

THE UNIVERSITY OF CHICAGO

DEFINING INVISIBLE PROBLEMS: THE INTERSECTION OF POLITICS AND SCIENCE  
IN AMERICAN PUBLIC OPINION ABOUT CLIMATE CHANGE

A DISSERTATION SUBMITTED TO  
THE FACULTY OF THE DIVISION OF THE SOCIAL SCIENCES  
IN CANDIDACY FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY

DEPARTMENT OF POLITICAL SCIENCE

BY

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CHICAGO, ILLINOIS

JUNE 2016

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To my dad, Jay Bass.

And to my mother, Susanne Frisch.

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## Acknowledgments

I entered graduate school in fall of 2007, as the US economy began to slide into its worst recession since the Great Depression. I felt incredibly lucky about the timing of my admission to the University of Chicago’s Political Science department, and am grateful for the generous funding I received from the Division of the Social Sciences. Against this backdrop, it was certainly not a bad time to become a graduate student.

Still, being a doctoral student isn’t exactly the best of times. Not that it’s the worst, either—but much of the time one can’t help but feel as though suspended in what should be a more transitional stage of life. PhD students, to steal Victor Turner’s language, occupy a somewhat liminal space “betwixt and between” the social categories to which our friends and family outside of academia<sup>1</sup> can readily relate. We’re adults, but we’re students. We’re researchers, published authors, and instructors, but we’re...still students. Many of us work while completing our doctoral programs, but we don’t have Real Jobs—we have short-term Grad Student Jobs. For a long time, we grapple with how to answer well-intentioned questions like “When do you graduate?” or “What’s next?”

This isn’t to say that there is anything for which I would trade the years of incredible intellectual growth and rigorous academic training I’ve received at Chicago. But at times I’ve struggled to maintain the long view, and to avoid the self-perception (filtered through misplaced anxieties about what society expects) that I was treading water while many in my age group worked their way out of the recession and towards the fulfillment of some impressively conceptualized 15 Year Plan.<sup>2</sup>

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<sup>1</sup> Also known within graduate student circles as “normal” or “real” people.

<sup>2</sup> That’s a thing, right?

I would like to extend the sincerest thanks to the wonderful mentors and friends who have been part of my trajectory as a PhD student. Each in their own ways, they have helped me learn from such moments of existential disquiet by offering, as appropriate, their reassurance, commiseration, or tough love. It wouldn't have been possible for me to complete this dissertation without their support, which normalized and neutralized the more atomizing aspects of the process.

Two people in particular deserve more acknowledgment than it is possible to provide here—but I'll try. First, my dissertation committee Chair, Professor John Brehm, provided patient guidance along every step of the way. John encouraged me to write out and assemble my research steadily and incrementally until, miraculously, it all added up to a dissertation. To mitigate the daunting nature of such a large project, John suggested I take inspiration from Wittgenstein's *Tractatus Logico-Philosophicus*, which he told me was essentially compiled from “shards” of political thought. Unfortunately for John, this resulted in his receiving countless shards of my own chapter drafts. He dutifully read and provided insightful comments on all of them—even when, more often than I would like to admit, I submitted them past the eleventh hour. I was frequently reminded of how rare it is to come by such close mentorship when one of my friends or colleagues would talk about their difficulties in tracking down elusive committee members. Many of them were impressed or even astonished when I told them that I meet with my Chair on a nearly weekly basis. In these meetings, I benefitted immeasurably from John's expertise. I could barely keep up with his suggestions for relevant readings (he seems to have immediate mental access to a vast inner library) and his conceptual and methodological suggestions. While I'm proud of this dissertation and excited that it is done, there is no question

that the final product would be leagues better if I had had the time and experience to implement all of John's advice.

In an environment that was sometimes isolating, I am also grateful that John always made an effort to connect with me as a scholar but also as a person. In addition to discussing the progress of my research, it was refreshing to chat with John about everything from Chicago's farmer's markets to music to the challenges he faces in appeasing his cats. John also provided a supportive presence at, and feedback on, the presentations I gave at the annual conference of the Midwest Political Science Association and at the University of Chicago's American Politics Workshop. When I look back at my time at the University of Chicago, I will always feel gratitude for John's guidance and for his confidence in this project.

The second person whose presence was critical to my time at the University of Chicago—and to my life in Chicago more generally—is my colleague and best friend, Dr. Maria/Mary Akchurin. I met Mary on the first day of Professor Mark Hansen's legendary Math Camp, and we quickly became friends after joining the same study group (aka The Original Quadrangle) and realizing that we were next-door neighbors. While the University of Chicago prides itself on cultivating thick skins and tough audiences, Mary was always ready to share in and celebrate even my humblest academic victories or milestones. On many occasions when I felt mentally exhausted, she helped me regain momentum by lending an empathetic ear as I talked through my frustrations, or by sending a well-timed text message asking if I'd like to work together. Whether we were carpooling to campus, working late hours at the Reg, throwing together an impromptu dinner, or walking aimlessly around the city because it was the first nice day in a long time, we created an exceptional amount of fun despite having scant free time and resources. In the (nearly) nine years since we moved to Chicago, we also both experienced many

big life changes and events, and without Maria’s friendship many of them would have been less meaningful or manageable.

Returning to my dissertation committee, I would like to thank Professors Eric Oliver and Betsy Sinclair for providing thoughtful feedback on my project, both when they were on campus and when their academic posts took them further afield. Eric Oliver encouraged me to develop even my most esoteric ideas—his continued enthusiasm for my Master’s thesis project (which many anonymous reviewers found too unconventional) is ultimately what pushed it through many drafts and submissions to publication. Betsy Sinclair is an exceptional teacher and mentor whose Causal Inference course not only helped me overcome my fear of quantitative analysis, but also made it fun. I also would like to thank Professor J. Mark Hansen for attending my dissertation defense as an examiner. Even though he was not formally on my committee, he took the time to read my dissertation and gave me extremely constructive and incisive suggestions that will help me address some of this project’s shortcomings.

While completing my coursework, I took challenging and engaging seminars with many others in the Political Science department. I am particularly grateful to Professor John McCormick, whose direct but kind feedback on a first-year seminar paper helped me become a better writer, and whose advice also helped me prepare for and pass my qualifying exam in political theory. I am also grateful to Professor Cathy Cohen: while I was in her Race and Politics course, she offered me the valuable opportunity to conduct applied research for her Mobilization, Change, and Political and Civic Engagement Project. In the Political Science department’s front office, Kathy Anderson’s institutional knowledge was absolutely indispensable. Kathy was always both reassuring and efficient, and I am thankful for the

dissertation “write-ins” that she organized, which helped many of us stay (or get back) on track towards our writing goals.

In the Department of Public Policy, Professor Ray Lodato gave me the chance to work as a teaching assistant for his Environmental Politics and Environmental Policy courses. At some point we lost count of how many times I had held these positions—but at any rate, it was always a pleasure to work with him. Ray is both a passionate instructor and a compassionate person who brings great energy into the classroom and to his students. Sitting in on Ray’s courses at the back of the classroom, his lectures inspired me to think about my own research from diverse perspectives. When I had wandered too far into the weeds of my own analysis, Ray’s classes often reminded me to return to the big, important, normative questions that arise when we consider how society’s relationship to the environment is mediated by political institutions.

Within my cohort I was lucky to meet and become friends with some of the smartest people I know. In our informal study groups and workshops, they provided critical conceptual advice and moral support. Throughout graduate school, Amir Fairdosi always lent an understanding ear when I experienced academic or personal roadblocks. Amir’s countenance is one of rare and deep kindness, and I am particularly thankful to him for introducing me to a mindful approach to daily life. Claire McKinney’s insights helped me grapple with the material for my qualifying exams in political theory and American politics, and during our first teaching experiences in “The Core.” She is also a co-founder of Arnold Movie Night, a tradition I hope we can revive one day soon over a glass of scotch. In our study and work groups, Tom Wood’s expertise in American politics amounted to public goods for which he probably was not adequately compensated (but we did provide an audience for his sardonic commentary, which has to count for something). I also benefited from the feedback I’ve received on my work from

Chad Levinson, and I continue to look forward to my chance meetings and catch-ups with Chad whenever I'm in Pick Hall. Gene Gerzhoy was also an indispensable member of our thesis proposal group, the Salonica Family Breakfast Club, and the Second Year Camping Expedition.

My broader University of Chicago network also includes Dr. Jaira Harrington, Dr. Marissa Guerrero, Dr. Chris Grauzil, and Dr. Francis McKay. For many years now, Jaira (aka Doctor J) has ceaselessly cheered me on towards the completion of this dissertation. She has always taken the time to stay in touch, even when she was doing fieldwork in Brazil and now from her postdoctoral position in Wake Forest. When I receive Jaira's inspiring travel updates, photos, and observations about daily life I am reminded to slow down my frenetic mental pace and take a broader perspective on life.

Marissa Guerrero and I stayed motivated to work on our dissertations by meeting in coffee shops all over Chicago, and we quickly became "actual" friends in addition to work buddies. Marissa always had encouraging advice about qualifying exams, teaching, and writing, and her positivity was reassuring at exactly the right times. Despite having moved back to the West Coast years ago, she continues to provide her post-PhD insights and support. I'm extremely thankful for the ways in which she's acted as an advocate on my behalf. Simply put, Marissa is the kind of person whose energy makes you want to pay it forward.

I am also grateful to have been "on the knowledge" with Chris Grauzil, who cared to check in even during insanely busy times. Chris's uncommon combination of personality traits make him both one of my favorite people to commiserate and to celebrate with. He's always generous with his time and skills (about which he's far too modest), and an incredibly devoted instructor who cares deeply about his students. Chris puts good ideas and good work first, regardless of their popularity—whenever I hear him talk about his work, it makes me want to be

a better social scientist. I look forward to receiving his dispatches from Brown next year, and for his sake, I hope that he's exaggerated the atrocity of Rhode Islanders' driving.

Francis McKay has also been a great friend for several years, and this year I was lucky to have him as a coworker in the MAPSS program. Although he doesn't tell me to keep calm during busy times, his equanimity is contagious—after debriefing with Francis about life or work, I would always return to my research with a clearer head and a fresher perspective on how to move forward. Francis is also a thoughtful gift-giver, brightens everyone's day with his impressive arsenal of jokes, and is a formidable adversary in Trivial Pursuit.

Shoutouts also go to Ahmad Qadafi, a member of the Original Quadrangle with a great smile; Etay Zwick, the founder and whip of Brunch Club, with whom I shared many Top 40-filled rides to and from campus; Meyosha (Mimi) Smiley, who provided so much more than coffee and hugs—her office was a place of stability amidst change; E.G. Enbar, who is an incredible bureaucrat (in the best sense of the word) and who made my work with the MAPSS program easier in countless ways; Juan Fernando Ibarra Del Cueto was an excellent and much too considerate officemate; I am also excited to follow the rising Americanist political scientists I met through the MAPSS program, including Erin Cikanek at the University of Michigan and Scott Cooley at the University of Chicago. I wish I could properly thank everyone I met at the University of Chicago whose feedback or friendship helped me complete this dissertation—and I apologize for any oversight I've made here.

My friends and family outside the University of Chicago have provided equally important moral support. Amanda Winterroth timed her move to Chicago and into our apartment impeccably, and she has been far too patient an audience to my daily gripes, unintelligible musings, non-stories, and non-sequiturs. Her return to the Midwest does present two problems in

that I miss her letters, and because our endless ability to generate inside jokes makes us pretty insufferable to anyone else in the vicinity. These are good problems to have, though.

I am also grateful that in Chicago I was able to reconnect with some of my oldest friends. Dr. Christie Choi is the OG of BFFs; she understands where I come from on a deep level. I also can't express how happy I am that over twenty years since we started having slumber parties, Dr. Kristin Davisson and I still have joint birthday (and yes, slumber) parties. Having been through the dissertation process before me, Kristin was always understanding when I complained about my busyness (in graduate school, it's important to have friends who'll let you be opportunistic with their time). I'm grateful that she continues to be an insightful and empathetic listener and friend, no matter what personal quandaries I'm facing. I would also like to thank Neal Pickle, Weykyoi Victor Kore, Anne Race, and Dr. Michael Just (especially for sending encouraging messages towards the end) for their inestimable friendship.

Last, and certainly not least, I would like to thank my small and far-flung family. My father, Dr. Jay Bass, never really suggested that I apply to graduate school, but he was nevertheless the most influential person in my decision to do so. During moments when I wanted to abandon this project, what motivated me the most was imagining how proud he'd be of me when it was finished. I am fortunate that he never questioned why I disappeared or stopped returning phone calls when I was studying for qualifying exams or in the final stages of completing this dissertation. Among other important life lessons, he's taught me how to be a good student, an independent and upstanding person, how to draw a banana, and how to make an outstanding martini.

My mother, Susanne Frisch, sent countless amazing care packages and often reminded me (in so many words) not to define my self-worth by my academic work. She also planned

much-needed vacations (it is no small feat to coordinate with the schedules of three adult-children), which provided the light at the end of whatever tunnel I was working through. Without these visits and trips, I also would have had far fewer opportunities to spend time with my brothers. My older brother, Phillip Bass, has always been a model for what it means to be a truly unique person; I often try to imagine what the world looks like through his eyes and to approach it with his level of curiosity. My younger brother, Timothy Bass, has inspired me with his courage to reinvent himself, and he impresses me every day as he works towards his goals. I'm excited to see where they will take him, and grateful for Tim's ability to listen, helpfully and nonjudgmentally.

Finally, I'd like to thank Joseph Guerrero. Luckily for me, Joe became a daily presence in my life about a year and a half ago—in a psychic sense, we've been inseparable ever since. Joe is the most perceptive and considerate person I know, and his enthusiasm for even the most mundane things is infectious. In the past several months when I was unmotivated to eat anything other than instant mac and cheese, he would come over and masterfully transform whatever was in my fridge into real food. When I was working late hours, his freezer meals and soups were my lifeline—as were his encouraging texts, and the countless thoughtful gestures through which he reminded me that there is always someone in my corner. It's a tall order, but I aspire to reciprocate Joe's generosity and supportiveness. I look forward to enjoying many more Midwestern storms, breakfast burritos, car rides to anywhere, and late night walks down Milwaukee Avenue together. While I was in the home stretch, these things not only kept me sane—they made me happy.

## **Abstract**

When scientific issues enter the realm of politics, how do ordinary citizens perceive policy debates in which both sides claim to rely on the best available scientific expertise? This dissertation examines this question using the case of the American public's views about anthropogenic climate change. Although some research has traced elite-level polarization over climate change through networks linking corporate funders, think tanks, and conservative politicians, fewer studies investigate how ordinary citizens think about the issue. Much of this burgeoning literature, moreover, makes two untested assumptions: first, that elite information flows and partisan rhetoric about climate change represent public opinion; and second, that public polarization over climate change can be attributed to widespread misinformation or differences in citizens' levels of factual knowledge.

While citizens' attention to political media and their scientific knowledge presumably impact their opinions about climate change in important ways, I argue that it is important to clarify how another factor—people's broader political predispositions—influences their receptivity to incoming information about the issue. Correspondingly, it is necessary to recognize how public discourses about climate change have evolved to encompass not only debates over climate science, but also claims about the political implications of regulatory climate policies. Taking these factors into consideration, I argue that climate change "skepticism" among ordinary citizens is less likely to reflect scientific misinformation than predispositional factors, such as wariness about expanded government regulation and executive overreach. In other words, people's perceptions of policy solutions might motivate how they define an otherwise invisible social problem.

The dissertation's empirical chapters test these arguments. Chapter 2 investigates how persuasive appeals about climate change in the mainstream media use cues that convey the economic, environmental, and political stakes of dealing with global warming. I analyze the editorial content of two major national newspapers with relatively different political constituencies—the *New York Times* and the *Wall Street Journal*—from 1988 to 2011, to determine if they used systematically different language related to themes of climate risk and policy. The analysis indicates that the two papers' editorial attention to climate change rose and fell together, but that the *New York Times* devoted significantly more space to the issue on its editorial pages. The *NYT* also featured significantly more editorials that referenced nature, disaster, and negative consequences from climate change. This chapter's analysis has two implications for those that follow. First, to the extent that the volume of coverage corresponds to a news source's potential agenda-setting effects—and to the extent that the *NYT* reaches a more liberal audience than the *WSJ* does—liberal citizens are exposed to more persuasive communications about climate change, whereas others might not think about the issue very much. Second, that the *NYT*'s appeals were more likely to use textual cues evoking climate change's long-term risks implies that the demographics comprising its readership will express greater concern about the issue, and potentially greater support for climate change mitigation policies.

In Chapter 3, I pick up and address these issues from a different angle. Using nationally representative survey data from the 2008-09 American National Election Studies, I examine two

dimensions of the public’s views about climate change. First, I test the idea underlying many real-world environmental advocacy campaigns: i.e., that people who believe climate change exists are more likely to be concerned about its consequences, and in turn, will become more likely to support climate change mitigation policies. Second, I investigate how people’s factual knowledge and their political predispositions might influence, and potentially alter, this configuration of opinions.

The results upheld the expectation that predispositions would influence people’s views about climate policies: a proxy for political predispositions had significant and direct effects on respondents’ support for three emissions policies to reduce global warming. Predispositions, moreover, did a better job of predicting policy support than people’s beliefs about the reality and potential severity of climate change. Thus, citizens do not necessarily draw on factual, domain-specific beliefs about the problem when they consider associated policy solutions—their opinions, rather, are more strongly associated with their broader political postures.

There was one important caveat to this conclusion. People’s factual scientific knowledge greatly overshadowed the effects of their political predispositions when they were asked if they supported a policy that would raise taxes on gasoline. Taken together, this chapter’s results indicate that environmental campaigns aiming to persuade citizens that climate change exists will have relatively circumscribed effects on public support for mitigation policies. Factual knowledge, however, is not irrelevant: broader and deeper civic scientific knowledge will likely be required to generate public support for policies that require citizens to pay personal or economic costs.

The fourth and final empirical chapter considers two additional factors that have been posited to influence citizens’ views about climate change, namely attitudes (as opposed to knowledge) about science, and traditionalist Christian beliefs. The chapter proceeds in two stages, and uses the same dataset as the previous chapter: first, I test the proposition that fundamentalist Christian views are associated with pessimistic or distrustful attitudes about scientific progress. In turn, I examine how both of these variables—fundamentalism and science attitudes—inform public views about climate change’s existence, causes, severity, and mitigation policies. In contrast to scholars who posit that religiosity is associated with antagonistic attitudes towards science, I do not find that fundamentalism dampens citizens’ enthusiasm about the social impacts of scientific progress. By and large, fundamentalist beliefs also did not account for variation in citizens’ views about climate change. Thus, although fundamentalists and the American Religious Right clash strongly with scientific expertise on issues with clear religious significance—such as evolution and abortion—the analyses presented here indicate that climate change does not evoke a comparable reaction. In contrast, people’s support for three emissions policies to mitigate climate change was consistently predicted by their political predispositions and their beliefs about the causes of climate change. As in the previous chapter, scientific knowledge and education strongly predicted support for increased taxes on gas.

The analyses presented in this dissertation indicate that communication initiatives to raise public support for climate change mitigation policies should take into account how those policies’ attributes might activate citizens’ political and ideological values. The findings presented here also indicate that unless people begin to experience what they perceive to be the direct effects of

climate change, they will be unwilling to pay personally for climate change mitigation policies. Broader social changes, including more comprehensive scientific education and civic knowledge, would be required to generate widespread support for policies that impose direct costs on citizens.

