

SAVING POLAR BEARS IN THE HEARTLAND?
USING FRAMING THEORY TO CREATE REGIONAL
ENVIRONMENTAL COMMUNICATIONS

by

HANNAH LEWMAN

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Despite the overwhelming evidence for anthropogenic (human-caused) climate change, a significant portion of the American public remains unconvinced. This disconnect between scientific certainty and public skepticism calls for communications that help to increase acknowledgment of climate change and support for adaptation strategies. This thesis examines framing theory and regional target audiences as a means of creating more effective environmental communications. A study of 1,000 respondents shows how people from nine different regions of the United States answer questions about climate change after exposure to eight messages that frame climate change in different ways. This study does not reveal many significant changes in attitude after exposure to different frames, nor is there a clear way to frame climate change differently in each region of the United States. What this study does reveal is that the most effective environmental communications are ones that do not threaten the lifestyles and identities of their audiences. This article includes a discussion of best practices for creating communications that balance audiences' two key functions: acquiring information and protecting their identities.

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Introduction

Climate change is real, humans contribute to it, and we are already feeling its effects. 97% of scientists would agree with those statements, according to an audit of 11,944 research papers by actively publishing climate scientists (Cook 6). While the vast majority of scientists agree about what is happening to our planet, only 27% of Americans think the majority of scientists believe climate change is caused by humans (Funk). The disconnect between scientific understanding and public opinion is staggering; just 69% of Americans believe climate change is happening (Marlon). Given the scientific certainty on the topic, the public's skepticism about climate change is in many ways a communications issue between the scientific community and the public.

Ever since John Tyndall's experiment-based account of the greenhouse effect in 1859, scientists have been trying to communicate the dangers of anthropogenic climate change (Hulme 121). Science writers publish high-profile articles about climate change in widely-circulated publications, advertising agencies do pro-bono campaigns for environmental groups, and the Ad Council puts its efforts toward anti-pollution and other sustainability-related campaigns. Communicators and scientists have been trying for decades to persuade the public that climate change is real and adaptation is necessary. These messages have worked for some audiences; the percentage of Americans who worry "a great deal" about climate change has risen from 35% to 45% over the last 27 years. Still, a huge portion of the United States remains unconvinced (Saad). To reach the audiences that still haven't accepted the claims of the scientific community, communicators need strategies for more effective communication. This

thesis will address new messaging strategies and best practices for environmental communications.

One strategy is providing different messages to different audiences, thus showing someone the information they would find most convincing. The way people respond to information about climate change is not just about the words they see on a page, it is about how the information clashes with or validates their cultural identity (Kahan 8). Given that different parts of the United States have distinct regional cultural identities (Woodard 3), one potential strategy for more effectively communicating about climate change is using distinct messages in different regions of the country. Researching which messages resonate most strongly in each region of the country could open the door to powerful regional messaging campaigns. These campaigns could leverage not only regional values, but also locally-relevant imagery and details about the regional effects of climate change.

By analyzing regional cultural differences to create tailored messaging, communicators may be able to more effectively convince the public to accept scientifically-established information about climate change. Changing public attitudes about climate change through communication is an important first step toward getting more Americans in favor of vital mitigation and adaptation policies.

Scope

Because the United States has only five percent of the world's population but emits about 25 percent of the world's greenhouse gases, communicating these issues to American audiences is a particularly high priority (Maibach 2). My thesis focuses on

the United States because of the disproportionate emissions and high levels of climate denial in the US.

Contribution

Social scientists have already researched the potential of highlighting regional *effects* of climate change (Spence 663) to create more pro-environmental attitudes. Given the regional divides in opinions about climate change, my work looks at the potential of leveraging regional *culture* to encourage pro-environmental attitudes. By exploring different ways to frame climate change and mapping which approaches resonate in each region of the country, I have developed a set of recommendations that communicators can use to create regionally relevant messaging.

Research Questions

Research Question One: Which frames are most effective for inspiring pro-environmental behavior in each region of the United States?

Research Question Two: How can these frames be applied to create regionally relevant advertising?

Sub Questions:

1A. What frames are correlated with responses that are statistically significantly different from the responses of people who saw other frames?

1B. What frames are correlated with responses that are statistically significantly different between people of different genders?

1C. What frames are correlated with responses that are statistically significantly different between people of different political ideologies?

- 1D. What frames are correlated with responses that are statistically significantly different between people of different races?
- 1E. What frames are correlated with responses that are statistically significantly different between people of different religions?
- 1F. What frames are correlated with responses that are statistically significantly different between people of different marital statuses?
- 1G. What frames are correlated with responses that are statistically significantly different between people of different income levels?
- 1H. Do any regions have statistically significantly different responses from other regions after exposure to certain frames?
- 1I. Do any regions have statistically significant different responses from other regions, regardless of frame?
- 1J. Are there any frames that are correlated with consistently high or low mean responses across many questions, even if answers to individual questions are not statistically significant?

Literature Review

Introduction

By looking at research on climate communications and analyzing best practices established by the academic world, communicators can develop strategies for creating messages that more effectively shift public opinion. This is important, as even minor wording changes can alter what people take away from a message and how willing they are to act. The following literature addresses framing theory, the established frames of climate change, how messages interact with identity, American cultural identity, and how communicators can tailor messages to different audiences.

Framing Theory

In "Framing: Toward Clarification of a Fractured Paradigm" Professor Robert Entman describes how communicators can use framing theory to change how an audience interprets information. Entman writes, "To frame is to select some aspects of perceived reality and make them more salient in a communicating text" (Entman 52). By highlighting certain facts, communicators can change how people "define problems," "diagnose causes," "make moral judgments" and "suggest remedies" (Entman 52). In the context of climate change, this theory describes how the details of a message can change what audiences perceive as the causes and solutions to the problem, how urgent they think the issue is and who they think is responsible for applying solutions. Framing is particularly important when "used to shape opinions about large-scale phenomena, like climate change, that are beyond an individual's direct experience"(Rademakers and Johnson-Sheehan 8). Because people may not have direct

experience with climate change, or they may not think of their experiences with climate as part of climate change, framing plays a large role in shaping people's understanding of the issue.

Framing Climate Change

When a communicator is trying to show that climate change is real, that humans are a cause and that pro-environmental behavior is important, they must carefully select which details to include and leave out of their messaging. In "Communicating Climate Change: Why Frames Matter for Public Engagement" Professor Matthew Nisbet offers a typology of frames applicable to climate change. These frames break down climate change messages into eight categories, as displayed in Figure 1.

Table 2. Typology of frames applicable to climate change	
Frame	Defines science-related issue as . . .
Social progress	A means of improving quality of life or solving problems; alternative interpretation as a way to be in harmony with nature instead of mastering it.
Economic development and competitiveness	An economic investment; market benefit or risk; or a point of local, national, or global competitiveness.
Morality and ethics	A matter of right or wrong; or of respect or disrespect for limits, thresholds, or boundaries.
Scientific and technical uncertainty	A matter of expert understanding or consensus; a debate over what is known versus unknown; or peer-reviewed, confirmed knowledge versus hype or alarmism.
Pandora's box/Frankenstein's monster/runaway science	A need for precaution or action in face of possible catastrophe and out-of-control consequences; or alternatively as fatalism, where there is no way to avoid the consequences or chosen path.
Public accountability and governance	Research or policy either in the public interest or serving special interests, emphasizing issues of control, transparency, participation, responsiveness, or ownership; or debate over proper use of science and expertise in decisionmaking ("politicization").
Middle way/alternative path	A third way between conflicting or polarized views or options.
Conflict and strategy	A game among elites, such as who is winning or losing the debate; or a battle of personalities or groups (usually a journalist-driven interpretation).

Figure 1

Some of these frames, such as the Scientific Uncertainty frame, are more common in the rhetoric of climate change denialists. For example, a message leverages the Scientific Uncertainty frame when it quotes a climate scientists who is in the 3% of scientists who do not believe that humans cause climate change. Other frames, such as the Morality frame, are popular with climate change believers. Technically, none of these frames inherently support one side of the climate change debate or another. Any one of these frames can be used in climate change activism or climate change denial.

These frames can appear in images, stories, organization mission statements or even in phrase-level framing, such as "creating green jobs" (Nisbet 18). The typology of frames demonstrates the multitude of ways one can communicate climate change.

Framing and Cultural Factors

Getting people to accept the reality of climate change is not as simple as exposing them to messages with scientific information. Audiences are most likely to accept frames that match with and reject frames that clash with their cultural identities (Kahan 8). Kahan explains that "there is no meaningful correlation between belief in human-caused climate change and various measures of science knowledge and reasoning dispositions"(Kahan 11). Belief in climate change "measures 'who one is' rather than 'what one knows'"(Kahan 8). When a person says they believe in climate change, they may be signaling their affiliation with an identity or sociopolitical position more than they are showing their knowledge of climatology. Because audiences must reconcile new information with their identities, it is most effective to present frames that both educate people about climate science and help them fulfill their cultural commitments.

When considering which identity groups tend to reject information about climate change, it is easy to think along party lines. Research shows that on social media, those who live in conservative-leaning states are more likely to talk about climate change as a hoax and those who live in liberal-leaning states are more likely to discuss how to prevent climate change (Jang and Hart). But as Professor Anthony Leiserowitz discusses in "Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values," saying that people of conservative identities are

completely unwilling to acknowledge climate information is both overly-simplistic and inaccurate.

Leiserowitz discusses what factors make someone most likely to consider climate change a high risk issue. Like Kahan, Leiserowitz argues "that simply providing more detailed and accurate information, while important, is not sufficient to generate appropriate public concern for some risks" (Leiserowitz 47). By measuring the values of egalitarianism (the belief that people are equal and deserve equal rights), fatalism (the belief that events are inevitable), hierarchism (the belief in systems of authority and hierarchy) and individualism (the belief in individual action), the study found that "values (egalitarian) were consistently stronger predictors of risk perception and policy preferences than all sociodemographic variables, including political party identification and ideology (liberal-conservative)" (Leiserowitz 63). These findings demonstrate that cultural values are the most important factor in whether or not an individual will accept the reality of climate change. This presents a communication opportunity because it means that demographic factors and political party identification are not insurmountable barriers to getting individuals to understand climate change. By framing scientific information in a way that speaks to an individual's values and identity, communicators may be able to create messaging that reaches those who remain unconvinced about climate change.

Regional Cultures in the United States

Given the mediating role values play between audience and message, tapping into American values in messaging about climate change could be a powerful method of communicating throughout the United States. Unfortunately for communicators, there is

no singular set of American values. As historian Colin Woodard describes in his book *American Nations: A History of the Eleven Rival Regional Cultures of North America*, the United States has many cultural regions with distinct, and at times contradictory, values. As a single message is unlikely to resonate with the entire country, creating regional messaging based on the values of different parts of the United States could be a practical solution. Though not everyone in a region has the exact same values, Woodard argues that because of shared history and deeply ingrained traditions, the residents of a region generally have more values in common with other people in that area than with people in other regions (Woodward 4).

One question that arises when creating regional messaging is whether an individual who moves to a region has the same values as other individuals in that region. Given that 100 million Americans have changed counties in the past decade, this is an important consideration (Bishop and Cushing 5). In *The Big Sort: Why the Clustering of Like-Minded America is Tearing us Apart* author Bill Bishop and sociologist Robert Cushing explain that increased mobility has actually led to more culturally homogenous communities in the United States, as people overwhelmingly move to places that reaffirm their values. The authors explain that regional cultures are actually more likely to reflect the values of the people who live there than ever before. This makes the United States, a country with highly polarized regions (measured by Bishop and Cushing as the percentage of counties with landslide elections), an ideal place to launch regionally-tailored communication campaigns.

Auxiliary Benefits of Regional Framing

Regional messaging campaigns do not just have potential because of the distinct values of each US region. Behavioral science research shows that framing climate change as a local issue can make it seem more important to audiences. Van der Linden, Maibach and Leiserowitz discuss the fact that "most people regard climate change as a nonurgent and psychologically distant risk--spatially, temporally, and socially"(van der Linden, Maibach, Leiserowitz 758). They offer best practices for making people see climate change as an urgent risk, including making climate change seem spatially close, citing experiences, and using social norms. Creating targeted regional communications means messages can discuss places that are nearby, use visual stimuli that the audiences have experience with, and leverage regional cultural norms.

Spence and Pidgeon argue that even though talking about local effects of climate change is not proven to lead audiences to believe risks are serious, speaking about local effects may be more effective in driving action, arguing that local framing can help emphasize "personal benefits which might come from action" (Spence and Pidgeon 663). In this way, regional framing offers an opportunity to both speak to the values of a segmented audience and to drive action.

The Strategic Communications Process

Though this literature on science communication and audience identity is relatively contemporary, strategic communicators in the advertising field have studied the effects of audience interpretation since the 1960s. In 1964, account planner Stephen King revolutionized advertising by positing that what matters most is not what goes into an advertising message, but how the consumer interprets it. King called this method the

“T-Plan.” To this day, advertising agencies account for the audience of a message, and not just the benefits of a brand, when they create messaging. Understanding audience psychographics is at the core of crafting effective advertising campaigns. If advertising professionals have persuaded people to change their beliefs and buying habits using this audience-focused method, it there is a chance that science communicators could do the same.

In his introduction to the T-Plan, King writes, “Most advertising aims to intensify or lessen people’s existing predispositions. It is not trying to drive something new into their brains”(Lannon 14). By finding the frame that most closely works with audiences’ existing predispositions, climate change communicators may be able to persuade people to accept new information about climate change. Instead of trying to reach consumers with frames that are “trying to drive something new into their brains” and do not fit their pre-existing worldviews, communicators can find frames that play on the beliefs people already have. These strategic communications best practices from the advertising field show why it is so important for science communicators to shift the focus from the content of their scientific messages to the beliefs of their audiences.

Measuring Belief

Measuring audience attitudes is not as simple as asking them what they think. This is especially true of a topic as politically-charged and polarizing as climate change. Kahan establishes best practices for measuring audience attitudes about climate change when he suggests phrasings for survey questions that “would likewise ease or eliminate the need to choose between conveying knowledge and expressing identity in the case of test takers culturally predisposed to disbelieve in climate change”(Kahan 22). These

phrasings include asking people whether they “acknowledge” or “understand” information rather than “believe in” it.

Another method is asking people to what extent they think scientists agree on issues, rather than asking respondents what they themselves believe. Utilizing these guidelines in surveys can help communicators measure what their audiences know about climate change. To gain a more accurate picture of audience beliefs, I have used Kahan’s best practices for question writing to craft my audience attitude survey for this study.

