

*Strategic Communication Research to Illuminate and Promote Public  
Engagement with Climate Change*

Connie Roser-Renouf, PhD,  
Edward Wile Maibach, MPH, PhD  
Center for Climate Change Communication  
George Mason University

**Abstract**

The Center for Climate Change Communication at George Mason University was established to develop and apply social science insights to help society make informed decisions that will stabilize the earth's life-sustaining climate, and prevent further harm from climate change. In this chapter, we describe our program of research and outreach efforts, focusing on the cognitive and affective drivers of climate change issue engagement, the roles of mediated and interpersonal communication in shaping climate change beliefs, attitudes and actions, and the applications of audience segmentation in developing outreach programs. We also describe the theoretical foundations of our work, and our three major outreach programs: *Climate Matters*, an innovative collaboration of climate scientists, meteorologists and social scientists to foster climate change communication among television weathercasters; the *Medical Society Consortium on Climate & Health*, an outgrowth of our research that identified a widespread lack of understanding that climate change affects human health; and *RepublicEn*, an initiative led by conservatives to catalyze a new narrative on climate change among conservatives, based in free-market thinking.

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**I. RATIONALE, MISSION, AND APPROACH**

**Introduction**

In this chapter we offer readers a non-traditional research narrative that is in varying degrees theoretical, empirical, practical and autobiographical. In a limited sense, the story we tell is ours—because we are the two scientists who founded the communication research team in question, that recently celebrated its 10<sup>th</sup> anniversary—but in a fuller sense it is the story of the many faculty members and students at our university, and other universities, with whom we have been fortunate to collaborate; our use of a plural pronoun to tell this story is meant to convey all of these people’s contributions to it. And while our narrative focuses primarily on our research, we recognize we stand on the shoulders of the giants who preceded us in the social sciences, and on the shoulders of investigators who are working concurrently with us in universities around the world; they deserve a full measure of credit for any progress we are making.

Our story also requires an upfront disclosure. We accept as true that harmful, human-caused climate change is happening, because—based on the evidence—nearly all of the world’s climate scientists, and all of the world’s legitimate science societies, are convinced this is so. As scientists with deep roots in the public health community, we feel an obligation to forewarn and forearm humanity so that people and society can understand the risks they face, and make the best possible decisions regarding how to manage those risks. We see this as akin to warning people and society about the health risks of tobacco use, and informing them of the range of potential options to manage those risks. In short, it’s fair to say that we have an agenda: to promote comprehension of climate change risks and thoughtful deliberation and decision-making

about how best to respond to them, or stated more briefly, to promote public engagement in climate change. Some critics claim that having an agenda inherently biases scientists and renders them advocates rather than honest brokers. We disagree; advocating for informed decision-making, based on the best available information, is a valuable approach to being an honest broker.

### **Communication Science in the Public's Interest**

Social scientists have long studied the processes by which communication influences public knowledge, attitudes and behavior on a range of important societal issues. Much of that research has focused on understanding the potential negative impacts of mass communication on society by fostering, for example, aggression, social mistrust and negative stereotypes through television content. Another large body of research has focused on the potential of strategic (or purposive) communication to enhance public well-being, with an emphasis on health and health behaviors, such as smoking prevention and cessation, drunk driving prevention, and seat-belts, condoms, and physical activity promotion. The bulk of this work has focused on changing the behaviors of at-risk individuals, although some has focused on building public support for policy changes that protect the public, such as banning smoking from public places.

Much can be learned about how to build public engagement with climate change from the extant research focusing on other societal challenges. However, in many ways, climate change poses different and potentially more difficult challenges for those who seek to promote public engagement in it.

- Most Americans hold serious misperceptions about climate change, viewing the threat as small and distant in space (not here), time (not yet) and species (not us).

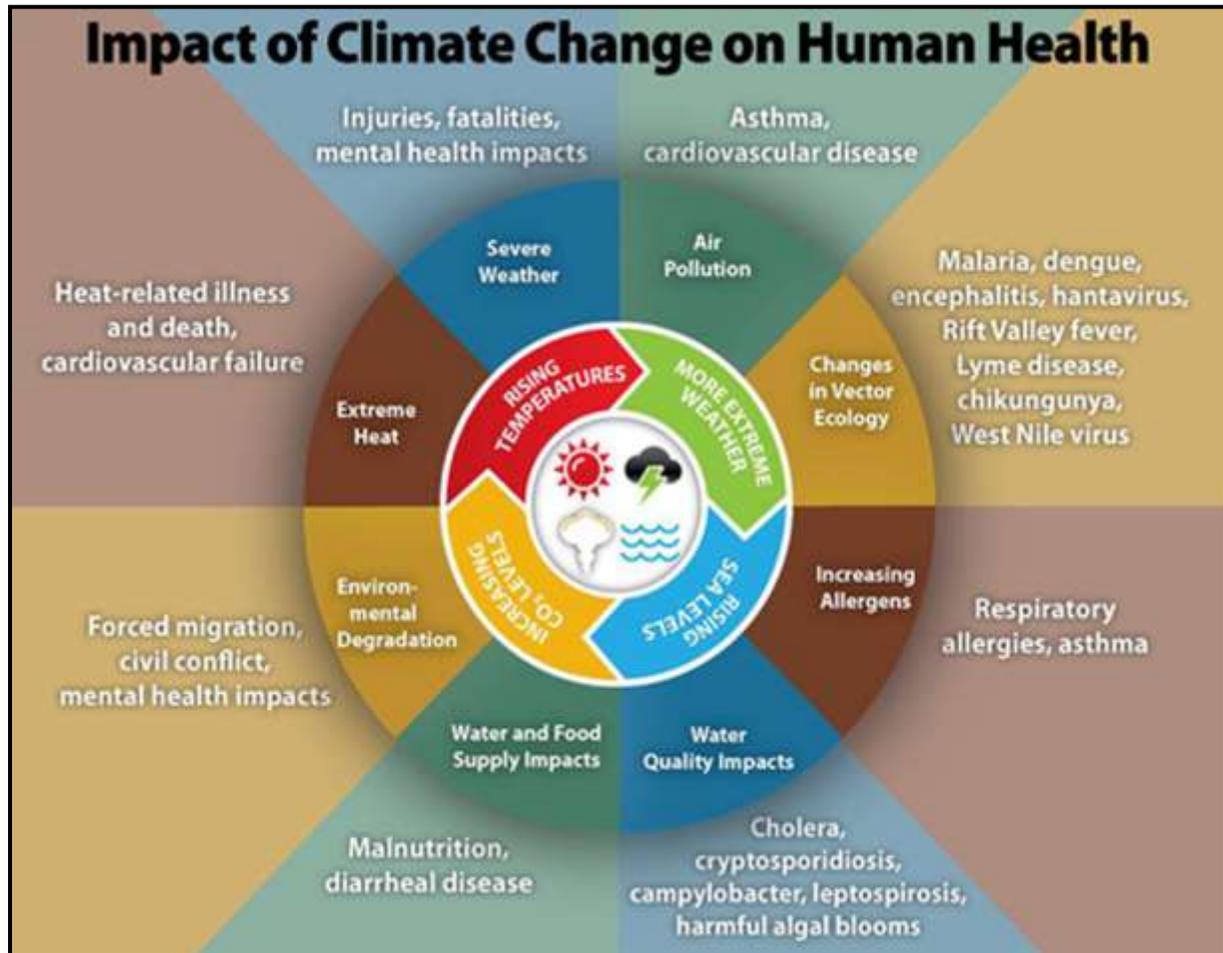
- Many politically conservative Americans flat out reject its reality (in response to what they have been told by their political leaders and by fossil fuel industry sponsored denial campaigns), and they are passionately and ideologically opposed to most proposed solutions.
- The most important solutions—i.e., greatly accelerating the transition to clean energy (so as to leave fossil fuels in the ground), and turning the tide on global deforestation and soil degradation—are neither well-understood nor directly influenced by ordinary citizens.
- The problem is global, having worldwide causes, and requiring worldwide solutions, which creates myriad challenges to mounting effective responses beyond those normally inherent in individual, local and national problems.
- The need for large-scale global solutions is urgent, because the earth’s climate system could reach one or more “tipping points” in the very near future, which would cause dramatic harm to humanity and to the ecosystems on which humans depend. Recent research finds that if carbon emission continue to rise after 2020, the temperature goals set in the Paris Climate Accord are likely to become unattainable (Figueres et al., 2017).  
Thus, we face an urgent threat that is poorly understood by large segments of the public.

Threat reduction will require widespread collective action, which is unlikely in the current highly polarized political context. These are the challenges we are working to address.

### **Health Threats Posed by Climate Change**

Climate change has a long list of impacts that are harmful to humans, including more extreme weather, heat, drought, flooding, sea level rise, increased ranges for vector-borne illnesses, longer allergy seasons, and increases in water and food borne-illnesses. Drought and sea level rise increase competition for scarce resources in developing nations, fostering conflicts

and migration. The Third National Climate Assessment by the U.S. Global Change Research Program—a collaboration of 13 federal agencies, including NASA and NOAA—tells us that these are not impacts expected in the future—they are happening now (Walsh et al., 2014).



**Figure 1: Impacts of Climate Change on Human Health**

(Source: Centers for Disease Control, 2016:

<https://www.cdc.gov/climateandhealth/effects/default.htm>)

Figure 1 was developed by the U.S. Centers for Disease Control (2016) to illustrate the connections between climate change and the harm it causes to humans, with changes to the climate illustrated in the innermost circle. As CO<sub>2</sub> levels increase, temperatures rise, causing more extreme weather and sea level rise. These changes lead to increases in the risk factors

shown in the middle circle, and ultimately, to the impacts on people shown in the outer circle. Increases in extreme heat, for example, entail longer lasting heat waves and less cooling overnight, which increase heat-related illnesses and cardiovascular failure. Insects and animals that carry deadly diseases, such as malaria and Lyme disease, are expanding their ranges, moving northward as higher temperatures increase the range within which they can survive. Environmental degradation in the form of droughts and flooding make once productive agricultural land less capable of supporting the people who live upon it. Increased competition in developing nations for scarce resources like potable water foster civil conflict and force people to migrate from their homes (Luber et al., 2014; Centers for Disease Control (CDC), 2016).

Clearly, climate change is not simply a danger to polar bears. Recognition of its massive threat to human's well-being prompted creation of the Center for Climate Change Communication at George Mason University in the fall of 2007.

### **Strategic Communication Research in Service of Earth's Climate**

We created the Center for Climate Change Communication (*4C*) in 2007 to promote public engagement in climate change through audience research, message testing, and the application of theories in science and risk communication. Specifically, the Center's stated mission is to "develop and apply social science insights to help society make informed decisions that will stabilize earth's life-sustaining climate and prevent further harm from climate change."

Our work is guided by several premises. First, "issue engagement" has cognitive, affective and behavioral components (Ockwell, Whitmarsh & O'Neill, 2009), all of which we consider in our research. Second, communication is not a magic bullet, but most successful strategic communication campaigns are "big messy programs" (Hornik, 2002) that convey simple, clear messages, repeated often, through multiple trusted sources (Maibach, in press).

With these in mind, we have focused on methods of increasing knowledge, and changing attitudes and behavior with a range of trusted sources working in diverse communication settings, both mediated and interpersonal.

Our four primary activities are:

- (1) Survey research and interviews to illuminate the processes by which public understanding, concern and skepticism about climate change are created;
- (2) Experimental research to identify effective messages in controlled settings;
- (3) Audience segmentation to identify motivationally coherent segments that may be effectively targeted with content specific to their needs and interests;
- (4) Outreach to increase public engagement including: field experiments and demonstration projects that test and/or scale up promising approaches to public engagement; and trainings and briefings to help communication practitioners and policy-makers improve their communication effectiveness through application of research findings.

Our program is grounded in the recognition that successful messaging begins with understanding the audience, and that a combination of surveys, interviews and experiments are the best foundation for building this understanding. Surveys and interviews can identify correlational relationships; experiments can then test whether the relationships are causal. For example, our research with cross-sectional survey data showed that awareness of the scientific consensus on climate change predicted mitigation policy support through several mediating key beliefs—that climate change is real, human-caused, harmful and solvable—and that this model was a better fit to the data than alternative models using the same variables but alternative paths of influence (Ding, Maibach, Zhao, Roser-Renouf & Leiserowitz, 2011). Through multiple message experiments, we've assessed the impact of the scientific consensus message, confirming

that the relationship originally identified with cross-sectional data is causal, and extending the findings by comparing different forms of the message (Myers, Maibach, Peters & Leiserowitz, 2015; van der Linden, Leiserowitz, Feinberg & Maibach, 2014; van der Linden, Leiserowitz, Rosenthal & Maibach, 2017).

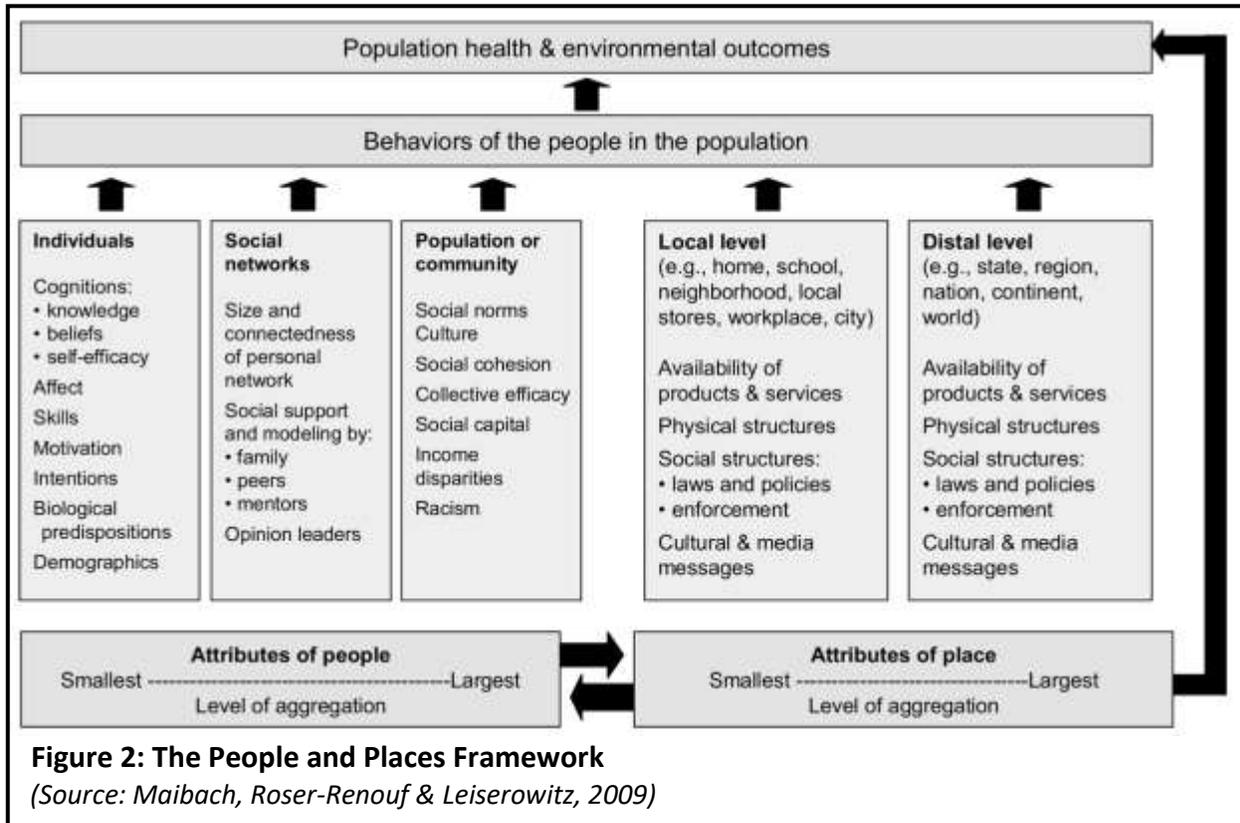
Survey data can also identify promising approaches for climate change messaging when combined with experimental data. For example, in one experiment we found that messages framing climate change as a health issue were positively received across opinion groups (Myers, Nisbet, Maibach & Leiserowitz, 2012). We subsequently assessed public understanding of the health threats of climate change in a survey, finding that few people were aware of the threats (Leiserowitz et al., Oct. 2014; Maibach et al., 2015a; Roser-Renouf et al., 2014a), which suggested that health would be a promising framing for information campaigns.

With this framework in mind, we began a program of research to identify effective methods of increasing the American public's issue engagement, mitigation policy support, sustainable behavior, and climate change activism. While our primary objective has been applied—i.e., to build public engagement with climate change—our work has also entailed contributions to the academic literature on climate change communication, and the training of young scholars to help build what is still a small research community into a larger, robust field. This more basic research feeds not only our own public engagement initiatives, but also provides insights useful to the fields of environmental communication and environmental psychology overall.

## II. THEORETICAL FOUNDING: THEORIES OF CHANGE

### The People & Places Framework

Much of our research is grounded in cognitive and social psychology. Theories of individual behavior, however, are not sufficient to understand individuals, social networks, or society as a whole. Social-ecological models such as the People and Places Framework (Maibach, Roser-Renouf and Leiserowitz, 2008) remind us that actions are shaped not only by individual factors like risk perceptions, but also by social factors, like norms and social networks, as well as the physical and the policy environment (see Figure 2). Volumes have been written on each of the theoretical perspectives encompassed by the People and Places Framework; below we provide the briefest of summaries of those that most strongly guide our research.



**Figure 2: The People and Places Framework**  
(Source: Maibach, Roser-Renouf & Leiserowitz, 2009)

## **Attributes of Place**

Social-ecological models make it clear that sustainable behavior is not possible if the local environment does not support it—if there is, for example, no mass transit in a community and housing is distant from work places, people will be forced to drive, regardless of their feelings about climate change. Research testing the ABC model of Guagnano, Stern and Dietz (1995) shows that the relationship between A (attitudes) and B (behavior) is contingent on C (conditions): Most people engage in very easy behaviors, such as curbside recycling, regardless of their attitudes, while few engage in very difficult behaviors, such as cycling long distances to work. Only actions of moderate difficulty are strongly related to attitudes. This points to the importance of place-based changes: sustainability will not be achieved by persuading people to change their behavior if the context does not support that behavior.

Our studies have shown that climate change attitudes are only weakly predictive of conservation behaviors in the U.S. Home energy use is more strongly related to demographic factors like home-ownership, age and income, and is more strongly motivated by economics than the environment (Maibach, Roser-Renouf, Akerlof, Leiserowitz & Nisbet, 2010a). Boucher's (2016) dissertation—using data from one of our nationally representative surveys—found that climate change beliefs influence the size of people's "carbon footprint" only at the highest level of issue engagement. Thus, the data support the insights provided by the model on the importance of place in determining behavior.

For people to live sustainably, policies and regulations are needed that change place-based characteristics in ways that encourage sustainable behavior, e.g., zoning that reduces the distances between work sites and housing, a carbon tax, and government rebates on purchases of solar panels and electric cars. These changes are less likely to be enacted in the absence of

community pressure, however, which is why some researchers argue that climate change activism is the most important action citizens can take (Ockwell et al., 2009). Thus, although our work to-date has drawn primarily on theories from the “people” side of the figure, the “places” side has been central to the selection of our dependent variables: We have focused most heavily on dependent variables that can lead to the largest reductions in carbon emissions, i.e., support for policies to mitigate climate change, and citizen activism in support of these policies.

### **Audience Perspectives**

Our research is grounded strongly in *Social Cognitive Theory* (Bandura, 2001), which posits that people's behavior is influenced by their expectations about the likelihood and desirability of outcomes associated with behaviors, and by their perceptions of their own ability to perform the actions that lead to positive outcomes, i.e., their self-efficacy. In the case of climate change, collective efficacy and proxy efficacy are also relevant, i.e., the ability of one's group to accomplish a shared task with a desirable outcome (e.g., influencing legislators), and the ability of those who represent you and your group (in this case, policy-makers), to take actions that will lead to positive outcomes (e.g., effective mitigation policies; Bandura, 2000).