## **Chapter 1: Introduction**

Controversies over scientific and technical issues have long affected American policymaking processes. The early 1950s, however, marked the beginning of a new era of controversy in which vested interests with institutional access began using “science to fight science” (Conway and Oreskes 2011, 14). The cigarette industry innovated this approach by funding research in order to contest scientifically established links between smoking and cancer. In the decades that followed, powerful corporate actors followed suit in a number of other policy domains and disputed scientific and medical consensus on the risks associated with DDT, acid rain, the ozone hole, and—the focus of this project—global warming (Conway and Oreskes 2011). The success of this approach lies not in outright denial (though examples of denialist claims on these issues certainly abound), but rather, it turns the scientific method on itself by appealing to reasonable doubt and unsettled science in order to claim that no real consensus exists.

Oppositional discourses over “unsettled” science also, importantly, incorporate symbolic themes through which scientific issues become associated with citizens’ political preferences and predispositions. Public controversy over the health risks of fluoridizing public water supplies, for instance, began in the 1940s and continued for decades despite scientific consensus that fluoride safely prevents tooth decay. Political dimensions of fluoride debates involved questions over who should decide if a chemical is added to public water supplies and whether this constitutes compulsory medication (Martin and Richards 1995). (Questions that, notably, parallel contemporary debates about childhood vaccination.) In the 1980s, Americans debated whether vitamin C can control or palliate cancer, despite strong scientific evidence that it cannot. The vitamin C controversy pitted the “cancer research establishment” against those who advocated

freedom of choice in cancer therapies, the holistic health movement, the health food industry, and megavitamin therapists (Martin and Richards 1995).

As the pace of scientific and technological advancement quickens, complex or technical issues more frequently make their way into the policy arena, and citizens more frequently encounter persuasive discourses in which questions of scientific evidence are intertwined with symbolic political appeals. In recent years, the American public has become polarized over laws that constrain the use of stem cells in scientific research, require manufacturers to label genetically modified foods, mandate vaccination schedules for public school children, and stipulate science standards for public school curricula. This project focuses on public contention over anthropogenic climate change (ACC), an issue that is situated at the intersection of science and politics that has become increasingly polarized since the mid-1990s.<sup>1</sup>

The increasingly important role of scientific expertise in policy processes brings up foundational questions about democratic participation, that echo those that John Dewey raised in *The Public and its Problems* (1927). Recognizing that increasingly complex technology leads to asymmetries in the social distribution of knowledge, Dewey was concerned about the ability of democratic states to maintain large-scale civic deliberation about technical and social problems, rather than evolving into technocratic regimes run by experts and elites. He asked how social inquiry can be organized so that popular consensus has a role in governing scientific practices and institutions. Dewey's inquiry, transferred to the case of ACC, and brings up several critical questions: How do ordinary citizens—who generally do not have much knowledge about climate

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<sup>1</sup> “Climate change” and “global warming” are technically distinct phenomena. Although “climate change” is generally more accurate, I use the terms interchangeably throughout this project. This is necessary to accurately describe other scholars’ measures and terminology when reviewing their research, and because the survey items I use in my own analyses refer to both “global warming” and “rising global temperatures.” For brevity, I use the acronyms ACC, CC, GW.

science—form beliefs about climate change? Without technical expertise, how do they arbitrate between competing elite claims about scientific evidence for CC’s existence and causes? And on what basis do citizens form judgments about CC’s potential risks and appropriate policy solutions? This project aims to make headway in addressing these questions. I examine how citizens’ alignment with, or opposition to, prevailing scientific consensus on ACC is related to several key characteristics, including their factual knowledge, their political preferences or predispositions, and the perceived credibility of expert knowledge.

### **Background: The politicization of uncertainty**

Climatologists agree that predominant modes of human energy production (which combust of fossil fuels) release greenhouse gases that, over time, are accelerating the overall rate of atmospheric warming. The projected long-term effects of anthropogenic climate change include more volatile and extreme weather patterns that will disproportionately impact coastal regions and equatorial nations, increased droughts (and consequently more wildfires), and impacts on natural ecosystems such as species loss and population pressures (Anderegg et al. 2010; Oreskes 2004a; Oreskes 2004b). Although some mainstream media discourses portray the climate science community as divided, 97-98% of the climate researchers most actively publishing the field agree with the Intergovernmental Panel on Climate Change’s (IPCC) basic tenets on climate change, i.e., that “anthropogenic greenhouse gases have been responsible for most of the unequivocal warming of the Earth’s average global temperature over the second half

of the 20<sup>th</sup> century.” These researchers’ expertise has been found to “vastly” overshadow that of skeptical<sup>2</sup> climatologists (Anderegg et al. 2010).

Among the American public, however, ACC is not particularly salient, and citizens systematically rank it as the least of their socio-political worries (Riffkin 2014b). Although global warming became the subject of mass attention during the abnormally hot and extreme summer of 1988, since that time, it has reemerged in the public arena only episodically. The issue periodically captures public attention in the wake of “focusing events” like weather-related disasters, major international negotiations, or public discourses involving well-known figures—for instance, Pope Francis’s encyclical on the environment, or former Vice President Al Gore’s documentary *An Inconvenient Truth*.

The attributes of the issue pose a number of barriers to public understanding and concern. In contrast to more immediate and localized environmental problems like acid rain or particulate pollution, climate change occurs on imperceptible, long-term, and global scales, and thus citizens cannot observe its effects firsthand. Climate science is also a highly specialized, technical field and therefore inaccessible to ordinary citizens unless they happen to be involved in some aspect of physical sciences research. Further, ACC has the features of a classic collective action problem: responsibility for incurring and mitigating climate change is fragmented across many agents, for which no single actor (including nations and regions as well as individuals) wants to take accountability. Mitigating and adapting to climate change will also require major long-term

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<sup>2</sup> The term “skepticism” covers a range of beliefs about scientific evidence for CC and its existence, causes, and potential consequences. Throughout this project, I follow McCright and Dunlap’s broad characterization of “skeptics” as people who challenge some aspect of what they perceive as the false consensus of “mainstream” climate science (2003, 355).

changes to the social and economic status quo, and citizens may avoid the issue altogether to reduce the cognitive dissonance associated with these changes (Gardiner 2008).

Taken together, these attributes have proved advantageous for corporate and political actors whose interests conflict with climate regulation, including business lobbies, carbon industries, wealthy individuals with stakes in extractive industries, and ideologically conservative foundations. McCright and Dunlap (2003) pinpoint the 1994 midterm elections in which Republicans took over Congress as a crucial moment in the development of a well-organized and politically conservative global warming countermovement. Increased Republican representation translated into heightened political and institutional access for these actors, and in turn, greater influence in Congressional hearings and national media. As Congress has grown more polarized over the past two decades, elites within the conservative movement and fossil fuel industries “have sent a consistent message—via conservative talk radio, television news, newspapers, and websites—to the American public” that “climate change is not real and thus does not warrant ameliorative action” (McCright and Dunlap 2011).

The visibility of these skeptical claims, moreover, is enhanced by journalistic practices. Because “balancing norms” require reporters to give equal time to both sides of controversial issues, media attention to CC skeptics is disproportionate to their status and credibility within the scientific community (Boykoff 2007). Media norms also disincentive scientists from engaging in media outreach: journalists work on short-term times scales, report on discernable events rather than incremental issues or stories, and benefit from emphasizing conflict (Boykoff 2007). Environmental scientist and climate modeler Stephen Schneider recounts numerous factors that led to climatologists’ learned avoidance of the media in the 1970s (when coverage of climatic issues dealt predominantly with “global cooling”) in order to protect their reputations within the

scientific community. Reporters—who were often general assignment reporters rather than science journalists—tended to use pithy quips as quotations without adequate context; when stories trickled from bigger media outlets to smaller sources, local coverage often distorted bylines and headlines, or presented factual information inaccurately (Schneider 1989, 201-2).

Given that climate change is abstruse, unobtrusive, and embattled, how does the public perceive and think about this issue area? If public opinion “can be understood as a response to the relative intensity and stability of opposing flows of liberal and conservative communications” (Zaller 1992, 185-6), one would expect citizens who are attuned to such communications about ACC to adopt the positions that align best with their own political predispositions. But as Zaller (1992) also makes clear, many citizens remain outside the orbit of elite discourses and thus these messages do not typically reflect the broader landscape of public opinion. The case of climate change introduces unique challenges to understanding Americans’ views because it gives rise not only to political debates between partisan elites, but also, to a manner of meta-elite discourse. That is, political debates over CC are not simply contests over preferred policy solutions to an agreed-upon problem: they entail struggles over the legitimacy of competing claims about expert knowledge in which both sides assert objectivity and neutrality—and in which one side invokes doubt about scientific consensus on the problem’s very existence and causes. Oppositional discourses about CC mitigation policies, consequently, portray them as imposing steep economic and political costs in order to deal with an ill-defined and overwrought problem.

To posit how people conceptualize or define CC as a problem, it is thus necessary to account for the influences of their political preferences, factual knowledge, and attitudes about science. Further, it is critical to theorize and understand how citizens’ beliefs about the problem go together with their perceptions of proposed solutions.

## **Public beliefs about climate change**

Although there is much evidence that public opinion on CC falls along political fault lines, Americans were not always particularly divided over environmental issues. During the “golden era” of environmental lawmaking in the 1960s and 70s, there was broad public support for government action on the environment, and bipartisan majorities in Congress passed twenty-two pieces of major environmental legislation that were signed into law by presidents of both parties (Klyza and Sousa 2013). Republican President Nixon (by no means remembered as an ardent environmentalist) created the EPA by executive order in 1970 and signed both the Clean Air and Clean Water Acts into law (1970 and 1972, respectively) with strong bipartisan support. Thus, when global warming became an issue of mass public awareness during the abnormally hot and extreme summer of 1988, it was not an immediately or inherently polarizing issue. As late as 1997, the public agreed that climate change exists, with nearly identical percentages of Democrats (46%) and Republicans (47%) saying that the effects of global warming had already begun (Dunlap 2008).

Americans’ opinions and beliefs about climate change began to diverge in the mid- to late-1990s and continue to cleave along well-documented political lines. By 2008, 76% of Democrats as opposed to 41% of Republicans believed warming was underway (Dunlap 2008). In 2013, most Democrats (84%) said that there is “solid evidence” for warming, while Republicans were split: 46% thought there is evidence, and 45% said there is not (Pew Research 2014).<sup>3</sup> Of the Republicans who did not think there is evidence, 70% identified with the “ultra

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<sup>3</sup> For comparison with aggregate national opinion in 2013, 67% of Americans said there is “solid evidence” the Earth is warming, and 44% said it was due to human activity.

conservative” (Skocpol 2013) Tea Party movement.<sup>4</sup> When asked further about the lack of evidence, 28% of Tea Party supporters (compared to 13% of other Republicans) said the science is unsettled (“we just don’t know enough yet”), indicating that these respondents might be receptive to additional information about scientific evidence for GW. But 41% of “Tea Partiers” (compared to 16% of other Republicans) rejected the possibility of evidence outright, saying that global warming is “just not happening” (Pew Research 2014). To be clear, Tea Party activists comprise a small portion of the electorate.<sup>5</sup> This demographic’s importance, rather, is that the extremity of its views contributed to its success as a grassroots countermovement to established environmental organizations. Tea Party mobilization was thus critical to conservative efforts to defeat comprehensive cap-and-trade legislation in 2009.<sup>6</sup>

These trends indicate that there may be several “issue publics” that are concerned with different aspects of ACC. Democrats, as compared to Republicans, became much more convinced over time that there is scientific evidence for global warming. Despite increasing scientific certainty and consensus on the matter since the late 1990s, Republicans, as a group, did not shift notably in either direction. The most conservative Republican identifiers, however, are very skeptical GW is happening and oppose mitigation policies that would expand environmental regulations. These trends indicate that partisanship may have asymmetrical effects on citizens’

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<sup>4</sup> Skocpol characterizes Tea Party supporters as such because they are highly attentive to conservative political media, extremely distrustful of government, and take anti-tax and anti-environment stances. The Tea Party formed in 2009 in reaction to the new Obama Administration’s priorities on health care and cap-and-trade: its main arguments against cap-and-trade claimed that nature should not take precedence over human needs and property rights, and that a free marketplace can better protect environment than big government initiatives (Skocpol 2013).

<sup>5</sup> In 2013, 22% of the electorate supported the Tea Party, a decrease from its peak of 32% in 2010 (Saad 2013).

<sup>6</sup> The American Clean Energy and Security Act, also known as the Waxman-Markey Bill, died in the Senate after protracted partisan debate.

beliefs and views and beliefs about CC, and that Democratic elites are paying more attention to the issue than Republicans. Further, to the extent that proposed CC policies activate or resonate with people’s political values or predispositions, their perceptions of policy solutions might bias how they define the nature of the problem. In the chapters that follow, I elaborate and test these propositions.

## **Chapter outline**

### **Chapter 2**

In Chapter 2, I compare patterns in persuasive discourses about climate change in two mainstream news sources—the *New York Times* and the *Wall Street Journal*—that have comparatively different political constituencies. I compile an original dataset of opinion and editorial pieces about climate change from 1988 (when global warming became a major issue in mainstream media) to 2011. I investigate whether the two papers’ editorial coverage used substantially different language related to climate risk and policy. The analysis finds that the *NYT* was significantly more likely to run editorials about climate change over this period than the *WSJ*. The *NYT*’s pieces also used negative, cautionary terms more frequently: that paper ran significantly more editorials that referenced nature, disasters, and projected consequences of climate change. However, the papers did not differ significantly in the incidence of pieces that used language invoking taxes, regulations, or skepticism about scientific evidence. This initial analysis sheds light on patterns of cyclical media attention to climate change, the two sources’ potential agenda-setting effects, and how these persuasive discourses constructed the risks and consequences associated with climate change.

## **Chapter 3**

In Chapter three, I examine two interrelated questions using public opinion data from the 2008-09 American National Election Studies. First, how do people’s beliefs about CC “go together?” More specifically, how are people’s beliefs about the existence and severity of global warming associated with their support for emissions policies? Second, I examine how each of these variables (i.e., beliefs about climate change’s existence and severity, and policy support) is associated with people’s scientific knowledge and political preferences. These analyses shed light on the nature of information people deploy to form opinions about the ACC. The results also have implications for the effectiveness of information-based approaches to climate communication and advocacy.

## **Chapter 4**

Lastly, I build on the analyses in Chapter 3 to examine how people’s views about two important cultural institutions—science and religion—are associated with their stances on climate change. In contrast to the previous chapter, where one of the key variables under consideration was scientific knowledge, here I examine broad attitudes about scientific progress. First, I test theories of “clashing worldviews” that posit intractable tensions between traditionalist Christian beliefs (fundamentalism) and scientific empiricism. Second, I examine how fundamentalism and attitudes about science predict beliefs and opinions specifically about climate change.

## **Chapter 2: In what terms do editorial narratives frame the risks and stakes of climate change?**

Despite increased scientific certainty about the causes and consequences of global warming, over the past twenty years a partisan and ideological gap has grown in Americans' opinions about the issue. Few ordinary citizens, of course, are climate experts—their views about global warming are therefore less likely to be informed by expert knowledge than by contextual cues in media and elite discourses. In this chapter, I develop and test hypotheses about two mainstream information flows and the cues they use to convey the economic, environmental, and political stakes of dealing with global warming. I analyze the editorial content of two major national newspapers with different political constituencies—the *New York Times* and the *Wall Street Journal*—over the 24-year time period from 1988 to 2011 to determine if they used systematically different language related to themes of climate risk and policy. Poisson regression analysis indicated that the two papers' editorial attention to climate change rose and fell at the same points in time, but that the *New York Times* devoted significantly more space to the issue on its editorial pages. The hypothesis that the *NYT*'s editorials would feature more references to nature, disaster, and the potential negative consequences of climate change was upheld. However, the hypothesis that the *WSJ*'s editorials would use more terms related to the economy, taxes, and regulation was not sustained; in fact, the left-leaning *NYT* was more likely to use such language. Lastly, although the *NYT* was less likely to use words connoting skepticism about climate change, this was not a significant difference between the paper, and neither used these terms frequently.

### **Introduction**

In this chapter I analyze the language used in persuasive writing about anthropogenic climate change (ACC) on the editorial pages of two high-circulation national newspapers. Because these newspapers both represent and target relatively different political constituencies, I examine whether they use systematically different linguistic cues to convey arguments about the reality and risks of climate change. Since different cues are likely related to different ways of framing the issue, this analysis provides insight into how mainstream news sources semantically construct (or deconstruct) ACC's status as a social problem. Further, since opinion pieces (unlike conventional news reports) aim to persuade or reinforce readers' views, this analysis has implications for understanding the considerations that citizens likely use to interpret discourses about the issue.

This chapter's analysis is motivated by two contrasting trends: on the one hand, scientific consensus about CC has increased over time; on the other, public disagreement about the issue has increased. Climatologists agree that anthropogenic greenhouse gas emissions are accelerating the pace of climate change, and project that its long-term impacts will disproportionately affect developing nations,<sup>1</sup> require costly adaptations to coastal infrastructure, and disrupt natural ecosystems (Anderegg et al. 2010; Boykoff 2007; Oreskes 2004b; Oreskes 2004a; Horwitz 2004; McCright and Dunlap 2003; Williams 2001). Yet while most Americans say they trust scientists and that protecting the environment should be a national priority (Pew 2009a), ACC has become an increasingly divisive political issue since the mid-1990s. In 1997 nearly identical percentages of self-identified Republicans and Democrats (47% and 46%, respectively) said that the effects of global warming had already begun—but by 2008, this figure had increased substantially among Democrats (to 76%), and had decreased slightly for Republicans (to 41%) (Dunlap 2008). Over the same period, partisan opinion gaps also expanded over whether the seriousness of global warming is generally exaggerated in the news, if there is a scientific consensus that global warming is occurring, to what extent it can be attributed to human or natural causes, and whether it poses a potentially serious threat (Dunlap 2008).<sup>2</sup>

At the elite level, controversy over climate change can be clearly linked to the interests and institutional activities of powerful actors with stakes in fossil fuel industries (Dunlap and McCright 2011). A well-developed literature using social movement theory describes how conservative foundations and corporate interest groups mobilized a climate skepticism

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<sup>1</sup> The most at-risk countries are low-lying equatorial nations (that will face increased risks from floods, tropical cyclones, tornadoes, and coastal erosion), developing countries in which agriculture sectors employ the majority of the population, nations with extant food insecurity issues.

<sup>2</sup> This item asked respondents “Do you think that global warming will pose a serious threat to you or your way of life in your lifetime?”

“countermovement” in response to environmentalists’ success in raising awareness about ACC in the late 1980s and early 1990s (Boussalis and Coan 2016). However, disagreement among ordinary citizens is more puzzling because they do not typically have immediate material incentives to deny (or for that matter, to defend) expert scientific opinion on the issue, and given that the public had previously expressed relatively unified support for CC mitigation policies.

