messages

about climate change is directly affected by social and political values. For instance, messages

that underline human ingenuity (Kahan et al., 2015), appeal to an individual's patriotism

(Feyinga et al., 2010; Wolsko, Ariceaga, & Seide 2017), or contain conservative themes such as

nationalism, stewardship, and purity (Feinberg & Willer, 2012; Whitmarsh & Corner, 2017) have

been demonstrated to be effective in reducing gaps between conservatives and liberals in terms

of climate change acceptance. By contrast, messages with anti-conservative appeals can

galvanize climate denialism. In particular, messages that emphasize the injustice of climate

impacts or appeal to the wellbeing of remote or unrelatable populations have been shown to have a "boomerang effect." For instance, Feinberg & Willer (2012) found that climate messages that emphasize the harm caused by climate change cause a reduction in pro-environmental attitudes in Republicans, and Whitmarsh & Corner (2017) found that arguments that advocate climate action for reasons of social justice are highly polarizing. One reason for this could be that climate action is perceived as a challenge to the social order, a hypothesis which is supported by work from Jylha and Akrami (2015), who found that climate denialism is motivated at least in part by a desire to maintain social hierarchies and human-nature hierarchies. Alternatively, the argument that climate change exacerbates injustice could be threatening to the worldview that the world is "just, orderly, and stable" and therefore reinforce skepticism (Feinberg & Willer, 2011).

Because climate acceptance is closely related to social and political values, it is important to craft messages that are consistent with the values of those who are skeptical, which for the sake of this study will be scoped to the values that are held by Republicans or political conservatives more generally. To ensure that the values of interest are current and widely held by self-identified Republicans, this study focuses on values that are held by greater than 50% of self-identified Republicans as indicated by the Public Religion Research Institute's 2019 American Values Survey, which draws from a statistically representative sample of 2800 voting-eligible adults.

The first question from the American Values Survey identified the top three issues for each party using a ranked choice methodology for twelve hot-button political issues such as health care, climate change, terrorism, and immigration. According to the survey, Republicans' top three issues going into the 2020 election are terrorism, immigration, and crime, with 63% of Republican respondents choosing terrorism as one of their top three, 60% choosing immigration

as one of their top three, and 50% choosing crime as one of their top three, with reducing the deficit and jobs and unemployment rounding out the top five. This finding suggests that national security and social order are of particular importance to conservatives. Follow up questions on the topic of immigration revealed that more than 89% of Republicans support more restrictive immigration laws, and 63% of Republicans believe that "immigrants are invading the country and changing American culture." Further supporting the idea that Republicans are concerned about the social order, 69% of Republican respondents agreed with the statement that "discrimination against whites has become as much of a problem as discrimination against blacks."

Later in the survey, respondents were asked to indicate which of seventeen social, political, and religious labels they identified with out of a list that included environmentalist, spiritual, traditional, progressive, America first, humanist, feminist, religious right, capitalist, nationalist, socialist, religious progressive, secular, the resistance, tea party, anti-religious, and deplorable. Of these labels, Republicans were most inclined to pick America first (90%) and traditional (86%), which suggests that Republicans are likely to be influenced by appeals to their sense of patriotism, in addition to appeals to the preservation of the social order.

In terms of climate change beliefs, the same survey found that Republican opinions on climate change are split nearly equally into the three categories of belief in anthropogenic climate change (30%), belief that climate change is caused by natural patterns (32%), and belief that climate change is not happening (35%). Perhaps more interestingly, two-thirds of Republican respondents (66%) agreed with the statement "climate change will cause little or no harm to me personally" (PRRI, 2019). Consistent with the Protection Motivation Theory, the fear based appeals that are so prevalent in the media (Scharks, 2016) are not likely to translate to

attitude change or action unless they successfully increase perceived susceptibility. Thus, it is important to craft messages that more definitively illustrate the likelihood of personal consequences. Based on the prior research regarding message effects and value frames, we proposed the following:

H2: Value-framed messages will be more persuasive than general scientific messages.

To test the proposed hypotheses, this experiment was crafted to test the effects of arguments about the impacts of climate change on immigration and national security on climate change beliefs. For the immigration argument, the two speakers are a professor of migration studies and a border patrol agent. For the national security argument, the messengers are a professor of national security studies and a soldier. Military personnel and border patrol agents represent professions respected by conservatives (Newport, 2017; Pew Research Center, 2019); whereas academics and scientists tend to be less highly regarded by conservatives than the general population (Funk et al., 2019; E. Nisbet, 2015; Hamilton, 2014; Gauchat, 2012). As a comparison, a more traditional argument about the effects of climate change (droughts, floods, global warming, etc.) were attributed to a scientist and its practitioner corollary, a high school science teacher. Finally, a no message condition was included as a control.

Method

For this experiment, two questionnaires were developed and programmed in Qualtrics. The first of these served as a pre-screening for identifying individuals who do not believe in anthropogenic climate change. The second of these contained the experiment and measured changes in various dependent variables of concern about climate change. This research was classified as exempt by Mississippi State University's Institutional Review Board.

Inclusion and Exclusion Criteria

To participate in the pre-screening, the only requirements were to be 18 years of age or older and residents of the United States. Individuals who qualified for and completed the screening were invited to participate in the experiment based on their answers to the true-false item "the climate is changing due to human activities, such as the combustion of fossil fuels" on a science literacy quiz. If the respondent answered false, finished the remainder of the survey, and provided enough information to be matched with his or her MTurk Worker ID, he or she was invited to participate in the experiment. All experiment responses were included in the final data analysis, unless the participant did not complete the experiment or provide enough information to be matched with an MTurk Worker ID.

Participant Characteristics

Table 1 describes the demographics of the pre-screening, qualifying, and participating populations. Comparative analyses to assess the statistical significance of differences between populations are included in the footnotes.

Table 1

Participant Characteristics

Characteristic	Pre-Screening	Invited to Experiment	Participated in Experiment
n[1]	6697[2]	896	414
Age,[3] mean (SD)	38.75 (12.75)	41.94 (13.61)	44.29 (13.89)
Science Literacy,[4,5] mean (SD)	5.78 (1.62)	5.61 (1.71)	5.89 (1.57)

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[1] Excludes individuals who did not consent to participate, did not qualify to participate, and did not finish.

[2] 150 did not finish, 7 did not consent, 2 did not qualify, and 46 were removed as duplicates.

[3] $t(1145.946) = -7.158, p < .001$ between pre-screening and invited populations; $t(770.203) = 3.980, p < .001$ between invited and participating populations.

[4] The science literacy score excludes the experiment qualification question about belief in climate change

[5] $t(1143.246) = 3.498, p < .001$ between pre-screening and invited populations, $t(666.475) = 6.470, p < .001$ between invited and participating populations.

Education[6,7], n (%)			
Less than 9th Grade	10 (0.1%)	3 (0.3%)	0 (0%)
9th Grade – 12th Grade	53 (0.8%)	9 (1.0%)	3 (0.7%)
High School Diploma	676 (9.7%)	94 (10.5%)	50 (12.1%)
Some College	1520 (21.7%)	184 (20.5%)	74 (17.9%)
Associate's Degree	766 (10.9%)	118 (13.2%)	59 (14.3%)
Bachelor's Degree	2763 (39.5%)	361 (40.3%)	159 (38.4%)
Master's Degree	1013 (14.5%)	107 (11.9%)	59 (14.3%)
Professional Degree or Ph.D.	188 (2.7%)	19 (2.1%)	9 (2.2%)
Gender[8,9], n (%)			
Male	3117 (44.5%)	471 (52.6%)	215 (51.9%)
Female	3844 (54.9%)	423 (47.2%)	197 (47.6%)
Other	35 (0.5%)	2 (0.2%)	1 (0.2%)
Race[10,11], n (%)			
White	5538 (79.1%)	742 (82.8%)	357 (86.2%)
Black	836 (11.9%)	100 (11.2%)	28 (6.8%)
Asian	545 (7.8%)	42 (4.7%)	19 (4.6%)
American Indian/Alaska Native	151 (2.2%)	16 (1.8%)	7 (1.7%)
Native Hawaiian/Pacific Islander	41 (0.6%)	4 (0.4%)	1 (0.2%)
Other	148 (2.1%)	20 (2.2%)	7 (1.7%)
Hispanic/Latinx[12], n (%)	908 (13.6%)	119 (13.3%)	33 (8.0%)
Political Ideology[13], n (%)			
Liberal	1333 (19.1%)	32 (3.6%)	20 (4.8%)
Moderate Liberal	1615 (23.1%)	43 (4.8%)	32 (7.7%)
Moderate	1882 (26.9%)	246 (27.5%)	102 (24.6%)
Moderate Conservative	1095 (15.6%)	231 (25.8%)	116 (28.0%)
Conservative	1070 (15.3%)	344 (38.4%)	143 (34.5%)

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[6] Eight individuals declined to provide their education level.