Theories that focus specifically on risk assessment and response can be considered in the context of social cognitive theory in that they examine outcome expectations and efficacy beliefs with a specific focus on perceived outcomes of threats.<sup>1</sup> We draw heavily on the *Extended Parallel Process Model* (Maloney, Lapinski & Witte, 2011; Witte, 1992), which posits that in response to a perceived threat, people first consider two dimensions of a threat's outcomes—its severity and their vulnerability to it. If perceived severity and vulnerability are high, they next assess the effectiveness and feasibility of methods of threat reduction. If the threat is perceived as

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<sup>1</sup>They differ from Social-Cognitive Theory in the emphasis some place on emotions—specifically, fear—as drivers of behavior.

high, but the methods of responding to it are perceived as ineffective or infeasible (i.e., people hold low response- and self-efficacy perceptions), they may engage in defensive avoidance; if, however, they perceive responses to be effective and feasible, they're likely to take action.

We also draw heavily on *Dual-Processing Theories* that examine the ways that different types of information-processing affect responses to messages. For our purposes, Tversky's and Kahneman's contrast between effortful and automatic processing is most relevant, i.e., some information is processed immediately, effortlessly, and automatically, while other content requires cognitive effort and thoughtful attention (Kahneman, 2003). The less effortful a message is, the wider its reception is likely to be (which is not the same as persuasion, but a necessary first step, in the view of most researchers).

A second dual-processing approach, the *Elaboration Likelihood Model* (ELM) developed by Petty and Cacioppo (1986), is also relevant in its exploration of the role of issue involvement as a predictor of the depth of message processing and responsiveness to peripheral message cues, such as the credibility of the source, as compared to the strength of the arguments presented.

These theories suggest guidelines on the design of messages: Effortful content is only appropriate for audiences who are motivated to expend the necessary cognitive effort to process it, and the more easily and automatically a message can be processed, the wider the audience that will understand it.

Motivation may shape not only the depth of processing, but also the cognitive strategies employed: When people are motivated to reach a particular conclusion, they often do so, applying differing standards for evidence to arguments that are congruent and incongruent with their desired conclusion (Kunda, 1990). “Solution aversion”—i.e., a dislike for proposed policy

solutions to climate change—has been shown to motivate much of conservatives’ rejection of climate science (Campbell & Kay, 2014).

A third audience perspective we have drawn on is *Construal Level Theory* (Trope and Liberman, 2011). When people consider distant attitude objects, their thoughts tend to be abstract and global, while their thinking about closer objects will be more concrete. Distance is defined here along multiple dimensions, including time, space and social similarity. This perspective informs our efforts to focus climate change communications on local impacts that are happening now: On most—but not all—dimensions of psychological distance, greater distance is associated with lower issue engagement (Spence, Poortinga & Pidgeon, 2012).

### **Social System Perspectives**

At the level of social systems, our work has been most heavily influenced by research on the diffusion of innovations (Rogers, 2010), the two-step flow of information, and opinion leadership (Katz, 1957; Valente, 2012). Innovations in technology, ideas and behaviors spread through social systems following an S-shaped curve, adopted first by a few innovators, who typically learn of the innovation from mediated sources. They're followed by early adopters, who are often opinion leaders. These opinion leaders play a pivotal role in promoting adoption by a larger proportion of the public: People are more readily persuaded by friends and family—and especially by the opinion leaders in their social network—than by mass media. Thus, information flows in at least two steps, and in many cases, multiple steps, from media through the interpersonal channels of opinion leaders to a broader audience. This perspective has particularly influenced our strategic objectives for the segment of the public that is highly concerned about climate change (the Alarmed; see Part IV), as we seek ways to activate them as opinion leaders, who will share their knowledge and concern with their friends and family.

## Theories about Media Effects

There are multiple theories that shed light on the ways that mediated content is received, used, and responded to. We draw heavily on two types.

*Framing Theory:* Message frames can provide receivers with heuristics, or cognitive shortcuts, shaping the way they form opinions, and frames that align with individuals' values and pre-dispositions can be particularly influential in shaping opinions. Focusing people's attention on an issue's personally important dimensions through message framing can increase message acceptance (Chong & Druckman, 2007). Of particular import for climate change communication is research demonstrating that political polarization on the issue can be reduced by messages that are framed in terms of conservative values (Feinberg & Willer, 2013; Feygina, Jost & Goldsmith, 2010; Wolsko, Ariceage & Seiden 2016).

*Selective Exposure and Reinforcing Spirals:* People tend to selectively expose themselves to media content that reflects their existing views, as conflicting information may arouse feelings of dissonance and discomfort. (Sears & Freedman, 1967). Selectivity protects people from experiencing the discomfort of hearing that their opinions and beliefs may be wrong, and is facilitated by the current fragmented media landscape (Bennett & Iyengar 2008). Widespread use of internet news sources with varying degrees of accuracy and objectivity facilitates selective exposure may be exacerbating the polarized state of public opinion in the U.S. (Tewksbury, 2005).

Media content helps to form opinions, but thereafter tends to have a reinforcing effect, as people choose to expose themselves to information that's consistent with their beliefs, which strengthens these beliefs and fosters future selective exposure in a "reinforcing spiral" (Slater, 2007).

## **Social Marketing Approach**

Although not a theory, the practice of social marketing—initiatives focused on helping populations of people change their behavior ways that are beneficial to them and to society—brings an important practical perspective to our translational research. Social marketing initiatives seek to promote beneficial behaviors not by changing people, but rather by changing the behavior being promoted. Specifically, to increase the likelihood that people will adopt a new behavior, social marketers endeavor to make the behavior easy to perform, rich in benefits that have perceived value to the adopters, and perceived to be socially normative. By (1) identifying and reducing barriers that impede people’s performance of a beneficial behavior; (2) identifying and offering benefits that people value; and (3) demonstrating that the behavior is normative or is becoming more normative, social marketers, in essence, make the behavior “easy, fun and popular.” This approach, for example, directly shaped our *Climate Matters* program, which has enabled hundreds of American TV weathercasters to begin reporting on the local impacts of climate change in their community (Maibach et al., 2016).

## **III. RESEARCH**

### **Research Collaborations and *Climate Change in the American Mind***

In 2008 we began a research collaboration with Yale’s newly-formed Program on Climate Change Communication titled *Climate Change in the American Mind (CCAM)*. The *CCAM* collaboration entails bi-annual nationally-representative surveys, which provide data on a wide range of variables, including Americans' understanding of climate change, their perceptions of its threat, support for mitigation policies, climate-relevant behaviors, values, interpersonal communication, media use and perceptions of the credibility of information sources.

To date, we've conducted 18 *CCAM* surveys, two of which were re-contacts of prior respondents, yielding panel data, and two of which included samples of adolescent-parent dyads, which allowed us to examine family dynamics around climate change. One of these surveys included an over-sample of Republicans, to examine their beliefs in greater depth; and another used a split-half design to compare responses when questions about “climate change,” rather than “global warming,” which is our standard term.<sup>2</sup>

The surveys serve multiple purposes, both applied and theoretical. Topline data is reported in research monographs and polling reports, and academic papers are written examining the dynamics at play in the formation of climate change opinions and the drivers of climate-relevant behavior. The surveys are the foundation for the Yale Climate Opinion Maps, which downscale to the state, county and media market levels many of the variables we have tracked on climate change beliefs and attitudes.

The survey data are also our most used resource for briefing communication practitioners and policy-makers. These poll findings—which typically show strong public support for climate action and clean energy—are widely cited in the news media, and are of great interest to policy makers who support, or are considering supporting, climate action policies. An article in *National Journal*, a political newspaper, reported White House sources as saying that our polling reports helped to convince President Obama to make climate action a bigger priority in his second term, because they demonstrated the public would support this move (Davenport, 2013, July 25). More recently (but less successfully), we've released polling reports showing strong public disapproval for the prospect of U.S. withdrawal from the Paris Climate Accord.

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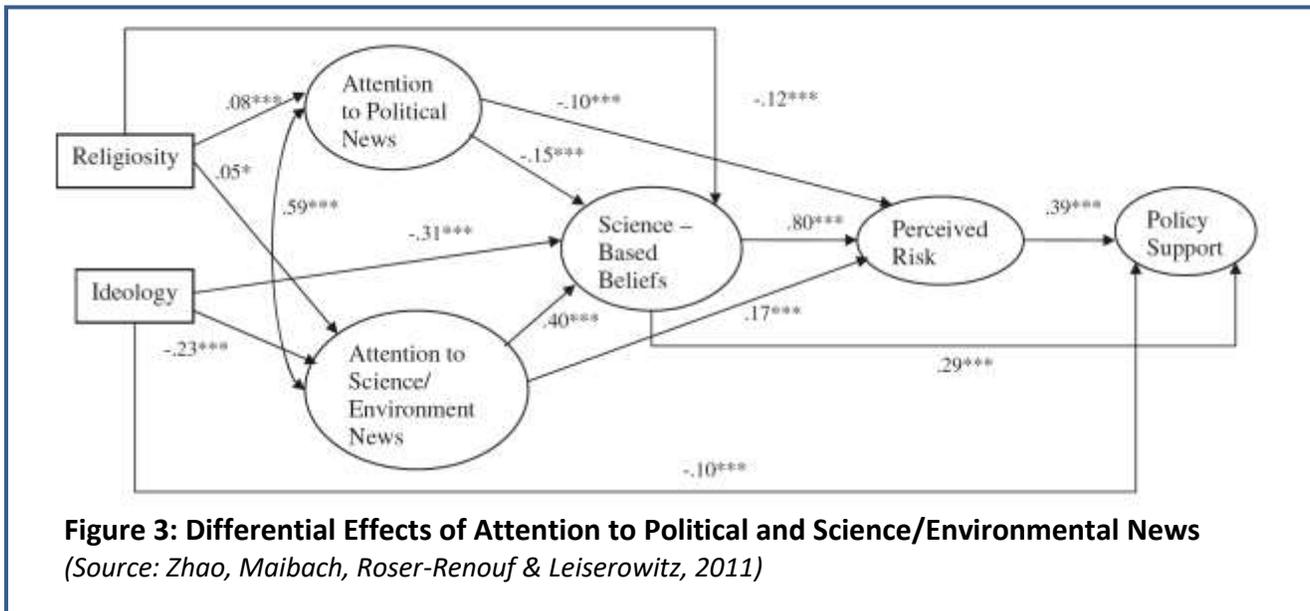
<sup>2</sup> While the climate science community prefers the term “climate change,” we continue using “global warming” in our surveys because it is still the most commonly used term among Americans (Leiserowitz et al., May 2014).

## **Media Effects on Perceptions and Issue Engagement**

Just over a third of Americans believe they have personally experienced climate change (36% in May 2017; Leiserowitz, Maibach, Roser-Renouf, Rosenthal & Cutler, May 2017), while the remaining two-thirds are relying on other sources of information to form their beliefs about the reality and harmfulness of climate change. When personal experience with a phenomenon are absent, media effects on beliefs and attitudes are likely to be greater (Ball-Rokeach & De Fleur, 1976). Thus, understanding the roles that the news media are playing in shaping public beliefs has been an important focus for our research. Some of this work has examined direct effects of exposure on beliefs, but a larger portion has analyzed the ways that individual attitudes and beliefs shape the ways that people use, process and respond to mass media. From this work we understand more clearly the role media play in the attitudinal polarization and skepticism surrounding climate change in the U.S.

Political polarization on climate change in the U.S. can be dated back to the late 1990s, when the attitudes of Republicans and Democrats began to diverge (Krosnick, Holbrook & Visser, 2000), eventually reaching a point where skepticism became something of a litmus test for Republicans (Dunlap & McCright, 2011). Major contributors to the polarization include disinformation campaigns funded by the fossil fuel industry, and media coverage of the issue, which for many years presented a “false balance” in coverage of the issue, fostering beliefs in the audience that the science is contested (Boykoff, 2007; Somerville & Hassol, 2011). A fragmented media environment, selective exposure to compatible news sources, and motivated reasoning within the audience (Campbell & Kay, 2014; Kunda, 1990) have all contributed to sustaining the polarization.

In 2011, we assessed differences in the impacts of attention to political news on climate change, as compared to scientific and environmental news. Political news has typically focused on controversy and has given voice to climate skeptics among Republican political elites, while scientific and environmental news have typically conveyed science-based information. We found that attention to science and environmental news is associated with beliefs more consistent with the global warming science, and with higher risk perceptions, and that the opposite is true of attention to political news: After controlling for attention to science and environmental news exposure, attention to political news has significant negative relationships with understanding that climate change is real, human-caused, harmful, and that scientists agree on the issue (Zhao, Leiserowitz, Maibach & Roser-Renouf, 2011; see Figure 3).

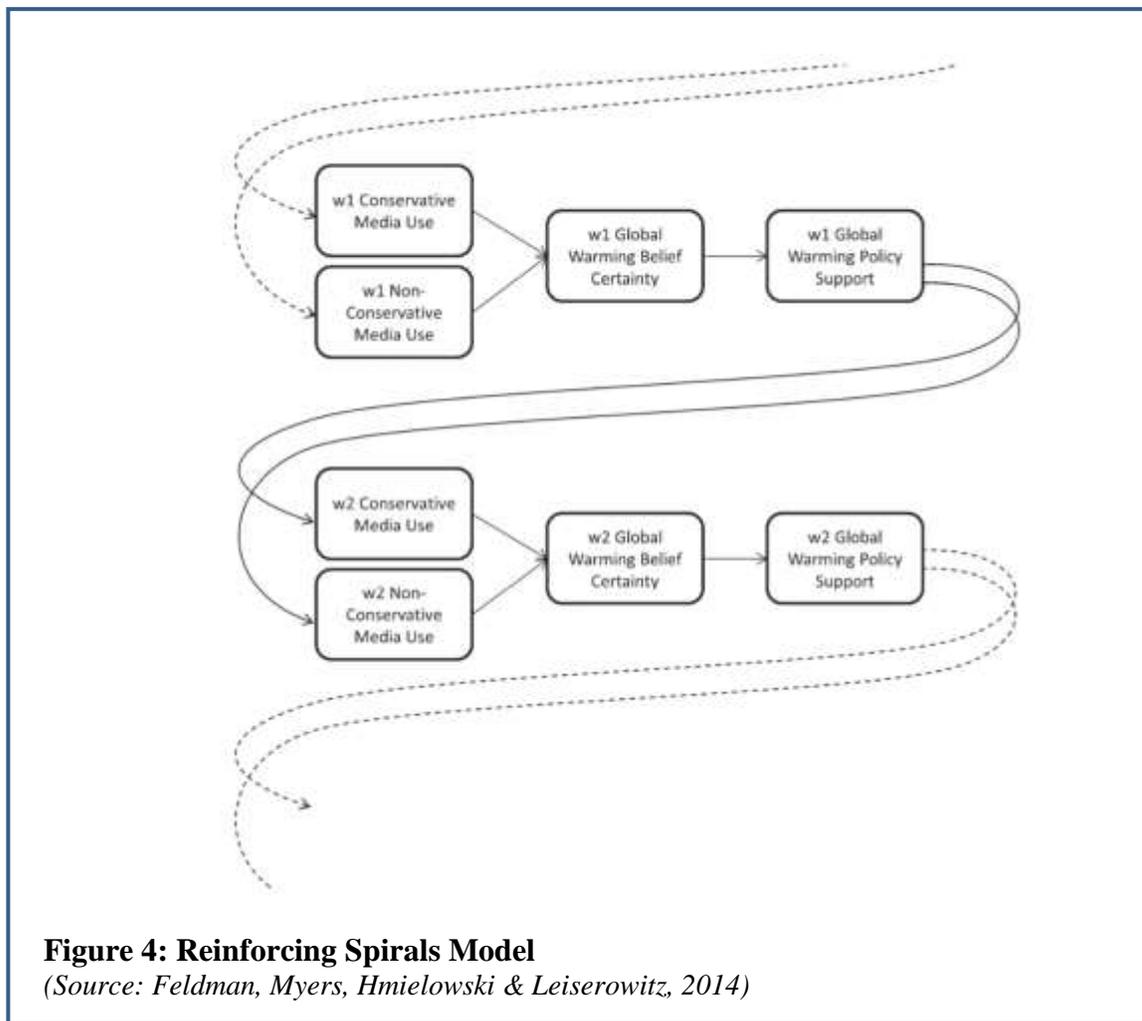


Within categories of news, particular news sources are significant contributors to the polarization. Content analyses show that conservative news media, such as Fox News and The Wall Street Journal carry more articles and opinion pieces that cast doubt on the scientific consensus than liberal and middle-of-the-road sources, such as MSNBC, CNN, The New York Times and The

Washington Post (Feldman, Maibach, Roser-Renouf & Leiserowitz, 2012; Theel, Greenberg & Robbins, 2013, Oct. 10).

An analysis of 2008 *CCAM* data found a negative association between Fox News viewership and acceptance of global warming, even after controlling for numerous potential confounding factors. Conversely, viewing CNN and MSNBC was associated with greater acceptance of global warming.. Further analyses revealed that the views of Republicans were strongly linked with the news outlet they watched, regardless of how well that outlet aligned with their political predispositions. In contrast, Democrats didn't vary much in their beliefs as a function of cable news use. This asymmetry suggests that Republicans are less skeptical when they are exposed to information on the reality and urgency of climate change. (Feldman et al., 2012).

Selective exposure to conservative news sources inhibits change, however, and can act over time to reinforce and strengthen climate skepticism—a process demonstrated in an analysis of *CCAM* panel data. Selectivity combined with media effects created a reinforcing spiral: Consuming conservative or non-conservative media at Wave 1 made people more likely to consume those same media at Wave 2, partly as an indirect result of the media's effects on global warming belief certainty and policy preferences. Wave 2 media use, in turn, further strengthened audiences' global warming belief certainty and policy preferences (Feldman, Myers, Hmielowski, & Leiserowitz, 2014; see Figure 4). The data further demonstrated that conservative media use decreased trust in scientists which, in turn, decreased certainty that global warming is happening. By contrast, use of non-conservative media increased trust in scientists, which, in turn, increased certainty that global warming is happening (Hmielowski, Feldman, Myers, Leiserowitz & Maibach, 2014).



Together, slanted news coverage, selective exposure and motivated reasoning can result in diametrically different interpretations of the same news. For example, 60 percent of the Republicans who were aware of Climategate<sup>3</sup> said they lost trust in scientists as a result, while three-quarters of Democrats said their trust in scientists was not affected (Leiserowitz, Maibach, Roser-Renouf, Smith & Dawson, 2012).

<sup>3</sup> In November, 2009, over 1,000 stolen emails between climate scientists were publically released, along with claims that they were evidence of scientific misconduct to mislead the public about climate change. Dubbed “Climategate,” the event drew widespread media attention. Multiple university investigations showed the charges against the scientists to be unfounded, and cleared them of all charges.