To expand on this point about personal incentives, it is important to consider the unique nature and attributes of the issue, as well as the information environment in which citizens are most likely to receive messages about it. Climate change is an “unobtrusive” issue, i.e., one with which people do not have firsthand experience (Zucker 1978); it is technical and complex, as well as spatially and temporally distant from citizens’ everyday lives. Zucker (1978) argues that in contrast to “obtrusive” issues with more personal salience for citizens, unobtrusive problems are more susceptible to agenda-setting effects—in the absence of media attention, that is, they are extremely unlikely to capture public attention. Moreover, although at times various conditions and “focusing events” have converged to push ACC into the public arena, the abstract and technical nature of the issue has still left it particularly open to political contestation. As Hilgartner and Bosk (1988) argue, the process by which an issue becomes defined as a social problem involves not only the problem’s struggle for attention in a crowded public arena, but also dynamic competition among the “communities of operatives” that coalesce around an issue to frame it in a particular way. To the extent that citizens’ judgments about ACC cannot rely on its observable features, personal experience, or expert opinion about its potential risks, the frames and interpretive cues deployed in public discourses become more important for these judgments.

Gamson and Modigliani's constructivist account (1989) expands on the importance of framing in the collective issue definition process. Policy issues acquire social meaning in the bi-directional feedback loop between the media and the public. Media discourses deploy "interpretive packages" of "metaphors, catchphrases, visual images, moral appeals, and other symbolic devices" that relate to a central organizing frame (1989, 2). The effectiveness of these frames, in turn, is contingent on the nature of the anticipatory schemas (i.e., the "life histories, social interactions, and psychological predispositions") that individuals use when they interpret media narratives (1989, 2). Winter (2008) elaborates the importance of frames for orienting people's opinions in low-information contexts: frames, often implicitly, establish links between preexisting psychological schemas and unfamiliar policy areas—even when the two are seemingly or logically unrelated. The resulting "[a]nalogical or metaphorical reasoning is an important strategy we use to understand and evaluate new situations. When we encounter something we do not understand—such as a new political issue—we attempt to understand it in terms of some other context we do understand" (2008, 24).

Media and elite discourses originating in the "climate change denial community" (McCright and Dunlap 2011) use several recurring frames and themes to challenge ACC's status as a social problem.<sup>3</sup> McCright and Dunlap's analysis (2003) of documents produced by conservative think tanks (which they characterize as "the most influential anti-environmental organizations at the national level") in the 1990s reveals that they disseminated three major counter-claims to ACC: that the evidentiary basis for global warming is weak, if not wrong; that the net effect of global warming—should it occur—would be beneficial; and that proposed

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<sup>3</sup> The "climate change denial community" encompasses diverse actors with material or ideological stakes in the issue, including fossil fuel corporations, contrarian scientists, conservative think tanks, conservative politicians, conservative pundits and media, public relations firms, and amateur climate bloggers (Dunlap and McCright 2011, 144).

climate policies would do more harm than good (354). While these discourses ostensibly concern various dimensions of the issue itself, they also use political cues and frames associated with economic liberalism to convey “[a] staunch commitment to free markets and disdain of governmental regulations” (McCright and Dunlap 2011, 144). Another frame that underlies skeptical claims is that of scientific uncertainty. These narratives raise questions about the certainty with which scientists understand ACC’s causes and potential consequences, the degree of uncertainty inherent in climate models, the credibility of individual scientists, and the credibility of the broader climate science community (Oreskes and Conway 2010).

Without making a direct causal claim about the impact of these interpretive frames on public views about climate change, public polarization over ACC indicates that skeptical media discourses have likely had a longitudinal, aggregate influence on many citizens’ beliefs and opinions. A more cautious formulation, perhaps, is that the political and psychological correlates of skeptical views among the public correspond to the central frames used skeptical media discourses. Hornsey et al.’s meta-analysis (2016) of studies examining “belief in climate change” found that political partisanship and ideology were stronger predictors of beliefs about the reality of CC than any other demographic variables. People who were skeptical about the reality of CC also were significantly more inclined than others to hold individualistic and hierarchical values,<sup>4</sup> and to adhere to free-market ideologies that oppose regulatory intervention. An analysis of Americans’ climate change beliefs, risk perceptions, policy preferences, and behaviors found that

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<sup>4</sup> Dan Kahan (and colleagues at Yale Law School’s Cultural Cognition Project) is perhaps the most enthusiastic proponent of using Douglas and Wildavsky’s (1982) two-dimensional conception of values (as falling along Hierarchy-Egalitarianism and Individualism-Communitarianism scales) to predict citizens’ acceptance of scientific information. In this conceptualization, hierarchical individualists associate authority with conspicuous social rankings, and condemn collective interference with decisions made by those in authority. Kahan et al. (2011) posit that these individuals reject messages about climate change risks “in part because they associate the issue with antagonism to commerce and industry.”

the public comprises six distinct “global warming audiences” ranging from citizens who are alarmed about the issue to those who completely dismiss the idea that it is a threat (Leiserowitz, Maibach, and Roser-Renouf 2008). Those characterized as “dismissive” (11% of the public) were not at all convinced GW is happening and did not believe there is scientific consensus on the issue (or, they thought the scientific consensus is that GW is not happening)—they were also far more likely than average to identify as Republican (72%), conservative (81%), and held the strongest individualistic values of any of the six GW demographics. They agreed in particular (83%) with a measure of individualism that invokes an oppositional view of big government (“Government regulation of business does more harm than good.”) (Leiserowitz, Maibach, and Roser-Renouf 2008).

In a study (Leiserowitz 2006) that prompted respondents to articulate the images they associated with GW responses that were skeptical or cynical fell into five categories of claims about GW: 1) that it is a natural phenomenon (e.g., GW is due to “Normal earth cycles”), 2) the issue is a matter of hype (“The ‘problem’ is overblown,” “Environmentalist hysteria”), 3) the science is unreliable (“Junk science,” “There is no proof it exists,” “10 years or so ago it was global cooling”), 4) the problem does not exist (“A false theory,” “There is no global warming”), and 5) conspiracy theories (“Hoax,” “Environmentalist propaganda,” “Scientists making up some statistics”) (Leiserowitz 2006, 54-5). These responses indicate that doubt about ACC is often associated with negative views of mainstream climate science. Additionally, the second and fifth response categories indicate that some respondents associated CC with more generalized negative attitudes towards environmentalists. Hoffman’s analysis (2011) of extreme skeptical rhetoric about CC also found that it links environmentalism with leftist politics more generally,

and referred to those who believe in the science of CC as “Lefties,” “Communists,” “Obama-ites,” “Warmists,” and “Alarmists.”<sup>5</sup>

On the other side of the issue, people who are convinced that ACC is real or threatening are not out of step with overall scientific assessments, and are therefore a less critical audience for environmentalist messages. Since their views do not obstruct climate policymaking, there is much less research on the symbolic dimensions of the communications and discourses that might shape their opinions on the issue. Perhaps the most visible contemporary effort to raise awareness about ACC is former Vice President Al Gore’s Academy Award-winning 2006 documentary *An Inconvenient Truth*, a film adaptation of Gore’s initiative to educate the public about GW with an extensive and engaging slide show. The presentation is a rebuttal to skeptical narratives about scientific uncertainty, and its predominant persuasive tactic is to focus on scientific consensus and evidence for the reality and human causes of GW. This focus on scientific evidence is integrated with material that evokes GW’s calamitous present and future consequences: e.g., deadly hurricanes, rising oceans, disease, drought, and famine (Rosteck and Frentz 2009). The movie received a tremendous amount of national attention and many citizens, it seems, were receptive to its claims. By April 2007, about one in six (16%) North Americans said they had seen the movie. Globally, of those who had seen it, 89% said that it had made them more aware of the issue of GW, 66% it had “changed their mind” about GW, and 74% said they had changed some of their habits as a result of seeing the film (The Nielsen Company 2007).

That *An Inconvenient Truth* (at least temporarily) raised public awareness about ACC and attracted so much media attention attests to the rhetorical efficacy of its appeals to scientific

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<sup>5</sup> These are the terms used in conference presentations and interviews with attendees at the largest climate deniers’ conference in the world, The Fourth International Conference on Climate Change. The conference is hosted by the Heartland Institute, cosponsored by nearly 120 nonprofit institutions, and drew an estimated 700 attendees (Hoffman 2011).

authority and future disaster. The film's success, in particular, may reflect that citizens who are concerned about ACC conceptualize it as a long-term and environmental problem. Research on the psychological antecedents of CC beliefs finds that many of "the convinced" on climate change think about it in the context of broader schemas of environmental risk or disaster. One of the most widely used constructs in environmental psychology is the "New Environmental Paradigm" (NEP), a scale from items about the importance of minimizing human impacts on the environment; Hornsey et al.'s meta-analysis (2016) found that the relationship between NEP and belief in climate change was stronger than any other antecedent variable they investigated.<sup>6</sup> Bord, Fisher, and O'Connor (1998) found that those who were concerned about GW associated it with a "general pollution model" characterized by concerns about the environmental and health impacts of contaminated air and water. (People who made sense of GW in terms of this model, interestingly, tended to conflate global warming and atmospheric ozone depletion, and had inaccurate beliefs about GW's anthropogenic causes: while did attribute it to human causes, they cited, e.g., pesticides or aerosols rather than greenhouse gas emissions. Thus while they were on the "right" side of the GW issue by the standards of broad scientific consensus, they did not necessarily have an accurate understanding of the phenomenon. In Leiserowitz's study (2006) that asked people about the images they associated GW, the most common responses mentioned negative or threatening environmental consequences: the single largest category of responses included associations to melting glaciers and polar ice caps. This was followed by generic associations to heat or rising temperatures; impacts on non-human nature; ozone depletion;

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<sup>6</sup> The NEP as originally developed by Dunlap and Van Liere (Dunlap and Van Liere [1978] 2008) uses twelve Likert-type items on a range of issues that represent broad worldviews about humans' relationship to nature—they ask about issues related to limits to economic growth, limits to natural resources, "balance of nature," anti-anthropocentrism, and a steady-state economy. They do not mention global warming or climate change.

alarmist images of disaster; and rising sea levels or flooding in coastal areas (and lastly, there was the category of skeptical responses described in detail above).

Taken together, these studies indicate that divergent public views about climate change are shaped by different definitions of the problem, and different perceptions of associated risks. On the one hand, skeptical citizens question the consistency and conclusiveness of the scientific evidence that is required to identify whether the problem exists—and further, it is not climate change, but proposed ameliorative policies, that threaten to impose a greater social cost. By contrast, the “convinced” on climate chance accept anthropogenic causal explanations for it, and associate it with environmental risks and natural disasters that pose enormous adaptive challenges to human infrastructure.

In the analyses that follow, I test whether this description of how the “convinced” and the “skeptical” conceptualize ACC is reflected in the interpretive cues that appear in one venue for public discourse: the opinion and editorial pages of the *New York Times* and the *Wall Street Journal*.<sup>7</sup> I chose these two newspapers, first, because relative to one another they represent different political constituencies. While the *Wall Street Journal* slants politically to the right, the *New York Times* has a leftward slant (Page 1996; Gentzkow and Shapiro 2010).<sup>8</sup> I anticipate that these papers’ opinion pieces about ACC will typically emphasize different aspects of the issue to make different arguments about the need for ameliorative action on climate change. Considered as political forums for more liberal-leaning and conservative-leaning audiences, these papers

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<sup>7</sup> Although editorials, op-ed pieces, and letters to the editor have distinct authors, I refer to these columns collectively as “opinion pieces,” “commentary,” or “editorial content.”

<sup>8</sup> As of 2012, the partisanship and ideology of the *WSJ*’s regular readership broke down as such: 20% Republican, 45% Independent, 31% Democrat; 32% conservative, 41% moderate, 21% liberal. The *NYT*’s readership identified as: 13% Republican, 39% Independent, 44% Democrat; 22% conservative, 35% moderate, and 36% liberal (*Pew* 2012).

provide a unique data source for examining the how the opinion leaders that represent these groups make persuasive appeals about ACC.

Second, I use mass-circulation newspapers because, as two of the most widely read and circulated newspapers in the US, they reach a very large number of ordinary citizens.<sup>9</sup> The volume of their coverage about ACC therefore affects public exposure to and awareness of the issue, and the tenor of this coverage plays an important role in the broader “process of collective definition” through which citizens come to think of something as a problem—or alternatively, as a nonissue (Hilgartner and Bosk 1988). Much prior research on CC discourses focuses on specific controversial claims by political elites (such as, for instance, Senator James Inhofe’s assertions that global warming is a “hoax”), or on the institutional and social movement processes that shape contrarian rhetoric. Such discourses ultimately have far-reaching effects on public views, but my focus here is more narrowly on one form of media that is disseminated directly to many citizens.

I use opinion pieces rather than news reports because they are more likely to reflect and reinforce their audiences’ views. Dalton, Beck, and Huckfeldt (1998) found that readers more accurately perceived the explicit political cues on newspapers’ editorial pages, where they are more apparent than in news reports; editorial content, resultantly, was significantly related to citizens’ electoral preferences. The flow of political information between newspapers and readers, moreover, is not strictly a one-way street—newspapers also respond to the ideology of their political constituencies (Gentzkow and Shapiro 2010), and since opinion pieces strive for persuasion rather than objectivity, they employ rhetoric that presumably says something about

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<sup>9</sup> As of 2013, the circulation rate (including normal print editions, branded print editions, and digital subscriptions) for the *WSJ* was 2,378,827, and for the *NYT*, 1,865,318. Circulation figures for only normal print editions were 1,480,725 for the *WSJ*, and 731,395 for the *NYT* (*Alliance for Audited Media* 2013).

the concerns of their anticipated readers. This choice of data, of course, reveals more about elite discourses than about public views, since the opinion pieces that get published in the prestige press (with the exception of letters to the editor) are usually from the papers' editors, regular columnists, or guest columnists from academic or policy spheres. Still, as persuasive, opinion-based discourses intended for a broad readership, widely circulated editorial content can provide an indication of the terms in which citizens are thinking about political and social issues, and the nature of public controversies surrounding those issues.

## **Data and Methods**

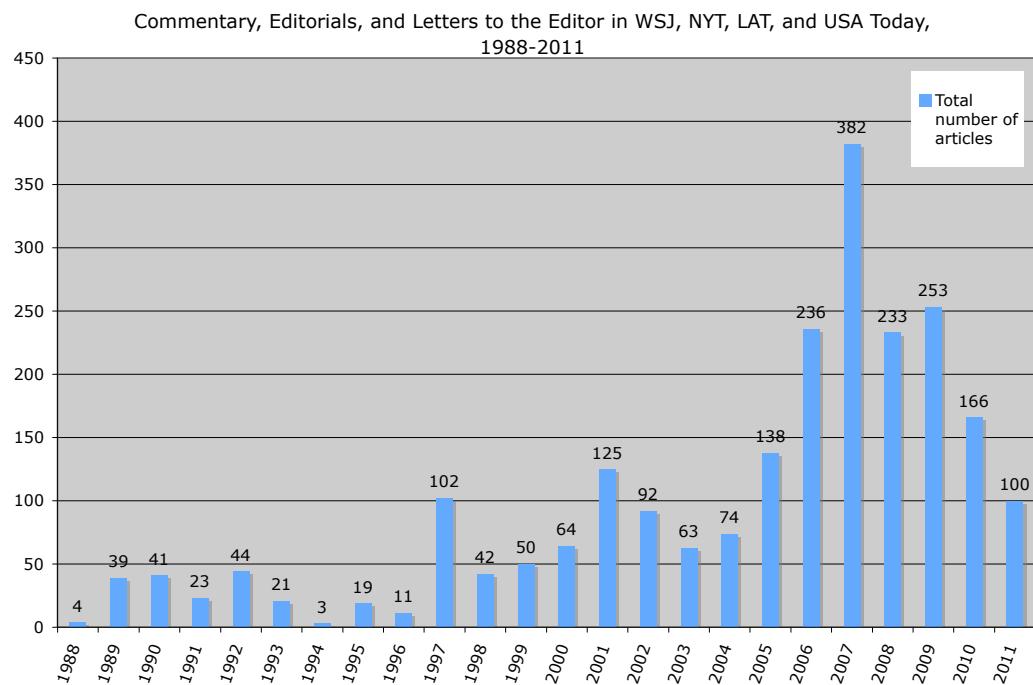
Based on the discussion above, I investigate whether the *NYT* and *WSJ*'s opinion pieces about climate change used textual cues related to environmental, economic, and contrarian positions on the issue: I expect the *NYT* to feature more environmental themes, and the *WSJ* to use more language that would appear in frames related to economic liberalism. I also expect the *WSJ*'s pieces to use more cues signaling broader skepticism about ACC and climate science.

The analysis uses opinion pieces from the two newspapers over the 24-year time period from 1988 to 2011. I chose 1988 as a starting point because it was a banner year for public attention to GW during which dramatic and abnormal weather events pushed the issue into mass public awareness for the first time (Schneider 1989).

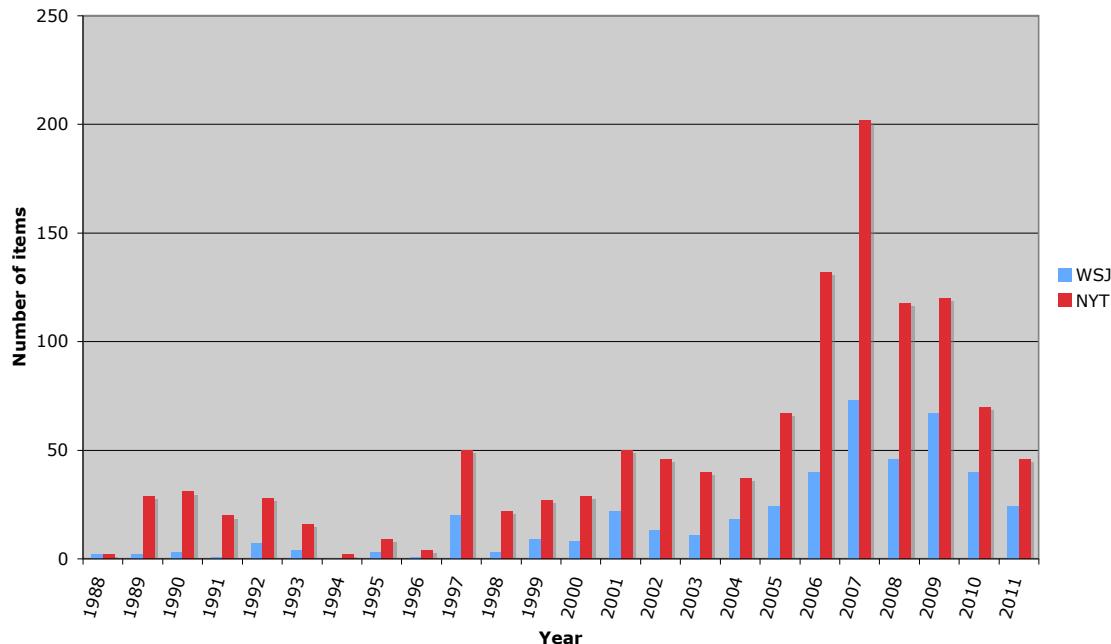
Using ProQuest's News and Newspapers database, I searched each newspaper's archives for opinion pieces (all articles filed as editorials, letters to the editor, op-ed pieces, and commentary) that had the terms "global warming" or "climate change" in their abstract or subject. The searches returned a total of 441 items from the *Wall Street Journal* and 1,197 from the *New York Times* over the 24-year period. To provide a comparison to other national

newspapers with high circulation and readership, I also performed this search on the archives of *USA Today* ( $n=173$  items) and the *Los Angeles Times* ( $n=514$ ). To provide an longitudinal overview of the volume of national editorial coverage about CC, Figure 2.1 depicts total annual citations (i.e., the aggregate number of citations from all four newspapers) for each year in the period under study. Figure 2.2 compares just the *NYT* and *WSJ*'s annual volume of editorial coverage.