[7] $\chi^2(7) \geq 15.051, p = 0.035$ between pre-screening and invited populations, $\chi^2(7) \geq 12.486, p = .086$ between invited and participating populations.

[8] One individual declined to provide his or her gender.

[9] $\chi^2(2) \geq 26.998, p < .001$ between pre-screening and invited populations, $\chi^2(2) \geq 0.377, p = .828$ between invited and participating populations.

[10] Percentages do not add up to 100% due to some individuals marking more than one race.

[11] $\chi^2(5) \geq 14.867, p = .011$ between pre-screening and invited populations, $\chi^2(5) \geq 15.603, p = .008$ between invited and participating populations.

[12] $\chi^2(1) \geq 0.267, p = .605$ between pre-screening and invited populations, $\chi^2(1) \geq 19.064,, p < .001$ between invited and participating populations.

[13] $\chi^2(4) \geq 708.844, p < .001$ between pre-screening and invited populations, $\chi^2(4) \geq 26.247, p < .001$ between invited and participating populations.

Political Party[14], n (%)			
Democrat	3010 (43.0%)	137(15.3%)	71 (17.1%)
Republican	1954 (27.9%)	497 (55.5%)	231 (55.8%)
Libertarian	416 (5.9%)	73 (8.1%)	29 (7.0%)
Green Party	77 (1.1%)	7 (0.8%)	4 (1.0%)
Other	166 (2.4%)	24 (2.7%)	15 (3.6%)
Do not identify with a party	1373 (19.6%)	158 (17.6%)	63 (15.2%)

T-test and Chi Square analyses reveal that there is a statistically significant association between an individual's beliefs in climate change and his or her age, science literacy, gender, political ideology, and affiliation with a political party. In general, the population that qualified for the experiment is older, less scientifically literate, more male, more conservative, and more Republican than the pre-screening population. Further, the population that qualified for the experiment is significantly whiter and includes a significantly smaller proportion of Asian Americans than the pre-screening population. These findings are consistent with the literature on every demographic metric (Nuccitelli, 2019; Funk & Hefferon, 2019). However, it should be noted that in terms of science literacy, studies have shown that increased science literacy can actually increase polarization on controversial science issues such as climate change (Kahan, 2012; Drummond, 2017).

In terms of the experiment, there are several significant differences between the invited and participating populations. These include age, with the average participant being 3.39 years older than the average invitee; science literacy, with the average participant scoring 0.28 points higher than the average invitee; race, with individuals identifying as black or Native Hawaiian/Pacific Islander being less likely to participate; and politically ideology, with participation decreasing with increasing conservatism. This could be due to the environmental

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[14] $\chi^2(5) \geq 473.904, , p < .001$ between pre-screening and invited populations, $\chi^2(5) \geq 8.436, p = 0.134$ between invited and participating populations.

focus of the first survey, which could have discouraged individuals with little interest in environmental issues (who tend to be more conservative) from participating in the experiment.

Sampling Procedure

Once IRB approval was received for our exempt experiment, we began to recruit participants for our research through Amazon's Mechanical Turk platform. Data collection began on February 5, 2020 and continued through March 23, 2020, with data collection for the pre-screening concluding on February 27, 2020 and data collection for the experiment beginning on March 2, 2020. For both surveys, we created MTurk HITs (human intelligence tasks) that consisted of a survey link and a space to provide a completion code, which was provided in Qualtrics upon completion of the survey. Once this completion code was submitted, workers were compensated for their participation through MTurk. For the pre-screening, this compensation was $0.25, and for the experiment, this compensation was $1.00. In total, the pre-screening was administered to 7100 individuals, which yielded a usable population of 896 individuals for the experiment once duplicates, incomplete surveys, non-qualifying individuals, and non-identifiable responses were removed. Of the 896 qualifying individuals, 416 ultimately started the experiment. Once duplicates, incomplete responses, and non-identifiable responses were removed, this yielded 414 usable responses.

Measures and Psychometrics

The pre-screening (Appendix B) consisted of two sections and could be completed in approximately five minutes. The first section was a science literacy quiz, which consisted of nine true-false or multiple choice questions to assess general science knowledge. Eight of these nine questions were adapted from the National Science Board's *Science and Engineering Indicators* report (NSB, 2018), and the ninth was added by us to serve as the qualifying metric for invitation

to the experiment. The second section of the pre-screening was adapted from existing environmental issues surveys from Pew Research and Gallup to assess attitudes and opinions about environmental issues and disguise the purpose of the survey (Pew, 2018; Newport, 2018). The pre-screening concluded with demographic questions for analysis purposes and a request for the participant's MTurk worker ID number to facilitate matching and compensation.

The experiment consisted of four sections. The first of these was the experimental manipulation, which included a short (120-150 word) message that was presented as a transcript for a television commercial for the six message conditions (Appendix A) and a prompt to continue to the rest of the survey for the no message condition. The second section (Appendix C) consisted of ten dependent variable questions, which were as follows:

1. The climate is changing

2. The climate is changing due to human activities, such as the combustion of fossil fuels

3. I am concerned about climate change

4. Climate change is a significant threat.

5. Climate change is a serious issue.

6. Climate change will personally affect me.

7. Climate change will affect our way of life as a country.

8. Reducing carbon emissions can slow the pace of climate change.

9. I am able to reduce the threat of climate change by reducing my carbon emissions.

10. It is easy to reduce my carbon emissions.

Each of these statements measured agreement on an 11-point Likert-type scale from 0 (strongly disagree) to 10 (strongly agree), where higher numbers represent a greater degree of belief or concern. For ease of analysis, the statements "climate change is a significant threat" and "climate

change is a serious issue" (dependent variables 4 and 5) were averaged to create the dependent variable of "Severity" ($r(412) = 0.954$, $p < .001$), and the statements "climate change will personally affect me" and "climate change will affect our way of life as a country" (dependent variables 6 and 7) were averaged to create the dependent variable of "Vulnerability" ($r(412) = 0.902$, $p < .001$). While the statements "I can reduce the threat of climate change by reducing my emissions" and "It is easy to reduce my carbon emissions" (dependent variables 9 and 10) were originally intended to be analyzed together as "self-efficacy," due to the low correlation between the two we only consider the latter question as "self-efficacy."

The third section consisted of two questions to assess the participant's willingness to act on any expressed belief in climate change. The first question consisted of ten policies that the U.S. Government could implement to mitigate climate change and asked the participant to mark all of the policies that he or she would support. In similar fashion, the second question consisted of twelve actions the participant could personally take to mitigate climate change and asked the participant to mark all of the actions he or she would personally take. Coding a check as a 1 and the absence of a check as a 0, the responses to each question were summed to give "Policy Support" and "Personal Action Scores" that ranged from 0-10 and 0-12, respectively.

The final section consisted of six questions to assess the reader's impression of the speaker in terms of whether he or she[15] was trustworthy, knowledgeable, likable, similar to the reader, sincere, and biased. Each of these questions was assessed on an 11-point semantic differential scale from 0 (*not at all*) to 10 (*very*). It should be noted that since the first five characteristics are positive characteristics and the sixth characteristic is a negative characteristic,

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[15] The gender and race of the spokesperson was intentionally made ambiguous by selecting a gender-neutral first name from the Social Security Administration's list of the top 100 names from the 1980s (SSA, n.d) and a racially-neutral last name from the 2010 census (Census Bureau, 2010).

there is some possibility for confusion. As a result, the overall impression of the speaker, or the

speaker score, was calculated as the average of only the first five questions. This overall

impression scale has good internal consistency (Cronbach alpha = 0.93), and factor analysis

suggests loading on a single factor. Finally, as with the pre-screening, the experiment concluded

with demographic questions for analysis purposes and a request for the participant's MTurk

worker ID number to facilitate matching and compensation.

Data Collection

As discussed previously, all data collection was completed in Qualtrics, except for

MTurk worker data that was used for matching purposes. Once data collection for a particular

phase was complete, the unprocessed Qualtrics data was downloaded into SPSS for ease of

analysis and compared with MTurk worker data to ensure that participant data could be matched

for both the pre-screening and the experiment.