Questions and Hypotheses

Based on the existing literature about environmental communications and regional cultural differences, I have developed hypotheses about what I will find when answering my two research questions: "Which frames are most effective for inspiring pro-environmental behavior in each region of the United States?" and "How can these frames be applied to create regionally-relevant advertising?" I predict that in each region, one frame will emerge as a "frontrunner" with a high correlation to pro-environmental attitudes. While I predict that many regions will have different frontrunner frames from other regions, I also expect that some neighboring regions may have the same "top" frames due to shared culture in certain quadrants of the country.

Method

Research Design

This study uses an online experiment to expose study participants to one of eight random climate change frames. Thus, I can assess differences in participants' perceptions of these frames based on their survey responses after exposure to different visual stimuli.

Using Nisbet's eight frames for climate change, I created eight persuasive messages that urge consumers to address climate change. I also created one control statement that has nothing to do with climate change.

Stimuli

The visual stimuli that respondents saw all feature the same stock image of the sky. I selected an image of the sky rather than an image of a forest or another natural setting to avoid stronger identification with the message in regions that have that type of landscape. Each of the stimuli, which appear in Appendix A, incorporates one of the frames that Nisbet has identified for communicating about climate change: the Social Progress frame, the Economic Development frame, the Morality frame, the Scientific Uncertainty frame, the Pandora's Box frame, the Public Accountability frame, the Middle Way frame, and the Conflict and Strategy frame. These messages incorporate language from Nisbet's own descriptions of the frames, which appear in Figure 1. Each respondent saw only one visual stimulus (one of the eight climate change frames or the control frame) for thirty seconds.

Pre-Test

To test whether these statements accurately represent the frame I intended for them to represent, I conducted an initial survey with 50 subjects and see if the subjects could accurately match the statements to the frames they were supposed to represent. I conducted this survey and recruited participants on Mechanical Turk, a labor crowdsourcing platform run by Amazon. Based on the survey settings, anyone on the site who was over the age of 18 and located in the United States was able to take the survey. For all nine messages, the majority of survey respondents correctly matched the message with the frame it was supposed to represent. For any message where fewer than two thirds of respondents correctly matched the message with the frame, I revised the message to more explicitly include language from Nisbet's frame descriptions. For example, the Middle Way frame originally read "Americans from all parts of the political spectrum should work together to find ways that work for everyone to keep our planet healthy," but was revised to "Americans from all parts of the political spectrum should find middle ground and ways to work together for solutions that keep our planet healthy." The messages that I updated to more directly match Nisbet's frame descriptions were the Social Progress, Scientific Uncertainty, Middle Way, and Conflict and Strategy frames. A table of all original messages and their revisions appears in Appendix A.

Data Collection

I recruited a total of 1,000 workers from Amazon's online crowdsourcing platform, Mechanical Turk, to test messages on a national scale. I posted the survey at a time when respondents from across the country would be online to guarantee subjects

from every region saw each message. In addition to geographic diversity, Mechanical Turk provides adequate representation of diverse political beliefs, as "liberals and conservatives in our MTurk sample closely mirror the psychological divisions of liberals and conservatives in the mass public"(Clifford, Jewell, and Waggoner 6). Numerous studies demonstrate the validity of samples drawn from Mechanical Turk (see Sheehan and Pittman, 2016, for a summary), but Clifford et al. speak specifically to representation of many different political groups Mechanical Turk samples, which is particularly relevant to research on climate change communications.

For this survey, I recruited people over the age of 18 in the United States. I kept this survey open to any legal adults because these are the people who can legally vote to show their opinions on environmental issues. I recruited a sample of 1,000 respondents because I was measuring the effect of nine messages in nine regions, meaning there were 81 possible conditions. For future research I would like to test messages on more respondents to establish a statistically significant sample size for all 81 conditions, but 1,000 respondents was the maximum possible with available funding.

Procedure

After indicating their consent, respondents answered a question about how important sustainability was to them personally and were then exposed to a random stimulus (see Appendix A for all visual stimuli). After viewing the message for thirty seconds, the respondent answered a set of questions about their attitudes toward climate change and climate change adaptation. These questions were developed in accordance with Kahan's best practices for measuring attitudes about climate change. Each

respondent also answered a set of demographic questions (see Appendix B for all survey questions).

Regions

In the survey, participants self-identified the region where they currently live, the region in which they've spent the majority of their life, and the region where they "are from" by their own definition. There are many ways to segment the regions of the United States, but I selected the map presented in Figure 2 because it most accurately reflects how this research could be applied in a strategic communications campaign. This is the Nielsen Company map of United States regions. Were the findings of this research to be used in a messaging campaign, the media placements would likely be purchased using this regional model, making this the most practical map for communications research. This nine-region model also offers more nuance than a traditional four-region model.

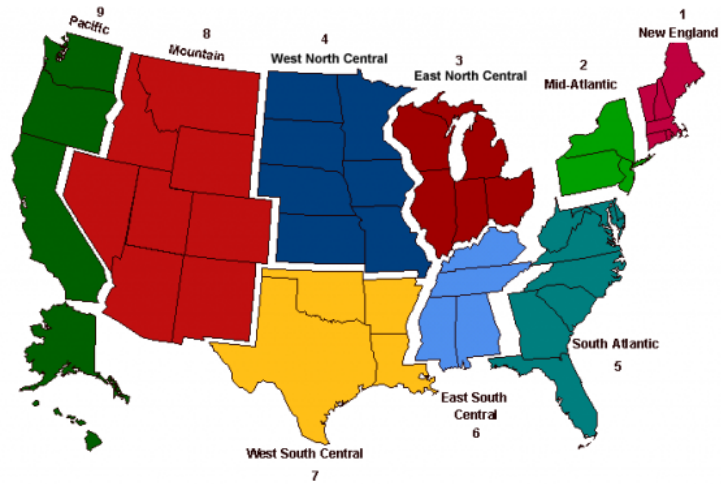


Figure 2

Data Analysis

Before beginning the process of data analysis, I examined the pre-message attitude question to make sure that a certain message group did not have a disproportionate number of respondents that were more or less interested in sustainability to begin with. After checking that there was an even distribution of people with different types of environmental attitudes across messages, I analyzed whether any frames were particularly effective in inspiring pro-environmental attitudes, both in particular regions and on a national scale.

I calculated mean audience attitudes after exposure to the messages by quantifying responses using the following system. For the attitude questions, which were all the post-message questions except the demographic questions, “no risk,” “highly disagree,” “no desire,” “no understanding,” “very unlikely,” and all other “option A” responses were assigned a value of one. All “option B” responses were assigned a value of two, all “option C” responses were assigned a value of three, all

“option D” responses were assigned a value of four, and all “option E” responses were assigned a value of five. This means, for example, that for the question “How likely are you to vote “yes” on legislation to reduce human carbon emissions?” if the mean score for a region was 1.2, region was closer to the “very unlikely” end of the scale than the “very likely” end. I used this system and ANOVA analysis, a method of analyzing variance that tests for statistically significant differences between means, to see which messages were correlated with statistically significantly different attitudes, both on a national scale and in individual regions.

I also analyzed the data to see if there were any other statistically significant correlations between attitudes, messages, and demographic factors. By conducting multivariate ANOVA analyses, I was able to see if demographic factors have significant interactions with certain frames.

Results

Respondent Demographics

The respondent sample from Mechanical Turk does not provide an equal number of respondents from each region of the country, but it does include a minimum of 54 respondents from each of the nine regions. The region with the fewest respondents is the New England region, with 54 respondents, and the region with the most respondents is the South Atlantic region, with 231 respondents.

In terms of a representative gender breakdown, the sample is relatively even, with 49.9% of respondents identifying as women, 49.8% of respondents identifying as men, and the remaining 0.2% of respondents identifying as other genders.

Respondents were also asked to self-identify in terms of race. The proportion of respondents from each racial category (see Appendix B, Question 16 for categories) were within 5% of the Census-estimated national averages for each category, with the exception of Hispanic or Latino respondents. In this survey sample, 5.9% of respondents identified as Hispanic or Latino, and the Census Bureau estimates that the current US population is 17.8% Hispanic or Latino (“U.S. Census Bureau QuickFacts: United States”). It is also important to note that the categories in this survey are slightly different than the categories on the US Census, which may account for some differences in numbers. The U.S. Census does not include an “other” category or a Middle Eastern or North African category, which the survey for this study does.

Though I posted this survey on Mechanical Turk without the phrases “environment” or “climate change” in the survey title to avoid self-selection and an liberal-leaning respondent sample, the sample ended up containing more liberal respondents than an average random sample of U.S. adults. A 2017 Gallup Poll shows that 36% of U.S. adults identify as conservative, 34% identify as moderate, and 25% identify as liberal (Gallup Inc). In the sample for this study, 27.3% of respondents identify as somewhat or very conservative, 25.1% identify as moderate, and 47.5% identify as somewhat or very liberal.

The religious affiliations of this respondent sample also deviate from average national religious affiliations. The proportion of Catholic and non-Christian religious people in this sample are both within 5% of the national averages, but non-Catholic Christian people are underrepresented in this study and Unaffiliated / Atheist / Agnostic people are overrepresented. Nationally, 70.6% of people identify as Christian and 22.8% of people identify as “unaffiliated” with a religion (Wormald). In my sample, 31.2% of people identify as Christian and 41.7% of people identify as “unaffiliated.” This may skew results, as religion can reflect larger socio-political positions that respondents wish to affiliate with.

The marital status of this respondent sample also has some deviations from the national averages of married, single, and divorced or widowed people. Nationally, 52.4% of people are married, 32% are single, and 15.59% are divorced or widowed (“Marital Status of the U.S. Population 2017, by Sex”). In the sample for this study, 41.3% are married, 34.5% are single, and 9% are widowed or divorced. These differences may also be because these respondents were over the age of 18, and that

national data set is for people over the age of 15. Another explanation for differences is the fact that this survey had a category for “living with a partner” that does not exist in the dataset for the entire nation.

In terms of income, households making below \$24,900 and above \$100,000 are underrepresented in this sample and people within that range are overrepresented. Nationally, 55.1% of households make between \$25,000 and \$99,999 but in my sample 71% of respondents have household incomes in this range (Vo).

National Data

To begin my analysis of survey results on a national scale and check whether there was an even distribution of the nine messages across people with different levels of pro-environmental sentiment, I tested for correlation between responses to the question “How important is environmental sustainability to you?” and the nine messages. There was no statistically significant correlation, meaning each message had a comparable number of respondents with each type of attitude, ranging from “not at all important” to “extremely important.” Knowing that a comparable sample of respondents saw each message, I was then able to analyze responses to the survey questions after exposure to each of the nine messages. I analyzed the data to see whether exposure to certain messages was correlated with responses that were statistically significantly different than the responses of those exposed to other messages.

Research Question 1A: What frames are correlated with responses that are statistically significantly different from the responses of people who saw other frames?

I conducted a one-way ANOVA analysis to see if there was any correlation between mean response and which message the respondent had seen. The five possible responses to each question were assigned a score from one through five, with “not at all likely” or “highly disagree” equivalent to one and “highly likely” or “highly agree” equivalent to five. This means all mean attitudes are on a scale of one through five, with a score closer to five showing a higher level of agreement. For this analysis, the message was the independent variable and the mean response to each question was the dependent variable, and mean difference was significant at the 0.05 level. This ANOVA test revealed that the only question where there was a statistically significant difference in means between groups that saw different messages was “To what extent do you think scientists agree about the causes of climate change?” ANOVA values for this question appear in Appendix C, Table 1.

To see which frames were correlated with a statistically significantly different response, I conducted a Post Hoc LSD test. Results for the Post Hoc analysis of this message appear in Appendix C, Table 2. For the question “To what extent do you think scientists agree about the causes of climate change?” people who saw the Scientific Uncertainty, Conflict and Strategy frame, and Control frame (in descending order of mean response), had mean responses that were statistically significantly greater than the mean response of people who saw the Economic Development frame. People who saw the Scientific Uncertainty frame also had a mean response that was statistically

significantly greater than the mean response of people who saw the Social Progress frame.

It makes sense that this is a question where groups that saw different messages had statistically significantly different responses, as it is a question that does not ask people about their own beliefs. Because this question asks respondents about the beliefs of other people, in this case scientists, respondents don't have to balance out the two roles that Kahan identified: knowledge gatherer and identity protector (Kahan 8). Respondents can answer this question in a way that both incorporates information from a message they just saw without challenging their own identity, unlike questions which ask people how much risk they believe climate change poses or whether they would like to take certain actions. In fact, respondents who saw the frame directly related to this question, the Scientific Uncertainty frame, had the highest mean response. It is important to note that just because exposure to this frame is correlated with a statistically significant response does not mean that this frame causes people to believe in climate change or agree with the scientists themselves. A respondent could answer "scientists mostly agree" while believing that scientists think this way because of hidden agendas or bad methodology. In this way, people are able to gather knowledge and acknowledge the message they just saw while still protecting their own identities.

Research Question 1B: What frames are correlated with responses that are statistically significantly different between people of different genders?

I also wanted to see if there were any interactions between frames and demographics on a national scale. To do so, I conducted two-way multivariate ANOVA analyses tests. My first test was on the interaction between gender and frame. The

multivariate test revealed no statistically significant overall interaction between gender and frame across questions, but a test of between-subjects effects revealed a statistically significant interaction between gender and frame in responses to the questions “To what degree do you agree the federal government should spend money to reduce the effects of climate change?” and “How likely are you to vote ‘yes’ on legislation to reduce carbon emissions?” (Appendix C, Table 3). A Tukey HSD Post Hoc test revealed which frame had a statistically significantly different mean response to these two questions. For the question “To what degree do you agree the federal government should spend money to reduce the effects of climate change?” women who saw the Morality frame and Scientific Uncertainty frame had a statistically significantly higher mean response than men who were exposed to the same frames, meaning women who saw these frames were much more likely than men to "highly agree" with the statement (Appendix C, Table 4).

Women who saw the Morality and Scientific Uncertainty frames also had statistically significantly higher mean responses to the question “How likely are you to vote ‘yes’ on legislation to reduce carbon emissions?” than men who saw the same frames (Appendix C, Table 4). For this question, a higher mean score means a mean response closer to "highly likely." It is important to note that men did have higher mean responses than women after exposure to some frames, but these were the two frames where the differences in responses between genders was statistically significant.