**Figure 2.1. Commentary on climate change in the *WSJ*, *NYT*, *LAT*, and *USA Today*, 1988-2011**



**Figure 2.2. Commentary, Editorials, and Letters to the Editor in *WSJ* and *NYT*, 1988-2011**



I defined three sets of thematic keywords that, I posit, are likely to function as interpretive cues in CC discourses that use economic, environmental, and contrarian frames. I then conduct a keyword search for each term within the databases I compiled of the *New York Times* and the *Wall Street Journal's* opinion pieces about ACC, and compare the prevalence with which they appear in each news source.

The first set of keywords, related to the economic frames, includes *tax*, *regulation*, and *economy*.<sup>10</sup> Since conservative discourses—at least at the elite level—often frame climate policies as detrimental to economic freedom and criticize government regulation (McCright and Dunlap 2003), I hypothesize that opinions about ACC published in the right-leaning *WSJ* (as

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<sup>10</sup> Searches were permitted to return variants of the key words: for example, when I searched my samples for the word “tax,” the results also returned pieces containing the words “taxes” and “taxation.”

opposed to left-leaning *NYT*) will be more likely to use language emphasizing the economic disincentives of ACC mitigation policies.

A second set of keywords is adapted from the response categories that Leiserowitz's study generated by asking respondents about the mental images they associate with global warming (2006). Most of these words imply concern about physical and environmental consequences of a warmer world. The seven corresponding keyword searches used the following criteria: 1) *melt*, 2) *temperature increase or heat*, 3) *nature or ecology*, 4) *ozone or ozone hole*, 5) *disaster or catastrophe*, 6) *flood or sea level*, and 7) *altered climate or changed climate*. (Words and phrases connected by “or” were included in the same search.) In light of the findings (discussed above) showing that concerned beliefs and opinions about ACC are strongly associated with both liberalism and generalized environmental concern, I hypothesize that the *NYT*'s opinion pieces will use these keywords evoking ACC's negative impacts at higher rates than the *WSJ*'s pieces.

Finally, the third set of keywords is also adapted from Leiserowitz's study (2006) and uses the skeptical images and phrases that some respondents associated with global warming. Skeptical or cynical responses included the belief that global warming has predominantly natural causes; that it is overblown or hyped; doubt about climate science; and conspiracy theories (e.g., that ACC is a “hoax” or “environmentalist propaganda”).<sup>11</sup> The four corresponding keyword searches used the following words: 1) *natural variation or natural cycle*, 2) *hype or hysteria or exaggeration*, 3) *junk science or no proof*, and 4) *hoax or propaganda*. I hypothesize that opinions about ACC featured in the *WSJ* will be more likely to use language that connotes

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<sup>11</sup> Leiserowitz (2006) identified a fifth category: flat denials of GW (e.g., “a false theory,” “there is no global warming”). Since there is no straightforward way to operationalize these responses as keywords, and since they are conceptually akin to “hoax” and “propaganda,” I did not include them in this analysis.

skepticism or denial of climate change. Table 2.1 summarizes all of the search terms used in this study.

Figure 2.1 shows that editorial coverage of ACC in the four most widely circulated and read national newspapers rose and fell several times between 1988 and 2011. The volume of this commentary peaked notably in 1997, 2001, and 2007, and then dropped off after 2007. These years correspond with notable events related to climate change. In December 1997 the Kyoto Protocol was adopted in Kyoto, Japan; in 2001, the George W. Bush administration withdrew the US's signature from the Kyoto accord<sup>12</sup>; and in 2007, Al Gore and the IPCC won the Nobel Peace Prize and the Supreme Court ruled that greenhouse gases can be regulated as pollutants.

Figure 2.2 shows that prior to 1997, the *WSJ* was unlikely to publish opinion pieces about GW. After 1997, opinion pieces in the *WSJ* and *NYT* generally increased and decreased during the same years. However, the *NYT* published many more opinion pieces related to climate change overall: the *WSJ* published a total of 441 editorials whereas the *NYT* published 1,197. That is, the *NYT*'s editorial and opinion pages devoted nearly three times as much space to the issue than the *WSJ*'s over the entire time period under study (Table 2.1). Year-to-year, the *NYT* also consistently published more commentary on climate change. During the peak year of 1997, the *NYT* published 50 editorial pieces about CC, while the *WSJ* published 20. These figures were nearly identical for the peak that occurred in 2001, when the *NYT* had 50 citations and the *WSJ* had 22. In 2007, both papers published the more commentaries on CC than they did during any other year in the sample: the *NYT* published 202, and the *WSJ* published 73 such pieces.

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<sup>12</sup> Former Vice President Al Gore had signed the Kyoto accord on behalf of the US, but the Senate never ratified it.

**Table 2.1. Frequency of WSJ and NYT commentaries featuring key words, 1988-2011**

Search terms	WSJ citations (441 total)	NYT citations (1,197 total)	Total citations (1,638)
tax	37% (161)	22% (261)	26% (422)
regulate	33% (145)	24% (284)	26% (429)
economy	59% (261)	49% (582)	51% (843)
melt	13% (59)	11% (137)	12% (196)
heat, temperature increase	18% (78)	16% (197)	17% (275)
nature, ecology	15% (66)	12% (142)	13% (208)
ozone, ozone hole	3% (12)	5% (55)	4% (67)
disaster, catastrophe	20% (88)	18% (211)	18% (299)
flooding, sea level	15% (67)	15% (183)	15% (250)
altered climate, change in climate	5% (22)	3% (35)	3% (57)
natural variation, natural cycle	2% (7)	0.6% (7)	.8% (14)
hype, hysteria, exaggeration	10% (45)	5% (64)	7% (109)
no proof, junk science	1% (6)	0.4% (5)	.7% (11)
hoax, propaganda	3% (14)	4% (42)	3% (56)

Note: Search terms allowed for variants of the key words, e.g., a search for “catastrophe” also returned results for “catastrophic.”

Proportionally, the *WSJ*’s commentary used the three economic words more often than the *NYT* (see Table 2.1). The *WSJ* used some variant of “tax” in 37% of its commentaries, (compared to the *NYT*’s 22%), and “regulation” came up in 33% of its pieces (for the *NYT*’s 24%). Interestingly, of all search terms, both newspapers used “economy” the most frequently (both proportionally and in terms of raw word counts): in the *WSJ*, 59% of the pieces used “economy,” and in the *NYT*, 49% did. There was no consequential difference in the proportion of each newspaper’s editorials that referred to the nature and temperature keywords. Still, from the standpoint of the raw word counts, the *NYT* invoked “melt,” “heat,” “nature,” “disaster,” and “flooding” twice as much as the *WSJ*, and the *NYT* referred to “ozone” or “ozone hole” nearly five times more than the *WSJ*.

Neither paper's opinion pieces tended to use the skeptical terms "natural variation," "no proof" or "hoax." The *WSJ* did, however, use "hype" in 10% of its editorials about climate change (proportionally, twice as often as *NYT*'s 5%). And somewhat unexpectedly, in terms of raw word counts the *NYT* used "hoax" three times as often as the *WSJ*.

To estimate the effects of news source (*NYT* vs. *WSJ*) on the volume and the nature of editorial coverage, I estimated a series of poisson regression analyses. In an initial regression, the dependent variable is the (annual) expected occurrence of editorial features about climate change. The remaining regression models estimate, in turn, the expected incidence of each of the fourteen key words or phrases.

The key independent variable is the news source, which is a dummy variable coded 1 for all observations from the *NYT*, and 0 for observations from the *WSJ*. To account for the effect of the passage of time, the models include an independent time trend variable: each year from 1988 to 2011 was coded to correspond to the values 0 through 23, respectively.<sup>13</sup> Further, since there was an anomalous uptick in the volume of CC opinion pieces in both newspapers in 2007 (that year accounted for 17% of the total articles in both the *WSJ* and the *NYT* samples), the models include a dummy variable for that year, coded 1 if an observation occurred during 2007, and 0 for all other years. To account for the possibility that exogenous factors affected the two newspapers' coverage differently over time or in 2007, the models also include two interaction terms: the interaction between the news source dummy and the time trend variable, and the interaction between news source and the 2007 dummy.

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<sup>13</sup> The dataset's rows correspond to newspaper-years. Thus, although the data represent a 24-year time period, the total  $N = 48$ . That is, 24 rows correspond to the *NYT* coverage, and 24 rows correspond to the *WSJ*.

## Results

I briefly summarize the analyses' results here before concluding with a more interpretive discussion. Table 2.2 presents the Poisson regression coefficients of the frequency with which CC opinion pieces appeared in the two newspapers between 1988 to 2011. The frequency varied by newspaper and by year—these variables had positive and significant effects ( $p < 0.001$ ), and thus the number of editorials about climate change is expected to increase over time in both papers, but the projected rate of growth is greater for the *NYT*. The *NYT*\*year variable had a small but significant negative effect ( $p < 0.001$ ), indicating that the gap between the newspapers' frequency of editorial coverage gradually shrank over time. The positive and significant effect ( $p < 0.001$ ) of the 2007 variable reflects the spike in both papers' editorials in that year; but the *NYT*\*2007 effect is not statistically significant ( $p = 0.29$ ), indicating that although editorial coverage soared for the *NYT* in 2007, it did not pay significantly more attention to CC in its editorials than the *WSJ*.

**Table 2.2. Poisson regression model of citations about climate change by news source and time, 1988-2011**

Independent variables	Coeff.	SE
<i>NYT</i>	1.81***	0.19
Year	0.14***	0.01
2007	0.85***	0.13
<i>NYT</i> x Year	-0.05***	0.01
<i>NYT</i> x 2007	0.16	0.15
Constant	0.73	0.17

$$\chi^2 (5, n = 48) = 106.2, p < 0.001$$

The remaining analyses used the same model to estimate the effects of the covariates on each of the fourteen key words (see Table 2.3-2.5). The *NYT*'s editorials about climate change are significantly more likely than the *WSJ*'s to use the key words *tax* ( $p < 0.001$ ), *regulation* ( $p <$

.001), *economy* ( $p < 0.001$ ), *heat* ( $p < 0.01$ ), *nature* ( $p = 0.01$ ), *ozone* ( $p < 0.001$ ), *disaster* ( $p = 0.01$ ), *flood* ( $p = 0.001$ ), and *changing climate* ( $p = 0.01$ ). The results thus do not uphold the expectation that the *WSJ* would employ the economic words at a significantly greater rate, but they do support the expectation that the *NYT* would use more language that evokes environmental problems or disasters.

As expected, the *NYT* was less likely than the *WSJ* to feature the skeptical keywords *natural cycle* ( $p = 0.39$ ), *hype* ( $p = 0.10$ ), *no proof* ( $p = 0.35$ ), and *hoax* ( $p = 0.64$ )—but these coefficients were not statistically significant, and there were few occurrences of these keywords in either newspaper. The *WSJ*'s pieces thus do not appear to have made extreme denialist claims using the same terms in which Leiserowitz's skeptical respondents thought about the issue.

**Table 2.3. Poisson regression models of citations using economic keywords**

Independent variables	“tax”	“regulation”	“economy”
<i>NYT</i>	1.56*** (.37)	1.25*** (0.38)	1.79*** (0.27)
Year	.17*** (.02)	0.17*** (0.02)	0.16*** (0.01)
2007	.69** (.22)	.87*** (0.22)	0.79*** (0.17)
<i>NYT</i> x Year	-.07*** (0.02)	-.03 (0.02)	-0.06*** (0.01)
<i>NYT</i> x 2007	.33 (.28)	.08 (0.27)	(0.11) (0.21)
Constant	-.77 (.31)	-.82 (0.33)	-0.11 (0.24)
$\chi^2$ (5, $n = 48$ )	368.73	368.73	727.25

For all  $\chi^2$ ,  $p < 0.001$ . Standard errors in parentheses.

**Table 2.4. Poisson regression models of citations using nature/ecology keywords**

Independent variables	“melt”	“heat,” “temperature”	“nature,” “ecology”	“ozone,” “ozone hole”	“disaster,” “catastrophe”	“flood”	“change in climate”
<i>NYT</i>	0.46 (0.52)	1.16** (0.37)	1.34** (0.52)	3.50*** (0.96)	0.97* (0.39)	1.49*** (0.45)	3.35* (1.36)
Year	0.12*** (0.02)	0.09*** (0.02)	0.15*** (0.02)	0.12* (0.05)	0.12*** (0.02)	0.19*** (0.02)	.23*** (0.06)
2007	0.93** (0.35)	0.81* (0.33)	0.61 (0.36)	0.91 (0.79)	0.22 (0.37)	1.20 (0.31)	1.85*** (0.44)
<i>NYT x Year</i>	0.02 (0.73)	-0.02 (0.02)	-0.03 (0.03)	-0.15** (0.06)	-0.01 (0.02)	-0.03 (0.03)	-0.15* (0.07)
<i>NYT x 2007</i>	0.04 (0.42)	0.30 (0.39)	0.17 (0.39)	-0.09 (0.96)	0.89 (0.41)	0.02 (0.36)	-1.00 (0.67)
Constant	-0.94 (0.42)	-0.14 (0.32)	-1.30 (0.45)	-2.50 (0.93)	-0.44 (0.33)	-0.81 (0.40)	-4.18 (1.25)
$\chi^2 (5, n = 48)$	203.35	181.18	183.38	41.47	254.13	222.70	63.29

For all  $\chi^2$ ,  $p < 0.001$ . Standard errors in parentheses.

**Table 2.5. Poisson regression models of citations using skeptical keywords**

	“natural cycle/variation”	“hype,” “hysteria,” “exaggeration”	“junk science,” “no proof”	“hoax,” “propaganda”
<i>NYT</i>	-1.25 (1.45)	-0.43 (0.54)	-1.76 (1.86)	-0.67 (1.44)
Year	.04 (0.06)	0.04 (0.03)	0.07 (0.06)	0.18** (0.06)
2007	-14.36 (2049.10)	1.83*** (0.37)	-16.33 5574.92	0.63 (0.77)
<i>NYT x Year</i>	0.07 (0.09)	0.06 (0.03)	0.10 (0.11)	0.09 (0.07)
<i>NYT x 2007</i>	15.10 (2049.10)	-0.84 (0.50)	-.10 (7884.13)	0.02 (0.88)
Constant	-1.74 (0.83)	-0.16 (0.38)	-2.21 (.98)	-3.41 (1.10)
$\chi^2 (5, n = 48)$	5.87, $p = ns$	73.59, $p < 0.001$	7.27, $ns$	106.20, $p < 0.001$

Standard errors in parentheses.

## Discussion

The most striking trend to emerge from this analysis is the sheer difference in volume of climate change-related opinion pieces that the two papers published between 1988 and 2011: the left-leaning *NYT* published nearly three times as many as the right-leaning *WSJ*. Since public opinion reflects an “accessibility bias” towards information that is more frequently or more recently covered in the media—i.e., people retrieve such information more easily from memory and it disproportionately influences their opinion and judgments (Iyengar 1990)—it stands to reason that the *NYT* has had greater agenda-setting effects on its audience. Further, the American prestige press and especially the *NYT*’s coverage affects other media sources’ agendas (McCombs 2005; Golan 2006), and thus the *NYT*’s agenda-setting on ACC can be expected to extend beyond its own content to the larger sphere of liberal-leaning media and its consumers.

A second implication of this analysis is that the public’s partisan differences on ACC might not reflect polarizing elite discourses so much as disproportionate concern on one side of the issue, and relative apathy on the other side. Although this chapter conceptualized and focused on discourses that represent “convinced” and skeptical positions on climate change, at the macro level Americans are not particularly concerned about the issue. Internationally, Americans are among the least concerned publics about CC; they are less likely than those in all other regions<sup>14</sup> to view it as a “very serious problem” (45%), to say it is “harming people around the world now” (41%), or to say they are “very concerned” that it will harm them personally (30%) (Stokes, Wike, and Carle 2015). When people are asked how much they worry about a variety of issues facing the country, climate change usually ranks at or near the bottom of the list; and though partisan differences are evident (10% of Republicans as opposed to 36% of Democrats said they

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<sup>14</sup> Regions represent 40 surveyed countries, and include Latin America, Africa, Europe, Asia/Pacific, and the Middle East.

“worry a great deal” about climate change), overall the issue was not a major worry for either group (Riffkin 2014a).<sup>15</sup> Since the majority of Americans are not particularly concerned about ACC, especially compared to issues with more immediate political or personal relevance, it may not be the case that conservatives and Republicans are extremely skeptical, but rather, the that the issue is particularly salient to the *NYT*’s more liberal, Democratic readership.

That few editorials in either paper used the extremely skeptical keywords reinforces this idea: the *WSJ*’s appeals, it can be inferred, did not take denialist positions that portray ACC as a matter of hype, hoax, propaganda, or natural variation. Despite my stated expectation, this result is unsurprising considering that both papers are mainstream, widely respected news sources and would lose credibility by representing fringe views or contradicting established scientific facts. Still, Hoffman’s (2011) analysis of all U.S. newspaper editorials over a two-year span found that the overwhelming majority of skeptical pieces (88%) referenced scientific uncertainty. The study’s coding scheme included but extended beyond the denialist views represented by the keywords I used here, and encompassed arguments about a lack of scientific consensus and the uncertainty of climate evidence and climate models.<sup>16</sup> This result suggests “that the skeptical logic centers on the idea that the problem definition of climate change is the crux of the debate” (Hoffman 2011, 13). In using Leiserowitz’s (2006) study as the basis for choosing skeptical search terms, I used terms that were probably too stark and overtly skeptical to appear in the

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<sup>15</sup> Yeager et al. (2011) argue that common question wording inflates estimates of Americans’ lack of concern about the environment and climate change. The most frequently used measure of the public’s agenda is Gallup’s open-ended question “What do you think is the most important problem facing the country today?” Less than 3% of people mentioned the environment or climate change in response to this question. But when asked about future, global problems (“What do you think will be the most serious problem facing the world if nothing is done to stop it?”) the number citing the environment or CC rose to 25%.

<sup>16</sup> Similar to the distribution of my sample between the *NYT* and *WSJ*, Hoffman found that 73% of articles were “convinced about CC” while 20% were skeptical.

*WSJ*. To the extent that that the smaller *WSJ* sample contained more doubtful views about ACC, I might have found important differences between the papers if I had used more muted science-related terms such as “climate models,” “certainty/uncertainty,” “hypothesis,” or “data.”

The *NYT*’s opinion pieces referred significantly more often to climate change’s physical risks in terms of heat, nature, the ozone layer, floods, and the changing climate. The relatively frequent use of such terms indicates that these pieces’ arguments appealed to the long-term consequences of ACC on human and natural flourishing. The *NYT*’s pieces, moreover, used terms like “disaster” and “catastrophe” with greater frequency, which convey not just consequences but also their potentially extreme severity. Building on this observation, in the following chapters I investigate, among other variables, how people’s perceptions of global warming’s severity is related to their beliefs about its existence and support for emissions mitigation policies.

Since this chapter treats the two newspapers as representing relatively different political audiences, the disproportional focus on physical risks in the *NYT* raises the question of why such appeals would be more likely to resonate with its audience than the *WSJ*’s. One explanation is that more conservative audiences are less worried about ACC’s future consequences because, as discussed above, they are less convinced that there is a problem. However, the well-established and strong relationship between CC views and political identity (partisanship and ideology) indicates that more is at play in these views than definitions of scientific problems and their attendant risks. To better understand political differences in public perceptions of climate change, it is necessary to theorize how the socio-cultural values and political priorities that underlie traditional measures of partisanship and ideology relate to CC risk perceptions. Leiserowitz (2006), for instance, found that egalitarianism consistently and significantly

predicted GW risk perceptions and policy preferences, and comments that this association is “all the more remarkable because the egalitarianism measures are not related to global warming, the risk under study, in any direct way.”