Conditions and Design

The experiment consisted of 7 conditions: a 2 (source: academic or scientist vs.

practitioner) x 3 (message theme: immigration vs. national security vs. science of climate

change) factorial design with a "no message" comparison group. The three academics were a

Professor of Migration Studies, a Professor of National Security Studies, and a Professor of

Climatology. The three practitioners were a border patrol agent, a soldier, and a high school

science teacher. For each theme, the message was identical across messengers, and across themes

the messages were standardized to be roughly the same length (120-150 words) and have roughly

the same reading level (~9th grade).[16] The value-framed messages were crafted based on actual

findings from the National Academy of Sciences and the U.S. Department of Defense (Feng,

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[16] As indicated by the Flesch-Kincaid grade level score.

Kreuger, & Oppenheimer, 2010; Department of Defense, 2019), and the general science message was developed using general climate change information from NASA and NOAA. The seventh condition, the no message condition, was included as a control. Messages used in each condition are available in Appendix A.

Results

Dependent Variable 1 – The climate is changing

A two-way ANOVA was conducted that examined the effect of the message source and the message theme on the first dependent variable, agreement with the statement "The climate is changing." While there was no significant main effect for theme and no significant interaction between the theme and source, the main effect for source type yielded an F ratio of $F(1, 319) = 42.491$, $p = .029$. As seen in the table below, individuals who read a message attributed to a practitioner consistently reported greater belief than individuals who read a message attributed to an academic. Interestingly, each of the practitioners' messages yielded higher belief in climate change than the no message condition, except for the soldier.

Table 2

Belief in Climate Change by Condition

Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	6.11 (3.18)	5.79 (3.12)	5.40 (3.26)	6.31 (2.78)
Practitioner	6.35 (2.78)	6.20 (2.83)	6.93 (2.60)	

Of even greater interest, when all message conditions are considered, there was a significant negative effect between the message and no message conditions, with the main effect for the presence or absence of a message yielding an F ratio of $F(1, 412) = 9.947$, $p = .002$. In other words, individuals reported a higher belief in climate change on average when they didn't see a message than when they did. Descriptive statistics for the range of responses are shown below:
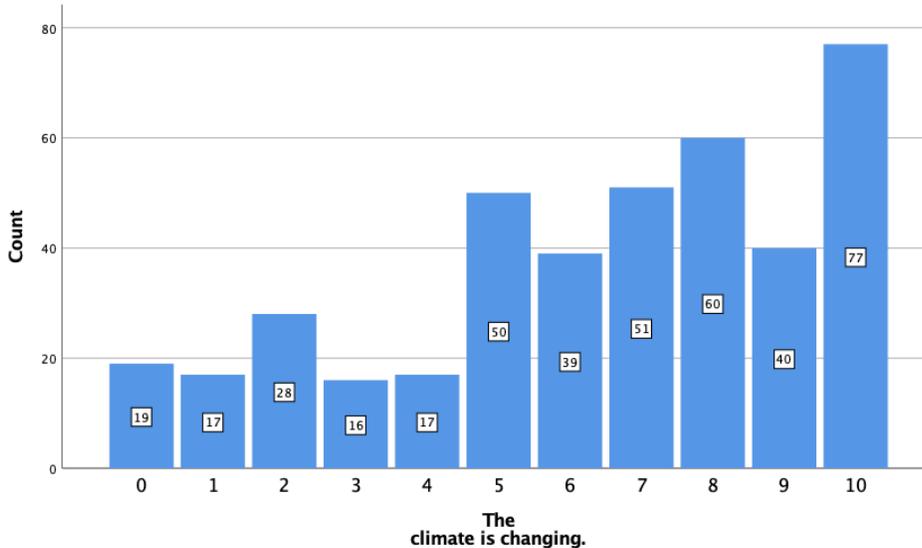
Figure 1 - Range of Responses for Dependent Variable 1

Dependent Variable 2 – The climate is changing due to human activities such as the combustion of fossil fuels

A two-way ANOVA was conducted that examined the effect of the message source and the message theme on the second dependent variable, agreement with the statement "The climate is changing due to human activities such as the combustion of fossil fuels." Surprisingly, no significant effects were observed for the source or the theme, and there was no significant interaction between factors.

Table 3

Belief in Anthropogenic Climate Change by Condition

Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	3.85 (3.41)	4.02 (3.20)	4.27 (3.17)	3.58 (3.08)
Practitioner	4.61 (3.14)	4.00 (3.23)	4.49 (3.17)	

As with the previous statement, there is a statistically significant effect between the message and no message conditions $F(1,128.59) = 7.117$, $p = 0.014$).[17] However, in this case, the effect is

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[17] A Welch one-way ANOVA was necessary due to the failure of Levene's test for equality of variances.

positive rather than negative. That is, individuals who saw a message reported a higher belief in anthropogenic climate change than individuals who were assigned to the no-message condition. In fact, out of the 39.6% of individuals who rated their belief in anthropogenic climate change as 6 or higher (Figure 2) more than 70% were assigned to one of the 6 message conditions, with the most persuasive source category being the practitioners and the most persuasive theme category being the immigration theme.
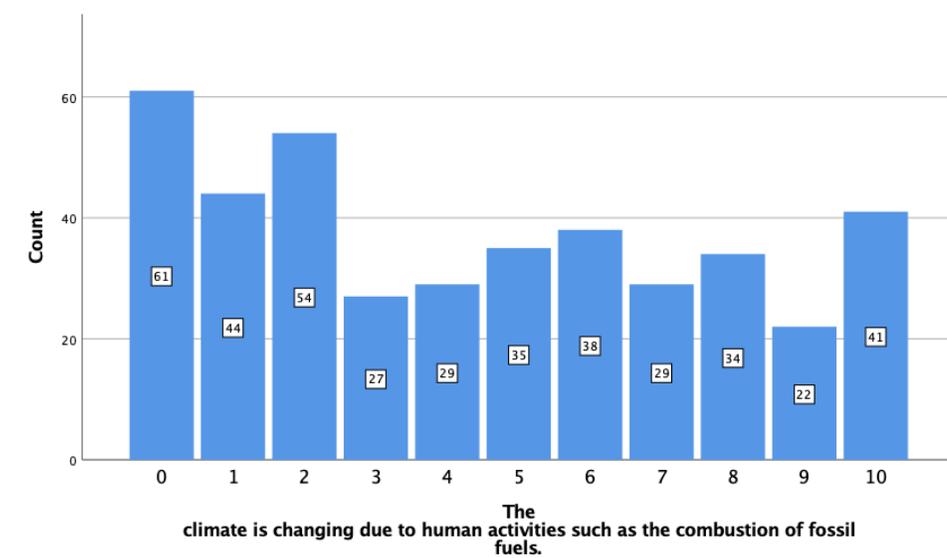

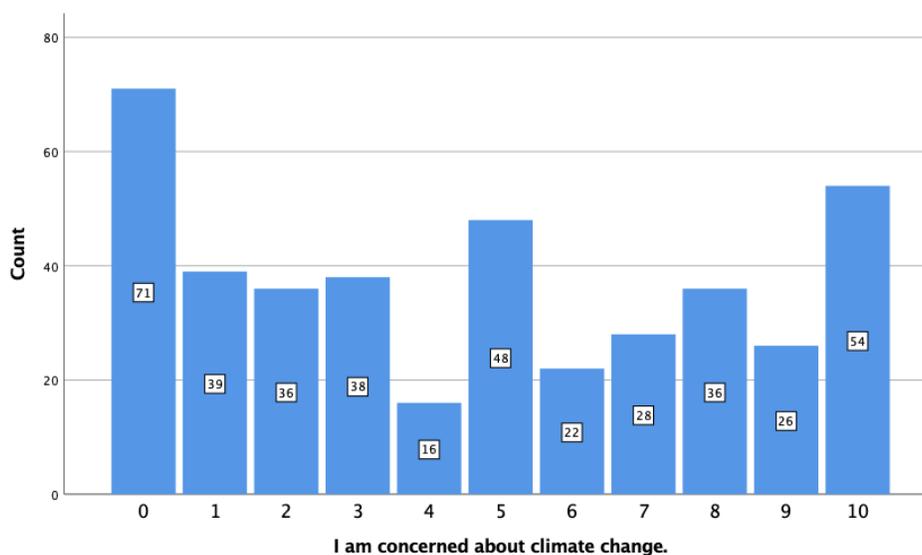*Figure 2 - Range of Responses for Dependent Variable 2*

Dependent Variable 3 – I am concerned about climate change

A two-way ANOVA was conducted that examined the effect of the message source and the message theme on the third dependent variable, agreement with the statement "I am concerned about climate change." While no significant effect was observed for the theme and there was no significant interaction between the factors, the main effect for source type yielded an F ratio of $F(1, 319) = 3.935$, $p = .048$. As seen in the table below, individuals who read a message attributed to a practitioner consistently reported greater concern than individuals who read a message attributed to an academic.