While there is no clear reason why the Morality and Scientific Uncertainty frames had a significant interaction with gender on these two questions, these results do indicate that there is a possibility for strategic messaging to be more effective on

women, at least in inspiring the actions listed in these questions: supporting federal spending on climate change mitigation and voting to reduce carbon emissions. One reason for this frame and gender interaction is that perhaps the Scientific Uncertainty message and the Morality message were less of an affront on the identities of women than on the identities of men. As Kahan writes, people are more likely to reject information if it clashes with who they perceive themselves to be (Kahan 8). Perhaps these frames fit into these women's understandings of who they were, so the information presented in the messages allowed women to change their attitudes. The Morality frame in particular talks about preserving for planet for future generations, something that may resonate with women socialized to be mothers and caretakers. Men may have felt these frames clashed with their identities, and protecting their identities closely meant that they could not change their attitudes based on the information in the messages.

Research Question 1C: What frames are correlated with responses that are statistically significantly different between people of different political ideologies?

The next test was on interactions between frames and political ideology. A multivariate test showed there was an overall statistically significant effect between political ideology and frame (Appendix C, Table 5). A test of between-subjects effects revealed a statistically significant interaction between political ideology and frame in responses to the question "To what extent do you understand what humans could do to reduce the effects of climate change?" (Appendix C, Table 6). All mean responses to this question are on a scale of one through five, with a score closer to five showing a high level of understanding and a score closer to one showing a low level of

understanding. Certain frame groups had statistically significantly different responses between people who self-identified as conservative, moderate, and liberal. "Very liberal" people who saw the Social Progress frame, Middle Way frame, Public Accountability frame, and Morality frame had mean responses that were statistically significantly higher than the responses of "very conservative" people who saw the same frames (Appendix C, Table 7). The most dramatic difference in attitudes between very liberal and very conservative people was the mean difference in attitudes of people who saw the Morality frame.

Frames that are statistically significant among liberals all include value judgments about what is right and what is wrong in terms of environmental action. The Social Progress frame contains the phrase "healthier and there would be progress," the Morality frame calls pollution "morally wrong," the Public Accountability frame says the government "should be held accountable," and the Middle Way frame says people "should find middle ground" to "keep our planet healthy." These messages all contain suggestions about what is right, as opposed to the Scientific Uncertainty or Economic Development frames, which use logical appeals instead of ethical ones. It makes sense that messages that position one side of the climate change debate as right and virtuous, using ill-defined terms like "healthy" and "progress" could be polarizing. It also makes sense that those who feel these messages validate their existing beliefs would have statistically significantly high levels of agreement and those that feel judged by these messages would have statistically significantly low levels of agreement. This once again corroborates Kahan's research on how people reject messages that threaten their cultural identities (Kahan 8).

Research Questions 1D-1G: Framing and race, religion, marital status, and income level.

I also conducted rounds of two-way multivariate ANOVA tests to see if there were any significant interactions between frames and four factors of race, religion, marital status, and income. For all four of these factors, initial multivariate tests revealed no statistically significant interaction between the demographic factor and which frame respondents saw. Subsequent between-subjects effects also did not show any statistically significant correlations between responses and the interaction of frames and these factors.

Research Question 1H: Do any regions have statistically significantly different responses from other regions after exposure to certain frames?

By conducting a two-way multivariate ANOVA analysis, I looked to see if exposure to certain frames had statistically significant correlation with mean responses to the survey questions in certain regions. This MANOVA analysis revealed no statistically significant interaction between region and frame. Subsequent tests of between-subjects effects also showed no significant interaction between region and frame in the mean responses to any single question. This analysis shows that on a national scale, there is no single frame per region that is correlated with significant responses to all questions.

Research Question II: Do any regions have statistically significant different responses from other regions, regardless of frame?

To examine regional differences, I conducted an ANOVA analysis with region as the independent factor and responses to survey questions as the dependent factor. The analysis revealed that different regions had statistically significant mean responses to the following questions: “To what degree do you agree that these extreme weather events are part of typical weather patterns,” “To what extent do you have a desire to take action to address climate change?” “To what degree do you agree the federal government should spend money to reduce the effects of climate change?” and “How likely are you to vote ‘yes’ on legislation to reduce carbon emissions?”(Appendix C, Table 8).

Subsequent Post-Hoc LSD tests reveal which regions account for the statistically significant differences in mean response to those questions (Appendix C, Table 9). For the question “To what degree do you agree that these extreme weather events are part of typical weather patterns,” people currently living in the East South Central, West South Central, and Mountain regions had statistically significantly higher agreement with the statement than people in the East North Central region. People living in the East South Central, West South Central, and Mountain regions also had statistically significantly higher agreement with the statement than people living in the Pacific region. People living in the West South Central region had statistically significantly higher agreement with the statement than people living in either the Mid-Atlantic or South Atlantic regions.

A few patterns emerge in the mean responses of regions in response to the question “To what extent do you have a desire to take action to address climate change?” People in the Mid-Atlantic region expressed a statistically significantly greater desire to take action than people currently living in the East South Central, West South Central, and Mountain regions. People currently living in the East North Central, South Atlantic, and Pacific regions also expressed a statistically significantly greater desire to take action than people living in the Mountain region.

The Post-Hoc LSD test showed similar regional divides in the mean differences in answers to the question “To what degree do you agree the federal government should spend money to reduce the effects of climate change?” People in the Mid-Atlantic and East North Central regions showed statistically significantly greater agreement with the statement than respondents in the West South Central region. People in the Mid-Atlantic, East North Central, West North Central, South Atlantic, and Pacific regions also showed statistically significantly greater agreement than people in the Mountain region.

In response to the question “How likely are you to vote ‘yes’ on legislation to reduce carbon emissions?” people currently living in the Mid-Atlantic region indicated that on average they were statistically significantly more likely to vote yes than respondents living in the South Atlantic, East South Central, West South Central, and Mountain regions. People living in the East North Central, South Atlantic, and Pacific regions were also indicated that they were statistically significantly more likely to vote yes on legislation to reduce carbon emissions than people currently living in the Mountain region.

Even for questions that did not have a statistically significant difference in mean responses between regions, looking at mean responses to all questions provides a picture of the regional differences in environmental attitudes (see Figure 3).

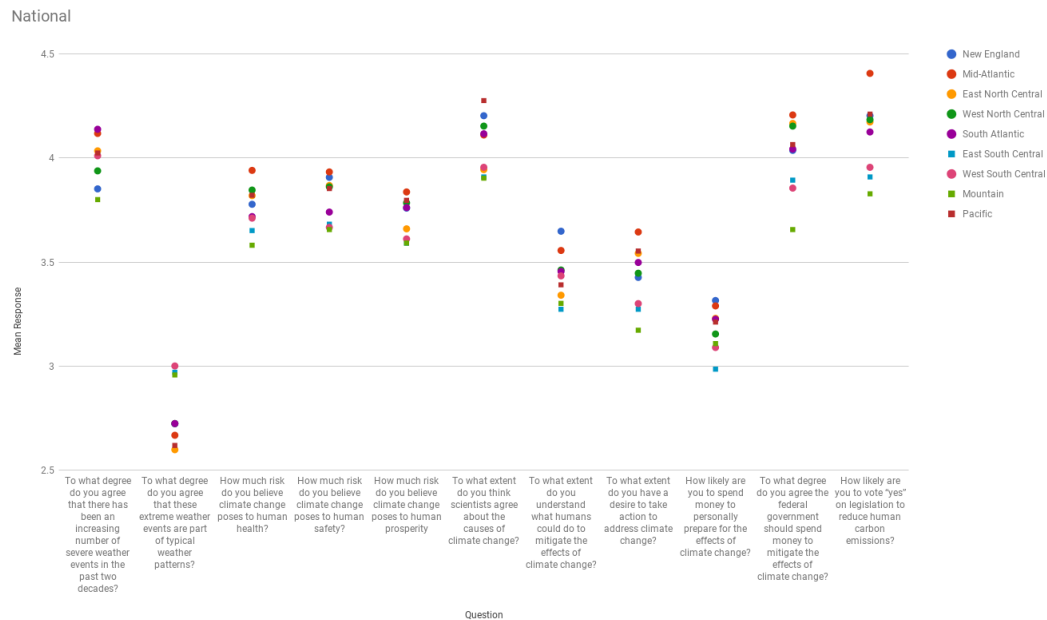


Figure 3

This scatter plot of mean responses to each question by region provides insight into how different regions view climate change and adaptation strategies. It also highlights patterns, showing that regions that generally believe climate change is a high risk to human health, safety, and prosperity tend to be the biggest proponents of actions to mitigate and prevent climate change.

Research Question Two: How can these frames be applied to create regionally-relevant advertising?

What this national data analysis shows is that while assigning a single frame to each region is not guaranteed to be effective, concentrating communications on certain

regions could be. Identifying and focusing on areas with low concern about climate change could allow communicators to more effectively use their resources. This strategy can also be paired with the insights about the interaction of political ideology and framing. When people feel like messages shame or belittle their current beliefs about climate change, they are more likely to ignore the message. Therefore, communications concentrated in regions with low levels of belief in climate change should avoid frames that clash with the cultural identities of the people in the region.

Regional Data

While the previous section concerns trends from subjects across the entire United States, this section looks at the data from each region individually. The survey asked people where they currently live, where they have spent the majority of their lives, and where they “are from” from their perspective. Because a communications campaign running on regional channels and in regional publications would reach people where they currently live, I have chosen to analyze the data based on this first question.

New England

Working with a dataset of responses from people who currently live in the New England region, I tested for correlation between responses to the question “How important is environmental sustainability to you?” and mean responses to the nine messages. There was no statistically significant correlation, meaning each message had a comparable number of respondents who found environmental sustainability extremely important, not at all important, and all attitudes in between. By conducting a one-way ANOVA analysis with frame as the independent factor and the mean response to each

question as dependent factors, I found that there were no statistically significant differences in means between groups that saw different messages.

Though there were no statistically significant differences between people who saw different messages, there is value in looking at the distribution of mean responses to all questions after exposure to different frames.

Figure 4

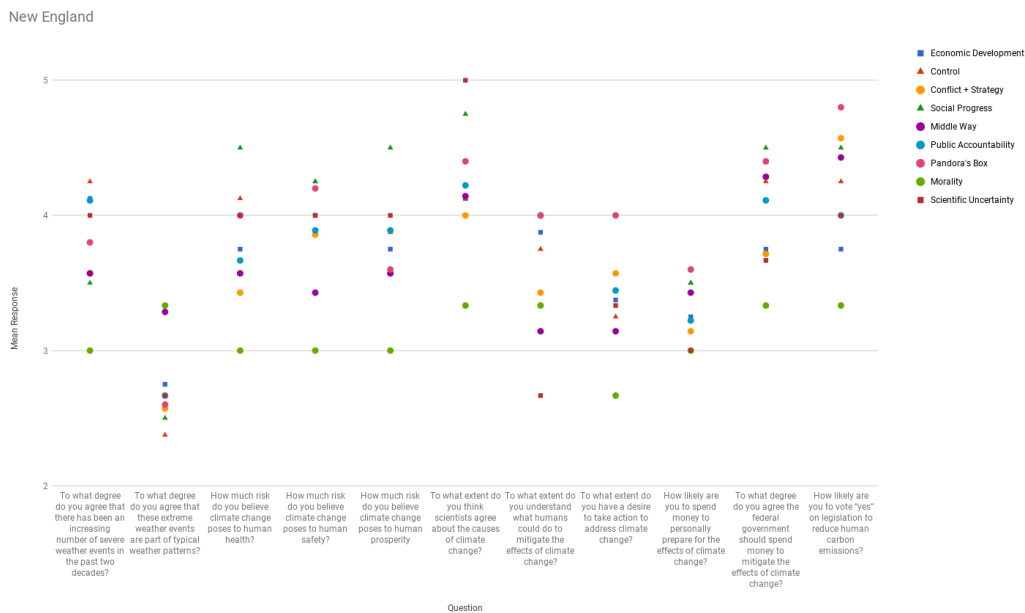


Figure 4 shows the mean responses to each question of different frame groups. The scatter plot shows that those who saw the Social Progress frame had the strongest pro-environmental attitudes, defined as concern about climate change and desire to take action, on four out of the 11 questions. The message for the Social Progress frame mentions taking fewer natural resources from the planet in order to create a healthier society. Given that none of the states in the North East region produce any crude oil, natural gas, or coal, people who saw that message may have been reminded of how

sustainable their region is and answered the survey in a way that represented this eco-friendly regional identity (“State Energy Profile Overview”). Unlike those from regions that have economies that rely heavily on the production of oil, gas, and coal, people from this region may not see the Social Progress message as a threat to their lifestyles and identities.

Those who saw the Pandora’s Box frame also had the strongest pro-environmental attitudes on four out of 11 questions. This may be because this message talks about extreme weather and this region has experienced ten severe weather events that caused over a billion dollars of damage each in the past ten years alone (“Billion-Dollar Weather and Climate Disasters: Table of Events”). Because severe weather events are such a relatable and relevant climate risk for people in this region, this message may have inspired people to respond more pro-environmentally.

Respondents who saw the Morality frame had the weakest environmental attitudes (greater disagreement with scientific consensus about climate change and less desire to take action to address environmental issues) on nine out of the 11 questions. This region's low levels of religious belief could explain why a message that describes environmentalism as a moral issue was so un motivating to these respondents. A Pew Research Center study by Lipka and Wormald looked at four key metrics to rank states by religiosity: what percent of people in the state said religion is very important in their lives, what percent of people in the state say they attend worship services at least weekly, what percent of people in the state say they pray daily, and what percent of people in the state say they believe in God with absolute certainty. These combined factors create an overall index for religiosity. All states in the New England region are

among the 15 least religious states in the US, including the five least religious states overall (Lipka and Wormald). Perhaps judgments about moral rights and wrongs strike people in this region the wrong way, and are therefore not the most compelling reason to behave pro-environmentally. Though these results are not statistically significant, the overall trends in responses provide insight into what types of messages might be motivating to people in the New England region.

Mid-Atlantic

Working with a dataset of responses from people who currently live in the Mid-Atlantic region, I tested for correlation between responses to the question “How important is environmental sustainability to you?” and the nine messages. There was no statistically significant correlation. By conducting a one-way ANOVA analysis to test for variance in mean responses to survey questions after exposure to different frames, I found that there were statistically significant differences in means between groups that saw different messages. Mean responses to all questions from the Mid-Atlantic region appear in Figure 5.