Lastly, although I expected the words related to taxes, regulations, and the economy to be used more frequently in economic liberalist frames, the regression analyses found that the *NYT* was more likely than the *WSJ* to use these terms. In fact, both newspapers’ opinions used the word *economy* more frequently than any other search term—this is all the more surprising since the analysis also included several relatively bland keywords that could be expected to come up in any writing about ACC (i.e., “change in climate,” “heat,” “temperature”). Drawing again on Hoffman’s (2011) analysis of CC editorials, that study found that comparable proportions of convinced and skeptical articles (24% and 21% respectively) used economic appeals, albeit to make opposing arguments about how cost-benefit analyses should be used, and the long-term and short-term costs and benefits of addressing (or not addressing) climate change. Since the discourses in the two papers are likely responding to one another and to broader policy debates, in the terms that those debates have established, the keywords used here might not only identify frames that invoke values related to economic liberalism, but also frames that use the same terms to make the opposite argument.

There are several limitations to the approaches used here. Most importantly, this chapter’s analyses revolve around textual content rather than discourse. Thus, while the analysis had strong implications for the newspapers’ relative agenda-setting effects, its implications for media frames and framing effects are necessarily inconclusive. Although keywords can spark affective associations for a reader and impact whether they accept a persuasive appeal, the methods I use here cannot describe the broader persuasive context in which the keywords

appeared. This is especially important since, as I mentioned above, media discourses respond to real world events and to one another. Thus, for instance, I read each of the forty-two *New York Times* editorials that contained the word “hoax” and found that they all used the word in the context of quoting and to criticizing Senator James Inhofe’s infamous stance that global warming “could be the greatest hoax ever perpetrated on the American people.” In this case, the presence of the keyword “hoax” in the *NYT*’s pieces was not a good measure of the authors’ skepticism; if anything, the word’s appearance represented oppositional responses to skeptical discourses.<sup>17</sup>

It is also important to note that the newspapers used in this analysis are increasingly losing readership to online news (though many of the opinion pieces in the sample I generated here were also published online), and most citizens say that they get their news from television. Those who read and contribute to the opinion pages of the *New York Times* and the *Wall Street Journal*, moreover, comprise a politically informed audience; although the papers are high-circulation news sources with strong agenda-setting capabilities, their content represents an elite information stream that does not necessarily correspond to broader public opinion (which, by many indications, is not immediately preoccupied with the issue). Further, although the *NYT* and the *WSJ* “slant” in opposing directions, the difference between the political demographics that read these news sources may not be big enough for them to represent particularly polarized positions on CC.

Nevertheless, these newspapers tend to represent more liberal and conservative positions relative to one another (e.g., Page 1996). Thus, these analyses provide a starting point for characterizing the features of these mainstream information flows about CC. In particular, the

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<sup>17</sup> In this sense, the frequency of a denialist term like “hoax” in the *NYT* does have interesting meta-implications for that paper’s CC discourse: it says something about how volubly its editors, columnists, and readers feel compelled to combat skeptical claims such as Inhofe’s.

left-leaning *NYT* (and most likely its readership) paid much more attention to climate change than the rightward-slanting *WSJ*, and was more likely to use textual cues that evoke its long-term risks. The regression results and the proportion of both papers' articles that use the words *economy*, *regulation*, and *tax*, moreover, indicate that both media outlets confronted economic and regulatory aspects of the issue in their persuasive appeals. The analyses presented here also provide a point of comparison to those that follow. In the subsequent chapters, I use public opinion data to evaluate (among other antecedents) the importance of partisanship as well as ideological predispositions for beliefs and opinions about climate change. Taken together with the present finding that the relatively liberal news source was more voluble on the issue, this will illuminate the extent to which the public is likely to receive and accept elite positions about climate change.

## **Chapter 3: Defining Problems and Solutions: How are knowledge and beliefs about climate change associated with support for emissions policies?**

This analysis provides an empirical test for an idea underlying many real-world environmental advocacy campaigns: that people who believe climate change exists are more likely to be concerned about its consequences, and in turn, more likely to support climate change mitigation policies. The analysis also seeks to disentangle the relative influences of factual knowledge and political predispositions on Americans' beliefs and opinions about climate change.

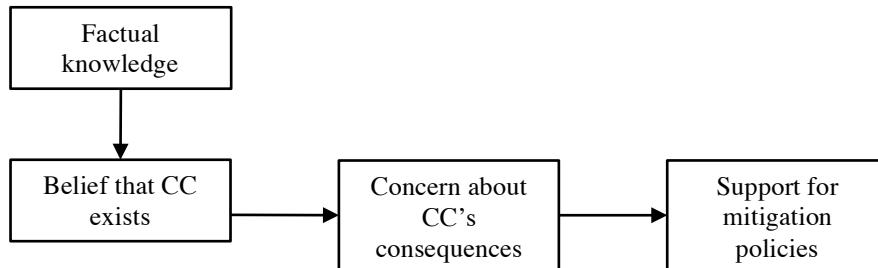
### **Introduction**

In this chapter, I investigate how Americans' beliefs about climate change inform their opinions about climate policies. I also aim to shed light on the relative importance of factual knowledge and political predispositions for citizens' opinions about three interrelated sub-issues: 1) whether climate change exists, 2) how severe its consequences will be, and 3) policies to reduce greenhouse gas (GHG) emissions. To do so, I use nationally representative public opinion data from the 2008-9 American National Election Studies (ANES) to conduct a series of analyses that examine the antecedents of each of these opinions, as well as how they influence one another.

These analyses address several gaps in public opinion and political psychology research. Both fields are paying increasing attention to citizens' climate change views. But this growing body of research remains quite fragmented, and there are several challenges to synthesizing this work into more comprehensive theories of public views and opinion formation. First, different studies investigate an array of key dependent variables, including people's beliefs, knowledge, opinions, and attitudes about climate change. But the relationships between these variables have received less attention, and thus it is unclear how people's views about these related but distinct elements of the CC issue domain "go together" and inform one another. This is important to

clarify from the standpoint of effective public communication about CC. As I describe below, a number of major CC communication campaigns have tended to emphasize scientific consensus about global warming's existence and human causes, with the aim of generating public concern about its projected consequences, and support for mitigation policies. Although the mental model underlying this approach (which is depicted schematically in Figure 3.1) is logically compelling, it assumes that people's beliefs about CC flow from one another in a rational, deductive process. Given these initiatives' limited success, and in light of research showing that people's views about CC are often motivated by symbolic or affective factors, one aim of this chapter is to empirically test the model depicted in Figure 3.1.

**Figure 3.1. Information-based model of policy support**



A second, related challenge is that different studies use similar terms to describe a number of closely associated, but conceptually distinct, independent variables that are posited to inform CC views. For instance, a host of measures of information or knowledge have been used, including college education (Zia and Todd 2010), self-reported knowledge about the issue (Malka, Krosnick, and Langer 2009), factual knowledge about CC's causes (R. J. Bord, O'Connor, and Fisher 2000), an index of "global warming IQ" (Wood and Vedlitz 2007), and broader, abstract scientific knowledge or "scientific literacy" (J. Miller 2010). To clarify the

nature of the information that might influence citizens' views about climate change and climate policies, I use measures for scientific knowledge, domain-specific "factual beliefs"<sup>1</sup> about climate change, and control for formal education.

Lastly, I elaborate the information-based model (Figure 3.1) to put it into closer dialogue with political psychology research finding that people's political predispositions or values bias their perceptions of the risks associated with climate change. To put these strands of research into conversation, I investigate how ideological predispositions are associated with beliefs about climate change's existence and severity, and support for emissions policies. Figure 3.2 depicts an elaborated version of Figure 3.1: the base model remains the same, but Figure 3.2 illustrates my intention to evaluate the relative influences of factual knowledge and political predispositions on each of the elements of climate change beliefs.

As I explain below, of the variables for climate change beliefs, I expect policy support to be most strongly associated with political predispositions. I posit that—particularly for conservative citizens—proposed emissions policies represent tradeoffs between environmental protection, on the one hand, and political priorities and values, on the other. Thus, for instance, citizens who object to government intervention in free market processes may associate climate policies with economic costs (e.g., job losses) or symbolic political tradeoffs (expanded government regulation). If political preferences and predispositions are disproportionately

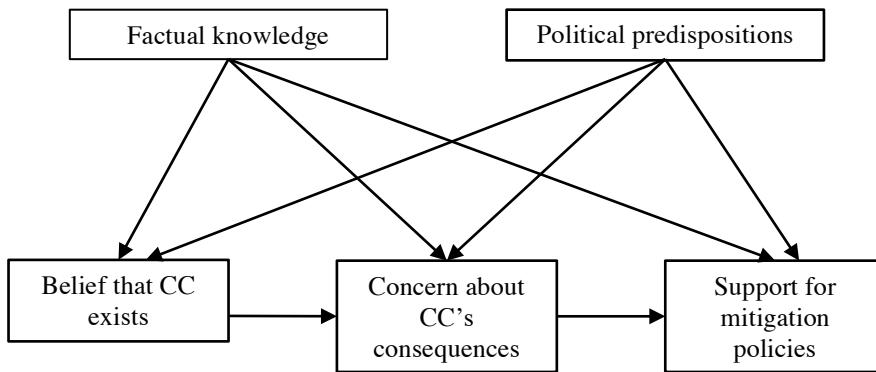
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<sup>1</sup> I use "factual beliefs" rather than "knowledge" to describe people's stances on matters of science—for instance, whether climate change has predominantly human or natural causes. Although citizens who say that human activity does not contribute to climate change are incorrect by scientific standards, I characterize this as a "factual belief" rather than "incorrect knowledge" because there are numerous exogenous factors that likely shape CC beliefs (such as perceived conflicts with political or religious values). Further, citizens whose views align with scientific expertise do not necessarily have more scientific knowledge than those who are skeptical. In short "factual beliefs" describe positions that could reflect either factual knowledge or other attitudes, beliefs, and information.

relevant for policy opinions, this in turn may influence whether citizens accept factual claims about the issue.

This hypothesis is not intended to refute, but rather, to complicate the idea that people draw on available factual information to evaluate climate policies. I suggest that a reverse process may also occur: that is, that people's perceptions of climate policies might also bias their factual beliefs about climate change's existence and severity.

**Figure 3.2. Updated information-based model of policy support**



### The perceived costs of solutions

Interestingly, as the issue of ACC has cycled in and out of mainstream media discourses over time, Americans seem to have become both more confident in their knowledge about the issue and more entrenched in their beliefs about it. The proportion of citizens saying they understand the issue of global warming "very well" went up gradually from 11% in 1992, to 21% in 2008, to a high of 33% in 2014 (Saad 2014). But the people who were the most confident about their knowledge were also least likely to concur with the scientific consensus that warming is predominantly due to human activity: 47% of those who said they understand GW "very well" believed it has human causes, compared to 62% of those saying they understand it "fairly well," and 59% who did not think they understand the issue well (Saad 2014). These trends reinforce an

image of the public as holding polarized views that reflect the politicization of climate science in elite or institutional spheres. Yet as I discussed in the previous chapter, in contrast to political and economic elites, most ordinary citizens do not have clear incentives to deny matters of scientific consensus on climate change. What considerations, then, inform their opinions about ACC?

To answer this question, I argue that it is important to consider how climate change controversy has evolved beyond questions of science to encompass the political and symbolic costs associated with climate policies. That is, legislators and elites associated with extractive industries have politicized the issue, first, by invoking doubt about scientific evidence and institutions—and subsequently, by criticizing environmental regulations (e.g., for their negative impacts on the economy and jobs) and demonizing supporters of CC mitigation.

Such appeals are particularly common in states and regions whose economies rely on extractive industries and where these industries are consequently enmeshed with local cultural identity. In West Virginia, for instance, where coal mines and chemical plants have a legacy as important job providers, the state's Republican Party portrays industrial production as a matter of regional pride and "cultural and existential survival" (Osnos 2014).<sup>2</sup> These appeals also invoke polarizing anti-regulatory themes. Commenting on the EPA's decision to rescind a permit for what would have been the largest mountaintop removal operation in West Virginia's history, the state's Republican Party chairman made a statement representative of such claims: "The Spruce Mine, in the heart of West Virginia coal country, is where we must join this battle against the

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<sup>2</sup> These claims, however, exaggerate the coal industry's importance as a local employer. Though coal production has increased in West Virginia since the 1970s, coalmining employment has decreased substantially throughout the postwar period (Bell and York 2010). Since most accessible seams have been depleted, the coal industry now directly employs only 3% of the state's workforce (Osnos 2014), and Wal-Mart is now the state's largest private employer (WorkForce West Virginia 2014).

liberal Democrats of DC. Obama’s foot-soldiers seek to destroy our very way of life for the sake of an agenda that guts our economy” (Mancini 2013; Osnos 2014, 43).

This example illustrates how contentious discourses about natural resource development intersect with, and have reframed, national discussions about climate change. Though the object of controversy was not climate change *per se* (but rather, the scope of executive authority to revoke the mining permit), climate policies that would regulate fossil fuel industries are vulnerable to the same framing and criticisms. Opposition to these policies has thus become tied to bigger political themes of government overreach and tradeoffs between environmental regulation and economic growth. Consequently, discourses about climate change have taken on these conversations’ symbolic and material dimensions. Symbolically, what is at stake is a cherished “way of life” that is under fire from overzealous bureaucrats (the “liberal Democrats of DC”). Materially, what is at stake is West Virginia’s decimated economy, which has long suffered from extreme poverty and income inequality. As a further example, high-profile Republicans (e.g., House Majority Leader Mitch McConnell), conservative commentators, and Democrats from coal-dependent states have invoked the rhetoric of “Obama’s war on coal” to contest EPA regulations on emissions from coal-fired power plants. The phrase carries a host of latent meanings, and creates connections between fossil fuel development, climate change mitigation, executive overreach and government intervention, and local economic woes.

I have traced the evolution of CC controversy to highlight a discrepancy between how skeptics perceive the issue, and the tactics whereby climate activists try to change their minds. On the one hand, CC skepticism is often related to opposition towards CC mitigation policies, rather than scientific evidence. On the other hand, as I describe in the following section, proponents of climate change mitigation often use communication strategies that emphasize

scientific evidence and consensus. To address enduring public polarization over the issue, it is important to consider whether skeptics and advocates for CC mitigation are talking past one another because they are concerned about related, but fundamentally different, problems.

Before fleshing out this idea, I should note that conservative opposition to mitigation policies is not solely based on arguments about government regulation of natural resources. Inglis (2014) describes a number of other objections: for instance, that climate action will stifle economic growth in the developing world, that it will increase domestic taxes, and that it clashes with a “sacred Christian worldview.”<sup>3</sup> My main conceptual focus in this discussion is on factual beliefs about CC, and on attitudes and values associated with economic liberalism, because these themes are most pervasive in skeptical discourses about climate change. The widespread association between these frames and climate change became increasingly entrenched throughout the 1990s—this deliberate coupling is even documented in a memo (integral to developing “the climate skeptic playbook” (Nisbet 2009, 18)) from Republican consultant Frank Luntz to lobbyists and Republican members of Congress. Luntz recommended that the issue be framed as scientifically uncertain, and claimed that emphasizing the dire economic consequences of climate action would score an ““emotional home run”” with conservative audiences (Nisbet 2009).

## **Climate communication**

Many climate change awareness initiatives seek to counteract public misinformation about climate science by publicizing corrective facts. Such informational approaches are characterized by a “deficit model” which assumes that greater public scientific literacy will increase public

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<sup>3</sup> It is well established that citizens who identify with the American Religious Right are more skeptical about climate change than others. I give deeper consideration to the religious beliefs of this demographic in the following chapter.

trust in scientists and scientific institutions (Gauchat 2012). In turn, polarized groups should, over time, converge on issues about which there is broad scientific consensus.

A number of successful environmental campaigns in the 1970s and 80s, such as those dealing with acid rain, followed this model. These initiatives mobilized in a sequence of strategic steps, whereby environmental advocacy groups would identify a problem, solicit physical and social scientists to propose technical or policy solutions, and conduct public education campaigns to develop support for legislative action on preferred solutions (Cox 2010).

Similarly, climate communication initiatives that follow this model aim to make basic facts about climate science more widespread and accessible. As I described in the previous chapter, the most well known such campaigns are perhaps Al Gore's *The Climate Project* and his 2006 documentary *An Inconvenient Truth*, both of which aimed to increase public concern about CC by making factual information more understandable and visually compelling (Nisbet and Kotcher 2009). In 2009, major environmental advocacy groups launched information campaigns to raise public support for cap-and-trade legislation: the League of Conservation Voters and the Natural Resources Defense Council, for instance, invested tens of millions of dollars in such public communication initiatives. These initiatives "presumably...were meant to get citizens to register more 'concern' about global warming, which in turn would supposedly make it easier for legislators to support cap and trade" (Skocpol 2013, 52). In other words, these well-funded communication campaigns operated along the lines of the model depicted in Figure 3.1, in which citizens with at least some factual understanding of climate change will become concerned about it, and in turn will support mitigation policies like cap-and-trade.

Despite the volume of resources these actors invest in climate communication, it is unclear how effectively or enduringly they impact public perceptions of climate change and

climate policies. On the one hand, for instance, *An Inconvenient Truth* received critical acclaim for increasing public awareness of and concern about climate change. In a *GeoJournal* symposium on the film's scientific accuracy, climatologist Steven Quiring (2008) praised the movie as "a powerful example of how scientific knowledge can be communicated to a lay audience. Scientists may argue about the accuracy of the message of AIT, but there is no debating its effectiveness."

But on the other hand, despite making a big initial impression, the longevity of the film's impacts is debatable. Jacobsen (2011), for instance, found evidence that the film had a significant but short-lived influence on consumer behavior: in the months following the film's release, there was a 50% increase in purchases of carbon offsets in areas where theaters showed the documentary.<sup>4</sup> However, most people did not re-purchase them when the offsets expired after a year. Further, although it is difficult to gauge the impact of public education initiatives like those that attempted to rally support for the Waxman-Markey (i.e., cap-and-trade) bill, that the legislation died in the Senate in the face of strong conservative opposition indicates that they did not have a widespread mobilizing influence (Skocpol 2013).

### **Mental models of climate change opinions**

The discussion above juxtaposed two elite information flows that target the American public: pro-mitigation messages aiming to correct public misinformation about CC, and skeptical discourses that frame the issue in terms of the social and political costs of mitigation. The critical corollary of these information flows is, of course, how they resonate with the public. Research on

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<sup>4</sup> Carbon offset retailers provide financial support toward projects estimated to offset customers' own carbon emissions (e.g., from a year of driving or a year of home energy consumption). The study investigated purchases among people living in zip codes within ten miles of theaters showing the documentary (Jacobsen 2011).

how citizens perceive messages about CC has mixed implications for how they weigh factual and political information.