Table 4

Concern about Climate Change by Condition

	Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	4.38 (3.29)	4.02 (3.34)	3.62 (3.23)	3.87 (3.44)
Practitioner	5.35 (3.51)	4.21 (3.36)	4.67 (3.45)	

As with the previous statement, there is a statistically significant positive effect between the message and no message conditions $F(1,129.28) = 7.132$, $p = 0.009$.[18] That is, individuals who saw a message reported a higher concern about climate change on average than individuals who were assigned to the no-message condition. In fact, out of the 40.1% of individuals (Figure 3) who rated their concern about climate change as 6 or higher, more than 70% were assigned to one of the 6 message conditions, with the most persuasive source category being the practitioners and the most persuasive theme category being the immigration theme.

Figure 3 - Range of Responses for Dependent Variable 3

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[18] A Welch one-way ANOVA was necessary due to the failure of Levene's test for equality of variances.

Dependent Variable 4 – "Severity"

A two-way ANOVA was conducted that examined the effect of the message source and the message theme on the fourth dependent variable, perceived severity. While no significant effect was observed for the theme or for the interaction between factors, the main effect for source type yielded an F ratio of $F(1, 319) = 5.003$, $p = .026$. As seen in the table below, individuals who read a message attributed to a practitioner reported greater perceived severity on average than individuals who read a message attributed to a practitioner.

Table 5

Perceived Severity by Condition

Comparison of Means (Standard Deviation)				
	Immigration	National Security	Science	No Message
Academic	4.45 (3.35)	4.17 (3.31)	3.58 (3.32)	3.78 (3.38)
Practitioner	5.59 (3.10)	4.37 (3.31)	4.69 (3.33)	

Though no overall significance was observed across theme, as the table above shows, there is a pretty drastic difference in perceived severity when the message is either an immigration-themed message or a science-themed message from a practitioner. Additionally, as with the previous statement, there is a statistically significant positive effect between the message and no message conditions $F(1, 412) = 6.262$, $p = 0.013$. That is, individuals who saw a message reported a higher perceived severity on average than individuals who were assigned to the no-message condition. In fact, out of the 40.6% of individuals who rated the severity of climate change as 6 or higher (Figure 4), more than 70% were assigned to one of the 6 message conditions, with the most persuasive source category being the practitioners and the most persuasive theme category being the immigration theme.
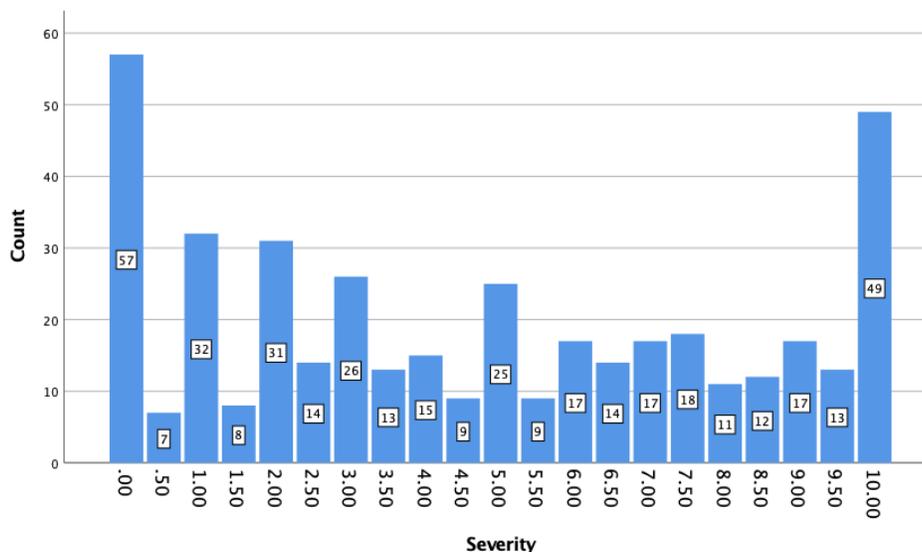
Figure 4 - Range of Responses to Dependent Variable 4

Dependent Variable 5 – "Vulnerability"

A two-way ANOVA was conducted that examined the effect of the message source and

the message theme on the fifth dependent variable, vulnerability. Surprisingly, no significant

effects were observed for the source or the theme, and there was no significant interaction

between factors.

Table 6

Vulnerability by Condition

Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	4.45 (3.24)	4.15 (3.24)	3.45 (3.04)	3.71 (3.20)
Practitioner	5.13 (3.07)	4.08 (3.22)	4.61 (3.40)	

However, there is a statistically significant positive effect between the message and no message

conditions $F(1,412) = 6.387$, $p = 0.012$. That is, on average, individuals who saw a message

reported a higher vulnerability to climate change than individuals who were assigned to the no-

message condition. In fact, out of the 40.3% of individuals who rated their vulnerability to

climate change as 6 or higher (Figure 5), more than 70% were assigned to one of the 6 message

conditions, with the most persuasive source category being the practitioners and the most

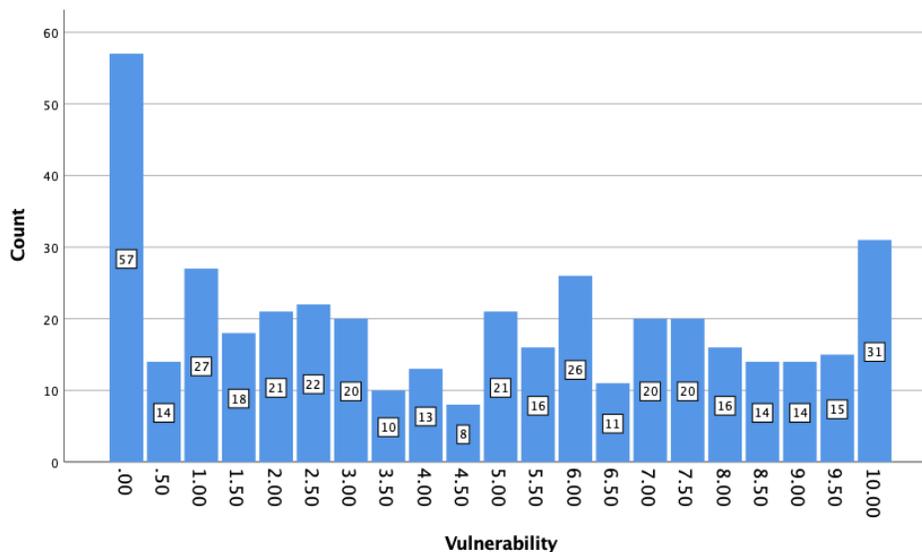persuasive theme category being the immigration theme.

Figure 5 - Range of Responses to Dependent Variable 5

Dependent Variable 6 – Reducing carbon emissions can slow the pace of climate change

A two-way ANOVA was conducted that examined the effect of the message source and

the message theme on the sixth dependent variable, agreement with the statement "Reducing

carbon emissions can slow the pace of climate change." No significant effects were observed for

the source or the theme, and there was no significant interaction between factors.

Table 7

Response Efficacy by Condition

Comparison of Means (Standard Deviation)				
	Immigration	National Security	Science	No Message
Academic	4.27 (3.52)	4.32 (3.19)	3.98 (3.21)	3.76 (3.18)
Practitioner	4.81 (3.30)	4.23 (3.31)	4.31 (3.49)	

However, there is a statistically significant positive effect between the message and no message

conditions $F(1,412) = 7.116$, $p = 0.008$. That is, individuals who saw a message consistently

reported greater belief that reducing emissions can slow the pace of climate change than individuals who were assigned to the no-message condition.
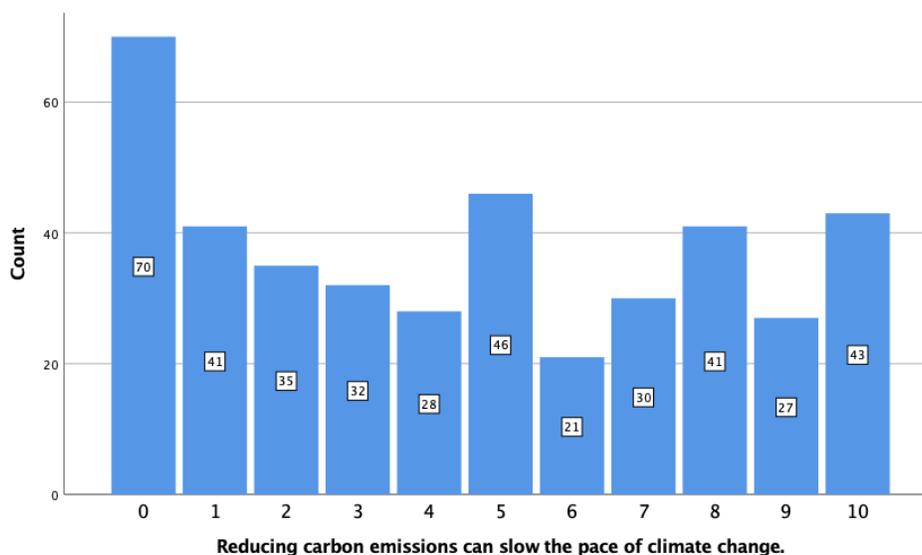

Figure 6 - Range of Responses to Dependent Variable 6

Dependent Variable 7 – "Self-Efficacy"

A two-way ANOVA was conducted that examined the effect of the message source and the message theme on the seventh dependent variable of self-efficacy. As with the response efficacy, no significant effects were observed for the source or the theme, and there was no significant interaction between factors.