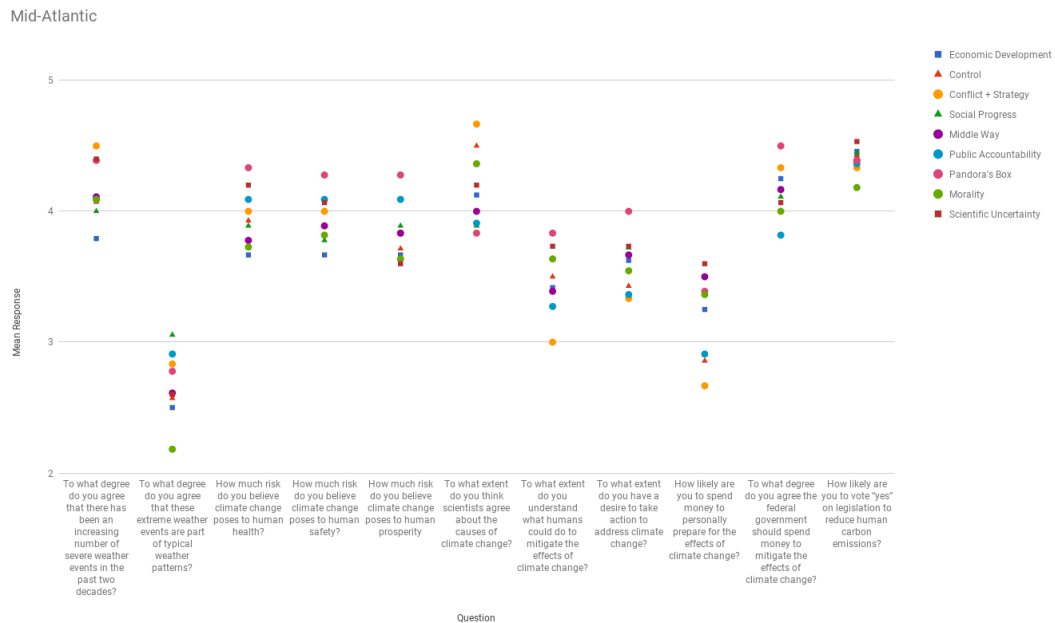


Figure 5

As the scatter plot in Figure 5 shows, the Mid-Atlantic region had a “top” frame in terms of correlation with pro-environmental attitudes (greater agreement with scientific consensus and higher desire to take action on environmental issues). For this region, the Pandora’s Box frame emerged as the frontrunner, with respondents who saw this frame answering the most pro-environmentally of any frame group on six out of 11 questions. This may be because this region has experienced 28 billion-dollar weather events in the past decade, so after seeing a message about the damage that climate change can cause, respondents answered questions while thinking of climate change as a serious threat (“Billion-Dollar Weather and Climate Disasters: Table of Events”).

In contrast, the Mid-Atlantic region had a less clearly defined “bottom” frame, in terms of correlation with anti-environmental attitudes, defined as disagreement with scientific consensus and low desire to take action on environmental issues. Respondents who saw the Economic Development frame had the most anti-environmental attitudes

on three out of 11 questions. This may be because this frame mentions wind power and two of the three states in this region, New York and Pennsylvania, produce non-renewable energy, include crude oil, natural gas, and coal gas (“State Energy Profile Overview”). Because these resources are important to the economy of this region, people who saw the Economic Development frame may have been less likely to answer pro-environmentally because they worried that actions to reduce climate change, like switching to wind power, will threaten their region's economy. People who saw the Morality frame had the most or second most anti-environmental attitudes on four out of 11 questions. This may be because the states in this region have relatively low levels of religious belief (New York is the 43rd most religious state in the country, Pennsylvania is the 27th most religious state, and New Jersey is the 19th most religious state) so this type of moral rhetoric may not be a compelling reason for people in this region to behave more sustainably (Lipka and Wormald). Once again, these results are not statistically significant, but taken as a whole across survey questions, these top and bottom frames reveal insights about the culture of the region.

East North Central

Working with a dataset of responses from people who currently live in the East North Central region, I tested for correlation between responses to the pre-test question “How important is environmental sustainability to you?” and the nine messages. There was no statistically significant correlation. By conducting a one-way ANOVA analysis with frame as the independent factor and the mean response to each question as dependent variables, I found that there was a statistically significant difference in mean responses between groups that saw different messages for the question "To what extent

do you have a desire to take action to address climate change?" (Appendix C, Table 10). I then ran a post-hoc LSD test to discover which specific frames were correlated with statistically significant differences in mean responses (Appendix C, Table 11). For this question, a response of one indicates "No desire" and a response of five indicates "Extremely high desire." Respondents who saw the Economic Development frame had a mean response to this question that was statistically significantly lower than the mean response of people who saw the Control frame, the Conflict and Strategy frame, the Middle Way frame, and the Pandora's Box frame. Respondents who saw the Pandora's Box frame also had a mean response to this question that was statistically significantly higher than the mean response of people who saw the Public Accountability frame and the Morality frame.

One reason that the Pandora's Box frame is correlated with such strong pro-environmental attitudes in this region could be because this frame focuses on the possibility of an increasing number of severe weather events, something the East North Central region has a plethora of recent experiences with. In the last ten years, the East North Central region has experienced forty weather events that caused over a billion dollars in damage each ("Billion-Dollar Weather and Climate Disasters: Table of Events"). Because this region has so many recent experiences with severe weather events, this frame may make climate change seem particularly threatening, in turn inspiring an increased desire to take action.

In contrast, respondents who saw the Economic Development had statistically significantly less desire to take action to address climate change than those who saw the Control, Conflict and Strategy, Middle Way, and Pandora's Box frames. One potential

cause of these significantly low means is the fact that the message for the Economic Development frame specifically mentions green energy, which could be seen as a threat to the non-renewable energy industries in the East North Central region. Michigan is the 13th biggest producer of electricity in the nation and produces coal, natural gas, and crude oil; Illinois is the ninth biggest producer of energy in the nation and the fourth biggest producer of coal; Indiana is the eight biggest producer of coal in the nation; and Ohio is the 7th biggest producer of natural gas (“State Energy Profile Overview”). The Economic Development frame could actually de-incentivize taking action to address climate change because green energy could be seen as a threat to the energy industries in the region.

For the majority of survey questions, there were no statistically significant differences in responses among people who saw different messages. There are, however, some interesting patterns in the scatter plot showing the mean responses of each frame group in the East North Central region (Figure 6).

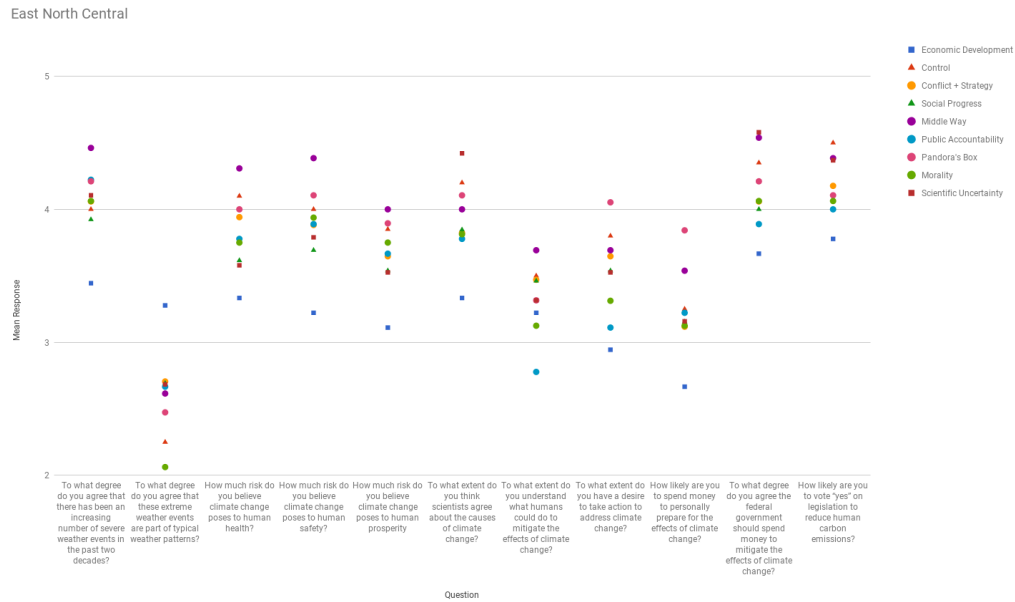


Figure 6

The scatter plot in Figure 6 shows that the group of respondents who saw the Middle Way frame had the greatest or second greatest most environmental responses of any group on seven out of 11 questions. In contrast, respondents who saw the Economic Development frame had the least environmental mean response of any frame group on ten out of 11 questions. As discussed, this may be because respondents see the message for the Economic Development frame as a threat to local industries. With the exception of the question “To what extent do you have a desire to take action to address climate change?” no individual question has statistically significant differences between groups that saw different messages. Taken altogether, though, this scatter plot paints a picture of which frames may have the power to evoke pro-environmental and anti-environmental sentiment.

West North Central

Working with a dataset of responses from people who currently live in the West North Central region, I first tested for correlation between responses to the question “How important is environmental sustainability to you?” and which frame respondents saw. There was no statistically significant correlation, meaning each message had a comparable number of respondents with different environmental attitudes. By conducting a one-way ANOVA analysis with frame as the independent factor and the mean response to each question as dependent variables, I found that there were no statistically significant differences in means between groups that saw different messages. Though no individual question had a statistically significant different mean response between groups that saw different messages, certain frame groups had consistently high or low mean responses.

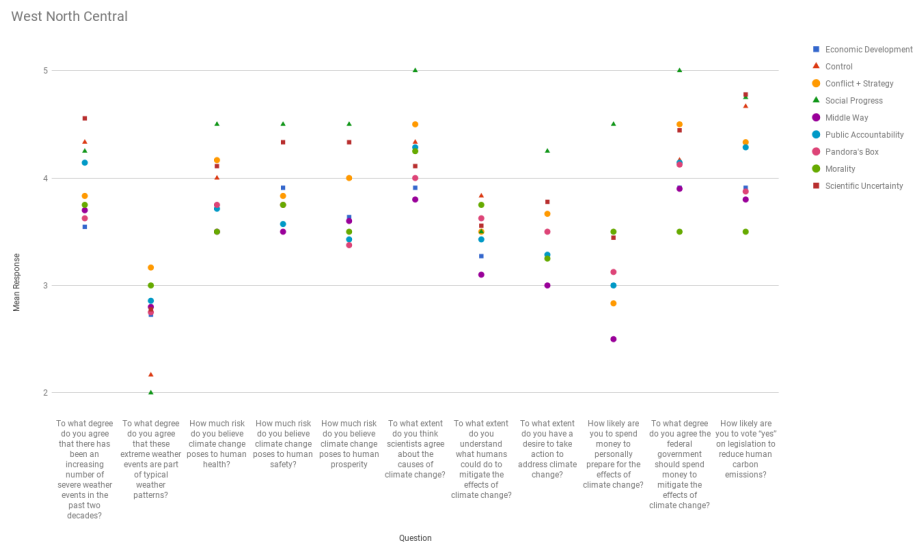


Figure 7

As Figure 7 shows, respondents who saw the Social Progress frame had the most pro-environmental mean response on eight out of the 11 survey questions. This is

surprising, because the message for the Social Progress frame mentions creating a better society by taking fewer resources from the planet, and five of the seven states in the West North Central region produce oil, gas, coal, or all three (“State Energy Profile Overview”). It seems that a region that relies on non-renewable resources would express anti-environmental sentiments after reading a message about using fewer resources to create a better society. That is what happened in other regions with strong fossil fuel economies, so it is unclear why that trend did not continue in the West North Central region.

In contrast, respondents who saw the Middle Way frame had the least or second least pro-environmental attitudes on seven out of the 11 questions. This may be because this region experiences above-average levels of climate change denialism (Marlon), and for people who identify as climate change deniers, the Middle Way frame is a reminder that the climate change is a "battle." As Kahan shows, people must balance the desire to acquire new knowledge with the desire to protect their identities, so they will reject information if it is at odds with their identities (Kahan 8). The Middle Way frame may put respondents who identify as climate change deniers into a mode of identity protection in which they don't want to make any concessions to climate change believers.

South Atlantic

Working with the data of people who currently live in the South Atlantic region, I first conducted a pre-test to ensure that no frame had a significant number of respondents with extremely pro-environmental or anti-environmental attitudes. I did so by testing for correlation between responses to the question “How important is

environmental sustainability to you?” and which message people saw. There was no statistically significant correlation. By conducting a one-way ANOVA analysis with frame as the independent factor and the mean response to each question as dependent variables, I found that there was a statistically significant difference in mean responses between groups that saw different frames for the question "To what degree do you agree that these extreme weather events are part of typical weather patterns?" (Appendix C, Table 12). To see which frames had statistically significant differences in means, I ran a post-hoc LSD test (Appendix C, Table 13). For this question, a response of one indicates "Highly disagree" and a response of five indicates "Highly agree." Respondents who saw the Pandora's Box frame or Middle Way frame had mean responses that were statistically significantly higher than the mean response of people who saw the Economic Development frame. Respondents who saw the Middle Way frame also had a mean response to this question that was statistically significantly higher than the mean responses of people who saw the Control frame, Conflict and Strategy frame, Social Progress frame, Public Accountability frame, Morality frame, and Scientific Uncertainty frame.

One possible reason that respondents who saw the Pandora’s Box frame had such significant levels of agreement with this statement is that over the past ten years the states of the South Atlantic region (Florida, Georgia, South Carolina, North Carolina, Virginia, West Virginia, Maryland, and Delaware), have experienced 46 weather events that caused over a billion dollars in damage each (“Billion-Dollar Weather and Climate Disasters: Table of Events”). It is possible that because there have been so many severe weather events in this region, people who live there think that

these extreme weather events are part of typical weather patterns. Perhaps the Pandora's Box message about living more sustainably to avoid a massive number of severe weather events was not motivating because residents of the region believe these weather events are normal, and do not want to acknowledge that they are linked to anthropogenic climate change because they do not want to accept a message that says consuming fewer resources could help prevent more catastrophic weather events. However, this does not explain why the Pandora's Box frame had essentially the opposite correlation in the East North Central region, where respondents who saw the Pandora's Box frame showed a stronger desire to take action to address climate change.