Some studies find evidence for information-based cognitive processes. For instance, Van der Linden et al. (2015) found that respondents who read a message about the scientific consensus on ACC (“97% of climate scientists have concluded that human-caused climate change is happening”) became significantly more likely to believe that it is happening, is anthropogenic, and poses a “worrisome threat.” These increases, in turn, predicted support for public action on climate change.<sup>5</sup> The authors posit that knowledge about the scientific consensus on CC is a “gateway belief” that supports (or undermines) other key beliefs and attitudes about the issue. Bord, O’Connor, and Fisher (2000) found that participants who thought CC is anthropogenic were also more likely to believe it is real and harmful, indicating that people’s beliefs about CC’s causes could also be an important “gateway belief.” But interestingly, this was true for respondents who correctly identified the human causes of climate change *and* those who identified incorrect human causes such as insecticides, aerosols, or nuclear power plants. This indicates that there are factual misperceptions on both sides of climate change debates, and raises questions about how accurate or detailed peoples’ knowledge about an issue needs to be in order for them to perceive it as a problem.

Relatedly, some studies indicate that climate change skeptics do not necessarily lack information about the scientific consensus. Although Kahan (2014) found substantial differences between conservative Republicans and liberal Democrats when they were asked if climate change is real and anthropogenic, these gaps disappeared when the same questions were prefaced

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<sup>5</sup> The authors did not specify their measure of “support for public action” on CC.

with the phrase “Climate scientists believe that...”<sup>6</sup> Conservative respondents thus seemed to know what climate scientists believe, but did not necessarily believe it themselves. In line with my central hypothesis, Campbell and Kay (2014) found that people’s beliefs about CC were motivated by the ideological implications of policy solutions (a cognitive bias they call “solution aversion”). Thus, Republicans who read about a regulatory climate policy became substantially less likely to say that humans are causing CC than those who read about a “free market” emissions policy, indicating that skepticism about climate science increased when these subjects considered ideologically aversive policies. Hardisty, Johnson, and Weber (2010) also found framing effects on people’s willingness to pay to reduce their “carbon footprint.” Republicans and Independents were willing to pay more for a product (e.g., an airline ticket) to support a carbon “offset,” but not to support an otherwise identical carbon “tax.” Importantly, respondents indicated that they reasoned differently when they considered these different options: when asked about an “offset,” both Democrats and Republicans first considered the advantages of the more expensive offset, rather than cheaper alternatives. But in the “tax” condition, Republicans first considered the advantages of the cheaper, non-tax option. Since the order in which people weighed the different options was associated with their ultimate choices, considering a “tax” seems to have invoked negative associations for Republicans and Independents that reduced their willingness to pay to reduce carbon emissions.

These findings leave us with two puzzles: what type of widespread information might increase public support for climate policies? And further, to what extent do people’s preexisting political commitments influence their receptivity to factual information about CC? If factual information drives how people think about climate change, as predicted by the “gateway beliefs”

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<sup>6</sup> Under this condition, liberal respondents also became slightly less likely to correctly answer “trick” questions overemphasizing the risks of climate change.

model, respondents' knowledge should have a discernible impact on their beliefs about CC's existence and severity—and in turn, these beliefs should be associated with greater support for mitigation policies. While I expect this to be the case, in the analyses that follow I also expect to see evidence for the “solution aversion” model. That is, I expect political predispositions to have a greater influence on support for mitigation policies than on beliefs about CC’s existence and severity.

### **Analytic approach**

This analysis proceeds in three stages corresponding to the hypothesized directional relationships between opinions about global warming’s existence, severity, and emissions policies. First, I examine how factual beliefs and knowledge are associated with respondents’ certainty that GW is happening. I regress the certainty with which people thought GW is happening on measures of general scientific knowledge and domain-specific beliefs about evidence for and causes of CC. Next, I test the second step of the process depicted in the figures above to evaluate whether people who were more certain GW is happening were also more likely say that it will have severe consequences. (In Figure 3.1, this step is represented by the arrow between beliefs about CC’s existence and concern about its consequences.)

Third, I build on the previous steps to evaluate how people’s beliefs about GW’s existence and severity influence their support for CC mitigation policies. The dependent variables are measures of support for three emissions reduction policies that would (1) heighten restrictions on power plant emissions, (2) improve fuel economy standards for new cars, and (3) increase taxes on gasoline.

To assess the influence of political predispositions, I include a measure of policy liberalism as a proxy in each step of the analysis. I expect policy liberalism to have a stronger effect in the final (third) analysis than in the prior two. That is, I expect predispositions to be more strongly associated with support for mitigation policies than with beliefs about CC's existence and severity.

All data were collected as part of the 2008-09 ANES panel study. This version of the ANES contains a number of items related to scientific knowledge and beliefs about climate change. The data were collected over the internet in twenty cross-sectional waves between January 2008 and August 2009. The data I use here are from Wave 2 (February 2008) and Wave 5 (May 2008).

### **Analysis Part 1: Beliefs about the existence of climate change**

#### **Dependent Variable**

*Certainty that global temperatures are or are not rising.* The dependent variable is a composite measure for the certainty with which respondents thought that GW is or is not happening. Respondents were asked if they believe that the world's temperature has been increasing gradually over the past century, and a follow-up question asked how certain they are about this belief.<sup>7</sup> **Table 3.1** displays the association between these two items. Notably, the data do not indicate that there was strong public disagreement over GW's existence: 86% of the NES sample said that temperatures are probably rising, and only 14% said that they probably are not. The majority of both groups were at least "somewhat" certain in their beliefs (79% of the

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<sup>7</sup> The combined measure ranges from -4 (those who are "extremely sure" that world temperatures have not risen) to 4 (extreme certainty that temperatures have risen),  $M = 1.75$ ,  $SD = 1.96$ . Since respondents did not have a neutral or "don't know" option, the 0 position combines all respondents who said they were "not sure at all" whether temperatures are (or are not) rising.

“believers” and 72% of the skeptics). But a greater percentage of the skeptical group (18%) was “not at all” certain, as compared to those who “believe in” warming (10%).

**Table 3.1. Certainty that global warming is happening**

	Extremely	Very	Certainty <sup>b</sup> Somewhat	Slightly	Not at all
<u>Existence of GW<sup>a</sup></u>					
Probably happening (N = 1,244)	250	346	382	146	120
% within row	20.10	27.81	30.71	11.74	9.65
Probably not happening (N = 203)	33	40	73	20	37
% within row	16.26	19.70	35.96	9.85	18.23

<sup>a</sup> “You may have heard about the idea that the world’s temperature may have been going up slowly over the past 100 years. What is your personal opinion on this? Do you think this has probably been happening, or do you think it probably hasn’t been happening?”

<sup>b</sup> “How sure are you that the world’s temperature has/not been going up?”

## Independent Variables

*Scientific evidence for global warming.* To distinguish between the effects of factual scientific knowledge and beliefs specifically about CC, the analyses include two measures related to the latter. One measure asked about scientific evidence for GW: respondents indicated if they agree that “There is not enough scientific evidence to support claims that the Earth is getting warmer.”<sup>8</sup>

*Anthropogenic causes of global warming.* The second measure is a true-or-false item about GW’s human causes: “The primary human activity that causes global warming is the burning of fossil fuels such as coal and oil.” Slightly more than half (57%) answered “true,” in

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<sup>8</sup> Throughout this project, I code variables so that lower values correspond to more skeptical views about CC, and higher values correspond to “believing in” climate change. This variable is reverse-coded and ranges from -5 (skepticism about scientific evidence) to 5 (disagreement with the skeptical statement),  $M = 1.06$ ,  $SD = 3.52$ .

line with the scientific consensus on GW. Table 3.2 shows the association between this variable and the dependent variable (certainty that GW is/is not happening). Among people who had said warming is probably happening, 62% answered “true,” compared to 27% of those who said warming probably is not happening. Among those who said warming is probably happening, those who were at least somewhat certain were more likely to answer “true” than those who were less certain. Within the smaller skeptical group, certainty was not strongly associated with answers about the anthropogenic causes of global warming.

**Table 3.2. Correct answers on item about causes of global warming<sup>a</sup>**

	Extremely	Certainty about GW existence <sup>b</sup>					Total
		Very	Somewhat	Slightly	Not at all		
<u>GW is happening</u> (freq.)	187	254	291	113	93	938	
% Correct (w/in row)	25.56	31.90	28.64	7.72	6.17	100%	
% Incorrect (w/in row)	10.70	19.15	34.93	19.15	16.06	100%	
<u>GW not happening</u> (freq.)	27	33	62	15	27	164	
% Correct (w/in row)	13.64	15.91	45.45	6.82	18.18	100%	
% Incorrect (w/in row)	17.50	21.67	35.00	10.00	15.83	100%	

<sup>a</sup> True or false: “The primary human activity that causes global warming is the burning of fossil fuels such as coal and oil.” (May 2008)

<sup>b</sup> “How sure are you that the world’s temperature has/hasn’t been going up?”

*Scientific knowledge.* This variable comprises a scale of respondents’ scores (the percent of correct answers) on 11 true-or-false questions about basic scientific constructs that “form the

intellectual foundation for reading and understanding contemporary scientific issues,” such as items about the atomic structure of DNA (J. Miller 2010).<sup>9</sup>

*Policy liberalism.* To evaluate how people bring their broader political predispositions and preferences to bear on climate change, I created a measure of policy liberalism.<sup>10</sup> I used principal components analysis (PCA) to assess if a common latent dimension underlies people’s support for government action on five contentious socio-political issues that tend to divide self-identified liberals and conservatives, and that are unrelated to climate change, energy, or the environment.<sup>11</sup> These items were chosen because they deal with a range of issues that are likely to tap into people’s socio-political predispositions (for instance, their, normative ideas about the proper scope of American citizenship and government). It is also, of course, possible that responses to these items reflect a person’s attention to elite positions, rather than their more innate political predispositions. However, I expect that most people—even those who pay minimal attention to politics—have at least vague opinions about these issues and that they are therefore acceptable as the basis of an index of broader political predispositions.

The first component from the PCA conformed closely to expectations for the attitudes that liberals and conservatives would express on these issues in 2008, suggesting that it is

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<sup>9</sup> The original science battery contained 14 questions, but I removed three that asked about climate change. See the appendix for the full list of questions and percentages of respondents answering each item correctly.

<sup>10</sup> I do not use a more traditional measure of political ideology (i.e., self-placement on a one-dimensional liberal–conservative scale) because such measures are highly correlated with partisanship, making it difficult to distinguish these variables’ influences.

<sup>11</sup> Respondents indicated if they favor or oppose government action on: (1) a constitutional amendment to ban gay marriages; (2) raising taxes on incomes over \$200,000 per year; (3) government payment for all health care; (4) suspending habeas corpus for terror suspects; and (5) granting citizenship to illegal immigrants. Next, they indicated how strongly they hold their position (“a great deal,” “moderately,” “a little”). I coded responses on each item to range from -3 (the most conservative position) to 3 (the most liberal position). The 0 position represents people who “neither favor nor oppose” a particular action.

suitable as an index of general political conservatism or liberalism.<sup>12</sup> This policy liberalism variable consists of scores computed for each respondent based on the five policy items and their loadings on the principal component, and ranges from -3.45 to 2.41 ( $M = 0.00$ ,  $SD = 1.29$ ). Lower scores correspond with more conservative attitudes and higher scores with greater liberalism.

*Partisanship and education.* Since mass partisan polarization tends to trace elite polarization (Zaller 1992; Hetherington 2001), controlling for the effects of policy liberalism as well as partisanship will indicate the relative importance of predispositions, as opposed to elite discourses, on beliefs about climate change. Four dummy variables represent political partisanship.<sup>13</sup> Lastly, I include a measure for educational attainment to distinguish between the effects of formal education, factual beliefs about climate change, and foundational scientific knowledge.<sup>14</sup>

## Models and results

The results of a nested regression analysis are reported in Table 3.3. The table features two models: (1) a base model examining the direct effects of partisanship and education, and (2)

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<sup>12</sup> The component has an eigenvalue of 1.67 and explains 33.35% of the total variance. Though the Cronbach's Alpha for the scale is below conventional standards ( $\alpha = 0.49$ ), each of the items comprising the scale had relatively large positive coefficients. (See appendix for component loadings.)

<sup>13</sup> (1) Those who identified as “strong” and “not very strong” Democrats; (2) “strong” and “not very strong” Republicans; (3) independent Democrats; and (4) independent Republicans. The reference group for each variable includes all other respondents.

<sup>14</sup> Education has five categories: (1) Less than a high school degree; (2) a high school diploma; (3) some college, but no Bachelor’s degree; (4) a Bachelor’s degree; and (5) a graduate degree.

an expanded model that adds the variables for policy liberalism, scientific knowledge, and beliefs about the human causes of and scientific evidence for CC.<sup>15</sup>

**Table 3.3. Summary of nested regression analysis for variables predicting certainty global warming is happening**

	Model 1		Model 2	
	B	SE	B	SE
Democrat	0.97***	(.21)	0.36*	(.19)
Ind. Democrat	1.02***	(.27)	0.36	(.23)
Republican	-0.79***	(.21)	-0.09	(.19)
Ind. Republican	-0.12	(.27)	0.24	(.23)
Education	0.20**	(.06)	0.004	(.06)
Policy liberalism			0.25***	(.05)
Science knowledge			1.39***	(.33)
Anthropogenic causes			0.49***	(.13)
Not enough evidence			0.21***	(.02)
Constant	0.97***	(.27)	0.38	(.25)
N	848		848	
R <sup>2</sup>	0.16		0.39	
F	31.94***		59.76***	
F for change in R <sup>2</sup>			82.23***	

Dependent variable scale: -4 to 4

Model 1 generally conforms to expectations about how people's partisanship and education are associated with their beliefs about GW's existence. But while higher education significantly predicted greater certainty that GW is happening, this effect was not particularly large in absolute terms: the most educated respondents were 0.80 points (out of nine) more certain that GW is happening than the least educated.

Further, in Model 1 partisanship had more substantial effects than education for all groups except independent Republicans. On average, Democrats and independent Democrats were one point (or about 12.5%) more certain than others that GW is happening. Unsurprisingly,

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<sup>15</sup> For brevity, Table 3.3 only reports the first and last steps of the four-step regression.

Republicans were more certain than others that GW is not happening, by an average of 0.79 points ( $p < 0.001$  for all of these groups). Independent Republicans were not very certain in their views, but were slightly more likely, on average, to say temperatures are not rising. That the coefficients for Democrats and Democratic leaners are larger than for Republicans indicates that partisanship has asymmetric effects on beliefs about GW, with Democrats perceiving the issue in more partisan terms than Republicans (and, most likely, accepting more messages about climate change from “their” elites).

In Model 2 (of Table 3.3) the direct effects of partisanship and education are drastically attenuated when the variables for policy liberalism, scientific knowledge, and factual beliefs about CC are taken into account. Democrats nevertheless remained significantly more certain than other groups that warming exists ( $b = 0.36, p < 0.05$ ). The coefficient for independent Democrats was the same, but not statistically significant). Republican partisanship, by contrast, was no longer associated with a clear opinion about GW’s existence. This reinforces the idea that among strong Democrats, party identification is more tightly associated with CC beliefs than it is among other partisan groups.

Policy liberalism had a significant and positive coefficient ( $b = 0.25, p < 0.001$ ): the most liberal respondents were on average 1.5 points more certain GW is happening than the most conservative. Thus, although public opinion polls consistently show that there is partisan polarization over CC, this analysis indicates that predispositional dimensions of political identity might underlie partisan divisions. That the same latent dimension underlying people’s stances on contentious socio-political issues also influences views about CC supports the idea that people think about CC in symbolic political terms.

Most striking about Model 2 is that the science knowledge index does a better job of predicting the certainty with which people believe GW is happening than any other variable ( $b = 1.39$ ,  $p < 0.001$ ). With scientific knowledge and factual beliefs about CC incorporated into the model, education is not a good measure of the how information (or sophistication) influences views about climate change.

Factual beliefs about CC were significantly and positively related to certainty that GW is happening. People's beliefs about human causes, however, were more than twice as important than their perception that there is (or is not) enough scientific evidence for GW. This is noteworthy since—in line with the “gateway belief” hypothesis (Van der Linden et al. 2015)—one might expect non-experts to reason from their perceptions of the climate science community in order to “define” GW as either a real phenomenon or a nonissue. The present results, however, indicate that causal attributions for GW might play a special role in the problem definition process. Of course, since the question about human causes asks about a matter of science, it is probably endogenous with the science knowledge index: that is, people with more scientific knowledge are more likely to understand the mechanics of the greenhouse effect, and therefore more likely to answer the question about human causes correctly. Still, the results indicate that factual beliefs about GW, and particularly causal attributions for GW, have independent effects on how people think about the problem's existence.

In sum, this analysis indicates that the extent to which citizens “believe in” climate change is significantly associated with their scientific knowledge, attribution to human emissions, Democratic partisanship, policy liberalism, and perceptions of scientific evidence. Though none of these findings is entirely unexpected, they raise two key points.

First, the present results complicate media narratives and public opinion surveys that emphasize only the association between partisanship and CC views. Here, partisanship was consequential for Democrats, whereas for other groups partisanship was not important when the model included a variable for policy liberalism. This implies that Democratic elites and (as the previous chapter's analysis found) left-leaning media have addressed the ACC issue more volubly than other partisan elites. Non-Democrats' views about ACC, it seems, are more strongly associated with the political predispositions that shape their stances towards other, unrelated controversial issues.

Second, this analysis reinforces other studies that have not found any meaningful relationship between education and "believing in" CC. But in contrast to studies that conclude that factual knowledge is inconsequential for public beliefs about CC, my results indicate that understanding the basic physical and life science constructs that are typically taught in middle and high school science classes does have an important impact on these views. It is important to further clarify the nature of the factual knowledge through which citizens' views might become more aligned with scientific consensus. This will require a better understanding of issues related to science education (e.g., how and when citizens acquire such knowledge), and the continued relevance of science in adult citizens' everyday lives (e.g., how often—if ever—non-experts need to recall basic scientific concepts).

### **Analysis Part 2: Beliefs about the existence and severity of climate change**

Because it is unclear how strongly people's beliefs about CC's existence bear on their perceptions of its risks and consequences, in this section I examine the antecedents of people's beliefs about GW's severity. On the one hand, van der Linden et al. (2015) found that people

who received information about the scientific consensus on CC became more likely to believe that it exists, is anthropogenic, and poses a “worrisome threat.” On the other hand, it is plausible that the relationship between factual beliefs and concern about CC is reciprocal, rather than unidirectional. People’s perceptions of CC’s risks are affected not just by facts but also by pre-cognitive, affective factors (Leiserowitz 2006), cultural worldviews (Kahan et al. 2011), and political priorities (Zia and Todd 2010). If these factors make the risks associated with CC more salient and accessible (or alternatively, easier to dismiss), they may also influence whether people think GW is a real problem. In other words, there may be circular relationships between beliefs about CC’s factual existence and views about its potential consequences.

To test for simultaneous or reverse causation between views about GW’s existence and its severity, I use instrumental variables estimation and structure the analysis as a system of two equations with two endogenous dependent variables.

### **Dependent and Instrumental Variables**

The measure for certainty about GW’s existence is the same as described above in Part 1. The instruments for this variable, which are assumed to directly influence it, but not the other endogenous regressor, are also familiar from above. These are the measures asking about the anthropogenic causes of GW and if there is enough scientific evidence for GW. My theoretical logic for designating these variables as instruments, I should emphasize, does not apply to all social problems but rather to issues like GW that are imperceptible and technically complex. I assume that when people consider such issues, their views about the state of scientific evidence, and what they accept as plausible causal explanations probably inform their beliefs about the

problem's existence. Since these two instruments do not mention GW's consequences, I assume that they do not directly influence people's perceptions of its severity.