Table 8

Self-Efficacy by Condition

Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	4.93 (3.10)	4.19 (2.84)	3.81 (3.14)	4.47 (2.90)
Practitioner	4.57 (2.93)	4.11 (2.76)	4.44 (3.25)	

Interestingly, there is a statistically significant negative effect between the message and no message conditions $F_{(1,412)} = 4.337$, $p = 0.038$. That is, individuals who saw a message were less likely on average to agree that it is easy to reduce their emissions than individuals who were

assigned to the no-message condition. As shown in the table above, the only exceptions to this trend are the two immigration-themed messages.
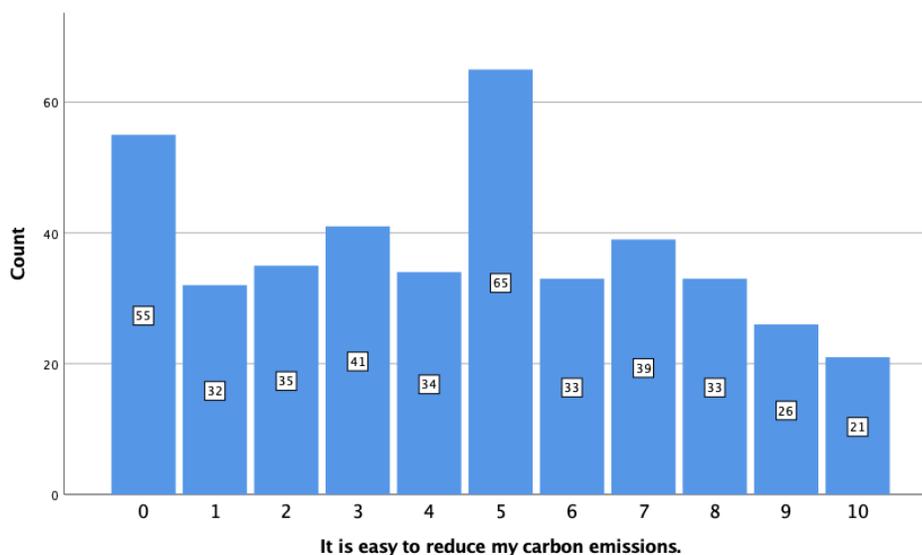

Figure 7 - Range of Responses to Dependent Variable 7

Source Effects – Speaker Score

To better understand the observed source effects, a two-way ANOVA was conducted that examined the effect of the source and theme on the speaker score. The main effect for source type yielded an *F* ratio of $F(1, 319) = 39.681$, $p = .010$. As would be expected, the average impression of the source was higher when that source was a practitioner rather than an academic. This is further illustrated in the table below, which shows the highest and lowest rated speaker for each of the five categories included in the speaker score.

Table 9

Highest and Lowest Rated Speakers by Category

	Highest Rated	*Lowest Rated*
Trustworthiness	High School Teacher	Climatologist
Knowledge	High School Teacher	Climatologist
Sincerity	High School Teacher	Climatologist
Likability	High School Teacher	Climatologist
Similarity to Me	Border Patrol Agent	Climatologist

Also of interest, there was a significant correlation between speaker score and political ideology, with the speaker score decreasing as the participant became more conservative (b = .209, p < .001, adjusted R^2=.041). This suggests that the perception of the speaker was influenced at least in part by existing ideological stances.

Table 10

Speaker Score by Condition

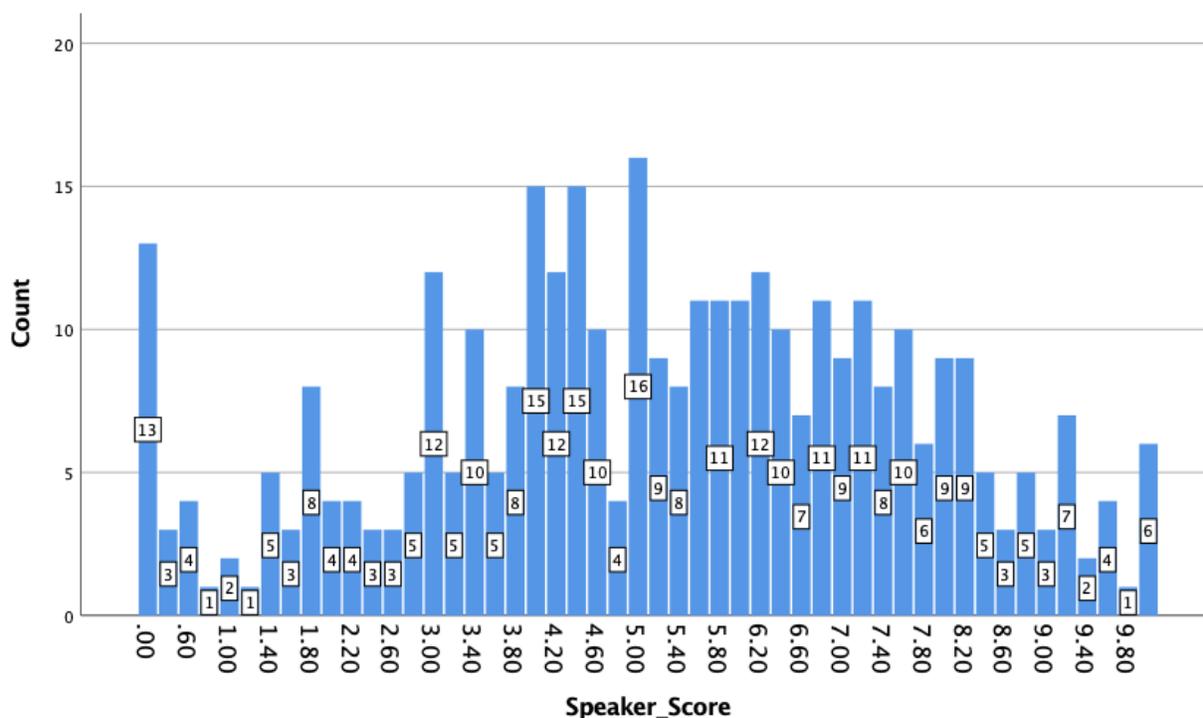|	Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	4.83 (2.31)	4.89 (2.51)	4.46 (2.69)	N/A
Practitioner	5.38 (2.22)	5.08 (2.49)	5.81 (2.25)	

Figure 8 - Range of Speaker Scores

Post-Experiment Support for Climate Mitigation Activities

To assess if and how expressed beliefs in climate change would translate to action, we asked participants to identify policies they would support and actions they would personally take

to mitigate climate change. The descriptive statistics are shown in Tables 11 and 13,

respectively, and the comparisons of means are shown in Tables 12 and 14, respectively.

Table 11

Aggregated Support for Government Climate Mitigation Actions

Government Actions	
A tax on carbon emissions	64 (15.5%)
Greater subsidies for renewable energy	175 (42.3%)
Greater subsidies for low or no emissions vehicles	132 (31.9%)
Stricter fuel economy standards	98 (23.7%)
A ban on hydraulic fracturing for natural gas, also known as fracking	80 (19.3%)
A ban on internal combustion engines	31 (7.5%)
A comprehensive decarbonization program like the Green New Deal	48 (11.6%)
Continued R&D for batteries, renewables, and low or no emissions vehicles	150 (36.2%)
Government-funded nuclear energy development	107 (25.8%)
A cap and trade program for carbon emissions	51 (12.3%)

In terms of policy support, more than one-quarter of our originally climate-denying respondents

expressed support for subsidizing renewable energy and low- or no-emissions vehicles,

continuing research and development for batteries, renewable energy, and low- or no-emissions

vehicles, and government-funded nuclear energy development.