The other group that had statistically significant levels of agreement with the question is the group that saw the Middle Way frame. This is interesting because in many ways the South Atlantic region holds middle-ground beliefs on climate change. Compared to the national average percentage of "adults who think global warming is happening," Florida has an average level of belief that is 1% higher than the national average, Georgia has an average level of belief that is 1% lower than the national average, South Carolina has an average level of belief that is 2% lower than the national average, North Carolina has an average level of belief that is the same as the national average, Virginia has an average level of belief that is 2% above the national average, West Virginia has an average level of belief that is 8% below the national average, Maryland has an average level of belief that is 6% below the national average, and Delaware has an average level of belief that is 2% above the national average (Marlon). With the exceptions of West Virginia and Maryland, most states in this region have nearly average levels of belief in global warming. In the Mechanical Turk survey

responses from this study, the mean response from the South Atlantic region fell in the middle on almost every question compared to responses from other states (Figure 3).

One first glance, these results make it seem that the South Atlantic region is relatively moderate. Analysis of the 2016 Presidential election results from this region show otherwise. While five states in this region went to Trump (Florida, Georgia, South Carolina, North Carolina, and West Virginia) and three went to Clinton (Virginia, Maryland, and Delaware), the margins by which nominees won their respective states shows a deep divide in the South Atlantic region. In West Virginia, Trump won by more than 42 points and in South Carolina he won by over 14. In Maryland, Clinton won by over 25 points and in Delaware she won by more than 11 (“Election Results 2016: President Live Map by County, Real-Time Voting Updates”). This is a region of great divides, with polarized states sharing borders but not opinions. Unlike those living in a region comprised of many states that are consistently liberal or conservative, an ideological bubble, people in the South Atlantic region are more likely to be near people they disagree with. The polarization within the region may make it feel like the two sides, climate change believer and climate change denier, cannot be reconciled. So, perhaps after seeing the Middle Ground frame, people on the denier side of the debate remembered the polarization around climate change. And while they might ordinarily have answered that all the extreme weather in the region does seem a little atypical, they decided that they did not want to concede anything to the climate change believers. Drawing attention to the polarization in the region may have prompted people to pick sides and consider their loyalties and identities, rather than answering based on their observations of the world. Those who didn’t see the Middle Ground frame may have

answered this question based on their own experiences with severe weather events, not thinking of this question as a statement about their identity in a much larger debate.

The rest of the questions showed no statistically significant differences in responses among people who saw different messages. While no other individual question has statistically significant results, there are trends in the mean response to each question of different frame groups (Figure 8).

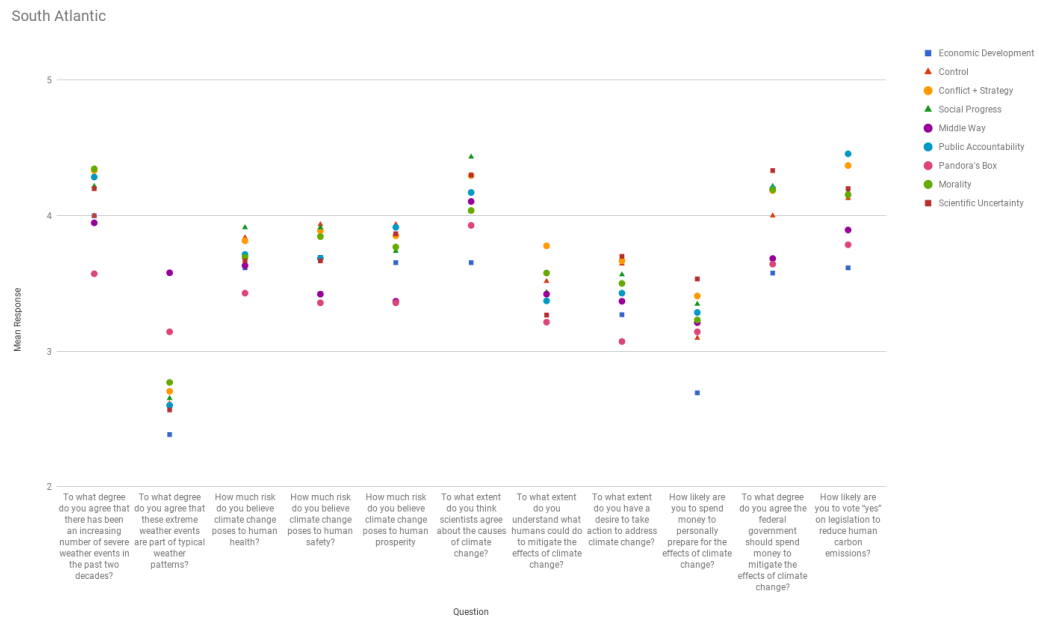


Figure 8

As the scatter plot in Figure 8 shows, people who saw the Pandora’s Box frame had the lowest or second lowest acknowledgment of climate change and desire to take action to address climate change on 10 out of the 11 survey questions. One potential reason for such a strong trend is that the message for this frame specifically mentions using fewer natural resources, something that could be seen as threatening to the non-renewable energy economies, particularly coal, in this region (“State Energy Profile Overview”). People who saw the Middle Way frame had the lowest or second lowest

acknowledgment of climate change and desire to take action on four out of the 11 survey questions. As previously discussed in the analysis for the question “To what degree do you agree that these extreme weather events are part of typical weather patterns?” this could be because the Middle Way frame reminds people that there are sides in the climate debate, motivating people to answer in a way that prioritizes identity protection over acknowledgment of information. In contrast, people who saw the Scientific Uncertainty frame showed the greatest acknowledgment of climate change and greatest desire to take action on five out of 11 survey questions. This may be because respondents answered these questions while thinking about what scientists believe, and thus ended up incorporating this information about the beliefs of scientists into their own answers.

East South Central

Working with a dataset of responses from people who currently live in the East South Central region, I checked for correlation between responses to the question “How important is environmental sustainability to you?” and which frame respondents saw to determine that there was a suitably even distribution of frames among respondents with different environmental attitudes. By conducting a one-way ANOVA analysis of mean responses to each question after exposure to different frames, I found that there were no statistically significant differences in means between groups that saw different messages. While no individual question had statistically significant differences in means between groups, there are some trends across all questions.

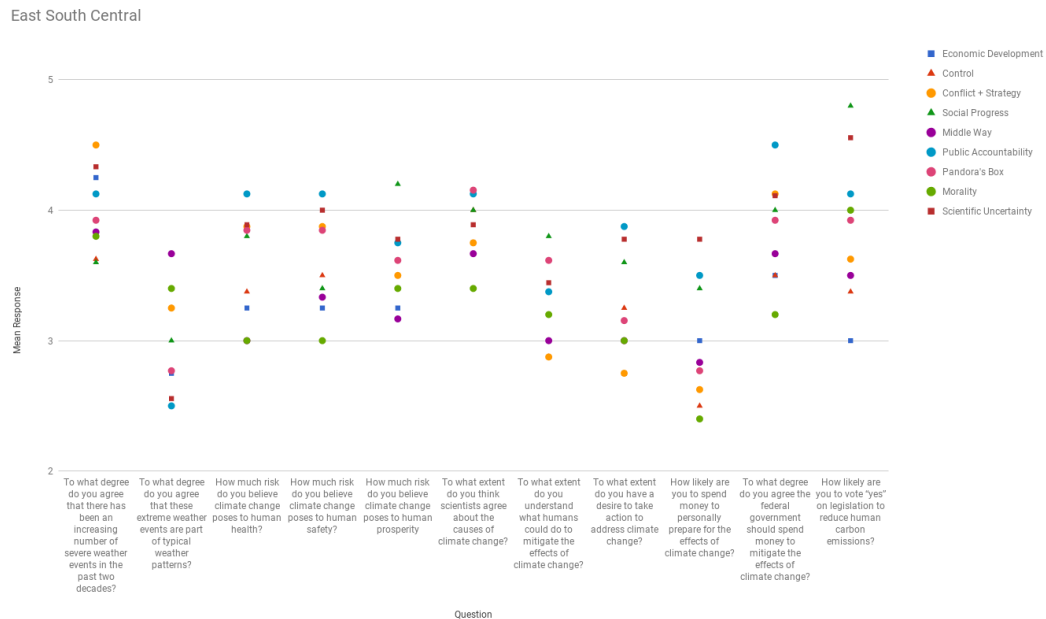


Figure 9

As Figure 9 shows, people who saw the Morality frame had the lowest or second lowest acknowledgment of climate change and desire to take action on seven out of the 11 questions. One potential reason the Morality frame is correlated with such anti-environmental sentiment is because the East South Central has some of the most religious states in the country, and the highly religious people of this region do not take well to being having their beliefs on climate change described as morally wrong. Of the four states in the East South Central region, three of them, Alabama, Mississippi, and Tennessee, are the three most religious states in the United States (Lipka and Wormald). For people who place such importance on a system of religious belief and morality, having their views on climate change described as “morally wrong” by the visual stimulus may have put these respondents into identity defense mode, causing them to answer questions in a way that prioritized defending their cultural identities over acknowledging their knowledge.

In contrast, people who saw the Public Accountability frame had the greatest or second greatest acknowledgment of climate change and desire to take action on seven out of the 11 survey questions. This could be because the message for the Public Accountability frame places blame on the US government, and the East South Central region has above-average levels of anti-government sentiment. This region is deeply conservative, with all four states going to Trump by more than 18 points, and some by nearly 30 points, in the 2016 election (“Election Results 2016: President Live Map by County, Real-Time Voting Updates”). According to Pew Research, Republicans are more likely to be “angry” and “frustrated” with the federal government, with only 9% of Republicans feeling “basically content” with the federal government, compared with 27% of Democrats (Fingerhut). This conservative dissatisfaction with the government could explain why a message blaming the government for messing up environmental policy is correlated with such consistent pro-environmental attitudes in such a conservative region. This frame allows an acknowledgment of climate change without threatening conservative identity because by acknowledging climate issues, conservative respondents are able to express their contempt for the federal government.

West South Central

Working with a dataset of responses from people who currently live in the West South Central region, I first determined there was no correlation between responses to the question “How important is environmental sustainability to you?” and frame. By conducting a one-way ANOVA analysis of mean responses to each question after exposure to different frames, I found that there no statistically significant differences in means between groups that saw different messages. While no individual question had

statistically significant results, there are patterns in which frame groups consistently had the highest and lowest mean results.

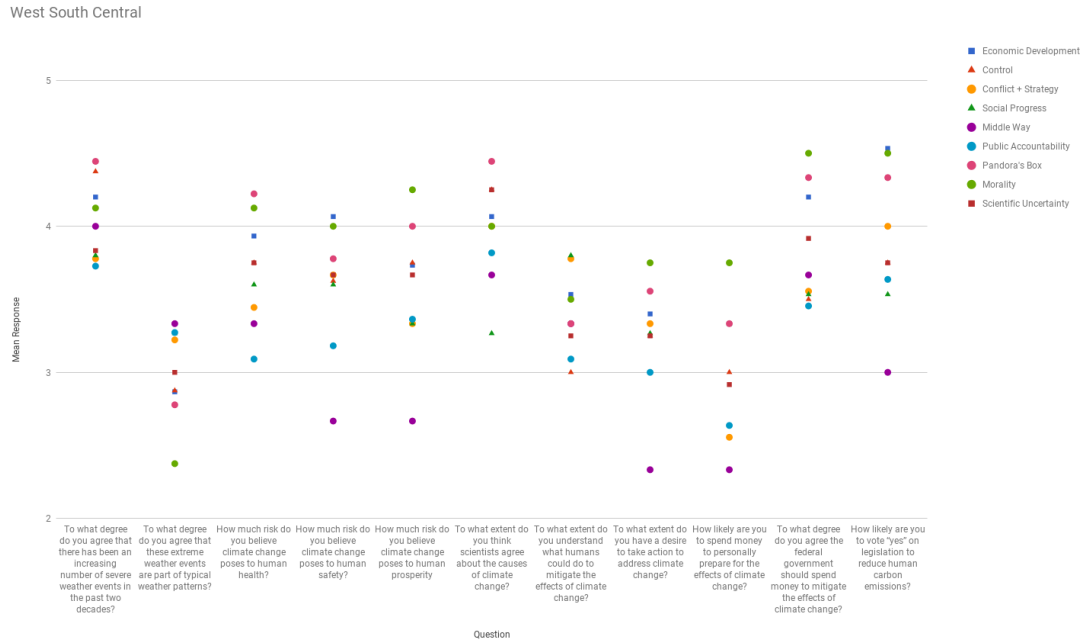


Figure 10

As the scatter plot in Figure 10 shows, respondents who saw the Middle Way frame had the least or second least pro-environmental responses on eight out of the 11 questions, meaning these respondents had the lowest acknowledgment of environmental issues and desire to take action to address them. My analysis of the South Atlantic region, that polarized regions react negatively to the Middle Way frame because these respondents are used to conflict between viewpoints, seems to fall apart here, as the West South Central region is something of an ideological bubble composed of four very conservative (“Election Results 2016: President Live Map by County, Real-Time Voting Updates”) and highly religious states (Lipka and Wormald). What may still be true is that this frame puts respondents into the mindset of identity protection rather than

knowledge acquisition, so after seeing this message respondents answered in a way that represented their identity group, rather than their knowledge on the issue of climate change.

For this region, respondents who saw the Morality frame had the most or second-most pro-environmental responses to eight out of the 11 questions. This is somewhat surprising, as respondents in the neighboring and similarly religious East North Central region had the opposite results. By the logic that the Morality frame offends highly religious people who do not believe in climate change, it seems the respondents from the West North Central region, which contains the fourth and fifth most religious states in the US, would have similarly anti-environmental attitudes after seeing this frame (Lipka and Wormald). While there is no clear explanation for these results, it is important to reiterate that neither the results from the West North Central region nor the results from the East North Central region are statistically significant.

Mountain

Working with the dataset of responses from people who currently live in the Mountain region, I first checked to ensure that there was no correlation between responses to the question “How important is environmental sustainability to you?” and frame. By conducting a one-way ANOVA analysis of mean responses to each question after exposure to different frames, I found that there were no statistically significant differences in means between groups that saw different messages. There are, however, trends in which frame groups consistently had the highest and lowest mean results.