## **Cognitive Drivers of Issue Engagement**

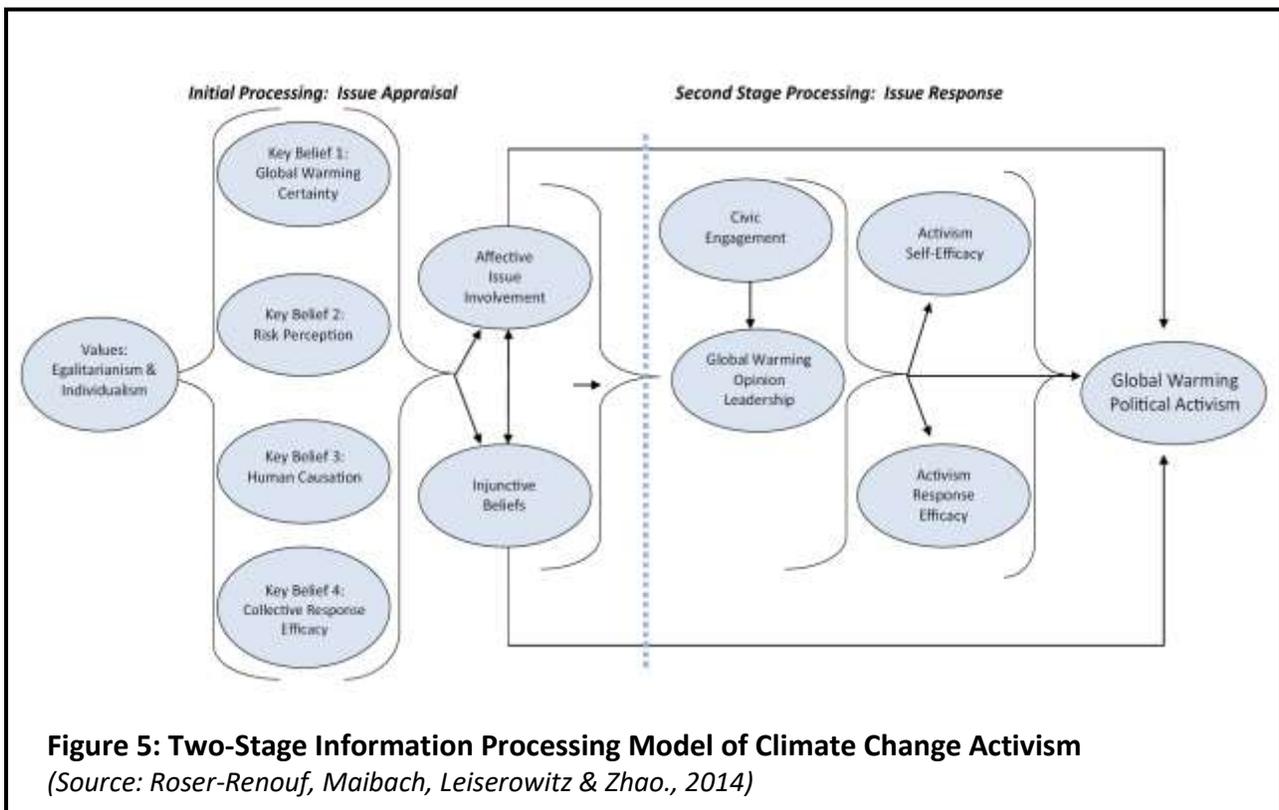
Despite the fact that climate skepticism is higher among Republicans than Democrats in the U.S., two-thirds of moderate and liberal Republicans now recognize that climate change is real (65%), as do 45 percent of conservative Republicans (Leiserowitz et al., 2017). Feldman and colleagues' 2012 finding that Republicans were less skeptical if they viewed CNN or MSNBC suggests that accurate information changes people's minds, even if tribal commitments do play a major role in determining beliefs (Kahan, Jenkins-Smith & Braman, 2011). Moreover, experiments by Ranney and his colleagues (e.g., Ranney & Clark, 2016) demonstrate that information can and does change minds, and that these effects endure over time. Thus, an important focus of our research has been to identify the specific and essential information that builds issue engagement and mitigation policy support, and that changes behavior. The key beliefs described below form a template for climate change communication.

### ***Four Key Beliefs***

Support for climate change mitigation policies and both political and consumer climate change activism are significantly higher among those who hold four key beliefs: They are certain that climate change is (1) real, (2) human-caused and (3) harmful, and (4) they believe that collectively humans can successfully reduce climate change (i.e., they have collective efficacy; Roser-Renouf, Atkinson, Maibach, & Leiserowitz, 2016a; Roser-Renouf, Maibach, Leiserowitz & Zhao., 2014b). Our analyses of *CCAM* data show that people who hold these four beliefs are more likely to be affectively involved with the issue, i.e., they worry more and view the issue as personally important. They're more likely to act as opinion leaders on the issue by discussing it with their family and friends; to have contacted legislators in support of mitigation policies; and

to make consumer choices with the objective of influencing others' consumption and changing corporate practices.

We modeled climate change political activism with the Two-Stage Information-Processing Model (see Figure 5), which is grounded in Social Cognitive Theory. It operationalizes climate change outcome expectations with two beliefs—climate change is real and harmful—and efficacy beliefs with two additional beliefs—humans are capable of reducing climate change and humans are causing it.<sup>4</sup> These beliefs are strongly predictive of affective issue involvement and injunctive beliefs (i.e., beliefs that government, corporations and citizens should take action to reduce the threat), which, in turn, predict opinion leadership, political efficacy perceptions and activism (Roser-Renouf et al., 2014b).



<sup>4</sup> Humans are capable of reducing climate change *because* humans are causing it; hence, human causation is a logical foundation for efficacy.

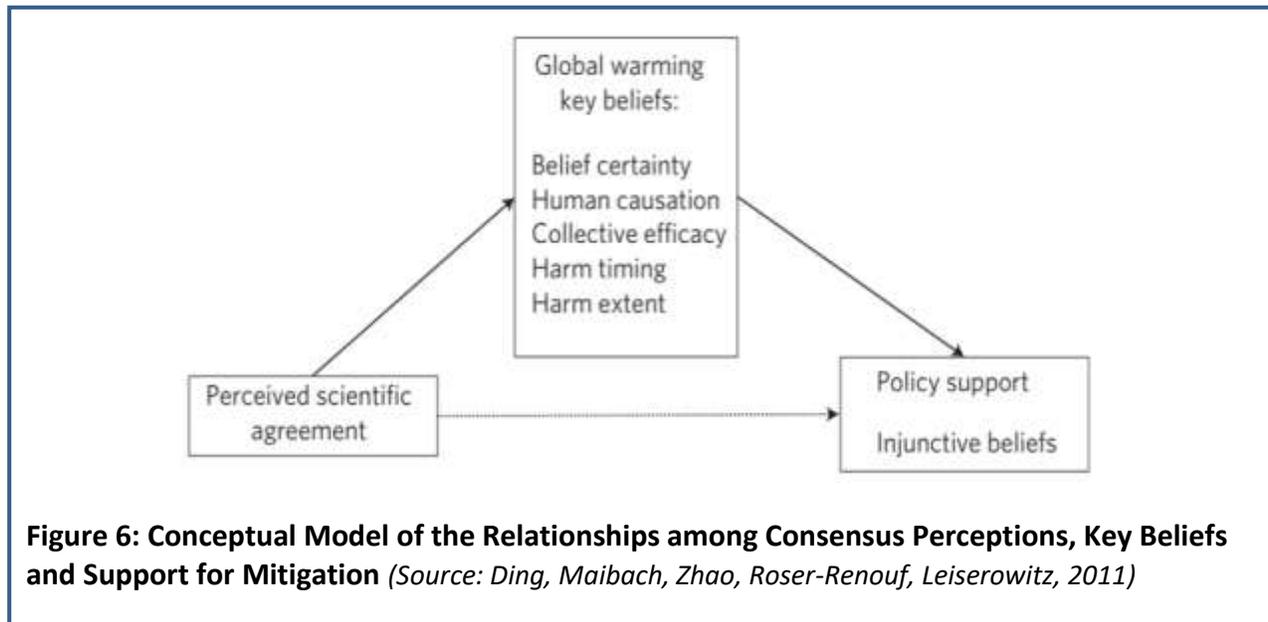
### ***A Fifth Key Belief: The Scientific Consensus***

In light of our research showing that recognition of the scientific consensus increases each of the original four beliefs, we've added a fifth key belief to the four listed above. This simple, clear message—"97% of climate scientists are convinced that human-caused climate change is happening"—is a useful and effective heuristic for shallow information-processors: People who are either unable or unwilling to learn more about the science demonstrating that human-caused climate change is occurring can easily understand that experts agree on these facts. Moreover, the consensus message directly addresses one of the primary tactics used by disinformation campaigns, i.e., asserting that the science isn't settled and scientists disagree on the issue. Published papers have quantified the high scientific consensus dating back to a paper published by Naomi Oreskes in 2004 (Oreskes, 2004), and replicated multiple times using multiple methods: The "consensus on consensus" is that 97 percent of climate scientists concur on the reality of anthropogenic climate change (Cook et al., 2016).

Our initial 2008 survey showed that fewer than half of Americans thought that "most scientists think global warming is happening" (46%), while a third believed "there is a lot of disagreement among scientists," and another quarter said they didn't know. By June of 2010, following the release of the stolen "Climategate" emails, the proportion recognizing that most scientists are in agreement fell by 14 percentage points to 33%, and the proportion who thought scientists disagree grew to 39 percent (Leiserowitz, Maibach, Roser-Renouf & Smith, May 2011). Correcting this misperception seemed an important avenue to engaging the public.

Our efforts to assess the importance of consensus perceptions as a predictor of other beliefs and attitudes began with an analysis of *CCAM* data, in which consensus perceptions were predicted to both directly increase policy support and injunctive beliefs, and to indirectly

increase these dependent variables through the four key beliefs (see Figure 6). The analysis strongly supported the hypotheses, and in comparisons to alternative models, only the hypothesized model fit the data well. (Ding et al., 2011).

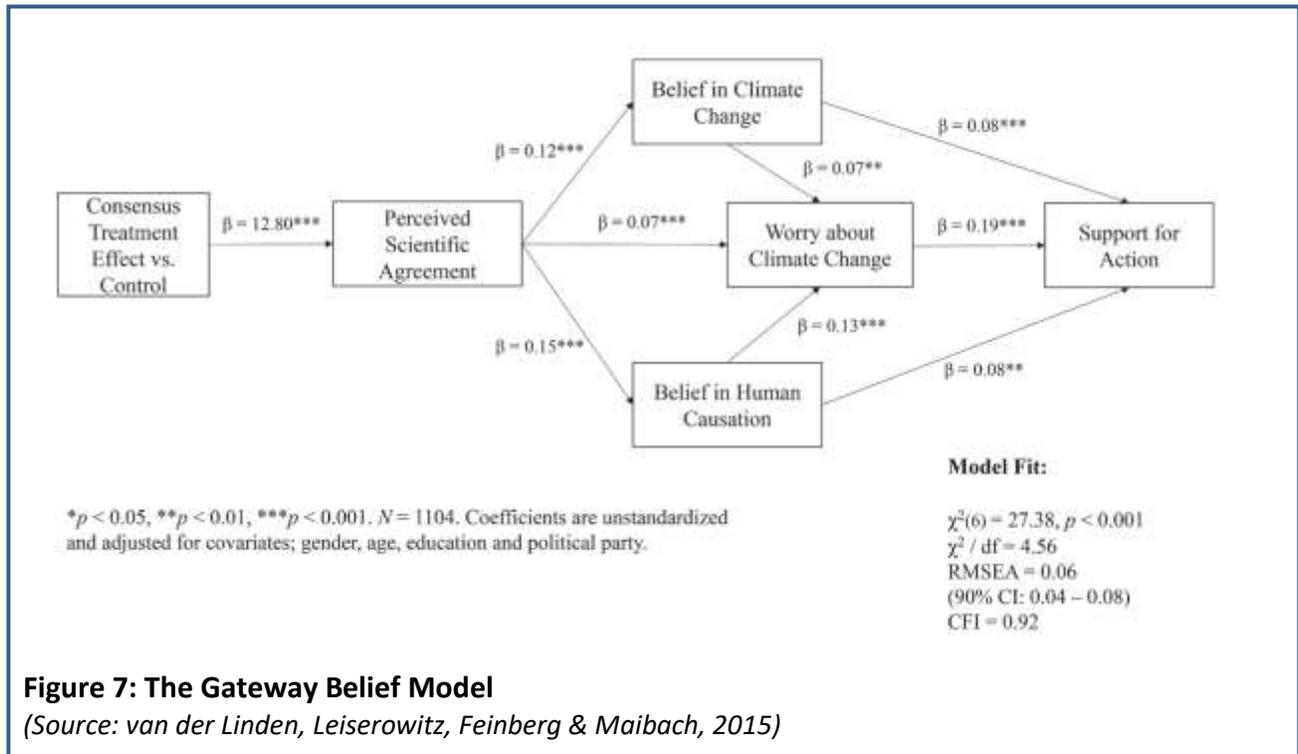


In light of these survey results, we began testing the relationships experimentally and examining ways that the consensus could most effectively be communicated. A comparison of metaphors, descriptive text and a pie chart to communicate the consensus found that all three were effective, but that the pie chart and descriptive text had greater recall and were most effective across political party lines (van der Linden et al., 2014).

A second experiment showed that numeric estimates of the consensus were more effective than non-numeric estimates in increasing consensus recognition (Myers et al., 2015); and a third experiment found that asking participants to estimate the level of consensus prior to revealing the actual level led to higher consensus estimates than simply the information alone, indicating that an “estimation-and-reveal” technique in public communication about the

scientific consensus can be effective (Myers et al., 2015). All three experiments found consensus messaging to be effective across party lines.

An experimental replication and extension of the Ding and colleagues findings tested a "gateway belief model," showing that increasing public perceptions of the scientific consensus is significantly and causally associated with an increase in the belief that climate change is happening, human-caused and a worrisome threat. In turn, changes in these key beliefs are predictive of increased support for public action (see Figure 7; van der Linden, Leiserowitz, Feinberg & Maibach, 2015a).



While these studies indicate that the consensus message can be effective, they may have limited external validity because outside the lab setting people are exposed to both information and disinformation. To begin to address this issue, we tested whether people can be "inoculated" against misinformation by providing not only the correct information, but also by explaining the

biased motivations and factual errors of disinformation campaigns. The study found that not only is inoculation effective, it works across the political spectrum (van der Linden et al., 2017).

In sum, these studies show that five key beliefs—climate change is real, harmful, human-caused and solvable, and that scientists agree on its reality, human-causation and harmfulness—are powerful drivers of mitigation policy support and climate change activism. In the next section we describe studies that have examined drivers of affective involvement with climate change, focusing on perceptions of its harmfulness and personal relevance.

## **Affective Drivers of Issue Engagement**

### ***Extreme Weather and Experiential Learning***

Even among Americans who accept that climate change is real, many continue to see it as a distant threat—distant in space (i.e., not here), time (i.e., not yet), and species (i.e., not us). Many think it's a threat to polar bears, future generations and people in developing nations, but not to them, their families or their communities (Leiserowitz, 2006). This is, perhaps, the most challenging of the barriers we face, as the impacts of climate change are not yet readily apparent to most people,<sup>5</sup> and in their absence, it is challenging to build issue engagement when many other threats appear to be more immediate and pressing. Humans have a “limited pool of worry” (Weber, 2006), and climate change can easily fall to the bottom of the list.

Weber's aptly sub-titled 2006 paper, "Why global warming doesn't scare us (yet)" made the point that affect is a stronger driver of risk perceptions than cognitions, and that people need personal experience with global warming to become truly involved with the issue. In response to increases in extreme weather in the U.S. (and Hurricane Sandy in particular), we focused our spring 2013 *CCAM* survey on Americans' experience of extreme weather events, and their

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<sup>5</sup>The 2017 hurricane season may change this. At this writing, however, it's too early to say.

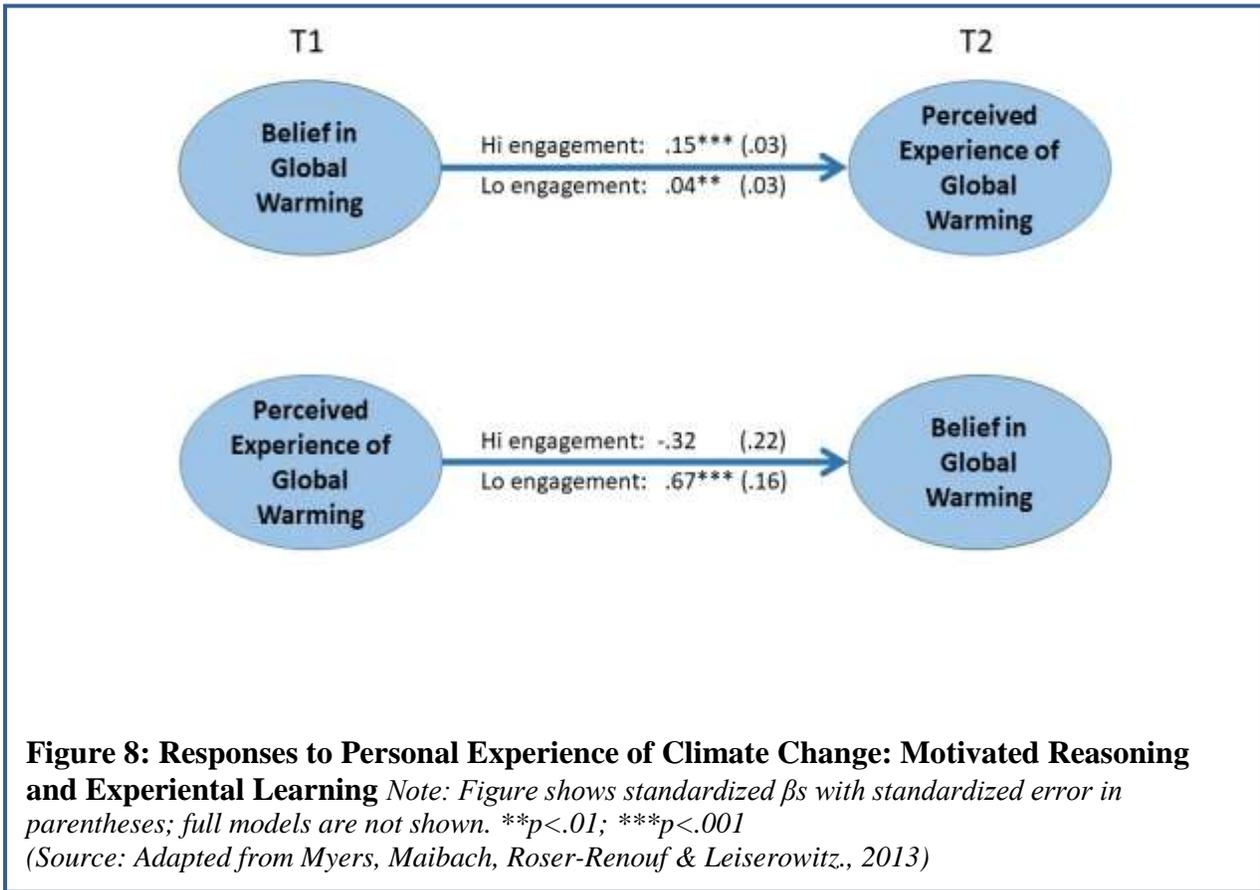
perceptions of the link between weather and climate change. We found that two-thirds of Americans (64%) believed that weather in the U.S. has become worse over the past several years, and over half (58%) agreed with the statement that "Global warming is affecting weather in the United States." Many believed that global warming increased the severity of extreme weather events such as Superstorm Sandy (46%) and record high temperatures (50%) (Leiserowitz, Maibach, Roser-Renouf, Feinberg & Howe, Apr. 2013).

Subsequent research on the accuracy of self-reported weather experiences revealed that reported experiences correspond well with recorded event impacts, both in the U.S. (Howe, Boudet, Leiserowitz & Maibach, 2014) and in India (Howe, Thaker & Leiserowitz, 2014). Belief that extreme weather is becoming more frequent is associated with higher concern about climate change, and is higher among those who watch television weather forecasts—a finding that points to the influence of weathercasters. (Bloodhart, Maibach, Myers & Zhao, 2015).

Together, these results suggested that extreme weather events can serve as "teachable moments" that help people to recognize the reality of climate change (Somerville & Hassol, 2011). Analyses of panel *CCAM* data indicate that this holds true for people who are uncertain about the reality of climate change: For those who are highly engaged and strongly convinced of the reality/non-reality of climate change, weather conditions are used to bolster their existing beliefs—an example of motivated reasoning—but among those who less engaged and unsure of their global warming beliefs, personal experience is associated with increased certainty in the reality of climate change. (Myers, Maibach, Roser-Renouf, Akerlof & Leiserowitz, 2013; see Figure 8<sup>6</sup>).

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<sup>6</sup> Figure 8 shows only a small piece of the model-testing. The analysis assessed six different models, including models with both synchronous and lagged effects of belief certainty and personal experience at T1 and T2, as well as all relevant controls, for both the highly and less engaged groups. Only two variables are shown here for simplicity. See the full paper for complete results.