Interestingly, there is a significant positive effect on support for climate mitigating

policies between the message and no message conditions $F(1, 412) = 4.793$, $p < .029$, meaning

that on average individuals who saw a message are more likely to support climate mitigating

policies than individuals who did not. Moreover, for those who saw a message, willingness to

support these policies was positively correlated with the participant's opinion of the speaker

r(357) = .451, $p < .001$.

Table 12

Policy Support by Condition

	Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	2.29 (1.83)	2.23 (1.91)	1.75 (2.20)	1.96 (2.31)
Practitioner	2.48 (2.05)	1.98 (2.10)	2.09 (2.19)	

Table 13

Aggregated Support for Personal Climate Mitigation Actions

Personal Actions	
Purchase energy efficient appliances	247 (59.7%)
Pay extra with your electric bill for renewable energy	46 (11.1%)
Sign a petition or participate in a climate march	38 (9.2%)
Switch to a low or no emissions vehicle	136 (32.9%)
Fly less frequently	108 (26.1%)
Install solar panels on your home	178 (43.0%)
Talk to friends and relatives about climate change	78 (18.8%)
Vote for a candidate who supports climate mitigation policy	69 (16.7%)
Monetarily support a candidate who supports climate mitigation policy	28 (6.8%)
Walk, bike, or use public transit instead of driving a personal vehicle	140 (33.8%)
Write a letter to your Senators or Representative supporting climate action	35 (8.5%)
Eat meat less frequently	80 (19.3%)

Personally, more than one-quarter of respondents expressed willingness to purchase energy

efficient appliances, switch to a low- or no-emissions vehicle, install solar panels on their homes,

fly less frequently, and walk, bike, or use public transit in lieu of driving.

Unlike the question about policy support, there is a significant negative effect on willingness to act personally to mitigate climate change between the message and no message conditions $F(1, 412) = 11.017$, $p = .001$. However, as with the policy support question, for those who did see a message, willingness to take these actions generally increases with the participant's opinion of the speaker $F(49, 309) = 2.530$, $p < .001$)

Table 14

Personal Action by Condition

Comparison of Means (Standard Deviation)			
	Immigration	National Security	Science	No Message
Academic	2.80 (2.37)	2.49 (2.14)	2.10 (2.11)	2.87 (2.62)
Practitioner	3.04 (2.33)	2.75 (2.64)	2.65 (2.72)	

Discussion

Summary of Results – Source Effects

As discussed above, there is a significant source effect in terms of belief in climate change, concern about climate change, and perceived severity of climate change, with individuals who read messages from practitioners expressing greater levels of each than individuals who read messages from academics. The one caveat to this finding is the soldier, who consistently produced the least belief and concern among the three practitioners and sometimes even produced less than some of the academics (namely the Professor of Migration Studies). This relative lack of persuasiveness may be due to issues with the national security message, rather than issues with the speaker. Unlike the immigration and science messages, which draw very straightforward links between climate change and undesirable consequences, the national security message requires additional processing to understand both the given

connection between climate change and compromised national security and the implicit connection between compromised national security and personal safety.

The previously discussed source effect is further quantified by looking at the speaker score. Overall, there is a significant positive effect on speaker score when the source is a practitioner, as opposed to an academic. These higher speaker scores not only translated to greater belief in and concern about climate change, but were also correlated with more policy support for climate mitigation and more personal willingness to act to mitigate climate change. All of these findings support our first hypothesis that practitioners will be more convincing messengers for this population than academics.

Notably, these source effects are only observed for general belief in climate change, rather than belief in anthropogenic climate change. This suggests that the link between carbon emissions and climate change should be drawn more clearly, particularly in the value-framed messages. This explanation is reinforced by the observation that the science theme, the only theme that explains how carbon emissions cause climate change, produced the greatest reported belief in anthropogenic climate change ($M = 4.38$, $SD = 3.16$).

Summary of Results – Theme Effects

Overall, no significant effect was observed in terms of the theme for any of the dependent variables. The most likely explanation for this is the underperformance of the national security theme due to the complexity of the message. While the connection between climate change and increased migration appeared to be made reflexively for the immigration theme, the national security message required links to be made between decreased national security and decreased personal safety that did not seem to be made as easily. This relative lack of persuasiveness from the national security theme is consistent with findings from Myers et al. (2012) that showed that

arguments about how climate change affects national security not only reduced the strength of belief in climate change, but also caused many participants to become angry. In their discussion, the authors suggested that this anger was due to the perceived co-opting of conservative values to push a non-conservative agenda.

Another potential explanation for the lack of a theme effect was the overperformance of the high school teacher. While the climatologist had the least effect on every dependent variable except belief in anthropogenic climate change, the high school teacher was consistently first or second in terms of effect. This is likely due to the high perceived knowledge (M = 5.29, SD = 2.92) and trustworthiness (M = 5.65, SD = 2.53) of teachers.[19]

Summary of Results – Message vs. No Message

While no significant effect was observed for theme, there was a significant difference between the message and no message condition for every dependent variable. This effect was positive for every dependent variable except one—the statement "The climate is changing." One explanation for this result is that some participants had a visceral reaction to the identity-threatening message that climate change is happening. This explanation is supported by regression analysis, which finds that political ideology, which was initially a strong predictor of qualification for the experiment, is also a significant predictor of post-message belief in climate change (b = .325, *p < .001,* adjusted R^2 =.103*).*

Summary of Results – Speaker Characteristics

As discussed in the theoretical background, the expertise, trustworthiness, likability, and similarity of the messenger to the recipient have a significant impact on the persuasiveness of a message. To see which of these characteristics was most dominant in terms of climate

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[19] The teacher was rated highest of all six speakers in terms of both knowledge and trustworthiness.

communication, participants were asked to rate the speaker's trustworthiness, knowledge, likability, sincerity, and similarity to themselves on an 11-point semantic differential scale, with 0 representing "not at all" and 10 representing "very." Interestingly, the science teacher achieved the highest average rating in every category except for similarity to the participant, and the climatologist received the lowest rating in all five categories (Table 9). In terms of overall impression, the border patrol agent closely followed the science teacher, achieving the highest rating in terms of similarity to the participant and the second highest rating in terms of trustworthiness, likability, and sincerity. The high overall impression of these two speakers translated to higher overall belief in and concern about climate change, while the low overall impression of the climatologist often dropped belief in and concern about climate change below their respective no-message baselines.

Summary of Results – Policy Support and Personal Action

As shown in Table 11, more than one-quarter of our originally climate-denying respondents expressed support for subsidizing renewable energy and low- or no-emissions vehicles; continuing research and development for batteries, renewable energy, and low- or no-emissions vehicles; and government-funded nuclear energy development. While this support is promising in terms of reducing opposition to general clean energy policies, it should be noted that this support could be due to the potential to reduce costs rather than the potential to mitigate climate change.

Another observation that can be made is that most skeptical individuals, even those who showed some movement toward belief and concern, are still hesitant to support government actions that would encourage or require them to change their behavior, such as a carbon tax, a cap and trade program, a ban on internal combustion engines, or a comprehensive

decarbonization program like the Green New Deal. Knowing this, it is likely more productive for political leaders to prioritize avenues of decarbonization that require less personal sacrifice and offer benefits beyond environmental protection.

In terms of personal action, Table 13 shows that more than one-quarter of respondents would be willing to purchase energy efficient appliances, switch to a low- or no-emissions vehicle, install solar panels on their homes, fly less frequently, and walk, bike, or use public transit in lieu of driving. As with the policy positions, most of these personal decisions would have the added benefit of being lower cost, so it is uncertain whether this support is driven by environmental or economic concern. However, research (Gromet, Kunreuther, & Larrick, 2013) has shown that overt environmental appeals can overshadow economic appeals for conservatives, leading them to purchase less-environmentally friendly light bulbs even when the economic benefits of the energy-efficient ones are greater. Thus, there is some support for the notion that this expressed support is motivated in part by concern about climate change.

Strengths

These findings make several new contributions to the literature. First, our findings specifically quantify conservative resistance to scientists, which had previously been observed but not fully understood in the context of climate change beliefs. Moreover, our findings show that this resistance extends to all academics and specifically shows that practitioners are regarded as more trustworthy, more sincere, more likable, and, surprisingly, more knowledgeable than their academic counterparts.

Additionally, while no statistically significant theme effect was found, the immigration argument shows significant promise in terms of influencing climate change beliefs, especially among conservatives. Particularly in terms of concern about climate change (dependent variable

3), perceived severity (dependent variable 4), and perceived vulnerability (dependent variable 5), the comparisons of means clearly demonstrate the comparative efficacy of the immigration argument over the climatologist's argument, particularly when the border patrol agent is the speaker.