Figure 11

As Figure 11 shows, people who saw the Morality frame had the lowest

acknowledgment of climate change and least desire to take action on ten out of the 11 survey questions. On first glance it seems that this could be a situation like the one in the East South Central region, where highly religious people are opposed to their climate change denialism being called immoral. But further investigation shows that unlike the highly religious East South Central region, the states in the Mountain region tend to have very low levels of religiosity. With the exceptions of Utah and New Mexico, the states of the Mountain region aren't even in the top twenty most religious states in the US (Lipka and Wormald). It is possible though, that even though many people in the Mountain region don't identify with an organized belief system like religion, they still oppose to being called immoral. Survey results show that compared to other regions, the Mountain region had the overall least environmental attitudes on

eight out of the 11 survey questions (Figure 3), meaning respondents of this region may have felt judged by the Morality frame and thus been unreceptive to the idea of acknowledging climate change or taking action to address it.

In contrast, people who saw the Conflict and Strategy frame had the greatest or second greatest acknowledgment of climate change and desire to take action on six out of the 11 questions. This is somewhat surprising, as the message for the Conflict and Strategy frame talks about climate change deniers losing the battle, and this region has above-average levels of climate change denialism. In fact, only five out of the eight states in the Mountain region have levels of climate change denialism that are above the national average (Marlon). It seems that the Conflict and Strategy frame might make people from this region feel attacked, putting them into an identity defense mode in which they answered more anti-environmentally. One possible reason for these surprising results is that this sample of survey respondents is not an accurate representation of the people and ideologies of the region. While a 2017 Gallup Poll reports that 25% of Americans identify as "liberal," survey data indicates that 33.4% of respondents from this region identify as "somewhat liberal" or "very liberal"(Gallup Inc). While these results are surprising, it is worth noting that none of the results from this region are statistically significant.

People who saw the Economic Development frame also had the greatest or second greatest acknowledgment of climate change and desire to take action on six out of the 11 questions. This is not surprising, as this frame talks explicitly about renewable energy, and this region of the country is a leader in renewable energy. In fact, in a ranking of states by the percentage of their energy that comes from renewable sources,

the Mountain region has the #1 and #8 state, Idaho and Nevada (“Renewable Energy Production By State”). Because this frame reminds respondents that the Mountain region’s economy is likely to benefit from acknowledging climate change and taking steps to address it, people who saw this frame may have answered more pro-environmentally than they would have had they seen a different frame.

Pacific

Working with the dataset of responses from people who currently live in the Pacific region, I conducted a pre-test to ensure that no frame had a significant number of respondents with extremely pro-environmental or anti-environmental attitudes. I did so by testing for correlation between responses to the question “How important is environmental sustainability to you?” and which message people saw. There was no statistically significant correlation. I then conducted a one-way ANOVA analysis with frame as the independent factor and the mean response to each question as dependent variables. For the questions "How much risk do you believe climate change poses to human prosperity?" and "To what extent do you think scientists agree about the causes of climate change?" there was a statistically significant difference in mean responses between groups that saw different frames (Appendix C, Table 14). For the question about human prosperity, a response of one indicates "No risk" and a response of five indicates "Extremely high risk." For the question about agreement among scientists, a response of one indicates "Scientists mostly disagree" and a response of five indicates "Scientists mostly agree." To see which frames had statistically significant differences in means, I ran Post-Hoc LSD tests on responses to these two questions (Appendix C, Table 15).

For the question "How much risk do you believe climate change poses to human prosperity?" respondents who saw the Morality frame had a mean response that was statistically significantly higher than the mean responses of people who saw the Economic Development frame, Pandora's Box frame, or Scientific Uncertainty frame. For the same question, respondents who saw the Social Progress frame had a mean response that was statistically significantly lower than the mean response of respondents who saw the Control frame, Conflict and Strategy frame, and Middle Way frame.

This could be because in terms of environmental attitudes, the Pacific region is an ideological bubble with more radically pro-environmental beliefs than other regions. Every state in the Pacific region has a mean belief in climate change that is greater than the national average, and Hawaii and California have mean levels of belief in climate change that are 10% and 7% higher than the national average, respectively (Marlon). Perhaps because people in this region are more likely to believe in climate change and be surrounded by people who also believe in climate change, they are more comfortable shaming those who do not believe in climate change by saying sustainability is a moral issue. These Pacific region respondents may also respond more dramatically to messaging saying environmental issues are moral issues because this is familiar rhetoric to them. After seeing a message saying that environmental issues have moral implications, these respondents may have answered more pro-environmentally than they normally would have because they were protecting their identities as "eco-friendly" people.

For the same question "How much risk do you believe climate change poses to human prosperity?" people who saw the Social Progress frame had a mean response that

was statistically significantly lower in terms of expected risk than the mean response of respondents who saw the Control frame, Conflict and Strategy frame, and Middle Way frame. This may be because the message for the Social Progress frame talks explicitly about taking fewer natural resources. Perhaps when people saw this message and began imagining the reality of using fewer resources and changing their lifestyles, it became harder to answer in a way that aligned with the ideal of the “eco-friendly” identity. The reality of living with less may have made these results skew more toward the camp of “maybe climate change isn’t that big of a problem.”

For the question "To what extent do you think scientists agree about the causes of climate change?" respondents who saw the Economic Development frame had a mean response that was statistically significantly lower than the mean responses of people who saw the Conflict and Strategy frame, Middle Way frame, Pandora's Box frame, Morality frame, or Scientific Uncertainty frame. This seems counter-intuitive because the message for the Economic Development frame talked specifically about wind power, and this region, and in particular California, Oregon, and Washington, creating a large portion of the United States’ wind power (“Twelve States Produced 80% of U.S. Wind Power in 2013”). One potential reason for this surprising finding is that the Economic Development frame promotes American economic dominance. This type of US-centric rhetoric may not resonate with the highly liberal respondents of the Pacific region (52% of respondents in this region identified as "somewhat liberal" or "very liberal" compared with Gallup's estimate that 25% of the nation is liberal), as America-first rhetoric is so thoroughly associated with conservatism (Gallup Inc).

For the same question, respondents who saw the Social Progress frame also had a mean response that was statistically significantly lower than the mean response of people who saw the Conflict and Strategy frame, Morality frame, and Scientific Uncertainty frame. Perhaps after seeing a message that said humans would have to consume less to address environmental issues, respondents did not want to acknowledge the reality of climate change. By believing, or at least responding, that scientists disagree about the causes of climate change, respondents may have felt more comfortable about their own consumption habits.

In the rest of the survey questions, there was no statistically significant difference in responses between groups that saw different messages. There are some patterns in which frames had the highest and lowest mean results.

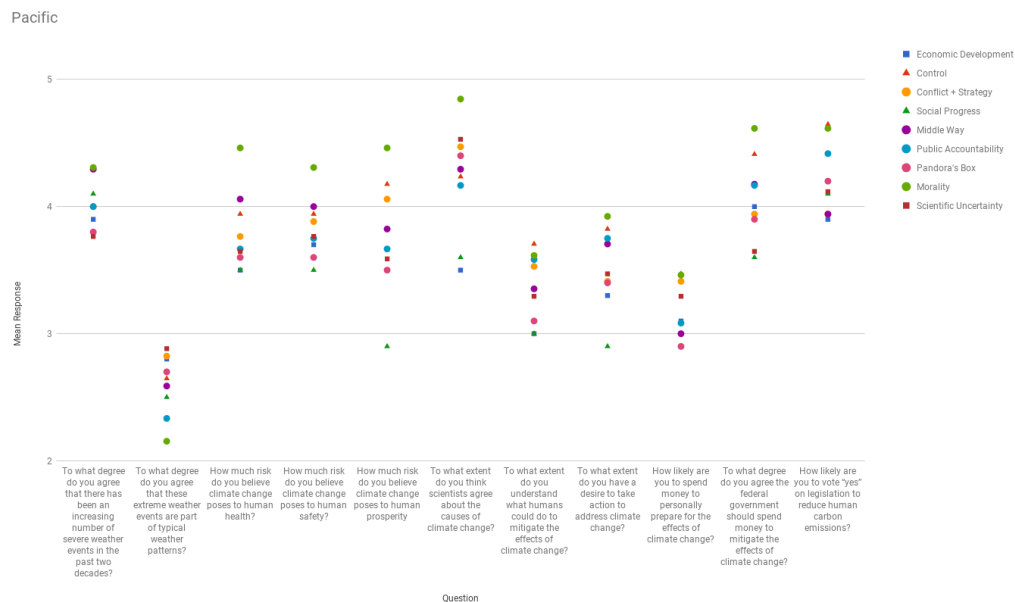


Figure 12

As the scatter plot in Figure 12 shows, people who saw the Morality frame had the strongest or second strongest pro-environmental attitudes (acknowledgment of

climate change and desire to take various types of action) on all 11 questions. As previously discussed, this may be because the Pacific region is more of a pro-environmental bubble than other regions (every state in this region has a level of belief in climate change that is above the national average, and some states have levels of belief in climate change 7-10% higher than the national average) (Marlon). Because of the above-average belief in climate change in this region, there may be a social expectation to care about environmental issues. This message may have pressured respondents to protect their identities as climate change believers by implying that people who deviate from these beliefs are in the moral wrong.

People who saw the Social Progress frame had the weakest or second weakest pro-environmental attitudes on six out of the 11 survey questions. As previously discussed, this may be because the message for the Social Progress frame specifically discusses using fewer natural resources, and the reality of changing their lifestyles may have prompted respondents to answer with less militant environmentalism.

Discussion

Research Question One

I expected to have a simple answer to my first research question: Which frames are most effective for inspiring pro-environmental behavior in each region of the United States? Before beginning my study, I assumed that in each region there would be one frame correlated with consistently high acknowledgment of climate change and intentions to behave pro-environmentally. I also expected regional cultures to explain which frames were successful and unsuccessful at motivating pro-environmental responses. After running an experiment with a thousand respondents and analyzing the data, it has become clear that these expectations do not reflect the reality of creating effective environmental messaging for the distinct regional cultures of the United States.

Only three regions had questions for which there was a statistically significant difference in answers among groups that saw different messages. In two of these regions, there was only significance on one question. In the majority of regions, there was not a single question that had a statistically significant difference in means between groups that saw different messages. Even in the regions where a certain frame was correlated with a statistically significantly higher mean response to a single question, there is no evidence the response indicates a lasting shift in attitude. Even if seeing the message caused a respondent to answer more pro-environmentally than they normally would have, this does not guarantee that the respondent will continue to exhibit pro-environmental behaviors once the message is no longer on their mind.

Research Question Two

Though there is no simple answer to the first research question, it does not mean that the data from this experiment cannot help answer the second: How can these frames be applied to create regionally-relevant advertising? Even without a definitive “top-scoring” frame from each region, results from the national message test reveal a number of insights about the types of frames that are most effective with different target audiences. This research did not yield results that are as simple as prescribing a single frame to each region, but by juggling multiple audience considerations, as strategic communicators do when building target audience profiles, one can leverage the insights from this research to design more effective environmental communications.

One of the biggest takeaways from this research builds Kahan's idea that communications are most effective when they do not ask people to choose between identity and knowledge. To reiterate Kahan's theory, people function as both knowledge acquirers and identity protectors, and when new information clashes with a people's identities, people are more likely to disregard the information than question their own identities (Kahan 8).

This first became apparent in my analysis when the only question where there was a nationally statistically significant difference in means between groups that saw different messages was in response to the question “To what extent do you think scientists agree about the causes of climate change?” This is the one survey question that asks respondents about the opinions of others (scientists) rather than about their own opinions and behaviors. In this way, people could answer the question and acknowledge their own knowledge of climate change without threatening their

identities. This indicates that messaging can help people acquire new knowledge and even express that knowledge so long as it doesn't make them threaten their own identities. There is not, however, any evidence that acknowledging the beliefs of climate scientists would make an individual behave more pro-environmentally themselves.

On the regional level, there was more promising evidence that communicators could leverage Kahan's theory about knowledge acquisition and identity protection to create better environmental communications. One insight based on regional analysis is that certain messages may put people into "identity protection mode" by drawing attention to the polarizing nature and "two sides" of the climate change conversation. Showing people these types of messages could remind them that their answers do not just represent what they know, but who they are and what side of the debate they are on. This is likely what happened with the Middle Way frame, a message that in theory says "Americans from all parts of the political spectrum should find middle ground" but which in reality may have put people in "identity protection mode" and created less middle ground. In the West North Central, South Atlantic, and West South Central regions, the Middle Way frame group had the weakest acknowledgment of climate change and desire to take any type of action of any frame group. One recommendation for communicators is to avoid messaging that asks people to pick sides in the climate debate.

Another way that messages may have put people into "identity protection mode" and created more anti-environmental attitudes was by threatening the way people live. The Pandora's Box and Social Progress frames both talk about using fewer natural resources and the Economic Development frame mentions switching over to wind

power. In the Mid-Atlantic and East North Central region, people who saw the Economic Development frame had the weakest acknowledgment of climate change and desire to take any type of action. In the South Atlantic region the group that saw the Pandora's Box frame, and in the Pacific region the group that saw the Social Progress frame, had the weakest environmental attitudes. For people whose livelihoods and state economies rely on the extraction of non-renewable resources, or for people who aren't comfortable with the idea of adapting to a more sustainable lifestyle, these messages may have prompted weaker acknowledgment of climate change and lower desire to take action to address it. After seeing messages that reminded them that adaptation might threaten their ways of life, audiences may have responded in ways that prioritized identity protection over information acknowledgement. Based on this, a recommendation for communicators is to avoid including information that makes people think their lives will be worse after adapting to live more sustainably. Even things that sound positive, such as transitioning to wind power, can be threatening for people from regions that produce other types of energy.

Another way certain messages put audiences into "identity protection mode" is by attacking, insulting, or shaming their identities. This occurred frequently with the Morality frame, which describes polluting, and by implication people who pollute, as "morally wrong." In the New England, Mid-Atlantic, East South Central, and Mountain regions, people who saw the Morality frame had the weakest acknowledgment of climate change and lowest desire to take action to address it. This is another lesson for communicators: telling audiences what is right and wrong is not a compelling way to get them to act. Messaging that judges and positions people who are already "eco-

friendly” as superior to people who are not may alienate audiences who do not see themselves as environmentalists. This may cause people who do not hold "green" beliefs and lifestyles to reject the messaging altogether and destroy any chances of getting them to adopt more sustainable behaviors.