Thus, the evidence suggests that extreme weather can help the majority of Americans who are still at least somewhat uncertain about the reality of climate change to learn that climate change is real and is affecting the U.S. Further, these findings show that television weather forecasts can help people to make the link between weather and climate change by highlighting the ways in which current weather anomalies are exemplars of the changes associated with climate change. These findings laid the foundation for our work with TV weathercasters, which is described in Part V.

## **Health Harms**

A primary motivation for the establishment of our research center was our recognition of the serious impacts climate change has on humans' health and well-being—a recognition increasingly shared by the public health and medical communities. Interviews we conducted with directors of city and county public health department in 2008 found that roughly 60 percent agreed that one or more serious public health problems would occur in their jurisdiction over the coming two decades due to climate change (Balbus et al. 2008). Only 11 percent strongly agreed, however, and four years later, the proportion that strongly agreed with the statement had more than doubled to 29% (Roser-Renouf, Maibach & Li, 2016d).

More recently, our surveys of medical societies have revealed that physicians are now seeing impacts of climate change in their patient populations. This includes doctors who treat pulmonary diseases, allergies, asthma, and those whose practices include a high proportion of African-American patients, i.e., populations we expect to experience greater health impacts of climate change (Sarfaty et al., 2015a; Sarfaty, Kreslake, Casale, & Maibach, 2015b; Sarfaty et al., 2016; Sarfaty, Mitchell, Bloodhart, & Maibach, 2014). For example, a 2014 survey of members of the National Medical Association—an organization of doctors who treat and/or are African-American—found that 61 percent say climate change is now affecting the health of their patients a great deal or a moderate amount (Sarfaty et al., 2014).

While public health and medical professionals are aware of the health threats associated with climate change, most of the public has been unaware. This may be due, in part to the typical framing of global warming in the news as an environmental and political issue with few references to its impacts on humans. Multiple researchers (including our team) have urged communicators to discuss human impacts, rather than impacts on iconic species like polar bears,

arguing that a greater understanding of the health impacts could engage people who continue to perceive the threat as distant and personally irrelevant (Maibach et al., 2008; Nisbet, 2009; van der Linden, Maibach & Leiserowitz, 2015b).

We first tested this proposition by assessing audience responses to short essays that emphasized one of three message frames—environmental, public health, or national security—and found that the public health frame was the most positively received of the three, and that this held true regardless of the respondents' prior beliefs about climate change (i.e., even climate skeptics responded positively; Myers et al., 2012).

In light of this finding, we assessed public understanding of the health impacts of climate change in a *CCAM* survey in 2014. Close to two-thirds of Americans had given little to no thought to the impacts of global warming on people's health (61%), and only a quarter could accurately name any type of climate change-related health harm in an open-ended question (27%; Leiserowitz et al., Oct. 2014; Maibach et al., 2015a). Accurate knowledge of the types of harm climate change was almost exclusively restricted to respondents who were highly concerned about climate change (i.e., the Alarmed, who are described in Part IV; they comprised 13% of the population at that time), and even among the most highly engaged, understanding was low with only a third able to name the most familiar climate-related health threat (lung diseases; Roser-Renouf et al., 2014a).

The ideal source for health impacts messaging is, naturally, a physician. In *CCAM* questions regarding trusted sources, respondents said their primary care physician is their most trusted source of information on the health harms of climate change, followed by the Centers for Disease Control and Prevention, the World Health Organization, and their local public health department (Maibach et al., 2015a). Together, these findings show that (1) the public knows little

about the health impacts of climate change; (2) health framing is positively received across opinion groups; and (3) physicians are trusted sources of information on this topic. Hence, we have been working with medical societies to recruit physicians to act as spokespeople on the issue. This work is described in Part V.

### **Moral Dimensions**

While risk perceptions are important drivers of affective involvement, another possible approach to engaging Americans is through their religious values. As a nation, we are unique among developed countries in our high religiosity. Over half of Americans (54%) say religion plays a very important role in their lives, as compared, for example, to 24 percent of Canadians and 21 percent of Australians (Pew Research Center, 2015). Many climate skeptics are high in religiosity, and our baseline survey suggested that many Americans could be responsive to a moral framing of climate change. When asked to name the most important outcome of action to reduce global warming, one in five said it would "protect God's creation." Few, however, recognized other moral outcomes of mitigation: Four percent said the most important reason to mitigate would be to "save many people around the world from poverty and starvation," and only one percent said the most important reason was to "protect the world's poorest people from environmental harm caused by the world's richest people" (Maibach, Roser-Renouf & Leiserowitz, 2009).

Pope Francis' release of an encyclical on climate change in 2015 addressed these latter points directly. His emphasis on the moral imperative of mitigation to protect the vulnerable poor worldwide was a framing most Americans had not previously heard, and given the high level of religiosity among Americans, the moral framing had high potential: In the spring of 2015, only 35 percent of Americans said global warming is a moral issue, in contrast to the proportions that

said it is an environmental (76%), scientific (71%), or political (54%) issue (Leiserowitz, Maibach, Roser-Renouf, Feinberg & Rosenthal, March 2015).

The pope was also a new voice on the issue, speaking from outside the politically-polarized arena. He spoke with the moral authority of his position leading the second largest religious denomination in the U.S.,<sup>7</sup> and when the pope stated that climate change is a moral issue that people of faith are called to address, he may have reached an audience that other sources have struggled to engage, i.e., the segments of the public that regard climate change as an issue that politicians debate and scientists study, but that has little personal relevance (Roser-Renouf, Stenhouse, Rolfe-Redding, Maibach & Leiserowitz, 2014c).

To assess the pope's impact, we conducted three *CCAM* surveys focusing on exposure to and acceptance of his message. The initial survey was conducted in the spring of 2015, prior to release of the encyclical at a time when few Americans (5%) were aware of it (Maibach, et al., 2015b). The second and third surveys were conducted in the fall, following the pope's visit to the U.S.; one of these surveys was a new independent cross-section, and the other was a re-contact of our spring respondents.

Both of the fall surveys showed that perceptions that global warming is a moral issue increased significantly between the spring and fall (see Table 1). Americans also became more certain that climate change harms the poor and people in developing nations, and the proportions that said the issue is personally important and worrisome increased (Leiserowitz, Maibach, Roser-Renouf, Feinberg & Rosenthal, Oct., 2015; Maibach et al., 2015b; previously unpublished *CCAM* data).

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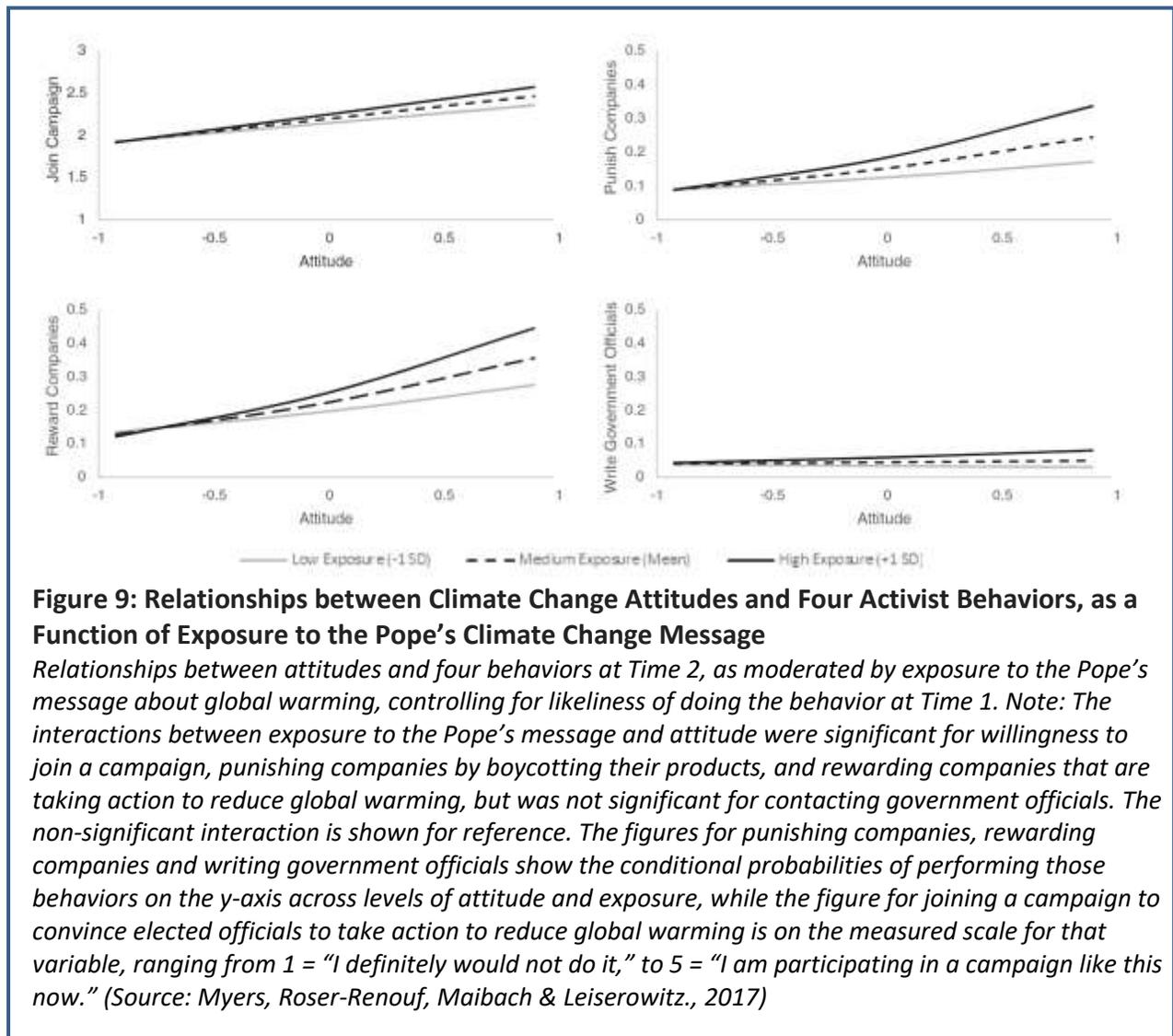
<sup>7</sup>Twenty-one percent of Americans are Catholic, second only to Evangelical Protestants, who make up a quarter of the population (Pew, 2013).

| <b>Table 1: Changes in Perceptions of Global Warming, March-Oct. 2015</b> |                    |      |                             |      |
|---|--------------------|------|-----------------------------|------|
|   | Panel <sup>a</sup> |      | Cross-Sections <sup>b</sup> |      |
|   | March              | Oct. | March                       | Oct. |
| GW is a moral issue   | 32%                | 38%  | 35%                         | 41%  |
| Certain gw is happening   | 34                 | 40   | 37                          | 40   |
| Issue is very/moderately important personally                             | 19                 | 26   | 21                          | 26   |
| Very/extremely worried  | 51                 | 56   | 52                          | 57   |
| GW will harm world's poor a great deal/moderate amount                    | 49                 | 61   | 53                          | 61   |
| GW will harm developing nations a great deal/moderate amount              | 48                 | 63   | 52                          | 61   |

<sup>a</sup>All panel comparisons significant,  $p < .001$ . Unweighted  $n=905$ . (Sources: Maibach et al., 2015b; previously unpublished CCAM data).

<sup>b</sup>Moral issue,  $p < .05$ ; certainty gw is happening, *n.s.*; personal importance and worry,  $p < .01$ ; gw will harm poor and developing nations,  $p < .001$ . March unweighted  $n=1,263$ ; Oct. unweighted  $n=1,344$ . (Sources: Leiserowitz, Maibach, Roser-Renouf, Feinberg & Rosenthal, Oct. 2015; previously unpublished CCAM data).

Further, exposure activated people who were already concerned about climate change prior to the pope's encyclical. They engaged in more consumer activism, and expressed greater willingness to join a campaign to convince government officials to act on climate; i.e., people became more likely to act on their beliefs (see Figure 11; Myers, Roser-Renouf, Maibach & Leiserowitz, 2017). The least common (and probably most difficult) behavior we assessed—contacting government officials in support of mitigation policies—was unaffected by exposure to the pope, but both boycotting and buycotting, based on companies' climate change-related practices increased as a function of exposure to the pope's climate change message.



We found that by the fall of 2016, when the pope's views on climate change were no longer prominent in the news, perceptions that climate change is a moral issue had reverted to their spring 2015 levels (Leiserowitz et al., May 2017). This drop may reflect the absence of message repetition: Without the reinforcement provided by hearing the moral message repeated, the changes witnessed in 2015 faded. Nonetheless, given its at least temporary effects on issue engagement, we view the moral climate message as a potentially effective means of engaging faith communities.

## Efficacy and Solvability Perceptions

If people come to recognize the threat of climate change without also believing there is something they can do to avert the threat, “fear control,” becomes more likely: Defensive avoidance, denial, and distortion are response strategies people may employ in the face of an unavoidable threat (Witte, 1992). Hence, it is counter-productive to frighten people with information on the harmfulness of climate change without simultaneously providing them with images of a positive future and the actions they personally can take to move society toward that future.

Efficacy beliefs are currently lacking in the U.S.: Forty-two percent of Americans agree with the statement, “The actions of a single individual won’t make any difference in global warming,” and few express confidence that we can and will reduce global warming. While seven

| <b>Table 2: Global Warming Solvability and Collective Efficacy Perceptions</b>                                 |     |
|--|-----|
| Humans can reduce global warming, and we are going to do so successfully.                                      | 7%  |
| Humans could reduce global warming, but it's unclear at this point whether we will do what's needed.           | 49% |
| Humans could reduce global warming, but people aren't willing to change their behavior, so we're not going to. | 24% |
| Humans can't reduce global warming, even if it is happening.   | 12% |
| Global warming isn't happening.  | 8%  |

*Unweighted n=1,266. (Source=Leiserowitz, Maibach, Roser-Renouf, Rosenthal & Cutler, May 2017)*

percent believe we will successfully reduce climate change, 44 percent believe we won’t—either because we’re not willing to change our behavior, humans aren’t capable of reducing climate

change, or climate change isn't happening. A plurality (49%) say it's unclear what will happen (see Table 2; Leiserowitz et al., May 2017).

Low efficacy perceptions reduce the motivation to act (Bandura, 2001), and they represent a significant barrier to public engagement. Climate change is a collective problem that requires collective action. Unlike health threats—e.g., smoking—most individual actions to reduce climate change appear to have minimal impact: If I quit smoking, my health immediately begins to improve; if I quit driving, no reduction in climate change is apparent. This perspective fails to account for the significant contagion effects of individual action (Christakis and Fowler, 2013), but most people are unaware of the power of social influence (Nolan, Schultz, Cialdini, Goldstein & Griskevicius, 2008).

Our research on political activism has highlighted the implications of efficacy perceptions for individual action: Among respondents who were certain climate change is real, and who had high risk perceptions (two of key beliefs), three percent had contacted a legislator in support of mitigation over the prior year. Among those who held these beliefs, but who also understood that humans cause and therefore can reduce climate change (two additional key beliefs that encompass efficacy), 40 percent had contacted a legislator (Roser-Renouf et al., 2014b). The belief that activism is effective and a high sense of personal efficacy to engage in it were both significant predictors of political activism on climate.

In our examination of consumer activism, we found that the belief that consumer activism can influence the practices of companies (i.e., high perceived effectiveness) strongly predicted the goal of influencing other consumers and companies with one's purchase decisions, which in turn predicted both opinion leadership and green consumption choices. The perceived effectiveness of consumer activism was quite low, however: Seventy-two percent of respondents

said their actions influenced companies “not at all” or “only a little” (Roser-Renouf et al., 2016a).<sup>8</sup>

### **Best Practices for Climate Change Communications**

In light of the research described above, together with other related research on science and risk communication, we published an overview of best practices for communicators and policy makers (van der Linden et al., 2015b). In brief, we suggest that:

- Localize the threat, emphasizing that it is hurting people in the audience’s own community here and now. Distant peoples and species are less engaging.
- Rely less on messaging that requires analytical thought and cognitive effort. Messages should, instead, be easily and automatically understood, with an emphasis on concrete experiences that audience members can relate to their own lives.
- Leverage both descriptive and injunctive norms by highlighting the effective actions others are taking and the power of collective action; and by avoiding communications that imply negative attitudes and harmful behaviors are widespread.
- Emphasize current benefits of mitigation actions, i.e., the co-benefits to our health and safety. Because humans are averse to losses, messages that suggest we sacrifice now for gains in the future are more likely to fall on deaf ears.
- Appeal to people’s deeply held values concerning environmental protection and concerning the well-being of others.

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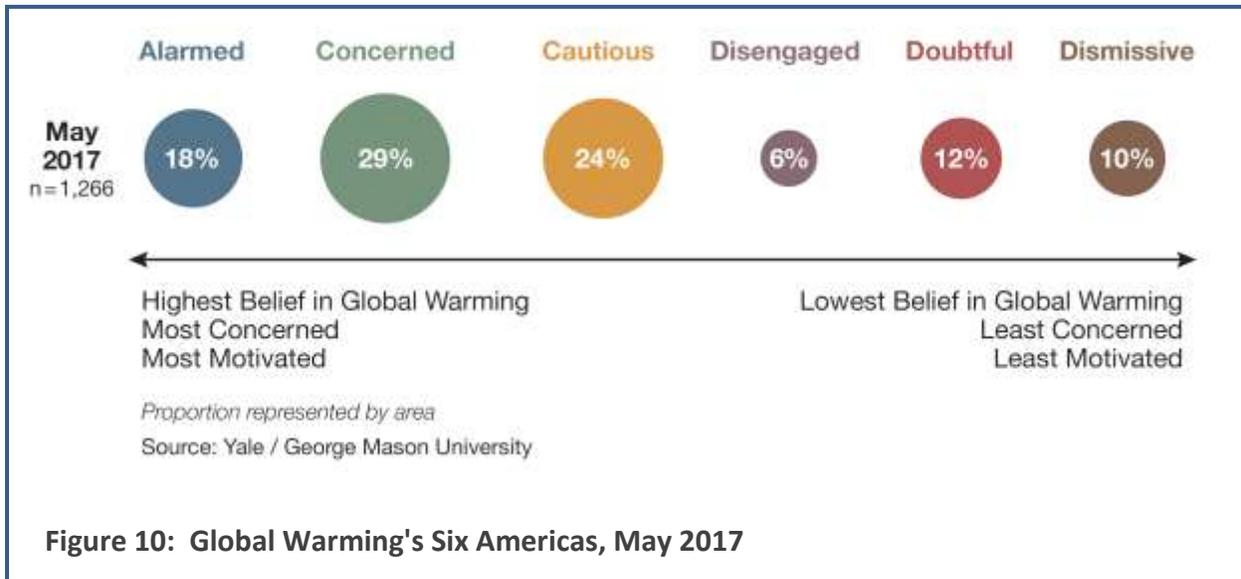
<sup>8</sup> This is a misperception. Boycotts that receive at least some national media attention have about a one-in-four success rate in influencing corporate practices (Friedman, 1985; King, 2008; Roser-Renouf, Leiserowitz & Rosenthal, 2016c); and for those that include public protests or demonstrations, the success rate jumps to about half (Friedman, 1985).

## PART IV. AUDIENCE SEGMENTATION

### Global Warming's Six Americas

The five best practices described above apply to messaging a broad audience. It's also true, however, that one size does not fit all. Audiences are diverse in their beliefs, informational needs, values and interests, and within each of the best practices there are a range of communication options. Some audiences are willing to expend cognitive effort to learn more about an issue they care about. Some are already frightened and need less information on threats and more on solutions. And some are open to making high effort behavior changes, while others are only willing to change small, simple behaviors. Campaigns to increase engagement must therefore work at multiple levels, contingent on characteristics of the audiences they are attempting to reach.