Limitations

As with any experiment, these results should be considered in light of some unavoidable limitations. Most notably, the use of MTurk presents some challenges in terms of data reliability. Because MTurk payments serve as supplemental income for many MTurk workers, there is an incentive for these workers to complete as many human intelligence tasks (HITs) as they can in the shortest amount of time. As a result, there are going to be some individuals who simply click through the survey without reading the questions or transcripts thoroughly enough for their answers to reflect their actual beliefs. According to time stamps from Qualtrics, the mean completion time for the experiment was 5 minutes and 46 seconds, though this is skewed due to 12 individuals who took between 20 and 90 minutes to complete the survey. Perhaps more tellingly, 66.2% of participants completed the survey in less than 5 minutes. These issues are exacerbated by the relatively small populations for each condition, which were a function of limited time and funding. While our populations are still large enough to give our results power, our ability to ameliorate random responses would be higher in a larger sample.

More specific to the results, our effect on climate belief was likely limited by our inability to target our messages to individuals based on their unique values. For future work, it would be interesting to add questions to the pre-screening to measure concern about immigration, national security, and other issues of interest so we can target the messages to those individuals who will be most receptive. Finally, the application of our findings is limited by the

fact that our transcript-style format would not be used in real life to convey messages about climate change. However, our results do lay a valuable foundation for future work with a more realistic format, such as a television commercial, an online advertisement, or narrative video for social media.

Implications

These findings inform the national conversation about climate change in a couple of key ways. First, by quantifying conservative resistance to academics and scientists, this study suggests that efforts at persuasion will be more successful when coming from "everyday" people, rather than scientists and other academics. Second, the descriptive persuasive effect of the immigration argument suggests that arguments about the secondary consequences of climate change can sometimes be more persuasive than primary arguments and therefore warrant further study.

Conclusion

In sum, the results support our first hypothesis that practitioners are more persuasive to the skeptical population than academics and scientists. For each of the first five dependent variables, the two most persuasive speakers were the high school science teacher and the border patrol agent, while the climatologist, the source of most climate information, was the least persuasive speaker for all but one of these variables. In addition to being the least persuasive, the climatologist was rated as the least knowledgeable, the least likable, the least sincere, and the least trustworthy, while the high school science teacher and border patrol agent were rated the highest in these categories. This antipathy toward the climatologist is consistent with findings from Bolsen et al. (2019) that show that attributing climate messages to climatologists reduces belief in, concern about, and support for mitigating climate change among skeptics. Together,

these findings suggest that the current approach to climate discourse, science-based appeals to authority, is highly ineffective at persuading skeptics to believe in climate change.

While the results do not support our second hypothesis that value-framed messages are more persuasive than scientific messages, value-framed messages should not be disregarded as a mechanism for influencing conservative beliefs. As shown in Tables 2 through 6, the immigration message consistently produced levels of belief and concern beyond those produced by the climatologist, with the improvement being especially noticeable when the speaker was the border patrol agent. These improvements simply were not strong enough to compensate for a less-persuasive national security theme and the unexpectedly persuasive high school science teacher.

Overall, roughly 40% of participants rated their belief in anthropogenic climate change as 6 or higher (Figure 2), meaning that they are more convinced than not convinced that climate change is caused by human activities. Similar proportions were observed for concern, severity, and vulnerability (Figures 3, 4, and 5). Across all four variables, these high ratings were most common when participants were assigned to practitioners and the immigration theme, in accordance with expectations. This finding shows significant promise for using value-framed climate messages from everyday people to persuade skeptics, even if a statistically significant effect for theme was not found.

For future work, it will be interesting to see what adjustments could be made to further increase belief in anthropogenic climate change, rather than climate change more generally. According to our results, the most obvious adjustment would be to clearly explain the link between carbon emissions and climate change in the value-framed messages, as we did in the science message, though there are certainly other mechanisms that can be pursued. There is also

potential for studying the moderating effect of political ideology on concern and belief and potential for incorporating other peripheral arguments and value frames into the experiment, such as those relating to agriculture and religion. Finally, with the foundation this research laid, it would be interesting to see if these findings translate to more realistic formats, such as narrative videos.

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Appendix A – Messages

Value: Cultural Maintenance/Social Order (9.1 reading level, 126 words)
Messengers: Professor of Migration Studies, Border Patrol Agent, Community Member

Hi, my name is Dr. Jamie Williams, and I'm a Professor of Migration Studies. Over the past twenty years, we've had a lot of discussions about how to secure our southern border and prevent illegal immigration. We've talked about walls and sensors and systems like E-Verify, but I would argue that the problem is changing. While people used to try to enter our country to escape poverty or violence, lately we've been seeing people come to escape droughts and famines. We've been seeing people come to start fresh after hurricanes have destroyed their homes. If we're going to slow the stream of people at our border, we need to act now to prevent these disasters from happening more frequently. We need to reduce our carbon emissions.

Hi, my name is Jamie Williams, and I'm a border patrol agent. Over the past twenty years, we've had a lot of discussions about how to secure our southern border and prevent illegal immigration. We've talked about walls and sensors and systems like E-Verify, but I would argue that the problem is changing. While people used to try to enter our country to escape poverty or violence, lately we've been seeing people come to escape droughts and famines. We've been seeing people come to start fresh after hurricanes have destroyed their homes. If we're going to slow the stream of people at our border, we need to act now to prevent these disasters from happening more frequently. We need to reduce our carbon emissions.

Value: Security (9.3 reading level, 126 words)
Messengers: Professor of National Security Studies, Soldier, Community Member

Hi, my name is Dr. Jamie Williams, and I am a Professor of National Security Studies. When you see reports about severe weather on TV, you probably don't think about how it affects national security. But when military bases are hit, trainings are delayed. Critical equipment can be lost. Operations are interrupted as personnel are moved. Because of the flooding in March, the U.S. Strategic Command had to be moved, and they oversee our nuclear weapons! Unfortunately, this is not an isolated case. The Department of Defense recently warned that more than 2/3 of the 79 most critical bases are vulnerable to disasters like flooding. If we don't act now to reduce our carbon emissions, we could find ourselves unprepared in the event of an attack.

Hi, my name is Lieutenant Jamie Williams, and I am stationed at Smith Air Force Base. When you see reports about severe weather on TV, you probably don't think about how it affects national security. But when military bases are hit, trainings are delayed. Critical equipment can be lost. Operations are interrupted as personnel are moved. Because of the flooding in March, the U.S. Strategic Command had to be moved, and they oversee our nuclear weapons! Unfortunately, this is not an isolated case. The Department of Defense recently warned that more than 2/3 of the 79 most critical bases are vulnerable to disasters like flooding. If we don't act now to reduce our carbon emissions, we could find ourselves unprepared in the event of an attack.

Value: Control (9.3 reading level, 136 words)
Messengers: Professor of Climatology, HS Science Teacher, Community Member

Hi, my name is Dr. Jamie Williams, and I am a professor of climatology. Over the past twenty years, we've been hearing a lot on the news about climate change, but they don't always tell you what climate change is or what causes it. When we put gas in our cars or burn coal in a power plant, we release carbon dioxide into the air. This carbon dioxide absorbs heat that is radiating up from the earth's surface, trapping it like a blanket. This warms the earth's surface, which not only increases the temperature, but also affects weather patterns, sea levels, and ocean acidity. Already, we're experiencing more frequent droughts, heat waves, floods, and hurricanes due to climate change. If we don't do take steps to reduce our carbon emissions now, these will only get worse.

Hi, my name is Jamie Williams, and I am a 10th grade science teacher. Over the past twenty years, we've been hearing a lot on the news about climate change, but they don't always tell you what climate change is or what causes it. When we put gas in our cars or burn coal in a power plant, we release carbon dioxide into the air. This carbon dioxide absorbs heat that is radiating up from the earth's surface, trapping it like a blanket. This warms the earth's surface, which not only increases the temperature, but also affects weather patterns, sea levels, and ocean acidity. Already, we're experiencing more frequent droughts, heat waves, floods, and hurricanes due to climate change. If we don't do take steps to reduce our carbon emissions now, these will only get worse.

Appendix B - Pre-Screening

Do you consent to participate in this research? (to determine qualification for the survey)
What is your year of birth? (to determine qualification for the survey)

In the following section, we will assess your understanding of basic scientific concepts. For each question, please mark the correct answer choice. There is no penalty for guessing.