*Severity of global warming.* This variable combines responses to a set of two items. The leading question read: "Scientists use the term 'global warming' to refer to the idea that the world's average temperature may be about five degrees Fahrenheit higher in 75 years than it is now. Overall, would you say that global warming would be good, bad, or neither good nor bad?" A follow-up question asked those who answered "good" or "bad" if they thought GW would be "extremely, moderately, or slightly" good or bad. Very few people said GW would be good ( $n = 31$ ), and responses overall clustered around indifferent options (34% said GW will be "good" or "neither good nor bad") or great concern (38% said it will be "extremely bad"). The combined measure ranges from 0 to 3, where 0 combines people who said GW would be "neither good nor bad" with the few who said it would be good. The other categories correspond to people who said GW would be (1) slightly, (2) moderately, or (3) extremely bad.

As expected, there is a positive correlation between the certainty with which people thought GW is happening and their perceptions of its severity (Table 3.4)<sup>16</sup> Among those who were "extremely sure" GW is occurring, 85% thought it would be extremely bad (and only 6% said it would be "neither good nor bad"). Conversely, of those who were "not sure at all" about GW, 65% said it would be good or "neither good nor bad," and only 8% thought it would be extremely bad. Of the very small group that was "extremely sure" global warming is not happening, nearly all (32 of 33 respondents) said it would be good or neither good nor bad.

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<sup>16</sup> The relationship between the two variables is statistically significant ( $p < 0.01$  ( $(24) = 579.20$ )).

**Table 3.4. Certainty GW is happening, by perceptions of its severity**

<u>GW Existence</u>	Good/ Neither	GW Severity <sup>a, b</sup>			Extremely bad	Total
		Slightly bad	Moderately bad	Extremely bad		
<b><u>Not happening</u></b>						
<b>Extremely sure</b>	N % w/in row	32 96.97	0 0.00	1 3.03	0 0.00	33 100.00
<b>Very sure</b>	N % w/in row	29 72.50	2 5.00	5 12.50	4 10.00	40 100.00
<b>Somewhat sure</b>	N % w/in row	45 61.64	4 5.48	16 21.92	8 10.96	73 100.00
<b>Slightly sure</b>	N % w/in row	11 55.00	3 15.00	6 30.00	0 0.00	20 100.00
<b>Not sure at all</b>	N % w/in row	102 64.97	13 8.28	29 18.47	13 8.28	157 100.00
<b><u>Is happening</u></b>						
<b>Slightly sure</b>	N % w/in row	70 47.95	18 12.33	39 26.71	19 13.01	146 100.00
<b>Somewhat sure</b>	N % w/in row	124 32.46	16 4.19	128 33.51	114 29.84	382 100.00
<b>Very sure</b>	N % w/in row	59 17.20	9 2.62	91 26.53	184 53.64	343 100.00
<b>Extremely sure</b>	N % w/in row	16 6.43	4 1.61	18 7.23	211 84.74	249 100.00
<b>Total</b>	N % w/in row	488 33.82	69 4.78	333 23.08	553 38.32	1,443 100.00

Pearson chi2(24) = 579.20 Pr = 0.00

<sup>a</sup>“Scientists use the term ‘global warming’ to refer to the idea that the world’s average temperature may be about five degrees Fahrenheit higher in 75 years than it is now. Overall, would you say that global warming would be good, bad, or neither good nor bad?”

<sup>b</sup>“Would you say it would be extremely, moderately, or slightly [good/bad?]”

The instrumental variables regression includes two instruments for people’s beliefs about how bad GW will be. These variables should influence how bad respondents say GW will be, without directly impacting their certainty about its existence.

*Environmental damage from fossil fuels.* This instrumental variable asked about potential environmental damage from the human activities that cause GW. On an 11-point scale, respondents rated the statement “If the present state of coal and oil use continues, serious long-term environmental damage will occur.”<sup>17</sup> Since the statement is about a negative consequence of using fossil fuels, stronger agreement with this item should predict stronger conviction that GW will be bad.<sup>18</sup>

*Skepticism about GW’s severity.* This instrumental variable asked if the severity of GW is overblown. On an 11-point scale, respondents rated the statement: “The dangers of global warming are being over emphasized for political reasons.”<sup>19</sup> People’s feelings about this statement should, in theory, bear directly on their evaluations about how bad GW will be. Respondents who think that CC activists (presumably, Democratic elites, environmental lobbyists, or climatologists) have political incentives to exaggerate the risks of GW are unlikely to say that it poses a severe threat.

Using the data at hand, I have tried to specify a model with instrumental variables that are logical antecedents of their instrumented regressors, and that do not directly influence the primary relationship under consideration. A disclaimer is nevertheless in order because it is extremely challenging to define valid exclusion restrictions to model opinions about climate change. As the issue has cycled in and out of media discourses over the past two decades, these

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<sup>17</sup> Responses are coded to range from -5 (completely disagree) to 5 (completely agree).

<sup>18</sup> This item does not mention climate change explicitly, but it invokes the issue by referring to coal and oil. Still, this item may conflate people who are worried about climate change and people who are worried about the other types of environmental damage from extractive processes (such as mountaintop removal or offshore drilling).

<sup>19</sup> Responses range from -5 to 5, and are reverse-coded so that negative responses correspond to greater skepticism (i.e., agreement that the dangers are politicized). The item’s negative wording was probably intended to identify people who did not closely read the survey questions. Unfortunately, the statement’s phrasing and passive voice probably confused some respondents.

discourses have used a number of frames and claims and focused on various dimensions of the issue. Early media coverage on GW focused on scientists' claims about GW's causes and consequences, but over time have increasingly incorporated the voices of politicians and special interests who argue for or against particular climate actions and policies (Trumbo 1996). This is all to say that many citizens probably learn and think about various dimensions of the issue simultaneously. Resultantly, their views about these dimensions (GW's existence, causes, consequences, and related policies) are probably mutually constitutive. Despite my best effort to specify and distinguish between different aspects of CC opinions, such distinctions necessarily impose an artificial order on a more complicated reality. In short, there is probably some degree of unavoidable endogeneity between all of the instruments and regressors included in this system.

Remaining independent and control variables (measures for partisanship, policy liberalism, scientific knowledge, and education) are the same as those used above in Part 1.

## Models and Results

Table 3.5 displays the results of the instrumental variables regression. The instrumental variables are italicized and listed directly below the regressors they are hypothesized to predict.) The analysis represents a system of two equations with two endogenous dependent variables. The first equation, in which people's certainty about GW's existence is the dependent variable, is nearly identical to the analysis reported above in Table 3.3 (Model 2)—but with the addition of the severity measure as a predictor. Inversely, the second equation regresses perceptions of severity on beliefs about rising temperatures.

**Table 3.5. 2SLS regression for beliefs about existence and severity of global warming**

	GW Existence <sup>a</sup>		GW Severity <sup>b</sup>	
	B	SE	B	SE
<b>GW existence</b>			0.44***	(0.11)
<i>Anthropogenic causes</i>	0.04	(0.17)		
<i>Not enough evidence</i>	0.09**	(0.03)		
<b>GW severity</b>	1.01***	(0.21)		
<i>Environmental damage</i>			0.03	(0.02)
<i>Politicization</i>			0.06**	(0.02)
Democrat	0.16	(0.21)	0.01	(0.14)
Ind. Democrat	0.11	(0.26)	0.03	(0.17)
Republican	-0.14	(0.21)	0.08	(0.14)
Ind. Republican	0.24	(0.26)	-0.08	(0.17)
Education	-0.08	(0.07)	0.07	(0.04)
Policy liberalism	0.12*	(0.06)	-0.04	(0.04)
Science knowledge	0.88*	(0.38)	0.04	(0.31)
Constant	-0.28	(0.31)	0.53**	(0.19)
N	779		757	
R <sup>2</sup>	0.34		0.29	

\*\*\* p<0.01, \*\* p<0.05, \*p<0.1

<sup>a</sup> Scale: -4 to 4

<sup>b</sup> Scale: 0 to 3

The results indicate that there is a reciprocal relationship between the regressors. Most interestingly, perceptions of severity had a substantially greater influence on beliefs about existence than vice versa. As compared to the analysis in Part 1 above, including the severity measure in the first equation also attenuated the effects of scientific knowledge and policy liberalism on beliefs about GW's existence. Though scientific knowledge still had a substantial effect on beliefs about GW's existence, it was not associated with judgments about how bad GW will be. In fact, none of the exogenous independent variables were meaningfully related to judgments about GW's severity.<sup>20</sup>

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<sup>20</sup> This model's fit is not quite as good as that in Part 1 (Table 3.3). The instrumental variables also perform more poorly than expected, and likely introduce inefficiencies into the model. Though the instruments were chosen on the logical grounds explained above, this analysis

Seen one way, these results provide evidence for information-based models of CC views. That is, people with more scientific knowledge were also significantly more certain that GW is happening, and in turn, thought that GW will be more severe. Since scientific knowledge predicts how people think about the factual reality of GW—but not how they make judgments about its consequences—believing in GW’s existence is perhaps a “gateway belief” that mediates the relationship between scientific knowledge and concern about GW.

At the same time, the results show that how people think about GW’s severity has a large, independent effect on whether they believe the problem exists. Since judgments about severity are not predicted by scientific knowledge, they may be more closely related to the affective or intuitive associations people have with climate change. This is in line with Leiserowitz’s (2006) finding that although most Americans do not perceive GW as a big local or personal concern, the mental images they associate with its risks (e.g., melting polar ice) carry an emotional valence that influences their feelings about the issue. Further, although highly politicized media discourses surround the issue, policy liberalism and partisanship did not bear directly on perceptions of CC’s severity. Thus, when people considered how bad GW will be, they did not seem to be guided by political elites’ positions or ideological predispositions. Perceptions about GW’s severity might be driven, rather, by other affective or psychological factors related to concerns about the environment, future generations, or personal property.

These possibilities indicate that there may not be one “issue public” that is particularly invested in mitigating climate change. Rather, within the broad issue area of climate change, there may be different types of “issue publics” that care about different aspects of the problem:

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indicates that further research needs to consider what other, unobserved factors might affect the primary relationship. For instance, a person’s attitudes towards fossil fuel companies (e.g., viewing them as either polluters or as job creators) may influence their beliefs, both about GW’s existence and about how bad it would be.

people who are concerned about the longer-term consequences of CC are motivated by different priorities than people who are more concerned about the short-term costs of climate policies. The former are more likely to advocate for CC mitigation out of concern about issues of environmental justice or degradation. The latter might oppose mitigation out of concern about, e.g., policies' effects on domestic jobs or perceived unfairness in the distribution of costs across developed and developing countries.

In the third stage of analysis below, I explore this idea by testing the full model depicted in Figure 3.2. This allows me to compare how opinions about emissions policies are informed by beliefs about CC (its existence and severity), on the one hand, and political predispositions (here, policy liberalism), on the other hand.

### **Analysis Part 3: Policy opinions and beliefs about the existence and severity of GW**

To test the full model depicted in Figure 3.2, I conducted a series of analyses using structural equation modeling (SEM) to predict support for three climate change mitigation policies.<sup>21</sup> I use the SEM approach because it yields estimates for direct and indirect relationships between variables, which makes it an appropriate method for testing the full, hypothesized multi-step model. All independent variables were described above.

### **Dependent variables**

*Emissions reduction policies.* The dependent variables measured support for three “ways that the federal government might try to reduce future global warming”: (1) imposing more stringent restrictions on GHG emissions from power plants; (2) requiring better fuel economy in

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<sup>21</sup> For comparison, I also conducted a series of similar OLS regressions, and include these results in the appendix.

new cars; and (3) increasing taxes on gasoline.<sup>22</sup> Table 3.6 indicates that the majority of the sample supported the policies impacting power plants (75%) and automakers and (88%). Conversely, most respondents (66%) opposed the gas tax, while only 20% supported it.

**Table 3.6. Distribution of support for emissions policies**

	<u>Cap power plant emissions<sup>a</sup></u>		<u>Improve fuel economy<sup>b</sup></u>		<u>Raise gas tax<sup>c</sup></u>	
	N	%	N	%	N	%
Oppose	135	9.33	66	4.55	944	65.2
Neither favor nor oppose	229	15.83	115	7.94	214	14.78
Favor	1,083	74.84	1,267	87.5	290	20.03
Total	1,447	100	1,448	100	1,448	100

<sup>a</sup> “Power plants put gases into the air that could cause global warming. Do you favor, oppose, or neither favor nor oppose the federal government lowering the amount of these gases that power plants are allowed to put into the air?”

<sup>b</sup> “Do you favor, oppose, or neither favor nor oppose the federal government requiring automakers to build cars that use less gasoline?”

<sup>c</sup> “Do you favor, oppose, or neither favor nor oppose increasing taxes on gasoline so people either drive less or buy cars that use less gas?”

People’s overwhelming opposition to the gas tax (the only policy that imposes an obvious personal cost) coheres with prior research finding chronically low public support for emissions policies that increase gas or electricity taxes (Krosnick and MacInnis 2013; Leiserowitz 2006). Thus although the majority of respondents said GW is probably happening and will be bad, and support measures to reduce emissions from power plants and cars, most people also were not personally willing to pay for mitigation.

In contrast, the broad appeal of the fuel economy policy indicates that fuel-efficient cars are inherently unobjectionable. This policy did not threaten to impose direct financial or behavioral costs on consumers, and people may even anticipate savings from more efficient

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<sup>22</sup> Responses are coded on a seven-point scale range from -3 (“Oppose a great deal”) to 3 (“Favor a great deal”).

vehicles. Restrictions on power plant emissions were also widely popular, though not quite to the extent of the fuel economy policy. It may be that some people perceive this policy as more interventionist than the others. Although this item did not explicitly propose to “cap” power plant emissions, this is what the hypothetical government action would do: some respondents might therefore associate it with contentious cap-and-trade proposals. Since controversy over cap-and-trade was intensifying when these survey items were in the field in early 2008, many citizens had probably been exposed to the “denialist” frames that were becoming more common in mass media coverage of the legislation (Gillis 2010; Skocpol 2013).

## **Analysis and Results**

I estimate three models corresponding to the three emissions policies. The existence, severity, and policy variables are all modeled as endogenous, dependent variables. Thus I include the same instruments for existence and severity as above in Part 2.

Table 3.7 aggregates the results of the three SEM analyses, and reports unstandardized path coefficients for indirect and total effects. (I do not include estimates for direct effects here, but they are represented by the OLS results reported in the appendix.) The two leftmost columns report estimates from the first and second steps of the analysis: the first predicting beliefs about GW’s existence, and the second, beliefs about how bad it will be. Since the results in these columns are constant across all three models, I only report them once.<sup>23</sup>

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<sup>23</sup> Modification indices for each of the three models suggest several alterations that would improve the models’ fit with the data. However, I limit the present discussion to the hypothesized model, and consider why future analyses might benefit from adding some of the suggested constraints.

**Table 3.7. Unstandardized parameters from structural equation models**

Effects	Total	GW Existence		GW Severity		Model 1: Cap power plant emissions <sup>a</sup>		Model 2: Improve fuel economy <sup>b</sup>		Model 3: Raise gas tax <sup>c</sup>	
		Indirect	Total	Indirect	Total	Indirect	Total	Indirect	Total	Indirect	Total
<u>GW existence</u>		--	.15*** (.02)	.06*** (.01)	.18*** (.03)	.03*** (.005)	.17*** (.03)	.02*** (.003)	.06 (.04)		
<i>Anthro causes</i>	.45*** (.13)	.07** (.02)	.07** (.02)	.08** (.03)	.08** (.03)	.08** (.03)	.08** (.03)	.03 (.02)	.03 (.02)		
<i>Not enough evidence</i>	.21*** (.02)	.03*** (.01)	.03*** (.01)	.04*** (.01)	.04*** (.01)	.04*** (.01)	.04*** (.01)	.01 (.01)	.01 (.01)		
<u>GW severity</u>			--	.38*** (.05)	--	.22*** (.04)	--	--	.16** (.07)		
<i>Environmental damage</i>		--	.07*** (.02)	.03*** (.01)	.03*** (.01)	.02*** (.004)	.02*** (.004)	.01* (.01)	.01* (.01)		
<i>Politicization</i>		--	.11*** (.01)	.04*** (.01)	.04*** (.01)	.02*** (.01)	.02*** (.01)	.02* (.01)	.02* (.01)		
Democrat	.35 (.20)	.05 (.03)	.15 (.12)	.10 (.06)	.25 (.19)	.08 (.04)	.15 (.16)	.04 (.03)	.26 (.24)		
Ind. Democrat	.29 (.24)	.04 (.04)	.15 (.15)	.09 (.07)	.19 (.23)	.07 (.05)	.14 (.20)	.03 (.03)	-.16 (.30)		
Republican	-.18 (.20)	-.03 (.03)	.02 (.13)	-.02 (.06)	.24 (.19)	-.02 (.04)	-.11 (.16)	-.004 (.02)	-.34 (.25)		
Ind. Republican	.16 (.24)	.02 (.04)	.04 (.15)	.03 (.07)	.33 (.24)	.03 (.05)	.09 (.20)	.01 (.03)	.09 (.30)		
Policy liberalism	.23*** (.05)	.03*** (.01)	.04 (.04)	.04** (.02)	.41*** (.05)	.04** (.01)	.27*** (.04)	.01 (.01)	.34*** (.07)		
Education	-.004 (.06)	-.001 (.01)	.08* (.04)	.03 (.02)	.03 (.06)	.02 (.01)	.03 (.05)	.01 (.01)	.46*** (.08)		
Science knowledge	1.55*** (.34)	.23*** (.06)	.81*** (.21)	.49*** (.11)	.59 (.32)	.39*** (.09)	-.0007 (.27)	.18* (.08)	1.81*** (.01)		
<i>N</i>				779		779		779			
$\chi^2(8)$				78.45***		90.76***		70.98***			
RMSEA				.11		.12		.10			
CFI				.94		.93		.94			

Standard errors in parentheses, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Taken together with the foregoing analyses, these results provide mixed support for a “gateway beliefs” model in which foundational beliefs guide how people define CC as a problem and evaluate potential solutions. Models 1 and 2 (predicting support for the power plant and automobile policies, respectively) provide evidence for this type of process. Scientific knowledge did not directly affect support for these policies. But when scientific knowledge is mediated by the beliefs that GW exists and that it will have bad consequences, it has moderate,

significant, indirect effects on support for restricting power plant emissions ( $b = 0.49, p < 0.001$ ) and improving fuel economy ( $b = 0.39, p < 0.001$ ).

Nevertheless, Models 1 and 2 also reinforce the findings from above—that is, people’s beliefs about the severity of GW are not necessarily contingent on the certainty with which they believe it exists. Although one must certainly think a problem is happening in order to be concerned about its consequences, the present results indicate that people do not necessarily form these beliefs in sequence, and that perceptions of GW’s severity might have independent sources and influences on policy opinions. Support for all three policies was more strongly associated with respondents’ perceptions of severity than with their certainty that GW is happening.

Model 3 tells a different story: here, scientific knowledge had a very large and direct effect on support for increasing gas taxes ( $b = 1.81, p < 0.001$ ) while “factual beliefs” about CC’s existence and severity were not particularly important.<sup>24</sup> It is not clear why greater scientific knowledge is associated with an increase in people’s willingness to pay for CC mitigation. When asked to think about increased taxes in relation to CC mitigation, people with more scientific knowledge might readily conceptualize the connection between the policy’s cost and the potential effectiveness of the policy solution (i.e., limiting driving would limit tailpipe emissions, and therefore reduce the greenhouse gases that contribute to climate change). In contrast, people who do not have a strong science background were unwilling to pay higher taxes on gas—even those who believed climate change is happening and that it will be bad stopped short of supporting this policy.