To distinguish target audiences for strategic communications, we used our first *CCAM* survey data (2008), to segment the American adult public into six audiences: *Global Warming's Six Americas* (Maibach, Leiserowitz, Roser-Renouf & Mertz, 2011; Maibach et al., 2009). The segmentation distinguishes among these audiences based on four sets of characteristics—beliefs and attitudes; issue involvement; climate-relevant behaviors; and preferred societal responses. These segmentation findings and a screening instrument we developed for use by other researchers have become some of our most widely used applications, as they provide an in-depth analysis of groups that are both internally consistent, and distinct from one other.



The Six Americas range across a spectrum of concern and issue engagement, with segments that accept and reject climate science at the ends of a continuum, and those that are less certain and less engaged in the middle (see Figure 10). At one end of the spectrum are the *Alarmed*, who are very concerned about the issue, accept that climate change is real, human-caused and harmful, and who support aggressive action to reduce it. At the other end are the *Dismissive*, who are unlikely to believe that climate change is real or a problem, and are likely to believe it is a scientific hoax. Between these two extremes are four groups—the *Concerned*, *Cautious*, *Disengaged* and *Doubtful*—with lower certainty and issue engagement. A selection of the measures used to identify the segments are shown in Table 3, illustrating differences among the groups<sup>9</sup>.

Unsurprisingly, the *Dismissive* and *Doubtful* are more likely to be conservative Republicans, while the *Alarmed* and *Concerned* are more likely to be liberal Democrats (Maibach et al., 2009). On scales of cultural values (Wildavsky and Dake, 1990), the *Dismissive*

<sup>9</sup> The full segmentation screener with all 36 items, a 15-item abbreviated screening instrument, and the methodology used in the segmentation can be found in Maibach et al., 2011.

| Table 3: Selected Segmentation Measures by Six Americas Segment |   |          |           |          |            |          |            |               |
|---|---|----------|-----------|----------|------------|----------|------------|---------------|
| Categories of Questions   | Survey Questions  | Segments |           |          |            |          |            | F or $\chi^2$ |
|   |   | Alarmed  | Concerned | Cautious | Disengaged | Doubtful | Dismissive |               |
| Global Warming Beliefs  | Certainty global warming is happening <sup>a</sup>                              | 8.66     | 7.84      | 6.57     | 6.07       | 4.8      | 2.87       | 451           |
|   | Human causation <sup>b</sup>  | 94%      | 77%       | 50%      | 47%        | 19%      | 5%         | 438.63        |
|   | Most scientists agree gw is happening <sup>c</sup>                              | 87%      | 69%       | 33%      | 22%        | 22%      | 12%        | 363.7         |
|   | Personal risk <sup>d</sup>  | 3.3      | 2.78      | 2.19     | 2.23       | 1.44     | 1.07       | 247.54        |
|   | Risk to future generations <sup>d</sup>   | 3.98     | 3.9       | 3.1      | 1          | 2.21     | 1.12       | 936.04        |
|   | Collective efficacy/solvability <sup>e</sup>                                    | 3.93     | 3.76      | 3.59     | 3.4        | 2.43     | 1.55       | 254.62        |
| Issue Involvement   | Affective rating of global warming <sup>f</sup>                                 | 5.82     | 5.38      | 4.17     | 4.29       | 3.67     | 3.11       | 172.66        |
|   | Worry about global warming <sup>g</sup>   | 3.7      | 3.05      | 2.3      | 2.25       | 1.59     | 1.14       | 599.79        |
|   | Personal importance of issue <sup>h</sup>                                       | 4.31     | 3.22      | 2.54     | 2.4        | 1.69     | 1.31       | 474.46        |
|   | "I could easily change my mind about global warming." <sup>i</sup>              | 1.31     | 1.97      | 2.61     | 2.77       | 2.1      | 1.52       | 112.55        |
|   | How often thought about global warming <sup>j</sup>                             | 3.6      | 2.65      | 2.08     | 1.8        | 1.99     | 2.18       | 142.62        |
| Behavior  | Contacted govt. official in support of mitigation <sup>k</sup>                  | 41%      | 9%        | 8%       | 0          | 1%       | 0          | 222.69        |
|   | Rewarded companies that reduced emissions by buying their products <sup>k</sup> | 73%      | 33%       | 23%      | 8%         | 11%      | 2%         | 297.63        |
|   | Stage of change for using mass transit/car pool instead of driving <sup>l</sup> | 3.92     | 3.4       | 3.12     | 2.61       | 2.33     | 2.48       | 14.9          |
| Preferred Societal Response                                     | Priority of global warming for president & Congress <sup>m</sup>                | 3.76     | 3.1       | 2.22     | 2.45       | 1.45     | 1.03       | 425.67        |
|   | Citizens should do more/less to reduce warming                                  | 4.66     | 4.22      | 3.61     | 3.82       | 3.05     | 2.31       | 205.09        |

<sup>a</sup>1=certain global warming not happening; 5=don't know; 9=certain global warming is happening

<sup>b</sup>Percent who say that assuming global warming is happening, it is primarily human-caused

<sup>c</sup>Percent who say that most scientists agree that global warming is happening

<sup>d</sup>1=low harm; 4=a great deal of harm; note: this analysis treats “don’t know” responses as missing. In the analyses to create the segmentation, these variables are treated as dummy variables and “don’t know” is included in the analysis. See Maibach et al., 2011 for details.

<sup>e</sup>1=global warming isn’t happening; 2=Even if global warming is happening, humans can’t reduce it; 3=Humans could reduce global warming, but humans aren’t willing to change our behavior, so we’re not going to; 4= Humans could reduce global warming, but it’s not clear at this point whether we’ll do what’s necessary; 5=Humans can and will successfully reduce global warming

<sup>f</sup>1=very good; 6=very bad

<sup>g</sup>1=not at all worried; 4=very worried

<sup>h</sup>1=not at all important; 5=extremely important

<sup>i</sup>1=strongly disagree; 4=strongly agree

<sup>j</sup>1=not at all; 4=a great deal

<sup>k</sup>Percent who have performed action at least once over the past year

<sup>l</sup>1=never do this and don’t plan to in the future; 10=always do this and plan to do so more often in the future

<sup>m</sup>1=low; 4=very high

<sup>n</sup>1=much less; 5=much more

*All comparisons  $p < .001$ ; unweighted  $n = 1,266$ . (Source: Leiserowitz et al., May 2017; previously unpublished CCAM data)*

end of the spectrum favor individualism over egalitarianism, while the reverse is true of the segments at the Alarmed end. People at the Dismissive end of the spectrum are more likely to be evangelical Christians, to reject evolution, and to be biblical literalists. Conversely, the Alarmed are more likely than other segments to be atheists, and they’re more likely to accept evolution and reject literal interpretations of the Bible (see Maibach et al., 2009; Roser-Renouf, Maibach, Leiserowitz, Feinberg & Rosenthal, 2016b).

The segments are not strongly distinguished by demographics, although there is some tendency for the Dismissive to be older, white males. Hispanics tend to be in the Alarmed and Concerned segments; and people with lower socio-economic status tend to be in the Disengaged segment. None of these differences are as strong as the differences in attitudes and beliefs, however (Maibach et al., 2011).

## **Applications and Extensions**

We have tracked the Six Americas since 2008 and worked with many organizations to apply the results, including federal agencies, park rangers, science museums, faith-based environmental groups, public health departments, water utilities, and transportation agencies. The segmentation has been used to profile specific sub-populations, including American zoo and aquarium visitors (Kelly et al., 2014), agricultural extension agents (Bowers, Monroe & Adams, 2016), visitors to national parks (Schweizer, Davis & Thompson, 2013), museum visitors (Leiserowitz & Smith, 2011; Phipps, 2011), and adolescents (Flora & Roser-Renouf, 2014). It has been used to study specific audience segments, for example the Alarmed (Doherty & Webler, 2016), and as an outcome measure to assess the impact of climate change educational interventions (Flora et al., 2014). Experimental research has used the segmentation as an independent variable to identify differences in the segments' responses to different message frames (Myers et al., 2012) and their responses to personal experiences with climate change (Myers et al., 2013).

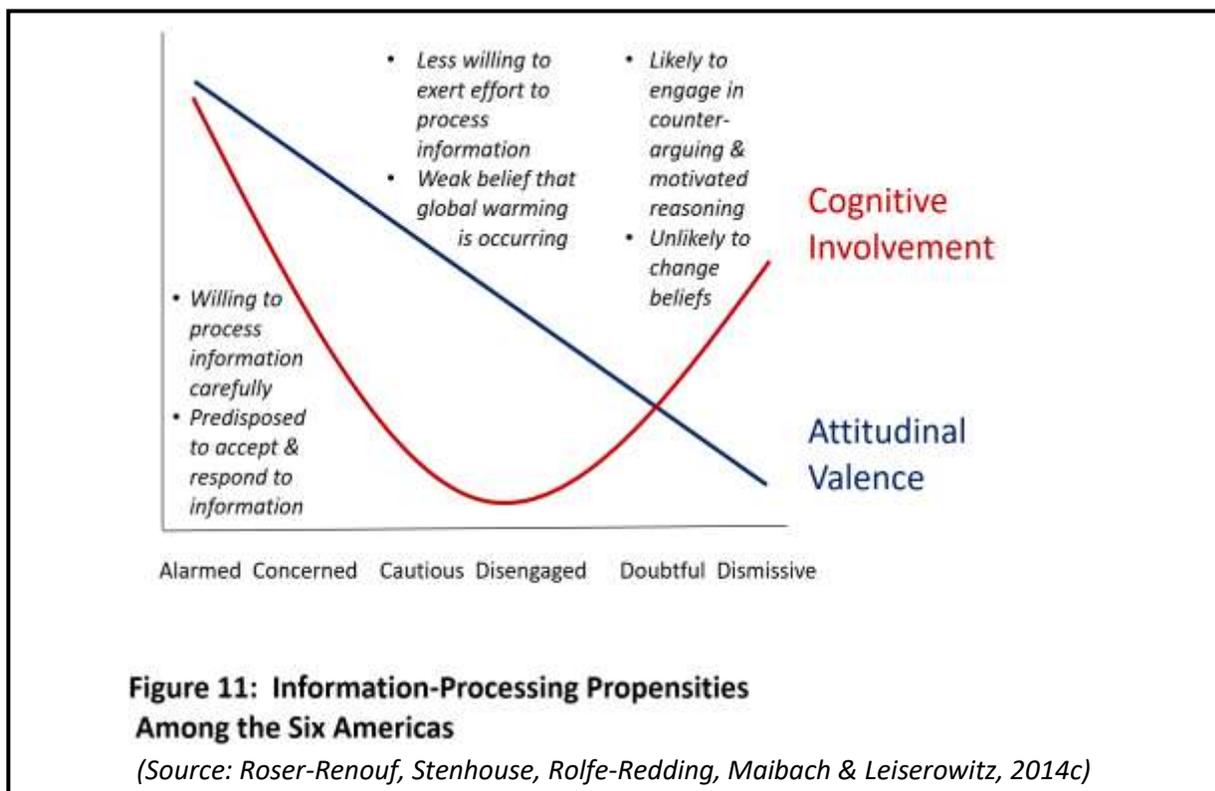
The segmentation has been replicated in Australia (Morrison, Duncan, Sherley & Parton, 2013), Germany (Metag, Fuchslin & Schäfer, 2015), India (Leiserowitz, Thaker, Feinberg & Cooper, 2013), and Singapore (Detenber, Roserthal, Liao & Ho, 2016). The segments identified in Australia and Germany closely resemble those in the U.S, with the important difference that Germany has no Dismissive segment. In India, the segments are quite different, with the largest segment of the population unfamiliar with the term "climate change," but once it has been explained, they readily agree that it is occurring. And in Singapore, only three segments were identified, with varying levels of concern and issue engagement, but little evidence of climate

skepticism. To date, results suggest that the segments are similar across developed nations, but that in developing nations, attitudes are structured differently.

In an important recent development, we have developed a reliable, much shorter, 4-item Six Americas screening instrument (Chryst et al., in preparation). This shorter instrument will make the segmentation tool practical for many additional research and communication planning purposes.

### Theoretical Underpinnings of the Six Americas and Their Implications for Communication Campaigns

Two theoretical dimensions underlie the Six Americas—*attitudinal valence* and *cognitive issue involvement* (see Figure 11; Roser-Renouf et al., 2014c). These dimensions link the segmentation to the literatures on information-processing, risk communication, and opinion leadership cited in the section on Theories of Change, and suggest a wealth of communication strategies for reaching and influencing the six groups.



Attitudinal valence is defined here as *the inclination to accept or reject the science of climate change*, as reflected in acceptance of the key climate change beliefs: Climate change is happening; harmful; human-caused; solvable; and scientists agree on its reality and human causes.

Issue involvement refers to *cognitive issue involvement*<sup>10</sup> as reflected in the amount of thought devoted to the issue and attitudinal certainty. Both the *Alarmed* and *Dismissive* think about the issue and are certain of their opinions, but the *Alarmed* are likely to accept all the key beliefs and are predisposed to accept messages that are consistent with the science, while the *Dismissive* reject the key beliefs and are predisposed to reject and counter-argue these same messages. The segments between the two end points devote less thought to the issue and are less certain of their views. The curvilinear relationship shown in Figure 11 is apparent in the segment means for thought and attitudinal certainty shown in Table 3, with thought following the pattern the figure, and willingness to change one's mind, a mirror image of this pattern.

The interaction of attitudes and involvement is strongly predictive of the level of attention people pay to information on global warming, their willingness to attend closely to information and process it deeply, and their inclination to accept information or to counter-argue and reject it.

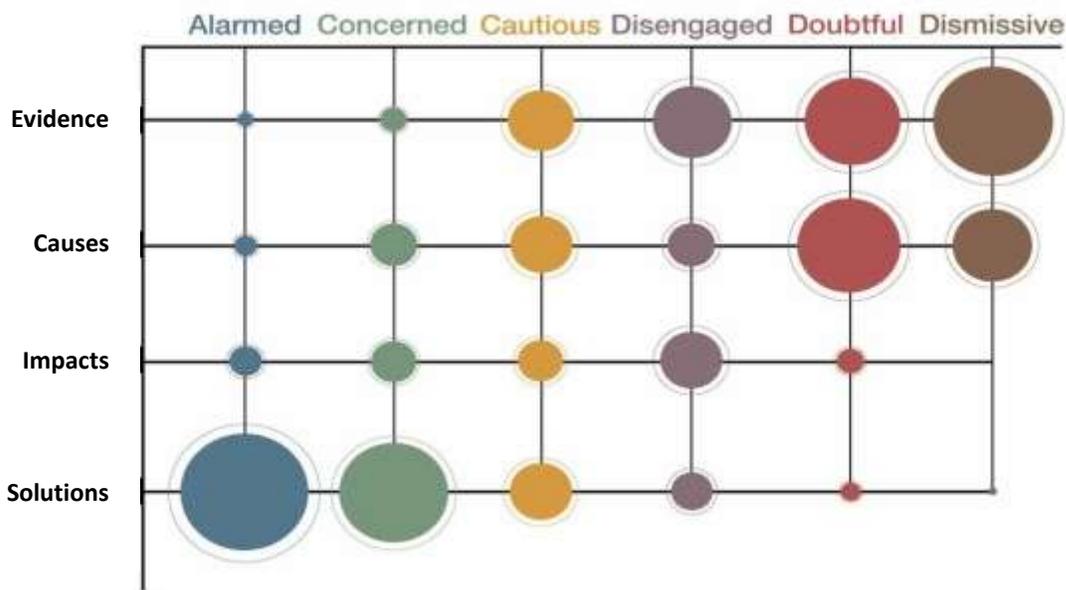
### **Informational Needs and Interests**

Communicators reduce their effectiveness if they focus on the information they want the audience to understand, while ignoring the information the audience is interested in hearing.

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<sup>10</sup>This pattern does not describe affective involvement, as reflected in worry, concern or personal importance. These characteristics follow the same pattern as attitudinal valence.

When asked what information they'd be most interested in receiving from a climate scientists (Figure 12; Roser-Renouf et al., 2014c), clear patterns are apparent among the Six Americas: The Alarmed overwhelmingly are interested in hearing about solutions to climate change—the actions they can personally take, as well as the actions that the U.S. can take. They also want to hear whether it's too late. The Concerned are also most interested in solutions information, although some express interest in causes and impacts. The Dismissive and Doubtful are most interested in information about the reality and causes of global warming. However, because both groups tend to be skeptical of the science, it's highly likely that many of them will engage in counter-arguing and motivated reasoning if



**Figure 12: Nature of the One Question the Six Americans Would Most Like to Pose to a Climate Scientist**

*The Six Americas are interested in learning different types of information about global warming, with the skeptical segments on the right most interested in information about the evidence for and causes of global warming, the concerned segments on the left interested in information about action to mitigate climate change, and the less involved segments in the middle varying widely in their questions. Unweighted N=1,010. (Source: Roser-Renouf, Stenhouse, Rolfe-Redding, Maibach & Leiserowitz, 2014c; figure edited from original by Ian Barin)*

presented with this information, so other ways of communicating with them are sometimes wiser. An initial focus on solutions that are consistent with conservative values may be a better starting point, both to avoid triggering identity protection (“This is a ‘liberal’ issue, and I’m a conservative”), and to address the fact that people are less likely to accept the problem as valid if they believe the solutions are unacceptable, i.e., “solution aversion” increases motivated skepticism about climate change (Campbell & Kay, 2014).

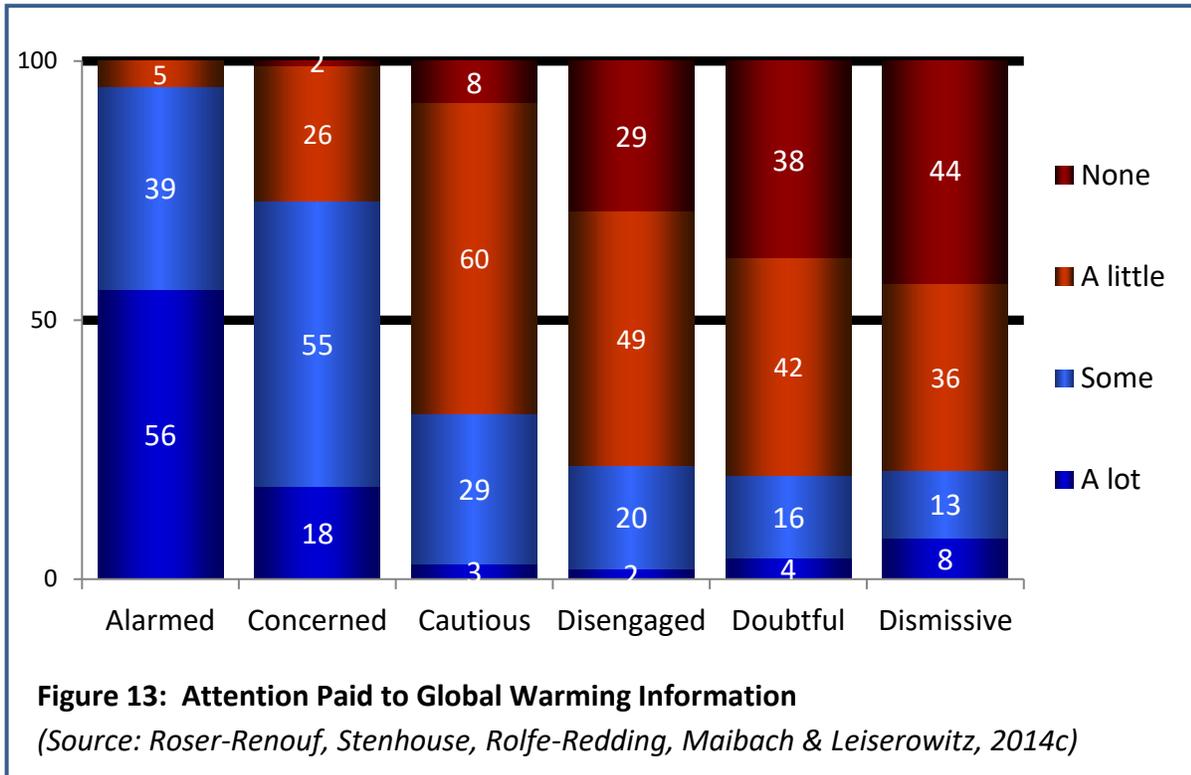
Patterns are less clear among the Cautious and Disengaged—their responses are distributed across all four types of information. Because these groups have given the issue very little thought, it’s likely that many don’t actually have actual questions, and have simply picked a random response on the survey. In light of this, we would most like them to learn that climate change is happening now in the U.S. and is harming people here; this follows from risk communication models, such as the Extended Parallel Process Model (Witte, 1992: People begin to search for information on solutions to a problem after they realize it's harmful and that they are vulnerable.