1. All radioactivity is man-made
    a. True
    b. False

2. Lasers work by focusing sound waves
    a. True
    b. False

3. Electrons are smaller than atoms
    a. True
    b. False

4. Which gas makes up most of the Earth's atmosphere?
    a. Hydrogen
    b. Nitrogen
    c. Carbon Dioxide
    d. Oxygen

5. How long does it take for the Earth to go around the sun?
    a. 1 day
    b. 1 month
    c. 1 year

6. Antibiotics kill viruses as well as bacteria
    a. True
    b. False

7. The climate is changing due to human activities, such as the combustion of fossil fuels.
    a. True
    b. False

8. The center of the earth is very hot
    a. True
    b. False

9. It is the father's gene that decides whether a baby is a boy or a girl
    a. True
    b. False

In the following section, you will read a series of statements about environmental issues. Please select the answer choice that best represents your viewpoint.

1. How much do you personally worry about the following issues: [a great deal, a fair amount, only a little, or not at all?]
    a. Pollution of drinking water
    b. Loss of rain forests
    c. Pollution of lakes and rivers
    d. Climate change
    e. Extinction of plant and animal species
    f. Air pollution

2. How much do you think the federal government is doing to: [too much, too little, about the right amount?]
    a. Protect air quality
    b. Protect water quality of rivers, lakes, and streams
    c. Protect animals and their habitats
    d. Protect open lands in national parks and nature preserves
    e. Reduce the effects of global climate change

3. Do you favor or oppose EXPANDING each of the following sources of energy in our country? [Favor, oppose]
    a. More solar "farms"
    b. More offshore oil and gas drilling in U.S. waters
    c. More nuclear power plants to generate electricity
    d. More coal mining
    e. More hydraulic fracturing, sometimes called fracking, for oil and natural gas
    f. More wind "farms"

4. Do you or do you not do each of the following in your everyday life in order to help protect the environment? [Yes I do this, No I don't]
    a. Eat less meat
    b. Drive less or carpool
    c. Use fewer plastics that can't be reused (e.g. plastic bags, straws, cups)
    d. Reduce your food waste
    e. Reduce your water usage

5. How would you describe your political ideology? [Conservative, moderate conservative, moderate, moderate liberal, liberal.]

6. Do you belong to a political party? [Republican, Democrat, Libertarian, Green Party, Other, I do not belong to a political party]

7. What is your gender? [Male, Female, Other]

8. What is your MTurk worker ID?

Appendix C - Experiment

In the following sections, you will read a series of statements. Please indicate how much you agree or disagree with each statement. (0 is completely disagree, 10 is completely agree)

1. The climate is changing.
2. The climate is changing due to human activities such as the combustion of fossil fuels.
3. I am concerned about climate change.
4. Climate change is a significant threat.
5. Climate change is a serious issue.
6. Climate change will personally affect me.
7. Climate change will affect our way of life as a country.
8. Reducing carbon emissions can slow the pace of climate change.
9. I am able to reduce the threat of climate change by reducing my carbon emissions.
10. It is easy to reduce my carbon emissions.

In the following section, you will see a series of measures that the government could take to reduce emissions and slow climate change. Please indicate which of the following, if any, you would support.

    a. A tax on carbon emissions
    b. Greater subsidies for renewable energy
    c. Greater subsidies for low or no emissions vehicles
    d. Stricter fuel economy standards
    e. A ban on hydraulic fracturing for natural gas, also known as fracking
    f. A ban on internal combustion engines
    g. A comprehensive decarbonization program like the Green New Deal
    h. Continued R&D for batteries, renewables, and low or no emissions vehicles
    i. Government-funded nuclear energy development

In the following section, you will see a series of measures that you could take to reduce emissions and support climate action. Please indicate which of the following, if any, you would support.

    a. Purchase energy efficient appliances
    b. Pay extra with your electric bill for renewable energy
    c. Sign a petition or participate in a climate march
    d. Switch to a low or no emissions vehicle
    e. Fly less frequently
    f. Install solar panels on your home
    g. Talk to friends and relatives about climate change
    h. Vote for a candidate who supports climate mitigation policy
    i. Monetarily support a candidate who supports climate mitigation policy
    j. Walk, bike, or use public transit instead of driving a personal vehicle
    k. Write a letter to your Senators or Representative supporting climate action
    l. Reduce meat consumption

The next section asks you to think about the spokesperson. How would you rate the speaker on each of the following characteristics? [11-point scale]

How would you rate the speaker's trustworthiness?

Not at all trustworthy										Very trustworthy
0	1	2	3	4	5	6	7	8	9	10

How would you rate the speaker's similarity to you?

Not at all similar to me										Very similar to me
0	1	2	3	4	5	6	7	8	9	10

How would you rate the speaker's knowledge?

Not at all knowledgeable										Very knowledgeable
0	1	2	3	4	5	6	7	8	9	10

How would you rate the speaker's likability?

Not at all likable										Very likable
0	1	2	3	4	5	6	7	8	9	10

How would you rate the speaker's sincerity?

Not at all sincere										Very sincere
0	1	2	3	4	5	6	7	8	9	10

How would you rate the speaker's bias?

Not at all biased										Very biased
0	1	2	3	4	5	6	7	8	9	10

How would you describe your political ideology? [Conservative, moderate conservative, moderate, moderate liberal, liberal.]

Do you belong to a political party? [Republican, Democrat, Libertarian, Green Party, Other, I do not belong to a political party]

What is your gender? [Male, Female, Other]

What is your year of birth?

What is your MTurk worker ID?

Appendix D – Consent Forms

Consent Form – Pre-Screening

We would like to ask you to participate in a research study at Mississippi State University. This study will help evaluate the science knowledge and environmental attitudes of the general population. If you participate in this study, you will be asked to complete an online survey to evaluate general science knowledge. The survey will present scientific statements and ask you to decide if each statement is true or false. We will also ask you to tell us how you feel about various environmental policies and issues. Finally, we will ask you some questions about yourself (gender, year of birth, etc.).

If you participate, this survey will take approximately 5 minutes. If you complete this survey, you will be eligible to complete an additional future survey (and will be granted qualifications through MTurk). Your answers will not be linked to your name.

Qualifications: This research is for residents of the United States over the age of 18; if you are not a resident of the United States and/or you are under the age of 18, please do not complete this survey. Also, you may only receive credit for completing the survey once.

Note: Before you begin, please note that the data you provide may be collected and used by Amazon as per its privacy agreement. Amazon Mechanical Turk and Qualtrics have specific privacy policies of their own. You should be aware that these web services may be able to link your responses to your ID in ways that are not bound by this consent form and the data confidentiality procedures used in this study. If you have concerns, you should consult these services directly.

Compensation: For successful completion of the survey, you will be awarded $0.25.

Risks: There are no known risks involved in participating in this study other than those encountered in day-to-day life.

Voluntary Participation: Please understand that your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may stop the survey at any time without penalty or loss of benefits.

Questions: If you have any questions about this research project, please feel free to contact Dr. Holli Seitz at HSeitz@comm.msstate.edu.

Please take all the time you need to read through this page and decide whether you would like to participate in this research study.

Would you like to participate?

Consent Form – Experiment

We would like to ask you to participate in a research study at Mississippi State University. This study will help us understand the environmental attitudes of the general population. If you participate in this study, you will be asked to read a short message and complete an online survey. The survey will present a series of statements and ask you to indicate your agreement with each statement on a scale of 0 to 10, or "completely disagree" to "completely agree." We will also ask you if you would support various actions the government could take to protect the environment and if you would take certain actions yourself to protect the environment. Finally, we will ask you some questions about yourself (gender, year of birth, etc.).

If you participate, this survey will take approximately 10 minutes. Your answers will not be linked to your name.

Qualifications: This research is for residents of the United States over the age of 18; if you are not a resident of the United States and/or you are under the age of 18, please do not complete this survey. Also, you may only receive credit for completing the survey once.

Note: Before you begin, please note that the data you provide may be collected and used by Amazon as per its privacy agreement. Amazon Mechanical Turk and Qualtrics have specific privacy policies of their own. You should be aware that these web services may be able to link your responses to your ID in ways that are not bound by this consent form and the data confidentiality procedures used in this study. If you have concerns, you should consult these services directly.

Compensation: For successful completion of the survey, you will be awarded $0.75.

Risks: There are no known risks involved in participating in this study other than those encountered in day-to-day life.

Voluntary Participation: Please understand that your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may stop the survey at any time without penalty or loss of benefits.

Questions: If you have any questions about this research project, please feel free to contact Dr. Holli Seitz at HSeitz@comm.msstate.edu.

Please take all the time you need to read through this page and decide whether you would like to participate in this research study.

Would you like to participate?