Another recommendation for communicators is to leverage relevant experiences to make climate change more relatable and urgent for target audiences. This is especially applicable at the level of regional communications, where mention of specific severe weather events can provide tangible, regionally relevant examples of the impacts of climate change. The Pandora’s Box frame specifically mentioned severe weather events, and people in the New England and Mid-Atlantic region who saw this frame had higher acknowledgment of climate change and desire to take action than people from those regions who saw other frames. In the East North Central region, people who saw the Pandora’s Box frame had a statistically significantly stronger desire to take action to address climate change than people in that region who saw three other frames. While these regions have all had ten or more billion-dollar weather events in the last decade, it is important to note that only groups who saw the Pandora’s Box message had these strong pro-environmental attitudes, not all respondents from those regions. It is also important to note that in the South Atlantic region, which has experienced 46 billion-dollar weather events in the past decade, people who saw the Pandora’s Box frame had a statistically significantly greater level of agreement with the message “To what degree do you agree that these extreme weather events are part of typical weather patterns?” which may be because there have been so many severe weather events that people think they are normal. This indicates that it is important to make the connection between an

increasing number of severe weather events and climate change when creating communications.

One final recommendation for strategic communication advises that even though there are not clear top frames for each region, there is still value in creating regional environmental communications because there are statistically significant differences in the current beliefs of different regions. Because people from some regions are already more inclined to believe in climate change and have a stronger desire to take action than people from other regions, it may be possible to create campaigns that are more radically pro-environmental for specific regions. This model could also allow communicators to build a funnel that brings people from climate change deniers to believers by starting with non-identity-threatening messages and slowly making the messaging more radical over time, eventually motivating people to believe in climate change and take action. This is an ambitious communications plan that would require sophisticated understanding of the audiences in each region, long-term communications commitment, and subtle changes over time. With an issue as polarized and identity-driven as climate change, though, this could be the kind of maneuvering it takes to persuade the American public to acknowledge what 97% of scientists already know: climate change is real, humans contribute to it, and we are already feeling its effects.

Applied Recommendations for Communicators

Professional communicators need simple, actionable steps to make the insights from this thesis useful. The following guide translates my research into a set of simple applied recommendations. This advice is specific enough to provide practical guardrails

for effective messaging but open enough to allow creative liberty in environmental communication campaigns.

1. Start small. You can use your resources more effectively by focusing your efforts on creating hyper-targeted campaigns in the regions that most need them.

2. Focus the message to address a single goal, as it is easier for a message to move the needle on one attitude than on many. First determine your communication goal (raise support for carbon tax, increase awareness about new scientific findings, etc) and then craft a message that directly relates to that end goal.

3. Craft messages that reinforce the identity of your audience (as a conservative, a mother, etc). Do not make people choose between what they know and who they are.

4. Avoid divisive messages. Referring to climate change as a debate or battle and mentioning the “two sides” can remind people that their attitudes are a reflection of what side they wish to associate with. Staying away from these polarizing messages increase the chances of people expressing their own opinions, and not the more radical opinions of their “sides.”

5. Refrain from mentioning change that threatens audiences’ ways of life. Even change that sounds positive, like using renewable resources, can be alarming to people who think they will not benefit from this transition.

6. Use non-judgmental language. Casting people who already believe in climate change as superior to people who do not can make this less environmental audience feel shamed. In turn, they are more likely to reject the messaging altogether.

7. Leverage relevant experiences that make climate change feel spatially and temporally close. Mentioning specific severe weather events and connecting them to climate change can help make environmental issues feel relevant and urgent.

8. Use phrases that have not been politicized. Whether you use terms that are commonly associated with left-wing hippies or right-wing conservatives, you run the risk of alienating people who do not want to identify with that sociopolitical position. When you use more neutral language, you increase the chances that a broad audience will pay attention to your message.

Limitations

It is important to acknowledge that there are a number of limitations to this research. The first is that the antecedents for these attitudes are unclear. Why would respondents from one liberal, mostly non-religious region exhibit elevated pro-environmental attitudes after seeing the Morality frame and respondents from another liberal, mostly non-religious region show the opposite behavior? Why would respondents from one conservative region show an increased desire to address climate change after seeing the Middle Way frame and respondents from a neighboring, demographically and ideologically similar region do the opposite? Analysis for one region often seems to contradict the explanation for another region's data. Because

there is no clear reason for results, most of the analysis, and especially the analysis for regions without statistically significant results, is composed of hypotheses that would need to be tested with future research. For this reason, I frequently used phrases like “maybe” and “possibly.” The data can help lead to insights, but it cannot provide definitive answers to every question, especially complicated cultural questions where there are many factors at play.

Other limitations come from the data collection methods. As mentioned in the methods section, samples drawn from Mechanical Turk tend to have respondents who exhibit stronger liberal attitudes than samples drawn through other survey methods (Clifford, Jewell, and Waggoner). And as the results section shows, this sample is not reflective of all demographic features of the United States. A flaw of surveys in general is that responses are based on peoples’ honesty and self-awareness about their own behaviors and attitudes, meaning the way people respond while taking a survey does not necessarily reflect how they always behave.

Another limitation is message source. Because the visual stimuli in the experiment had no message source, people may not have accepted, or in some cases rejected, the information in the way they might have if the messages came from a recognizable source. Message source can be a powerful factor, and one study has even shown how pro-environmental messages from Republican politicians can be significantly more influential on Republican audiences than messages from scientific sources (Augenstein). Not including a message source may change how much audiences trust and acknowledge the information contained in the messages.

Finally, because of budget constraints, this survey only had 1,000 respondents despite having 81 different conditions (meaning a particular frame in a particular region). This means that for conditions with very few respondents, one outlier's radical beliefs could have skewed the mean response for that condition. It would have been ideal to get more respondents to create samples less susceptible to influence by a single respondent.

The messaging format, an image that a respondent saw for thirty seconds, is also limiting. It makes sense that deeply ingrained attitudes about climate change and sustainability would be difficult to change with a single 30-second exposure to a message. In brand communications campaigns, targets will usually see a message three or more times on various media over a certain window of time. This method of strategic messaging is likely more effective at creating long-term attitude and behavior shifts. It is possible that some of these frames would be correlated with more significant results if there had been an opportunity to expose subjects to the messages multiple times over a longer period.

Future Research

After using this research to get an overview of environmental attitudes and the impact of framing across the United States, it would be interesting to do a deep dive into one particular region. By building upon the insights from this research, communicators could create a more sophisticated and regionally-tailored campaign. Then, with surveys to test attitudes in the region before, during, and after the campaign ran, they could see if the campaign was effective in moving the needle on a number of metrics such as acknowledgment of climate change and desire to take action.

Communicating climate change is complex, and there is no magical messaging solution to transform the United States into a nation of environmental activists. It is not an easy task, but it is an immensely important one. Climate change is the issue of our time. It demands the attention of not only scientists, but creative people, communicators, and innovators of all types. I hope the insights in this thesis can help guide some of them.

Appendix A



Figure 13: Visual Stimulus for Social Progress Frame



Figure 14: Visual Stimulus for Economic Development Frame



Figure 15: Visual Stimulus for Morality Frame

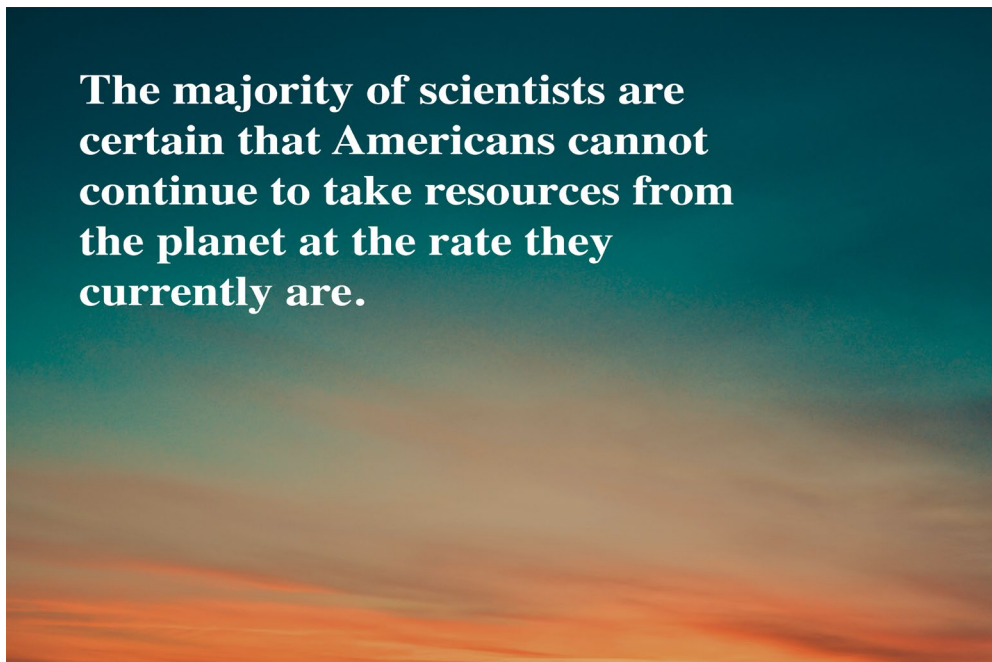


Figure 16: Visual Stimulus for Scientific Uncertainty Frame



Figure 17: Visual Stimulus for Pandora's Box Frame



Figure 18: Visual Stimulus for Public Accountability Frame



Figure 19: Visual Stimulus for Middle Way Frame



Figure 20: Visual Stimulus for Conflict and Strategy Frame



Figure 21: Visual Stimulus for Control Statement

Frame	Original Message	Revised Message (if applicable)
Social Progress Frame	If Americans extracted fewer resources from the planet, natural ecosystems would be healthier and the quality of life for our entire society would improve.	If Americans took fewer resources from the planet, natural ecosystems would be healthier and there would be progress across society.
Economic Development Frame	If Americans increased investments in wind power, the United States would become a global economic leader in renewable energy.	---
Morality Frame	Americans should acknowledge that polluting the planet for future generations is morally wrong.	---

Scientific Uncertainty Frame	The majority of scientists agree that Americans cannot continue to extract resources from the planet at the rate they currently are.	The majority of scientists are certain that Americans cannot continue to take resources from the planet at the rate they currently are.
Pandora's Box Frame	If Americans do not find a way to slow their consumption of resources, the planet could reach a tipping point and begin to experience a massive number of catastrophic weather events.	---
Public Accountability Frame	The US government has let the country's natural resources be plundered and should be held accountable to the American people to find solutions.	---
Middle Way Frame	Americans from all parts of the political spectrum should work together to find ways that work for everyone to keep our planet healthy.	Americans from all parts of the political spectrum should find middle ground and ways to work together for solutions that keep our planet healthy.
Conflict and Strategy Frame	The climate change deniers have officially lost the debate and those on the side of science should start taking action.	The climate change deniers have officially lost the battle and those on the side of science should start taking action.
Control Statement	The World Wide Web was introduced in 1989.	---

Appendix B

Pre-Message Question:

Q1. How important is environmental sustainability to you?

- A. Not at all important
- B. Slightly important
- C. Moderately important
- D. Very important
- E. Extremely important

Post-Message Questions:

Q1. To what degree do you agree that there has been an increasing number of severe weather events in the past two decades?

- A. Highly disagree
- B. Disagree
- C. Do not agree or disagree
- D. Agree
- E. Highly agree

Q2. To what degree do you agree that these extreme weather events are part of typical weather patterns?

- A. Highly disagree
- B. Disagree
- C. Do not agree or disagree
- D. Agree

E. Highly agree

Q3. How much risk do you believe climate change poses to human health?

A. No risk

B. Low risk

C. Moderate risk

D. High risk

E. Extremely high risk

Q4. How much risk do you believe climate change poses to human safety?

A. No risk

B. Low risk

C. Moderate risk

D. High risk

E. Extremely high risk

Q5. How much risk do you believe climate change poses to human prosperity?

A. No risk

B. Low risk

C. Moderate risk

D. High risk

E. Extremely High risk

Q6. To what extent do you think scientists agree about the causes of climate change?

A. Scientists mostly disagree

B. Scientists somewhat disagree

C. Scientists equally agree and disagree

E. Scientists somewhat agree

E. Scientists mostly agree

Q7. To what extent do you understand what humans could do to mitigate the effects of climate change?

A. No understanding of possible actions

B. Very little understanding of possible actions

C. Moderate understanding of possible actions

D. High understanding of possible actions

E. Very high understanding of possible actions

Q8. To what extent do you have a desire to take action to address climate change?

A. No desire

B. Very little desire

C. Moderate desire

D. High desire

E. Extremely high desire

Q9. How likely are you to spend money to personally prepare for the effects of climate change?

A. Very unlikely

B. Somewhat unlikely

C. Neither likely nor unlikely

D. Somewhat likely

E. Very likely

Q10. To what degree do you agree the federal government should spend money to mitigate the effects of climate change?

- A. Highly disagree
- B. Disagree
- C. Do not agree or disagree
- D. Agree
- E. Highly agree

Q11. How likely are you to vote “yes” on legislation to reduce human carbon emissions?

- A. Very unlikely
- B. Somewhat unlikely
- C. Neither likely nor unlikely
- D. Somewhat likely
- E. Very likely

Q12. Based on the map above, in which region do you currently live?

- A. New England
- B. Mid-Atlantic
- C. East North Central
- D. West North Central
- E. South Atlantic
- F. West South Central
- G. Mountain
- H. Pacific

Q13. Based on the map above, in which region have you spent the majority of your life?

- A. New England
- B. Mid-Atlantic
- C. East North Central
- D. West North Central
- E. South Atlantic
- F. West South Central
- G. Mountain
- H. Pacific

Q14. Based on the map above, how would you answer if someone asked you what region you are from?

- A. New England
- B. Mid-Atlantic
- C. East North Central
- D. West North Central
- E. South Atlantic
- F. West South Central
- G. Mountain
- H. Pacific

Q15. What is your gender?

- A. Female
- B. Male
- C. Other

Q16. Which best describes your race? (option to select multiple)

- A. Black or African American
- B. Hispanic, Latino, or Spanish origin
- C. Asian
- D. White
- E. American Indian or Alaska Native
- F. Middle Eastern or North African
- G. Native Hawaiian or Other Pacific Islander
- H. Other

Q17. Which best describes your political ideology?

- A. Very conservative
- B. Somewhat conservative
- C. Moderate
- D. Somewhat liberal
- E. Very liberal

Q18. Which best describes your religious affiliation?

- A. Protestant / Other non-Catholic Christian
- B. Roman Catholic
- C. No religion / Atheist / Agnostic
- D. Other non-Christian religion
- E. Mormon / Latter-Day Saints
- F. Jewish
- G. Muslim / Islam

Q19. What is your current marital status?

- A. Legally married
- B. Living with a partner
- C. Divorced / Separated / Widowed
- D. Single, never married

Q20. What is your annual income level?