The challenge is to gain the middle segments’ attention long enough to communicate this information: They pay little attention to global warming information (Figure 13). This holds true of the Doubtful and Dismissive as well, although we also know that a fraction of the Dismissive are paying close attention to information on the issue, as they are actively engaged in attempts to undermine the science.<sup>11</sup> Low information-seekers are the people we seek to reach with messages that require minimal cognitive effort, and for whom the five best practices most strongly apply. The heuristics and cues that audiences with low issue involvement rely on, as identified in the

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<sup>11</sup> This is readily apparent in the comments sections accompanying online news reports about climate change, which typically contain large numbers of comments disputing climate science.

Elaboration Likelihood Model (Petty & Cacioppo, 1986), are essential in reaching these groups with both information that will interest them and draw them into the issue, as well as the information we believe they need.



In reaching them, simple, clear messages that trigger automatic processing are essential: Three-quarters of the Disengaged say they have difficulty understanding news reports on global warming, and majorities of the Disengaged, Doubtful and Dismissive say they don't want to hear about the subject (See Table 4; Roser-Renouf et al., 2014c). Even among the Alarmed, close a quarter report they have difficulty understanding global warming news.

| <b>Table 4: Ability and Motivational Barriers to Climate Change Communication</b> |                |                  |                 |                   |                 |                   |
|---|----------------|------------------|-----------------|-------------------|-----------------|-------------------|
|   | <b>Alarmed</b> | <b>Concerned</b> | <b>Cautious</b> | <b>Disengaged</b> | <b>Doubtful</b> | <b>Dismissive</b> |
| "I have difficulty understanding news reports about global warming."              | 23%            | 39%              | 44%             | 77%               | 35%             | 19%               |
| "In general, I don't like to read or hear anything about global warming."         | 10%            | 28%              | 37%             | 59%               | 57%             | 72%               |

*Note: Cells show the proportions in each segment who agreed with the statements. (Source: Roser-Renouf, Stenhouse, Rolfe-Redding, Maibach & Leiserowitz, 2014)*

## **Communication Objectives and Strategies**

Based on our understanding of the segments' beliefs, their issue involvement, information needs, interests, and their willingness and ability to attend to information on global warming, we have developed general objectives and communication strategy recommendations for audiences that are very concerned about climate change (the Alarmed and many of the Concerned); the skeptics (the Dismissive and many of the Doubtful); and the uncertain, uninvolved middle segments (the Cautious and Disengaged, and some of the Concerned and Doubtful). A full application of the segmentation would entail six different sets of recommendations, but space in this chapter, as well as the challenges of putting such a complex campaign into place, make it more practical to distinguish between three approaches instead of six.

### ***The Middle Segments***

The best practices outlined in section 11 apply to communicating across segments, but are most relevant for the uncertain middle segments, as they are unlikely to attend to effortful content, such as reading textual material or interpreting graphs and figures. Communicators should attempt to engage the middle segments with easily processed messages that illustrate local, concrete impacts, as well as the co-benefits of actions that will mitigate the threat.

Invoking norms constructively is also likely to be beneficial. Use of peripheral cues—likable and authoritative sources, humor, and narratives of people they can identify with—can help as well. Essentially, the two core social marketing recommendations we have mentioned several times apply most strongly to the middle segments; i.e., (1) Simple, clear messages, repeated often, by a variety of trusted sources, and (2) Recommended behaviors should be presented as easy, fun and popular. Messages should communicate the key beliefs—particularly the scientific consensus message—and behaviors should be simple, while still being effective at reducing emissions.

An excellent example of a campaign that employed these techniques is the “Wicked Smaht” campaign in Boston, which effectively applied the research described in this chapter. The campaign communicated the key beliefs—climate change is real, harmful, human-caused and solvable, and scientists agree—over the course of a year on subways and buses (Sciencetogo.org, 2017). A dozen posters were designed, and a new one appeared each month (see Figure 16 for examples). The first poster adapted the “estimate and reveal” technique tested by Myers and colleagues (2015): It engaged people with a question about the scientific consensus, which would not be answered until the second month, when the message described the 97 percent consensus among climate scientists that human-caused climate change is happening. For four months, each poster addressed a different impact of climate change on Boston: sea level rise, extreme storms and heat waves, and the spread of vector-borne diseases. The final five months addressed solutions by describing local organizations, individuals and groups that were working to reduce their emissions—an approach intended to activate social norms by presenting sustainable behaviors as “popular,” as well as building collective efficacy, hope, and perceptions that climate change is solvable. The use of one clever ostrich in glasses with several less-clever ostriches who

often voiced climate skeptic arguments allowed for humor and a light touch, avoiding any gloom-and-doom or guilt messaging.

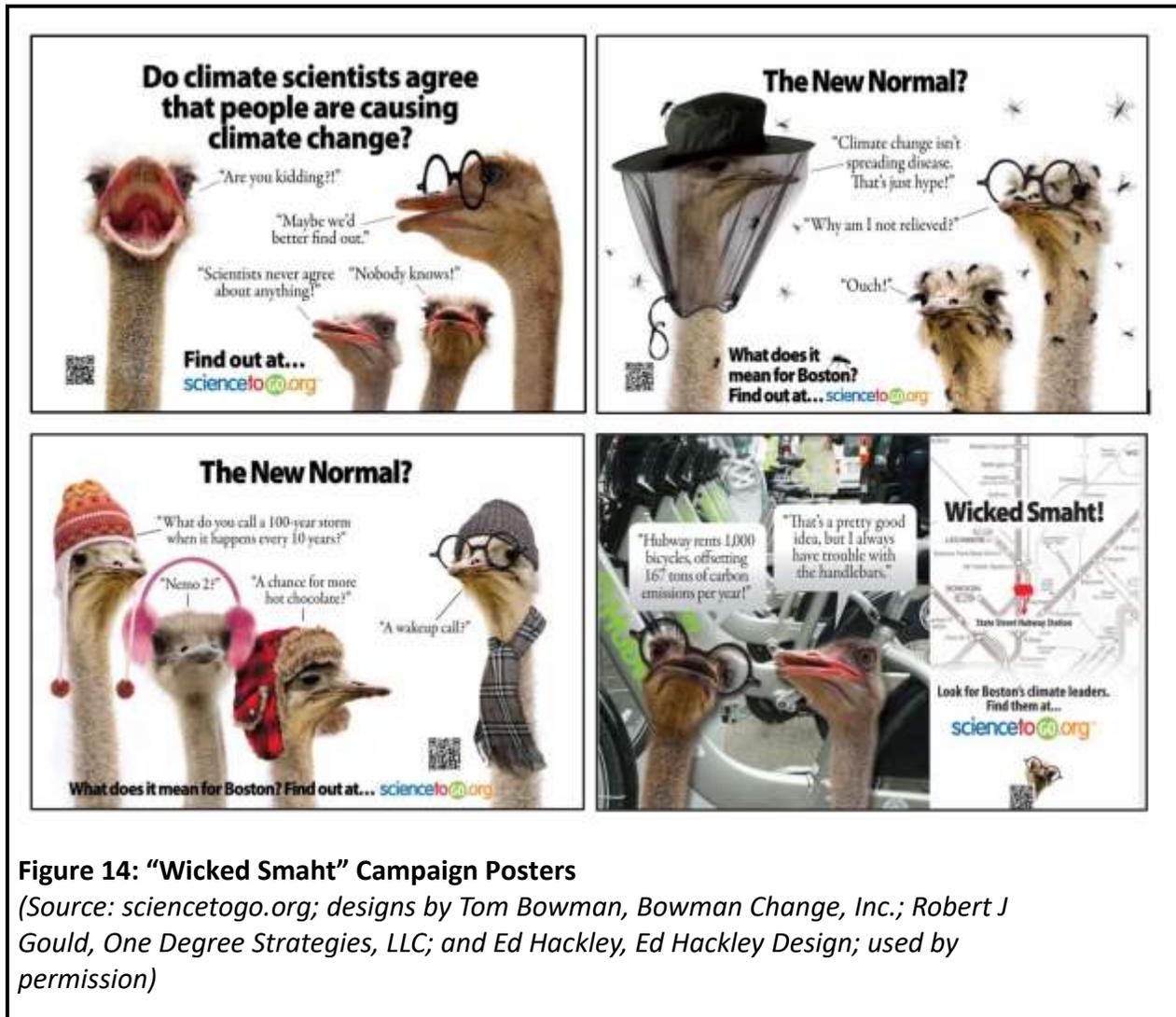


Figure 14: "Wicked Smaht" Campaign Posters

(Source: [sciencetogo.org](http://sciencetogo.org); designs by Tom Bowman, Bowman Change, Inc.; Robert J Gould, One Degree Strategies, LLC; and Ed Hackley, Ed Hackley Design; used by permission)

### *The Alarmed (and to some extent, the Concerned)*

Unlike the middle segments, the Alarmed and many of the Concerned are willing to extend the time and cognitive effort necessary to learn more detailed information about climate change. They're also looking for ways they personally can help reduce the threat. Hence, rather than trying to change their attitudes on the issue and engage them, we aim to enlist them as opinion leaders, social role models and climate activists.

The Alarmed and Concerned are likely to comprise the largest proportion of adult visitors to online sources of information on climate change, such as the National Climate Assessment, NASA’s and NOAA’s online climate change resources, AAAS’s “What We Know” site, and Skeptical Science—all excellent sources of climate change information.<sup>12</sup> Close to 90 percent of visitors to NASA’s climate change website, for example, belong to these two segments (59% Alarmed and 29% Concerned; Myers, Rolfe-Redding, Roser-Renouf & Maibach, 2014). The same is true of visitors to science and technology museums (74%, Leiserowitz and Smith, 2011), and zoos and aquaria (64%; Kelly et al., 2014).

Information obtained from these and similar sources is likely to be shared with others: 85 percent of the Alarmed say they discuss global warming often or occasionally with family and friends (Leiserowitz et al., May 2017). Moreover, people trust their family and friends as information sources on global warming as strongly as they trust climate scientists (i.e., 69% trust their family and friends and 70% trust scientists; Leiserowitz et al., March 2015). Hence, providing them with some of the facts that support the key beliefs can equip them to convince those around them. Information on risks should always be paired with efficacy-building hopeful messages, as despair and a sense that it’s too late can foster issue avoidance, rather than heightening engagement.

Advocacy organizations seeking to recruit new members should note that only eight percent of the Alarmed say they’re currently participating in a campaign to convince government officials to reduce global warming, but another two-thirds say they’d be willing to join such a campaign (68%). Moreover, more than half say they’ve never been contacted by an environmental organization that works on global warming (55%; Leiserowitz et al, 2017). One of

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<sup>12</sup> See: [nca2014.globalchange.gov/](http://nca2014.globalchange.gov/); [climate.nasa.gov](http://climate.nasa.gov/); [noaa.gov/climate](http://noaa.gov/climate); [whatweknow.aaas.org/](http://whatweknow.aaas.org/); and [skepticalscience.com/](http://skepticalscience.com/)

the strongest predictors of political participation is being asked (Brady, Verba and Schlozman, 1995), and in recruiting the Alarmed, activist groups should stress that their participation can make a difference, as this is a strong predictor of joining a social movement (Burstein, Einwohner & Hollander, 1995). The social marketing admonition that recommended behaviors should appear easy, fun and popular applies here as well: Many people join advocacy groups for the social benefits of group membership (van Zomeran, 2008).

### ***The Dismissive (and to some extent, the Doubtful)***

While we might like to overcome the skepticism in these segments regarding the reality and human causes of climate change, changing people's minds when they're firmly convinced of their opinions is difficult and rare. A more promising objective may be to build their support for a swift transition to clean energy by focusing on its co-benefits and through discussing policies that are consistent with conservative values.

Half of the Dismissive and Doubtful identify as Republicans, and the vast majority of these say they are conservative Republicans. With strong individualistic values, they dislike the policy options for reducing climate change that have been promoted by liberals. Further, the climate skepticism among Republican party's political elites has been a particularly powerful contributor to the issue's polarization. A longitudinal study comparing factors that contributed to decline in climate change beliefs and concern between 2002 and 2010 found that statements by political elites had by far the greatest impact on conservatives' expressed concern about climate change—greater than weather extremes, advocacy campaigns, scientific news, media coverage or extreme weather<sup>13</sup> (Brulle, Carmichael & Jenkins, 2012).

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<sup>13</sup>The authors note that although weather did not affect opinions during the years they analyzed, it could in the future.

Some experimental work has identified promising messages for reaching and influencing Republicans and conservatives, e.g., explanations of the science (Ranney & Clark, 2016) and the scientific consensus message (van der Linden et al., 2017). Conservatives and Republicans have also been found to respond well to environmental messages that use conservative value frames—loyalty, purity, authority and patriotism (Feinberg & Willer, 2012; Feygina et al., 2010; Wolsko et al., 2016).

Segment and party identification are not synonymous, however: Close to half of Republicans belong to the Doubtful and Dismissive groups (48%), but one in five Republicans belong to Alarmed and Cautious segments (21%), and close to a third belong to the Cautious and Disengaged (31%; previously unpublished *CCAM* data, May 2017). Hence, research demonstrating that Republicans have been influenced by particular messages or message frames does not necessarily generalize to the Doubtful and Dismissive.

One study we conducted to test the impact of various message frames on the Six Americas was highly instructive. We expected a national security framing of climate change to be positively received by the Doubtful and Dismissive; instead, it elicited anger. The most positively received message across all segments was a public health framing of climate change that emphasized the health co-benefits of redesigning urban areas to encourage walking and biking and reducing the need to drive (Myers et al., 2012).

In light of this study, as well as Brulle and colleague's (2012) evidence of the influence of political elites, our primary recommendation for communicating with the Dismissives and Doubtful is to reach out through conservative sources they trust who are proposing conservative responses to climate change they can accept. When acceptable solutions are available to them, the motivated reasoning and solution aversion that have promoted climate skepticism (Campbell

& Kay, 2014) may be reduced. We will return to this approach in Part V, when we describe the activities of RepublicEn, our outreach program to conservatives led by Bob Inglis, a former Republican Congressman from South Carolina who advocates for free-market responses to climate change.

## **PART V: OUTREACH**

The research described in Part II identified three sources who were particularly likely to be influential with audiences, i.e., television meteorologists, medical professionals and Republican elites. We have major outreach programs with each of these, and—in light of the importance of journalists in shaping audience perceptions of the issue—we are about to extend our work with meteorologists into television newsrooms.

We also advise a wide range of other climate change communicators, as we work to instantiate a “big messy program” with many credible messengers delivering the same simple, clear messages through multiple channels. These other communicators include federal and state agencies, park rangers, public health departments, science and natural history museums, aquaria, zoos, college campus leaders, and faith communities.

### **Demonstration Project: *Climate Matters***

Our most significant outreach program has been to TV weathercasters, through *Climate Matters*, a demonstration project that trains and supports TV weathercasters to report on the local impacts of climate change in their media market. The NSF-funded program has gradually expanded over the past eight years from a pilot-project with one weathercaster in Columbia, South Carolina to nationwide operation with over 430 weathercasters in over half the nation’s media markets. In September 2017, in partnership with five journalism professional societies (Radio & Television Digital News Association, National Association of Black

Journalists, National Association of Hispanic Journalists, Society of Environmental Journalists, and the Kneeland Project), the program began expanding beyond weathercaster into television, radio, newspaper and digital newsrooms.

### **Rationale for Communicating Climate Change Through TV Weather Forecasts**

For a variety of reasons, TV weathercasters are potentially effective climate change communicators. Their audience is large, and diverse in age, income, education and racial demographics. Our *CCAM* surveys have shown them to be a highly trusted source of global warming information, and 70 percent of the public say they watch the local weather forecast closely (e.g., Maibach et al., 2009). Further, they are highly skilled science communication professionals.

The local weather forecast has the potential to help viewers link climate issues with their personal lives. People learn complex information most quickly when it is offered in the form of concrete examples and narratives that are easily applied to their experience. The more times they encounter information presented this way, the stronger the lesson will be. When weathercasters are able to present information about climate change in conjunction with related local weather events, it can help people understand that they are personally experiencing the effects of climate change, fostering the understanding that it is a serious issue. Severe weather events offer particularly strong climate change learning opportunities, as many of these events are becoming more common and more severe as a result of global warming.

### **Weathercasters' Climate Change Beliefs, Attitudes, and On-Air Reporting**

*Climate Matters* was initiated at a time when few television newscasts were actually reporting about climate change on the air. In 2010, more than half of television news directors said their newscasts discussed climate change less than once a month (Maibach, Wilson and

Witte, 2010b); and 80 percent of weathercasters said they discussed climate change less than once a month during their forecasts (Maibach, Wilson and Witte, 2010c).

In 2009, immediately prior to the launch of the pilot-test in South Carolina, we used snow-ball sampling to identify TV weathercasters who were actively reporting on climate change, but were able to identify only 16 weathercasters of this type anywhere in the U.S. (Rowan, et al., in press).

In a 2010 survey we conducted with weathercasters nationwide, we learned that 94% of weathercasters said they are the only people in their newsroom trained in science or the environment (Maibach et al., 2010c). While all have had extensive experience as science communicators, and many have had scientific training, at that time only slightly more than half believed that climate change is happening, and only a third believed that it is human-caused (54% and 31%, respectively; Maibach et al., 2010c).<sup>14</sup> Many weathercasters said they would like to report on climate change, but most cited a range of barriers that impede them from doing so including: lack of time on air; lack of time to produce stories; lack of access to broadcast quality climate change graphics; lack of access to climate scientists; and the belief that it is inappropriate to discuss climate change on air.

### **The Launch and National Scale-Up of *Climate Matters***

In 2010, we launched *Climate Matters* as a 1-year pilot-test at WLTX-TV, the CBS affiliate in Columbia, South Carolina, in partnership with their chief meteorologist Jim Gandy, his news director Marybeth Jacoby, and Climate Central (a science communication non-profit

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<sup>14</sup> Over the past seven years, we have made consistent efforts to educate members of this community about climate change, primarily through presentations and workshops at their annual professional meetings. In our 2017 survey of weathercasters we found that 95 percent now say climate change is happening, an increase of 41 percentage points. Understanding of human causation has also changed, though less dramatically: 49 percent now say it is mostly or entirely human-caused, an increase of 18 percentage points, and another 21% say it is equally caused by human activity and natural events (Maibach et al., 2017).

organization). A team of broadcast meteorologists, climate scientists, communication scientists, writers and graphic designers developed scripts and graphical materials for twelve short segments on climate change, which Gandy presented on air throughout the year, when time permitted and conditions were appropriate. These video segments were also displayed on the station's website, along with additional print content developed by Jim throughout the year. The segment topics were selected based on foreseeable local weather events (see Table 5). Each 90-second segment was designed to be a self-contained short lesson on climate change, focusing on one or two major points selected to be as connected as possible to the experiences of the viewer. For example, a segment on poison ivy explained how certain plant pests thrive under increasing carbon dioxide levels and are likely to become more prevalent without intervention. The team's goal was to show viewers that climate change is an issue that already impacts their everyday lives, thus helping to correct the misperception that climate change is a distant problem.

The effects of the Climate Matters pilot-test were assessed with surveys conducted before the program's launch, and at the end of the year; both cross-sectional and panel data were collected. These surveys revealed that, in comparison to viewers of other stations in Columbia, WLTX viewers became significantly more likely to report that climate change was happening and harmful, regardless of whether or not they specifically remembered seeing the segments. Those who were able to recall specific Climate Matters segments were also more likely to attribute climate change to human causes (Zhao et al., 2014).