- A. Less than \$25,000
- B. \$25,000-\$50,000
- C. \$50,000-\$75,000
- D. \$75,000-\$100,000
- E. \$100,000-\$150,000
- F. More than \$150,000

Appendix C

Understanding These Tables

- Frame 1 = Economic Development
- Frame 2 = Control
- Frame 3 = Conflict and Strategy
- Frame 4 = Social Progress
- Frame 5 = Middle Way
- Frame 6 = Public Accountability
- Frame 7 = Pandora's Box
- Frame 8 = Morality
- Frame 9 = Scientific Uncertainty

Table 1					
To what extent do you think scientists agree about the causes of climate change?					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19.625	8	2.453	1.989	.045*
Within Groups	1223.480	992	1.233		
Total	1243.105	1000			

Table 2						
Dependent Variable: To what extent do you think scientists agree about the causes of climate change?						
LSD						
(I) frame	(J) frame	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Up per Bou nd

1.00	2.00	-.377*	.141	.007	-.65	-.10
	3.00	-.401*	.145	.006	-.68	-.12
	9.00	-.442*	.139	.002	-.72	-.17
2.00	1.00	.377*	.141	.007	.10	.65
3.00	1.00	.401*	.145	.006	.12	.68
4.00	9.00	-.323*	.148	.030	-.61	-.03
9.00	1.00	.442*	.139	.002	.17	.72
	4.00	.323*	.148	.030	.03	.61

Table 3

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^c
frame * Gender	To what degree do you agree the federal government should spend money to reduce the effects of climate change?	24.641	9	2.738	2.059	.031*	.019	18.534	.871
	How likely are you to vote "yes" on legislation to reduce carbon emissions?	24.628	9	2.736	1.907	.048*	.017	17.162	.839

	frame	What is your gender?	Mean	Std. Deviation	N
To what degree do you agree the federal government should spend money to reduce the effects of climate change?	8.00	Female	4.27	1.000	56
		Male	3.58	1.500	38
		Total	3.99	1.266	94
	9.00	Female	4.34	.814	61
		Male	3.88	1.303	64
		Total	4.10	1.113	125
How likely are you to vote "yes" on legislation to reduce carbon emissions?	8.00	Female	4.48	.914	56
		Male	3.53	1.484	38
		Total	4.10	1.262	94
	9.00	Female	4.49	.829	61
		Male	3.91	1.400	64
		Total	4.19	1.189	125

Effect	Value	F	Hypothesis df	Error df	Sig.
Wilks' Lambda	.914	1.371 ^b	64.000	1910.000	.029*

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^c
frame * ideology	To what extent do you	42.148	32	1.317	1.693	.010*	.054	54.177	.996

	understand what humans could do to reduce the effects of climate change?								
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Table 7

	frame	Which best describes your political ideology?	Mean	Std. Deviation	N
To what extent do you understand what humans could do to reduce the effects of climate change?	4.00	Very conservative	3.56	1.130	9
		Somewhat conservative	3.28	.843	25
		Moderate	3.23	.908	26
		Somewhat liberal	3.67	.784	27
		Very liberal	4.27	.884	15
		Total	3.54	.930	102
	5.00	Very conservative	3.00	.866	9
		Somewhat conservative	2.90	.768	21
		Moderate	3.50	1.009	30
		Somewhat liberal	3.29	.717	21
		Very liberal	3.68	.820	19
		Total	3.32	.886	100
	6.00	Very conservative	3.17	1.169	6
		Somewhat conservative	3.30	1.105	23
		Moderate	3.18	1.029	34
		Somewhat liberal	3.32	.945	25
		Very liberal	3.70	.993	27
		Total	3.36	1.028	115
	8.00	Very conservative	1.88	.835	8
		Somewhat conservative	3.70	.733	20
		Moderate	3.27	.703	22
		Somewhat liberal	3.50	.906	26
		Very liberal	3.94	.873	18
		Total	3.44	.957	94

Table 8

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	19.491	8	2.436	1.969	.047*

To what degree do you agree that these extreme weather events are part of typical weather patterns?	Within Groups	1227.564	992	1.237		
	Total	1247.055	1000			
To what extent do you have a desire to take action to address climate change?	Between Groups	19.349	8	2.419	2.080	.035*
	Within Groups	1153.342	992	1.163		
	Total	1172.691	1000			
To what degree do you agree the federal government should spend money to reduce the effects of climate change?	Between Groups	25.105	8	3.138	2.369	.016*
	Within Groups	1313.996	992	1.325		
	Total	1339.101	1000			
How likely are you to vote "yes" on legislation to reduce carbon emissions?	Between Groups	26.410	8	3.301	2.280	.020*
	Within Groups	1436.184	992	1.448		
	Total	1462.593	1000			

Table 9							
LSD							
Dependent Variable	(I) Based on the map above, in which region do you currently live?	(J) Based on the map above, in which region do you currently live?	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
To what degree do you agree that these extreme weather events are part of typical weather patterns?	2. Mid-Atlantic	7. West South Central	-.333*	.151	.028	-.63	-.04
		3. East North Central					
	6. East South Central	6. East South Central	-.372*	.165	.025	-.70	-.05
		7. West South Central	-.403*	.149	.007	-.70	-.11
		8. Mountain	-.360*	.148	.015	-.65	-.07
	5. South Atlantic	7. West South Central	-.277*	.138	.045	-.55	-.01
		3. East North Central	.372*	.165	.025	.05	.70
	6. East South Central	9. Pacific	.352*	.170	.038	.02	.68
		7. West South Central					
	7. West South Central	2. Mid-Atlantic	.333*	.151	.028	.04	.63
		3. East North Central	.403*	.149	.007	.11	.70

		5. South Atlantic	.277*	.138	.045	.01	.55
		9. Pacific	.382*	.154	.013	.08	.68
	8. Mountain						
		3. East North Central	.360*	.148	.015	.07	.65
		9. Pacific	.339*	.153	.027	.04	.64
	9. Pacific						
		6. East South Central	-.352*	.170	.038	-.68	-.02
		7. West South Central	-.382*	.154	.013	-.68	-.08
		8. Mountain	-.339*	.153	.027	-.64	-.04
	To what extent do you have a desire to take action to address climate change?	2. Mid-Atlantic					
6. East South Central			.372*	.162	.022	.05	.69
7. West South Central			.344*	.147	.019	.06	.63
8. Mountain							
		8. Mountain	.472*	.145	.001	.19	.76
3. East North Central							
		8. Mountain	.370*	.143	.010	.09	.65
5. South Atlantic							
		8. Mountain	.326*	.132	.014	.07	.59
6. East South Central							
		2. Mid-Atlantic	-.372*	.162	.022	-.69	-.05
7. West South Central							
		2. Mid-Atlantic	-.344*	.147	.019	-.63	-.06
8. Mountain							
		2. Mid-Atlantic	-.472*	.145	.001	-.76	-.19
		3. East North Central	-.370*	.143	.010	-.65	-.09
		5. South Atlantic	-.326*	.132	.014	-.59	-.07
		9. Pacific	-.381*	.148	.010	-.67	-.09
9. Pacific							
		8. Mountain	.381*	.148	.010	.09	.67
To what degree do you agree	2. Mid-Atlantic						
		7. West South Central	.352*	.157	.025	.04	.66
	8. Mountain	.551*	.155	.000	.25	.86	

the federal government should spend money to reduce the effects of climate change?	3. East North Central	7. West South Central	.311*	.155	.045	.01	.61
		8. Mountain	.511*	.153	.001	.21	.81
	4. West North Central						
		8. Mountain	.498*	.186	.008	.13	.86
	5. South Atlantic						
		8. Mountain	.387*	.141	.006	.11	.66
	7. West South Central						
		2. Mid-Atlantic	-.352*	.157	.025	-.66	-.04
		3. East North Central	-.311*	.155	.045	-.61	-.01
	8. Mountain						
		2. Mid-Atlantic	-.551*	.155	.000	-.86	-.25
		3. East North Central	-.511*	.153	.001	-.81	-.21
		4. West North Central	-.498*	.186	.008	-.86	-.13
		5. South Atlantic	-.387*	.141	.006	-.66	-.11
		9. Pacific	-.409*	.158	.010	-.72	-.10
	9. Pacific						
		8. Mountain	.409*	.158	.010	.10	.72
How likely are you to vote "yes" on legislation to reduce carbon emissions?	2. Mid-Atlantic						
		5. South Atlantic	.282*	.130	.031	.03	.54
		6. East South Central	.498*	.181	.006	.14	.85
		7. West South Central	.452*	.164	.006	.13	.77
		8. Mountain	.579*	.162	.000	.26	.90
	3. East North Central						
		8. Mountain	.346*	.160	.031	.03	.66
	5. South Atlantic						
		8. Mountain	.298*	.148	.044	.01	.59
	6. East South Central						
		2. Mid-Atlantic	-.498*	.181	.006	-.85	-.14
	7. West South Central						
		2. Mid-Atlantic	-.452*	.164	.006	-.77	-.13
	8. Mountain						
		2. Mid-Atlantic	-.579*	.162	.000	-.90	-.26

		3. East North Central	-.346*	.160	.031	-.66	-.03
		5. South Atlantic	-.298*	.148	.044	-.59	-.01
		9. Pacific	-.383*	.165	.021	-.71	-.06
	9. Pacific						
		8. Mountain	.383*	.165	.021	.06	.71

Table 10					
To what extent do you have a desire to take action to address climate change?					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	15.713	8	1.964	2.008	.050*
Within Groups	132.037	135	.978		
Total	147.750	143			

Table 11						
Dependent Variable: To what extent do you have a desire to take action to address climate change?						
LSD						
(I) frame	(J) frame	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-.856*	.321	.009	-1.49	-.22
	3.00	-.703*	.334	.038	-1.36	-.04
	5.00	-.748*	.360	.040	-1.46	-.04
	7.00	-1.108*	.325	.001	-1.75	-.46
2.00	1.00	.856*	.321	.009	.22	1.49
3.00	1.00	.703*	.334	.038	.04	1.36

5.00	1.00	.748*	.360	.040	.04	1.46
6.00	7.00	-.942*	.400	.020	-1.73	-.15
7.00	1.00	1.108*	.325	.001	.46	1.75
	6.00	.942*	.400	.020	.15	1.73
	8.00	.740*	.336	.029	.08	1.40
8.00	7.00	-.740*	.336	.029	-1.40	-.08

Table 12					
To what degree do you agree that these extreme weather events are part of typical weather patterns?					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.185	8	2.648	2.169	.031*
Within Groups	271.084	222	1.221		
Total	292.268	230			

Table 13						
Dependent Variable: To what degree do you agree that these extreme weather events are part of typical weather patterns?						
LSD						
(I) frame	(J) frame	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00						
	5.00	-1.194*	.334	.000	-1.85	-.54
	7.00	-.758*	.366	.040	-1.48	-.04
2.00						
	5.00	-.966*	.322	.003	-1.60	-.33
3.00						
	5.00	-.875*	.331	.009	-1.53	-.22

4.00	5.00	-.927*	.343	.007	-1.60	-.25
5.00	1.00	1.194*	.334	.000	.54	1.85
	2.00	.966*	.322	.003	.33	1.60
	3.00	.875*	.331	.009	.22	1.53
	4.00	.927*	.343	.007	.25	1.60
	6.00	.979*	.315	.002	.36	1.60
	8.00	.810*	.334	.016	.15	1.47
	9.00	1.012*	.324	.002	.37	1.65
6.00						
	5.00	-.979*	.315	.002	-1.60	-.36
7.00	1.00	.758*	.366	.040	.04	1.48
8.00						
	5.00	-.810*	.334	.016	-1.47	-.15
9.00	5.00	-1.012*	.324	.002	-1.65	-.37

Table 14		
		Sig.
How much risk do you believe climate change poses to human prosperity?	Between Groups	.032*
	Within Groups	
	Total	
To what extent do you think scientists agree about the causes of climate change?	Between Groups	.036*
	Within Groups	
	Total	

Table 15						
LSD						
Dependent Variable	(I) frame	(J) frame	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval

						Lower Bound	Upper Bound
How much risk do you believe climate change poses to human prosperity?	1.00	8.00	-.962*	.449	.034	-1.85	-.07
		2.00	4.00	1.276*	.425	.003	.43
	3.00	4.00	1.159*	.425	.007	.32	2.00
		4.00	2.00	-1.276*	.425	.003	-2.12
	3.00		-1.159*	.425	.007	-2.00	-.32
	5.00		-.924*	.425	.032	-1.77	-.08
	8.00		-1.562*	.449	.001	-2.45	-.67
	5.00	4.00	.924*	.425	.032	.08	1.77
		7.00	8.00	-.962*	.449	.034	-1.85
	8.00		1.00	.962*	.449	.034	.07
		4.00	1.562*	.449	.001	.67	2.45
		7.00	.962*	.449	.034	.07	1.85
		9.00	.873*	.393	.028	.09	1.65
	9.00	8.00	-.873*	.393	.028	-1.65	-.09
		1.00	3.00	-.971*	.395	.015	-1.75
	5.00		-.794*	.395	.046	-1.58	-.01
	7.00		-.900*	.443	.044	-1.78	-.02
	8.00		-1.346*	.416	.002	-2.17	-.52
	9.00		-1.029*	.395	.010	-1.81	-.25
	3.00	1.00	.971*	.395	.015	.19	1.75
To what extent do you think scientists agree about the causes of climate change?	1.00	3.00	-.971*	.395	.015	-1.75	-.19
		5.00	-.794*	.395	.046	-1.58	-.01
		7.00	-.900*	.443	.044	-1.78	-.02
		8.00	-1.346*	.416	.002	-2.17	-.52
		9.00	-1.029*	.395	.010	-1.81	-.25
3.00	1.00	.971*	.395	.015	.19	1.75	

		4.00	.871*	.395	.029	.09	1.65
	4.00						
		3.00	-.871*	.395	.029	-1.65	-.09
		8.00	-1.246*	.416	.003	-2.07	-.42
		9.00	-.929*	.395	.020	-1.71	-.15
	5.00	1.00	.794*	.395	.046	.01	1.58
	7.00	1.00	.900*	.443	.044	.02	1.78
	8.00	1.00	1.346*	.416	.002	.52	2.17
		4.00	1.246*	.416	.003	.42	2.07
	9.00	1.00	1.029*	.395	.010	.25	1.81
		4.00	.929*	.395	.020	.15	1.71

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