In 2012, Climate Matters was expanded to ten TV stations in ten different media markets, with all participating weathercasters receiving localized climate change content, including high resolution graphics ready for on-air use. Starting in 2013, participation in Climate Matters grew rapidly (supported by a combination of NSF and philanthropic funding). By the beginning of

| <b>Table 5: Climate Matters Design</b> |  |   |
|--|--|---|
| <b>Date</b>                            | <b>Activity</b>  |   |
| 11 May-15 Jul 2010                     | Baseline survey of panel sample  |   |
| 2 Aug. 2010                            | Campaign began   |   |
|  | <b>Segment Name</b>  | <b>Description (length)</b>   |
| 2 Aug. 2010 (again 8 Sept. 2010)       | High temperatures  | Increasing number of >95oF days as GHG emissions increase--separate segment for each summer month (1:18)                          |
| 12 Aug. 2010                           | Extreme heat   | Increasing likelihood of > 101oF days for today, 2040s, and 2070s (1:16).   |
| 25 Aug. 2010                           | Climate  | Baseball statistics analogy explains difference between weather and climate (1:54).   |
| 16 Sept. 2010                          | Hurricanes   | Climate change may make hurricanes less frequent but more intense (1:30).   |
| 1 Oct. 2010                            | Intense storms   | Climate change may be making intense rainfall more intense in the U.S. (1:55).  |
| 12 Nov. 2010                           | Sea level rise   | Rate of sea level rise along South Carolina coast may triple (1:54).  |
| 9 Mar. 2011                            | Poison ivy   | More CO2 may make some plant pests like poison ivy grow better (1:31).  |
| 22 Apr. 2011                           | Human cause  | How we know greenhouse gas increase is due to people (1:20).  |
| 12 May 2011                            | Air quality  | Connection between warmer temperature and code red smog days (1:07).  |
| 31 May 2011                            | Heat and human health  | Heat is already the top weather-related killer in the U.S., and GHGs will likely increase the heat index in the Southeast (1:23). |
| 9 Jun. 2011                            | Drought  | Drought outlook to explain risk for increased drought in a warmer world (2:23).   |
| 12 Jun. 2011                           | Global weirding  | Global warming can cause opposite weather extremes (1:26).  |
| 10 Jul.-30 Aug. 2011                   | Follow-up survey of panel sample; survey of new cross-sectional sample |   |

2014, for example, over 100 weathercasters were participating. Currently (in fall 2017), we have

over 430 weathercasters participating in the project (including 31 who broadcast in Spanish), broadcasting from 262 stations in 136 of America's 210 media markets, including 24 of the top 25 media markets. Moreover, on-air reporting about climate change by weathercasters increased over 1,200% in the four-year span from 2013 to 2016.

In short, the program—now a partnership involving our university, Climate Central, NOAA (National Oceanic and Atmospheric Association), NASA and the American Meteorological Society—has blossomed into a resource for informal climate education nationwide. Every week, a team of meteorologists, research scientists, data analysts, journalists, and creative designers put together a comprehensive package of content about various current climate change topics. Each package includes TV-ready visuals, detailed descriptions of the latest science behind the week's topic, current climate change information from NASA, NOAA and other sources of climate change data, and a round-up of new climate research findings. The packages are designed to be current and relevant, and to dramatically reduce the production burden for weathercasters interested in including climate change education as part of their segments. *Climate Matters* has also expanded beyond the short TV weather segment to support weathercasters in climate change education across a variety of mediums. To engage with growing digital content consumption, *Climate Matters* offers interactive media and tweetable facts that can be easily embedded in station websites or social media. They provide a range of resources that are suitable for the local community outreach presentations that many weathercasters give. *Climate Matters* also provides video and production support to meteorologists who are interested in developing and producing their own original climate change stories and specials.

An impact evaluation of the national scale-up of Climate Matters is currently underway.

Multi-level modeling is being used to analyze *CCAM* data on audience beliefs within media markets, using a quasi-experimental, dose-response, non-equivalent group design with multiple time points.

### **Climate Matters Expands Into Newsrooms**

In September of 2017, *Climate Matters* began offering resources to non-weather journalists to extend the reach of local climate reporting and education. In partnership with a range of journalism associations (including Society of Environmental Journalists, Radio & TV Digital News Association, National Association of Black Journalists, National Association of Hispanic Journalists, and The Kneeland Project), we are now offering *Climate Matters* reporting resources to journalists around the nation. We have high hopes that extending *Climate Matters* deeper into the newsroom (i.e., beyond TV weathercasters) will help end the dearth of local climate reporting, and thereby help Americans better understand the local relevance of the problem, and local solutions.

### **Additional Outreach Efforts**

#### ***Program on Climate and Health***

Our Program on Climate and Health was started in 2013 under the directorship of a physician—Mona Sarfaty, MD—in recognition of the severe impacts climate change has on human health. The program has several objectives: to illuminate public and health professionals' understanding of the health harms associated with climate change and the health benefits created by climate solutions; to increase public and health professional awareness of the climate change and health connections; and to encourage life-saving preventive and protective action.

Over the past several years, we have surveyed physicians in multiple medical societies, focusing on specialties that are most likely to include patients vulnerable to climate change

(including the National Medical Association, which serves African-American physicians and patients; the American Academy of Allergies, Asthma and Immunology; and the American Thoracic Society); and we have used our *CCAM* surveys to further explore public understanding of the climate-health nexus. Three important findings have emerged from this research thus far: (1) Most Americans are largely unaware of the health harms associated with climate change (and who is mostly likely to be harmed); (2) Conversely, most physicians are aware of the health harms, and many are convinced that climate change is already harming some of their patients; and (3) People trust their physicians most as a source of information about climate and health. These findings strongly suggest an important role for America’s physicians in educating the public and policymakers about the human health aspects of climate change.

### ***The Medical Society Consortium on Climate & Health***

In the spring of 2017, we launched an important new initiative—*The Medical Society Consortium on Climate & Health*—with the aim of activating the American medical community to teach the public and policy makers about the human health relevance of climate change. Specifically, the mission of the Consortium is to inform the public and policymakers about the harmful effects of climate change on Americans, and about the immediate and long-term health benefits associated with decreasing greenhouse gas emissions and other preventive and protective measures. Initially composed of nine major medical societies (which collectively represent half of America’s doctors), the Consortium recently released its first report entitled: “*Medical Alert! Climate Change is Harming our Health*” (Medical Consortium on Climate and Health, 2017).

Since the spring of 2017, membership in the Consortium has grown to 13 medical societies, and 19 other health and climate science organizations have joined as “affiliates.” In

addition, several hundred physicians have volunteered to help the Consortium by serving as climate and health advocates in their community—to speak with community groups, the media, and local policymakers.

The trusted voices of these 13 medical societies and hundreds of volunteer physicians are seeking to convey five simple messages: (1) There is a scientific consensus about human-caused climate change, therefore doctors have a responsibility to take action so that people aren't needlessly hurt; (2) In communities across America, climate change is already harming people's health; (3) The health of any American can be harmed by climate change, but some people face greater risks than others (e.g., children, pregnant women, elder, people with chronic illness & allergies, the poor); (4) Unless we take concerted action, the harms to our health are going to worsen; and (5) The most important action we can take to protect our health is to reduce heat-trapping pollution by reducing energy waste and accelerating the transition to clean, renewable energy.

### ***Engaging Conservatives: RepublicEn***

*RepublicEn* was started in 2012 by Bob Inglis, a former six-term Republican Congressman from South Carolina, who serves as the group's executive director. Inglis lost his seat in Congress in 2010 in large part due to his acceptance of the science of climate change and his advocacy for free-market solutions to mitigate the threat. Through *RepublicEn*, he is seeking to catalyze a new narrative on climate change among conservatives based in free-market thinking, with the objective of generating support for climate solutions and the political will needed to press for an aggressive response.

Through media interviews, community events, and a rapidly growing online community, the *RepublicEn* team educates Republicans on climate science, public opinion and—perhaps

most importantly, in light of what we understand about solution aversion—tax reform. They call for the repeal of all subsidies for fuel production, and for a revenue-neutral carbon tax on companies for the greenhouse gases they emit.

**CAN FREE ENTERPRISE SOLVE CLIMATE CHANGE?**

They need to hear a yes.  
And they need to see some courage.

**DARE TO ASK.  
DARE TO ANSWER**

They've been driven by talk radio's out-sized personalities. They've been told of vast conspiracies of godless scientists, cooking the data so as to win more grants from controlling bureaucrats. When will someone tell them the truth? Climate change is a risk. No, not an apocalypse. But a problem that needs sound judgment and solid economics.

**Who will step up? Who will lead?**

**republicEn.org**  
Energy Optimists. Climate Realists.

**Figure 15: RepublicEn Facebook Post**  
(Source:<https://www.facebook.com/republicen/photos/a.210244879118841.55519.114226275387369/1051156848360969/?type=3&theater>)

In 2015, Inglis was awarded the *John F. Kennedy Profile in Courage* Award for political courage by the John F. Kennedy Library Foundation. On September 12, 2016, Inglis and *RepublicEN* advisor Katharine Hayhoe—a climate scientist at Texas Tech University—were named on the Politico 50 list for their work on what Politico called articulating “the conservative case for fighting climate change.” Politico’s top 50 ranking is described as a “guide to the thinkers, doers and visionaries transforming American politics in 2016” (Politico Magazine,

2016).

Ironically, given the inexplicable anti-climate science views being expressed by President Trump and his administration, the past year may prove to be a watershed moment for Republican embrace of climate solutions. A growing list of prominent Republicans have come out in support of a revenue-neutral carbon tax to address climate change and strengthen our economy, 29 Republican members of Congress have joined the Climate Solutions Caucus, and our *RepublicEN* team is more energized than ever. Inglis recently summarized his feelings about the opportunity at hand: “We're making progress. Conservatives are going to come around on climate. We're going to realize that we're all in this together, and the world is going to celebrate American leadership. This is our generation's moon shot” (RepublicEn, 2017).

## **PART VI: CONCLUSIONS**

Our research center continues to expand both its outreach and research activities with as much speed and energy as we can muster. Although we have addressed many of the questions we had a decade ago, as many or more remain. And while Americans’ increasingly recognize the reality and threat of climate change, we still lack an issue-public of sufficient size and strength to push policy makers into effective action. Political polarization remains a barrier to progress on climate, and much of our thinking is focused on methods of de-polarizing the issue.

Looking back over the past decade’s work, we can say with some satisfaction that we’ve been both busy and productive, and we plan to remain so. We’ve observed progress on climate action in the U.S.—the Clean Power Plan, higher fuel standards for automobiles, the Paris Climate Accord—and we’ve observed setbacks—the current plans to withdraw the U.S. from the Paris Climate Accord, and the appointments of climate change skeptics to head federal agencies charged with protecting our environment and resources. Public opinion has been trending in the

right direction, with close to half of the American public now in the Alarmed and Concerned Six Americas segments, but the three-year window to start reducing our emissions identified by Figueres and colleagues (2017) is closing. There is still reason to hope, but no time to dally.

## REFERENCES

- Ball-Rokeach, S.J., & DeFleur, M.L. (1976). A dependency model of mass-media effects. *Communication Research*, 3, 3-21. doi:10.1177/009365027600300101
- Balbus, J., Ebi, K., Finzer, L., Malina, C., Chadwick, A., McBride, D.,...Maibach, E. (2008). *Are We Ready? Preparing for the Public Health Challenges of Climate Change*. Retrieved from National Association of County and City Health Officials website: [http://www.naccho.org/uploads/downloadable-resources/Are-we-ready\\_14\\_view.pdf](http://www.naccho.org/uploads/downloadable-resources/Are-we-ready_14_view.pdf)
- Bandura, A. (2000). Exercise of human agency through collective efficacy. *Current Directions in Psychological Science*, 9, 75-78. doi:10.1111/1467-8721.00064
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52, 1-26. doi:10.1146/annurev.psych.52.1.1
- Bennett, W.L., & Iyengar, S. (2008). A new era of minimal effects? The changing foundations of political communication. *Journal of Communication*, 58, 707-731. doi:10.1111/j.1460-2466.2008.00410.x
- Bloodhart, B., Maibach, E., Myers, T., & Zhao, X. (2015). Local climate experts: The influence of local TV weather information on climate change perceptions. *PloS One*, 10, e0141526. doi:10.1371/journal.pone.0141526
- Boucher, J.L. (2016). Culture, carbon, and climate change: A class analysis of climate change belief, lifestyle lock-in, and personal carbon footprint. *Social Ecology: Journal for Environmental Thought and Sociological Research*, 25, 53-80. doi:10.17234/SocEkol.25.1.3
- Bowers, A.W., Monroe, M.C., & Adams, D.C. (2016). Climate change communication insights from cooperative Extension professionals in the US Southern states: Finding common ground. *Environmental Communication*, 10, 656-670. doi:10.1080/17524032.2016.1176947
- Boykoff, M.T. (2007). Flogging a dead norm? Newspaper coverage of anthropogenic climate change in the United States and United Kingdom from 2003 to 2006. *Area*, 39, 470-481. doi:10.1111/j.1475-4762.2007.00769.x
- Brady, H. E., Verba, S., & Schlozman, K. L. (1995). Beyond SES: A resource model of political participation. *American Political Science Review*, 89, 2, 271-294. doi:10.2307/2082425
- Brulle, R. J., Carmichael, J., & Jenkins, J. C. (2012). Shifting public opinion on climate change: an empirical assessment of factors influencing concern over climate change in the US, 2002-2010. *Climatic change*, 114(2), 169-188. doi:10.1007/s10584-012-0403-y
- Burstein, P., Einwohner, R., & Hollander, J. (1995). The success of political movements: A bargaining perspective. In J. Jenkins & B. Klandermans (Eds.), *Politics of social protest:*

- Comparative perspectives on states and social movements* (pp. 275–295). Minneapolis, MN: University of Minnesota Press.
- Campbell, T.H., & Kay, A.C. (2014). Solution aversion: On the relation between ideology and motivated disbelief. *Journal of Personality and Social Psychology*, *107*, 809. doi:10.1037/a0037963
- Centers for Disease Control and Prevention (CDC). (2016). *Climate Effects on Health*. Retrieved from CDC website: <https://www.cdc.gov/climateandhealth/effects/>
- Chong D. & Druckman J.N. (2007) Framing theory. *Annual Review of Political Science*, *10*, 103-126. doi:10.1146/annurev.polisci.10.072805.103054
- Christakis, N.A., & Fowler, J.H. (2013). Social contagion theory: examining dynamic social networks and human behavior. *Statistics in Medicine*, *32*, 556-577. doi:10.1002/sim.5408
- Chryst, B., Marlon, J., van der Linden, S., Leiserowitz, A., Maibach, E. & Roser-Renouf, C. (in preparation). Six Americas short survey. Will be submitted to *Environmental Research Letters*.
- Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R., Verheggen, B., Maibach, E. W.,... Nuccitelli, D. (2016). Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*, *11*, 4, 048002 doi:10.1088/1748-9326/11/4/048002
- Davenport, C. (2013, July 25). Why it finally makes sense to talk about climate change. *National Journal*.
- Detenber, B., Rosenthal, S., Liao, Y., & Ho, S.S. (2016). Audience segmentation for campaign design: Addressing climate change in Singapore. *International Journal of Communication*, *10*, 4736–4758. Available at: <http://hdl.handle.net/10220/41984>
- Ding, D., Maibach, E., Zhao, X., Roser-Renouf, C. & Leiserowitz, A. (2011). Support for climate policy and societal action are linked to perceptions about scientific agreement. *Nature Climate Change*, *1*, 462-466. doi: 10.1038/NCLIMATE1295
- Doherty, K.L., & Webler, T.N. (2016). Social norms and efficacy beliefs drive the Alarmed segment’s public-sphere climate actions. *Nature Climate Change*, *6*, 879-884. doi:10.1038/nclimate3025
- Dunlap, R. E., & McCright, A. M. (2011). Organized climate change denial. In J. Dryzek, R. Norgaard & D. Schlosberg (Eds.), *The Oxford handbook of climate change and society* (144-160). New York: Oxford University Press.
- Feinberg, M., & Willer, R. (2013). The moral roots of environmental attitudes. *Psychological Science*, *24*, 56-62. doi:10.1177/0956797612449177

- Feldman, L., Maibach, E., Roser-Renouf, C., & Leiserowitz, A. (2012). Climate on cable: The nature and impact of global warming coverage on Fox News, CNN, and MSNBC. *International Journal of Press/Politics*, *17*, 3-31. doi: 10.1177/1940161211425410
- Feldman, L.M., Myers, T.A., Hmielowski, J.D., & Leiserowitz, A.A. (2014). The mutual reinforcement of media selectivity and effects: Testing the reinforcing spirals framework in the context of global warming. *Journal of Communication*, *64*, 590-611. doi: 10.1111/jcom.12108
- Feygina I, Jost JT, Goldsmith RE (2010) System justification, the denial of global warming, and the possibility of “system-sanctioned change”. *Personality and Social Psychology Bulletin*, *36*, 326-38. doi:10.1177/0146167209351435
- Figueres, C., Schellnhuber, H. J., Whiteman, G., Rockström, J., Hobley, A., & Rahmstorf, S. (29 June 2017). Three years to safeguard our climate. *Nature*, *546*, 593-595. doi:10.1038/546593a
- Flora, J., & Roser-Renouf, C. (2014). Climate change activism and youth. In UNICEF (Eds.), *The Challenges of Climate Change: Children on the Front Line*, pp. 86-91. Available at: [https://s3.amazonaws.com/academia.edu.documents/34335801/Challenges\\_of\\_Climate\\_Change-Children\\_on\\_the\\_Front\\_Line.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1506619508&Signature=ntciaZCcEDuQVqs0z1mIVhC0YaA%3D&response-content-disposition=inline%3B%20filename%3DInequality\\_climate\\_change\\_and\\_children\\_s.pdf](https://s3.amazonaws.com/academia.edu.documents/34335801/Challenges_of_Climate_Change-Children_on_the_Front_Line.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1506619508&Signature=ntciaZCcEDuQVqs0z1mIVhC0YaA%3D&response-content-disposition=inline%3B%20filename%3DInequality_climate_change_and_children_s.pdf)
- Flora, J. A., Saphir, M., Lappé, M., Roser-Renouf, C., Maibach, E.W., & Leiserowitz, A.A. (2014). Evaluation of a national high school entertainment education program: The Alliance for Climate Education. *Climatic Change*, *127*, 419-434. doi.org/10.1007/s10584-014-1274-1
- Friedman, M. (1985). Consumer boycotts in the United States, 1970–1980: Contemporary events in historical perspective. *Journal of consumer affairs*, *19*, 96-117. doi:10.1111/j.1745-6606.1985.tb00346.x
- Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude-behavior relationships: A natural experiment with curbside recycling. *Environment and Behavior*, *27*, 699-718. doi:10.1177/0013916595275005
- Hmielowski, J.D., Feldman, L. M., Myers, T. A., Leiserowitz, A. A., & Maibach, E. W. (2013). An attack on science?: Media use, trust in scientists, and perceptions of global warming. *Public Understanding of Science*, *23*, 866-883. doi: 10.1177/0963662513480091
- Hornik, R. (2002). *Public Health Communication: Evidence for Behavior Change*. Mahwah, NJ: Lawrence Erlbaum.

- Howe, P.D., Boudet, H., Leiserowitz, A., & Maibach, E.W. (2014). Mapping the shadow of experience of extreme weather events. *Climatic Change*, *127*, 381-389. doi:10.1007/s10584-014-1253-6
- Howe, P.D., Thaker, J., & Leiserowitz, A. (2014). Perceptions of changes in rainfall and extreme events among the Indian public. *Climatic Change*, *127*, 211-225. doi: [10.1007/s10584-014-1245-6](https://doi.org/10.1007/s10584-014-1245-6)
- Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, *14*, 147-174. doi:10.1080/13669877.2010.511246
- Kahneman, D. (2003). A perspective on judgment and choice: mapping bounded rationality. *American Psychologist*, *58*, 697-720. [doi.org/10.1037/0003-066X.58.9.697](https://doi.org/10.1037/0003-066X.58.9.697)
- Katz, E. (1957). The two-step flow of communication: An up-to-date report on an hypothesis. *Public Opinion Quarterly*, *21*, 61-78. doi:10.1086/266687
- Kelly, L.A.D., Luebke, J.F., Clayton, S., Saunders, C.D., Matiasek, J., & Grajal, A. (2014). Climate change attitudes of zoo and aquarium visitors: implications for climate literacy education. *Journal of Geoscience Education*, *62*, 502-510. doi:10.5408/13-078.1
- King, B. G. (2008). A political mediation model of corporate response to social movement activism. *Administrative Science Quarterly*, *53*, 395-421. doi:10.2189/asqu.53.3.395
- Krosnick, J. A., Holbrook, A. L., & Visser, P. S. (2000). The impact of the fall 1997 debate about global warming on American public opinion. *Public Understanding of Science*, *9*, 239-260. doi:10.1088/0963-6625/9/3/303
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, *108*, 480. <http://psycnet.apa.org/doi/10.1037/0033-2909.108.3.480>
- Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic Change*, *77*, 45-72. doi.org/10.1007/s10584-006-9059-9
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G. & Howe, P. (Apr. 2013). *Extreme Weather and Climate Change in the American Mind, April 2013*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/?s=Extreme+Weather+and+Climate+Change+in+the+American+Mind%2C+April+2013>
- Leiserowitz, A., Feinberg, G., Rosenthal, S., Smith, N., Anderson A., Roser-Renouf, C. & Maibach, E. (May 2014). *What's In A Name? Global Warming vs. Climate Change*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/?s=+Global+Warming+vs.+Climate+Change>

- Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (Oct. 2015). *Climate change in the American mind: October, 2015*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/?s=Climate+change+in+the+American+m ind%3A+October%2C+2015.+>
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (March 2015). *Climate change in the American Christian mind: March, 2015*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/?s=Climate+change+in+the+American+C hristian+mind%3A+March%2C+2015.>
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., Rosenthal, S., & Marlon, J. (Oct. 2014). *Public Perceptions of the Health Consequences of Global Warming: October, 2014*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/?s=Public+Perceptions+of+the+Health+C onsequences+of+Global+Warming>
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., Rosenthal, S., & Cutler, M. (2017). *Climate change in the American mind: May 2017*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/all/may2017ccam/>
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., Smith, N., & Dawson, Y. E. (2012). Climategate, public opinion, and the loss of trust. *American Behavioral Scientist*. 57, 818-837. doi: 10.1177/0002764212458272
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Smith, N. (May 2011) *Climate change in the American Mind: Americans' global warming beliefs and attitudes in May 2011*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/all/the-climate-change-in-the-american-mind-series-may-2011-2/>
- Leiserowitz, A. & Smith, N. (2011) *Knowledge of Climate Change Among Visitors to Science & Technology Museums*. Retrieved from Yale Program on Climate Change Communication website: <http://environment.yale.edu/climate/files/MuseumReport.pdf>
- Leiserowitz, A., Thaker, J., Feinberg, G., & Cooper, D. (2013) *Global Warming's Six Indias. Yale University*. Retrieved from Yale Program on Climate Change Communication website:[http://climatecommunication.yale.edu/wp-content/uploads/2016/02/2013\\_05\\_Global-Warming%E2%80%99s-Six-Indias.pdf](http://climatecommunication.yale.edu/wp-content/uploads/2016/02/2013_05_Global-Warming%E2%80%99s-Six-Indias.pdf)
- Luber, G., Knowlton, K., Balbus, J., Frumkin, H., Hayden, M., Hess, J., Ziska, L. (2014). Ch. 9: Human Health. *Climate Change Impacts in the United States: The Third National Climate Assessment*. In J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, (Eds.), *Third National Climate Assessment* (pp. 220-256). doi:10.7930/J0PN93H5.  
<http://nca2014.globalchange.gov/report/sectors/human-health>

- Maibach, E. (in press). Increasing public awareness and facilitating behavior change: Two guiding heuristics. In L. Hannah and T. Lovejoy (Eds.) *Climate Change and Biodiversity, 2<sup>nd</sup> edition*. New Haven, CT: Yale University Press.
- Maibach, E., Cullen, H., Placky, B., Witte, J., Seitter, K., Gardiner, N.,...& Sublette, S. (2016). TV meteorologists as local climate educators. *Oxford Research Encyclopedia of Climate Science*. doi:10.1093/acrefore/9780190228620.013.505
- Maibach, E., Kreslake, J., Roser-Renouf, C., Rosenthal, S., Feinberg, G. & Leiserowitz, A. (2015a). Do Americans understand that global warming is harmful to human health? Evidence from a national survey. *Annals of Global Health, 81*, 396-409. doi:10.1016/j.aogh.2015.08.010
- Maibach, E. W., Leiserowitz, A., Roser-Renouf, C., & Mertz, C. K. (2011). Identifying like-minded audiences for global warming public engagement campaigns: An audience segmentation analysis and tool development. *PLoS one, 6*, e17571. doi:10.1371/journal.pone.0017571
- Maibach, E., Leiserowitz, A., Roser-Renouf, C., Myers, T., Rosenthal, S. & Feinberg, G. (2015b). *The Francis Effect: How Pope Francis Changed the Conversation about Global Warming*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/?s=The+Francis+Effect%3A+How+Pope+Francis+Changed+the+Conversation+about+Global+Warming>
- Maibach, E., Perkins, D., Timm, K., Myers, T., Woods Placky, B., et al....Seitter, K. (2017). *A 2017 National Survey of Broadcast Meteorologists: Initial Findings*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/tag/2017+tv-weathercasters/>
- Maibach, E., Roser-Renouf, C., Akerlof, K., Leiserowitz, A., & Nisbet, M. (2010a). Saving energy is a value shared by all Americans: Results of a global warming audience segmentation analysis. In Erhardt-Martinez, K., & Laitner, J. (Eds.) *People-Centered Initiatives for Increasing Energy Savings* (pp. 99-112). Available at: <http://www.aceee.org/sites/default/files/publications/ebook/eb01.pdf>
- Maibach, E., Roser-Renouf, C., & Leiserowitz, A. (2008) Communication and marketing as climate change intervention assets: A public health perspective. *American Journal of Preventive Medicine, 35*, 488-500. doi:10.1016/j.amepre.2008.08.016
- Maibach, E., Roser-Renouf, C. & Leiserowitz, A. (2009). *Global Warming's Six Americas 2009: An Audience Segmentation Analysis*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/all/climate-change-in-the-american-mind-global-warmings-six-americas/>
- Maibach, E., Wilson, K. & Witte, J. (2010b). *A National Survey of News Directors about Climate Change: Preliminary Findings*. Retrieved from George Mason Center for

Climate Change Communication website:

<https://www.climatechangecommunication.org/?s=A+National+Survey+of+News+Directors+about+Climate+Change>

Maibach, E., Wilson, K & Witte, J. (2010c). *A National Survey of Television Meteorologists about Climate Change: Preliminary Findings*. George Mason University. Fairfax, VA: Center for Climate Change Communication. Retrieved from George Mason Center for Climate Change Communication website:

<https://www.climatechangecommunication.org/tag/2010+tv-weathercasters/>

Maloney, E. K., Lapinski, M. K., & Witte, K. (2011). Fear appeals and persuasion: A review and update of the extended parallel process model. *Social and Personality Psychology Compass*, 5, 206-219. doi:10.1111/j.1751-9004.2011.00341.x

Medical Society Consortium on Climate and Health (2017). *Medical Alert! Climate Change Is Harming Our Health*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/all/medical-alert-climate-change-is-harming-our-health/>

Metag, J., Füchslin, T., & Schäfer, M. S. (2015). Global warming's five Germanys: A typology of Germans' views on climate change and patterns of media use and information. *Public Understanding of Science*, 26, 434-451. <https://doi.org/10.1177/0963662515592558>

Morrison, M., Duncan, R., Sherley, C., & Parton, K. (2013). A comparison between attitudes to climate change in Australia and the United States. *Australasian Journal of Environmental Management*, 20, 87-100. doi:10.1080/14486563.2012.762946

Myers, T. A., Maibach, E., Peters, E., & Leiserowitz, A. (2015). Simple messages help set the record straight about scientific agreement on human-caused climate change: the results of two experiments. *PloS one*, 10. doi:10.1371/journal.pone.0120985

Myers, T.A., Maibach, E.W., Roser-Renouf, C., Akerlof, K., & Leiserowitz, A. A. (2013). The relationship between personal experience and belief in the reality of global warming. *Nature Climate Change*, 3, 343-347. doi: 10.1038/nclimate1754

Myers, T. A., Nisbet, M. C., Maibach, E. W., & Leiserowitz, A. A. (2012). A public health frame arouses hopeful emotions about climate change: A letter. *Climatic Change*, 13, 1105-1112. doi: 10.1007/s10584-012-0513-6

Myers, T., Rolfe-Redding, J., Roser-Renouf, C., & Maibach, E (2014). *Visitors' Experiences with NASA's Earth Observatory and Global Climate Change Resources*. George Mason University, Fairfax, VA: Center for Climate Change Communication.

Myers, T. A., Roser-Renouf, C., Maibach, E., & Leiserowitz, A. (2017). Exposure to the Pope's Climate Change Message Activated Convinced Americans to Take Certain Activism Actions. *Global Challenges*, 1, 1-8. doi:10.1002/gch2.201600019

- Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. *Environment: Science and Policy for Sustainable Development*, 51, 12-23. doi:10.3200/ENVT.51.2.12-23
- Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative social influence is underdetected. *Personality and social psychology bulletin*, 34(7), 913-923. doi:10.1177/0146167208316691
- Ockwell, D., Whitmarsh, L., & O'Neill, S. (2009). Reorienting climate change communication for effective mitigation: forcing people to be green or fostering grass-roots engagement? *Science Communication*, 30, 305-327. doi:10.1177/1075547008328969
- Oreskes, N. (2004). The scientific consensus on climate change. *Science*, 306, (5702), 1686-1686. doi:10.1126/science.1103618
- Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in experimental social psychology*, 19, 123-205. doi:10.1016/S0065-2601(08)60214-2
- Pew Research Center. (2013). Question Search. Retrieved from: <http://www.pewglobal.org/question-search/?qid=408&cntIDs=&stdIDs=>
- Pew Research Center. (2015). *How do Americans stand out from the rest of the world?* Retrieved from: <http://www.pewresearch.org/fact-tank/2015/03/12/how-do-americans-stand-out-from-the-rest-of-the-world/>
- Phipps, M. (2011). *Global Warming's Six Americas: A Science Museum of Minnesota Audience Segmentation Analysis*. Retrieved from: [http://www.informalscience.org/sites/default/files/6Americas\\_with2011data.pdf](http://www.informalscience.org/sites/default/files/6Americas_with2011data.pdf)
- Politico Magazine (2016). *Politico 50: Our guide to the thinkers, doers and visionaries transforming American politics in 2016*. Retrieved from: <http://www.politico.com/magazine/politico50/2016>
- Ranney, M. A., & Clark, D. (2016). Climate change conceptual change: Scientific information can transform attitudes. *Topics in Cognitive Science*, 8, 49-75. doi:10.1111/tops.12187
- RepublicEn. (2017). *RepublicEn: Engaging Conservatives*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/republicen/>
- Rogers, E. M. (2010). *Diffusion of innovations*. New York: Simon and Schuster.
- Roser-Renouf, C., Atkinson, L., Maibach, E., & Leiserowitz, A. (2016a). The consumer as climate activist. *International Journal of Communication*, 10: 4759-4783. Retrieved from: <http://ijoc.org/index.php/ijoc/article/view/4702>
- Roser-Renouf, C., Maibach, E., Leiserowitz, A., Feinberg, G., Rosenthal, S., & Kreslake, J. (2014a). *Global Warming's Six Americas: Perceptions of the Health Consequences of*

- Global Warming And Update on Key Beliefs*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/all/global-warmings-six-americas-in-october-2014-perceptions-of-the-health-consequences-of-global-warming-and-update-on-key-beliefs-2/>
- Roser-Renouf, C., Maibach, E., Leiserowitz, A., Feinberg, G., & Rosenthal, S (2016b). *Faith, Morality and the Environment: Portraits of Global Warming's Six Americas*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/all/faith-morality-and-the-environment-2016/>
- Roser-Renouf, C., Maibach, E., Leiserowitz, A. & Rosenthal, S. (2016c). *Takin' It to the Mall: Consumer Activism on Global Warming*. Retrieved from George Mason Center for Climate Change Communication website:  
<https://www.climatechangecommunication.org/all/takin-it-to-the-mall-consumer-activism-on-global-warming/>
- Roser-Renouf, C., Maibach, E., Leiserowitz, A., & Zhao, X. (2014b). The genesis of climate change activism: From key beliefs to political action. *Climatic Change*, 125, 163-178. doi:10.1007/s10584-014-1173-5
- Roser-Renouf, C., Maibach, E. W., & Li, J. (2016d). Adapting to the changing climate: An assessment of local health department preparations for climate change-related health threats, 2008-2012. *PloS one*, 11. doi:10.1371/journal.pone.0151558
- Roser-Renouf, C., Stenhouse, N., Rolfe-Redding, J., Maibach, E., & Leiserowitz, A. (2014c). Engaging diverse audiences with climate change: Message strategies for Global Warming's Six Americas. In: A. Hansen & R. Cox (Eds.), *Handbook of Environment and Communication* (pp. 368-386). New York: Routledge.
- Rowan, K., Kotcher, J., Walsh-Thomas, J., Baldwin, P., Trowbridge, J., Thaker, J., Witte, J., ...& Maibach, E. (in press). Best practices of “innovator” TV meteorologists who act as climate change educators. In D. O’Hair (Ed.), *Risk and Health Communication in an Evolving Media Environment*. London: Routledge.
- Sarfaty, M., Kreslake, J., Bloodhart, B., Price, K., Casale, T., Folstein, S., & Maibach, E. (2015a). *Views of Allergy Specialists on the Health Effects of Climate Change, Key Findings: Membership Survey of the American Academy of Allergy, Asthma, Immunology, December 2015*. Retrieved from George Mason Center for Climate Change Communication website: <https://www.climatechangecommunication.org/all/views-of-allergy-specialists-on-the-health-effects-of-climate-change-2/>
- Sarfaty, M., Kreslake, J., Casale, T., & Maibach E. (2015b). Views of AAAAI members on climate change and health. *Journal of Allergy and Clinical Immunology-In Practice*. Advance online publication. doi:10.1016/j.jaip.2015.09.018

- Sarfaty, M., Kreslake, J., Ewart, G., Guidotti, T., Thurston, G., Balmes, J., & Maibach, E. (2016). Views of American Thoracic Society international members on climate change and health. *Annals of the American Thoracic Society* October 2016, 13, 1808-13. doi:10.1513/AnnalsATS.201604-229BC
- Sarfaty, M., Mitchell, M., Bloodhart, B., & Maibach, E. (2014). A survey of African-American physicians on the health effects of climate change. *International Journal of Environmental Research and Public Health*, 11, 12473-12485. doi:10.3390/ijerph111212473
- Sciencetogo.org. (2017). *About the Project*. Retrieved from the Sciencetogo.org website: <http://sciencetogo.org/about/>
- Schweizer, S., Davis, S., & Thompson, J. L. (2013). Changing the conversation about climate change: A theoretical framework for place-based climate change engagement. *Environmental Communication: A Journal of Nature and Culture*, 7, 42-62. doi:10.1080/17524032.2012.753634
- Sears, D. O. & Freedman, J. L. (1967) Selective exposure to information: A critical review. *Public Opinion Quarterly*, 31, 194-213. doi:10.1086/267513
- Slater, M. D. (2007). Reinforcing spirals: The mutual influence of media selectivity and media effects and their impact on individual behavior and social identity. *Communication Theory*, 17, 281-303. doi:10.1111/j.1468-2885.2007.00296.x
- Somerville, R. C., & Hassol, S. J. (2011). The science of climate change. *Physics Today*, 64, 48. doi:10.1063/PT.3.1296?ver=pdfcov
- Spence, A., Poortinga, W., & Pidgeon, N. (2012). The psychological distance of climate change. *Risk Analysis*, 32, 957-972. doi: 10.1111/j.1539-6924.2011.01695.x
- Tewksbury, D. (2005). The seeds of audience fragmentation: Specialization in the use of online news sites. *Journal of broadcasting & electronic media*, 49, 332-348. doi:10.1207/s15506878jobem4903\_5
- Theel, S., Greenberg, M. & Robbins, D. (2013, Oct. 10). Media sowed doubt in coverage of UN climate report. Retrieved from Media Matters for America website: <https://www.mediamatters.org/research/2013/10/10/study-media-sowed-doubt-in-coverage-of-un-clima/196387>
- Trope, Y., & Liberman, N. (2011). Construal level theory. In P. Van Lange, A. Kruglanski & E. T. Higgins (Eds.), *Handbook of Theories of Social Psychology*, 1 (118-134). Los Angeles: Sage.
- Valente, T. (2012) Network interventions. *Science*. doi:10.1126/science.1217330

- van der Linden, S., Leiserowitz, A., Feinberg, G., & Maibach, E. (2014). How to communicate the scientific consensus on climate change: plain facts, pie charts or metaphors? *Climatic Change Letters*. doi:10.1007/s10584-014-1190-4
- van der Linden, S. L., Leiserowitz, A. A., Feinberg, G. D., & Maibach, E. W. (2015a). The scientific consensus on climate change as a gateway belief: Experimental evidence. *PloS one*, *10*. doi:10.1371/journal.pone.0118489
- van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the public against misinformation about climate change. *Global Challenges*, *1*. doi:10.1002/gch2.201600008
- van der Linden, S., Maibach, E., & Leiserowitz, A. (2015b). Improving public engagement with climate change: Five “best practice insights from psychological science. *Perspectives on Psychological Science*, *10*, 758-763. doi: 0.1177/1745691615598516
- Van Zomeren, M., Postmes, T., & Spears, R. (2008). Toward an integrative social identity model of collective action: a quantitative research synthesis of three socio-psychological perspectives. *Psychological Bulletin*, *134*, 504. doi:10.1037/0033-2909.134.4.504
- Walsh, J., Wuebbles, D., Hayhoe, K., Kossin, J., Kunkel, K., Stephens, G.,...Somerville, R. (2014). Our changing climate. In J. Melillo, T. Richmond & G. Yohe, (Eds.), *Third National Climate Assessment* (pp. 19-67). Retrieved from <http://nca2014.globalchange.gov/report/our-changing-climate/introduction>
- Weber, E. U. (2006). Experience-based and description-based perceptions of long-term risk: Why global warming does not scare us (yet). *Climatic Change*, *77*, 103-120. doi: 10.1007/s10584-006-9060-3
- Wildavsky, A., & Dake, K. (1990). Theories of risk perception: Who fears what and why? *Daedalus*, *119*, 41-60. Stable URL: <http://www.jstor.org/stable/20025337>
- Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs*, *59*, 329-349. doi:10.1080/03637759209376276
- Wolsko, C., Ariceaga, H., & Seiden, J. (2016). Red, white, and blue enough to be green: Effects of moral framing on climate change attitudes and conservation behaviors. *Journal of Experimental Social Psychology*, *65*, 7-19. doi:10.1016/j.jesp.2016.02.005
- Zhao, X., Leiserowitz, A., Maibach, E., & Roser-Renouf, C. (2011). Attention to science/environment news positively predicts and attention to political news negatively predicts global warming risk perceptions and policy support. *Journal of Communication*, *61*, 713-731. doi:10.1111/j.1460-2466.2011.01563.x
- Zhao, X., Maibach, E., Gandy, J., Witte, J., Cullen, H., Klinger, B.,...Pyle, A. (2014). Climate change education through TV weathercasters: Results of a field experiment. *Bulletin of the American Meteorological Society*, *95*, 117-130. doi:10.1175/BAMS-D-12-00144.1