Lastly, partisanship was not meaningfully associated with policy support but the policy liberalism scale moderately affected support for all of policies, with some variation in the

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<sup>24</sup> To ensure that income does not confound the effects of scientific knowledge, I examined the correlation between these two variables and found it to be relatively small ( $r = 0.24$ ).

magnitude of these effects: for the emissions policy,  $b = 0.41$  ( $p < 0.001$ ); for the fuel economy policy,  $b = 0.27$  ( $p < 0.001$ ); and for an increased gas tax,  $b = 0.34$  ( $p < 0.001$ ). Partisanship was not meaningfully associated with policy support. These effects represent (almost entirely) the direct influence of the liberalism variable, and this supports the hypothesis that political predispositions are directly associated with perceptions of CC mitigation policies. But these results do not unequivocally support my hypothesis that predispositions are more important for policy opinions than for factual beliefs about climate change's existence and severity—although this was generally true, there was not a big difference in the magnitude of policy liberalism's effects on “believing in” CC, and supporting the fuel economy policy.

## Conclusion

One purpose of this chapter was to test the basic information-based model (Figure 3.1) in order to better understand how people’s beliefs about climate change go together and inform one another—that is, how definitions of the problem inform support for policy solutions. Figure 3.1 depicts a process of reasoning by hierarchical inference, but as discussed above, there is mounting evidence that people might more realistically “reason backwards” (Sniderman et al. 1986), for instance out of an aversion to proposed CC mitigation policies (Campbell and Kay 2014).

The analyses in this chapter both found support for a model of hierarchical reasoning, but also complicate it. The SEM results indicate that people did “reason forwards” through the steps depicted in Figure 3.1 when they considered the regulatory policies that would limit emissions from power plants and require carmakers to improve fuel economy. But when people considered the increased gas tax, there was a strong direct association between scientific knowledge and

support for the policy, and this effect was not mediated by people's beliefs about GW's existence and severity. (The increased gas tax was also the only dependent variable on which education had a significant and substantial impact.) The meaning of objective scientific knowledge remains a bit of a puzzle here: it is unclear why such knowledge is disproportionately associated with support for the policy that imposes direct costs on consumers, as compared to the policies that would hold polluting industries more accountable for greenhouse gas emissions. One might expect social class to confound and inflate the effects of scientific knowledge, but the analyses controlled for formal education, and I also did not find a meaningful correlation between income and people's scores on the scientific knowledge index.

The second aim of this chapter was to test the elaborated model (Figure 3.2) that takes into account how people's general political preferences might impact their views about CC. Though it is difficult to make direct comparisons of effect sizes across the dependent variables, the analyses supported the hypothesis that policy liberalism bears more strongly on people's support for the emissions policies than on their beliefs about GW's existence and severity. Taking into account the scale on which each dependent variable is scored, a minimum-to-maximum shift on policy liberalism (i.e., from the most conservative to the most liberal position) was associated with a 14% increase in certainty that GW is happening, a 34% increase in support for restricting power plant emissions, a 23% increase in support for higher fuel economy standards, and a 28% increase in support for higher taxes on gas. And, surprisingly, policy liberalism was essentially unrelated to people's evaluations of how bad GW would be.

Of course, it is to be expected that a measure developed from people's preferences on other political issues would predict their support for government action on emissions. I also cannot account for the extent to which these preferences might reflect respondents' attention to

partisan elite discourses about the policy issues on which the liberalism scale is based. Nevertheless, as I argued above, the policy liberalism scale represents the general preferences underlying political opinions, rather than specific political opinions themselves. That this underlying dimension is associated with opinions about social and political issues that are both contested (and thus they are not obscure) and entirely unrelated to climate change or the environment increases its validity as a measure of political predispositions for the purposes of the present analyses. Since policy liberalism had at least a moderate, direct, and statistically significant influence on support for all three emissions policies, people may consider these policies in ways that are distinct from, and plausibly come prior to, their beliefs about the problem's existence and severity. In other words, citizens with strong political predispositions may be more likely to "reason backwards" about climate change, starting from affective evaluations of the symbolic links between proposed climate policies and their own predispositions.

Several additional results reinforce this idea. Policy liberalism was particularly important for the measure that would restrict emissions from power plants. Whereas citizens were more unified in their opinions about the two other policy measures—i.e., one was widely popular (improved fuel economy) and the other widely unpopular (higher gas taxes)—the power plant measure resembles the more polarizing real-world proposals for a cap-and-trade system. Oppositional discourses, for instance, make symbolic and political appeals (e.g., those that fall under the rubric of "Obama's war on coal") to conservative audiences' concerns about economic costs, foreign dependency, or government regulation. To the extent that people's reasoning about particular climate policies is motivated by "solution aversion," the rational or logical process

depicted in Figure 3.1 less aptly characterizes how citizens probably think about the components of the CC issue domain.

This discussion could be interpreted as a testament to the success with which elite communications (especially from conservative camps) have primed citizens to accept or reject messages about CC mitigation policies. As I described in the previous chapter, the attributes of complex and “unobtrusive” issues makes it difficult for ordinary citizens to connect them directly to their everyday lives, and might make their views particularly dependent on such elite communications. However, the results of the present analyses—in particular, the relative importance of policy liberalism vis-à-vis partisanship—pose an important challenge to this view. All of this chapter’s analyses indicated that policy liberalism (a proxy for political predispositions) had a bigger influence on people’s CC views than did partisanship (an indicator of people’s inclination to receive partisan elites’ messages). Thus, although controversies over the problems and solutions associated with climate change originated within elite-level political networks and coalitions, there is nevertheless a two-track relationship between these actors’ appeals and public opinion—or as Gamson and Modigliani (1989) put it, media discourses and public opinion are “two parallel systems of constructing meaning.” Although elite and media discourse “dominates the larger issue culture” (3, 1989) that characterizes an issue domain, these discourses must nevertheless resonate with larger cultural themes and with the practical experiences and knowledge that people bring to bear on the information they encounter about political issues and events.

## Chapter 3 Appendix

Scores on the items listed in Table 3.8 comprise the “science knowledge score” used in this chapter’s analyses.

**Table 3.8. Science knowledge quiz items**

<b>“For each statement, please indicate if you think that it is true or false. If you don’t know or aren’t sure, just check the ‘not sure’ box.”</b>		<b>% Correct</b>	<b>N</b>
1	Nuclear power plants destroy the ozone layer. (False)	38	1150
2	The earliest humans lived at the same time as the dinosaurs. (False)	26	1148
3	The continents on which we live have been moving their location for millions of years and will continue to move in the future. (True)	75	1146
4	Human beings, as we know them today, developed from earlier species of animals. (True)	39	1147
5	More than half of human genes are identical to those of mice. (True)	32	1148
6	Antibiotics kill viruses as well as bacteria. (False)	67	1142
7	Ordinary tomatoes, the ones we normally eat, do not have genes, whereas genetically modified tomatoes do. (False)	57	1138
8	Lasers work by focusing sound waves. (False)	53	1140
9	Electrons are smaller than atoms. (True)	59	1149
10	The universe began with a huge explosion. (True)	32	1146
11	All plants and animals have DNA. (True)	85	1149

**Table 3.9. Component loadings on policy liberalism measure**

	<u>Component 1</u>
Gay marriage	0.39
Taxes on 200k	0.52
Health care	0.52
Habeas for suspects	0.40
Citizenship	0.39

Eigenvalue = 1.67, Proportion of variance explained = 33.35%

Overall KMO = 0.62

**Table 3.10. OLS regression estimates for emissions policy support**

	Cap power plant emissions		Improve fuel economy		Raise gas tax	
	B	SE	B	SE	B	SE
GW existence	0.10***	0.03	0.10***	0.02	0.05	0.04
GW severity	0.37***	0.04	0.19***	0.04	0.15**	0.06
Democrat	0.12	0.16	0.14	0.13	0.24	0.20
Ind Democrat	0.15	0.19	0.15	0.16	-0.01	0.25
Republican	0.07	0.16	-0.01	0.13	-0.21	0.21
Ind Republican	0.18	0.20	0.20	0.17	-0.002	0.26
Education	0.03	0.05	0.01	0.04	0.39***	0.06
Liberalism scale	0.28***	0.04	0.25***	0.04	0.31***	0.06
Science knowledge	0.25	0.26	-0.37	0.22	1.35***	0.35
Constant	0.60**	0.20	1.92***	.17	-3.67***	0.26
R <sup>2</sup>		0.25		0.21		0.20
N		1,066		1,066		1,066

\*p &lt; 0.05, \*\* p &lt; .01, \*\*\*p &lt; .001

Scale for all policies: -3 to 3 (“Oppose a great deal” to “Favor a great deal.”)

## **Chapter 4: Attitudes about science, Fundamentalist Christian beliefs, and climate change views**

This chapter addresses two main research questions. First, are fundamentalist Christian beliefs disproportionately associated with pessimistic or distrustful attitudes about science? Second, to what extent are public views about climate change informed by fundamentalist beliefs and science attitudes?

### **Introduction**

A growing body of research seeks to clarify the determinants of climate change “denialism,” especially within the American public (see Hornsey et al. 2016 for a recent meta-analysis). Skeptical opinions about anthropogenic climate change (ACC) are consistently associated with political conservatism, as well as conservative elites who argue against government action on ACC. Such arguments claim, for instance, that mitigation policies would diminish domestic jobs in resource-rich states, cede geopolitical advantages to other big polluters like China and India, and disadvantage developing nations as they aspire to rise from poverty.

Conservative Christian activists have deployed the same frames in appeals against national climate legislation. But to make these political and “worldly” arguments more germane to communities of faith, such discourses also sometimes incorporate scriptural and Biblical justifications and thereby reinforce “the conventional wisdom...that Christianity, and particularly orthodox Christianity, leads people to be opposed to environmental regulation” (Wald and Calhoun Brown 2011, 193). The sociologist of religion Laurel Kearns (2011) goes so far as to state, “[i]n the case of the United States...one cannot examine political inaction/action on climate change without understanding the role of religious groups” (414), and particularly the Christian groups that sometimes exert an “enormous influence on public policy issues in the US” (418).

In this chapter I examine whether, and how, conservative Christians' religious beliefs clash with scientific consensus on the CC, and whether the stances taken by high-profile religious activists and organizations mirror their constituencies' opinions. While religious leaders often deploy the same (non-religious) skeptical arguments made by conservative political elites and pundits, they also use overtly religious rhetoric to frame opposition to CC mitigation. Such arguments echo a "wise use agenda" that prioritizes humans' needs over environmental conservation (and which undermined environmental efforts under the Reagan and both Bush administrations). In a seminal and controversial article in *Science* in 1967, Lynn White Jr. traced these cultural attitudes towards natural resources to the Christian belief that God's divine plan calls for humans to dominate non-human Creation. White warned that "we shall continue to have a worsening ecologic crisis until we reject the Christian axiom that nature has no reason for existence save to serve man" (1967).

White's commentary foreshadowed continued tensions between environmental protection (such as measures to mitigate CC) and worldviews characterized by Biblical literalism. Some scholars interpret the Religious Right's oppositional arguments about CC to signify not just anti-environmentalism, but also indicative of deeper conflicts between scientific and religious worldviews. As the sociologist of religion Elaine Ecklund observes, "Scientists tend to view the impact of religion on science education entirely through a frame of conflict, often blaming Americans' poor understanding of science on religion, arguing in particular that fundamentalist forms of Christianity inhibit science learning" (2010, 8). In line with this view, evolutionary biologist Jerry Coyne argues on epistemic grounds that there is no tenable "accommodationist" position between science and theistic faith: the former relies on reason and evidence, whereas the latter provides no method for discovering or testing truths about the world (Coyne 2015). Coyne

points to debates over GW as one of the most significant examples of conflict between the two worldviews, alongside other volatile issue areas such as evolution and embryonic stem-cell research.

Skeptical messages about ACC from religious activists, think tanks, policymakers, and pundits provide ample anecdotal evidence that conservative Christians are wary of the mainstream scientific establishment. Still, it is unclear if these discourses translate into broader public opinion on ACC and attitudes about science. For one, while most Americans say they believe in God, a smaller segment of the population subscribes to the orthodox or fundamentalist views that are promulgated in anti-environmentalist and anti-science discourses.<sup>1</sup> This smaller demographic of fundamentalists probably has relatively circumscribed effects on macro-level public opinion about ACC.

Moreover, few studies have empirically tested the hypothesis that orthodox religious beliefs among the general public are associated with anti-science attitudes, which in turn leads to greater skepticism about climate change.<sup>2</sup> Research that does investigate the relationships between these variables tends to measure religiosity, science attitudes, and CC skepticism differently. Nevertheless, these studies indicate that in contrast to the “conventional wisdom”

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<sup>1</sup> There is some ambiguity about how prevalent such values and beliefs are in American society. This is because scholars have variously defined evangelical Protestants by denomination, religious views and values, and respondents’ self-identification, leading to wide-ranging estimates that between 10 and 40 percent of the adult population are evangelical Protestants (Wald and Calhoun-Brown 2011). Similar problems affect estimates of fundamentalism. A 2004 survey found that 10.8% of adults identified themselves as Protestant fundamentalists, but that only 4.5% exhibited the “minimal characteristics” of fundamentalism such as biblical literalism and hostility to religious modernization (Green 2016, 30).

<sup>2</sup> I use “science” to refer to a complex of institutions, researchers, and practices founded on an epistemic ethos of “scientific materialism”—i.e., the premise that “the material forces of the universe are external to, and hence unaffected by, human concerns, and that these material forces operate in ways that can ultimately be ascertained through a dynamic process of human inquiry” (Ellison & Musick 1995).

among secular observers, conservative Christians are not much more skeptical about science and about ACC than other Americans. For instance, public opinion data shows that most that most people of faith do not see conflicts between their religious beliefs and science—and like most other Americans, they tend to have enthusiastic attitudes about scientific progress (Funk and Alper 2015). On the issue of ACC, Smith and Leiserowitz (2013) found that evangelical Christians are indeed more skeptical than the general public, but not extensively so. Thus evangelicals were less likely than non-evangelicals to believe GW is happening, is caused by humans, and were less worried about it—nevertheless, majorities of evangelicals did believe GW is happening, is anthropogenic, and were at least somewhat worried about it. The authors further found that although evangelicals were less likely than non-evangelicals to support climate change and energy policies, majorities of both groups still supported the policies.

In light of these trends, the present analysis explores two main research questions. First, are fundamentalist Christian beliefs disproportionately associated with pessimistic or distrustful attitudes about science?<sup>3</sup> Second, to what extent are public views about climate change informed by fundamentalist beliefs and science attitudes? Taken together, the analyses below aim to shed light on the extent to which religiously motivated attitudes about science account for Americans' perceptions of climate change. To carry out these analyses, I use the same nationally representative survey data as in the previous chapter (from the 2008-9 ANES panel study). This dataset is particularly useful because it included a special wave on science and environmental attitudes.<sup>4</sup>

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<sup>3</sup> Although I could fruitfully investigate a number of religious communities, I focus on the denominations most clearly associated with CC skepticism. These fall under the umbrella of the New Christian Right and are traditionalist, non-mainline Protestant denominations.

<sup>4</sup> See <[http://www.electionstudies.org/studypages/2008\\_2009panel/anes2008\\_2009panel\\_MethodologyRpt.pdf](http://www.electionstudies.org/studypages/2008_2009panel/anes2008_2009panel_MethodologyRpt.pdf)>

## **Background**

It is important to note, first, that US religious activism on climate change is not uniformly “skeptical.” A long history of faith-based, evangelical environmentalism continues among those known as “creation care” advocates, who see it as a Biblical responsibility to mitigate climate change (Kearns 2011). A number of faith-based organizations support this view, including the Evangelical Climate Initiative, the Evangelical Environmental Network, ‘Restoring Eden’ Christians for Environmental Stewardship, and the Young Evangelical Climate Initiative (Smith & Leiserowitz 2013). And though scientists are generally much less religious than the general public (Pew 2009b), there are notable exceptions within the climate science community, such as the evangelical Christian climate scientist Katharine Heyhoe, who has received public attention for arguing that theological justifications for CC skepticism amount to a “smokescreen” for conservatives’ aversion to climate regulation (Rosenberg 2015).

The religious skeptics that Heyhoe criticizes invoke the rhetoric of “wise use” and “stewardship” of God’s Creation to advance conservative economic priorities. Kearns (2011, 421) describes groups associated with the Christian stewardship agenda<sup>5</sup> as part of a “well-funded, religiously based, free market, counter mainstream environmentalism, conservative green movement.” Though these groups’ policy goals are ultimately economic and “worldly” rather than spiritual, their persuasive appeals use theological and scriptural frames. The prominent conservative evangelical group The Cornwall Alliance, for instance, uses Biblical appeals to contest scientific evidence for ACC, stating that the Earth is “the product of infinitely wise design” and therefore is “robust, resilient, self-regulating, and self-correcting” in the face of

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<sup>5</sup> These include, e.g., The Cornwall Alliance for the Stewardship of Creation, and the Acton Institute for the Study of Religion.

human activity. Consequently, the group claims, “fears of destructive manmade global warming,” are “unfounded or undue” (Cornwall 2014). That God’s design includes abundant resources for human use justifies the central argument that resource development and extraction constitutes “scripturally sound stewardship.” Interestingly, the stewardship movement has also appropriated creation care advocates’ focus on social and environmental justice (Kearns 2011) to make the opposing argument that policies to curb greenhouse gases would “prolong [the risks of poverty]” in the developing world (Cornwall Alliance 2015).

The perception among scientists, environmentalists, and the public that evangelical Christians have anti-environmentalist attitudes attests to the Christian stewards’ success in overshadowing the messages of creation care advocates. The Cornwall Alliance, for instance, circulated its 2000 *Declaration on Environmental Stewardship* to 37,000 religious leaders, and its list of “notable signers” boasts well-known conservative Christian leaders including Jerry Falwell, James Dobson, and Chuck Colson. The stewardship movement also mobilized to oppose a 2006 “Evangelical Call to Action” on climate change, which was endorsed by prominent creation care evangelicals and stated that CC is real and anthropogenic, that it will greatly impact the world’s poor, and that “Christian moral convictions” demand an urgent response to the problem.<sup>6</sup> In response, the Cornwall Alliance published an open letter to the signers of the “Evangelical Call to Action” which argued against “the extent, the significance, and perhaps the existence of the much-touted scientific consensus on catastrophic human-induced global warming.” The visibility of the Christian “stewardship” movement reinforces public perceptions that religious worldviews are irreconcilable with the empirical scientific inquiry.

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<sup>6</sup> Notable endorsers of the pro-mitigation “Call to Action” included evangelical lobbyist Richard Cizik and megachurch pastors Rick Warren, Joel Hunter, and Bill Hybels. See <<http://repository.berkleycenter.georgetown.edu/060201EvangelicalClimateInitiativeClimateChangeEvangelicalCallAction.pdf>>

The examples from the Christian stewards and the Cornwall Alliance illustrate how traditionalist Christian beliefs rooted in creationism and intelligent design are deployed to cast doubt on scientific consensus and to justify conservative economic priorities. But it is unclear if these beliefs, which most scientists agree clash with the scientific method, indicate that conservative Christians hold distrustful or hostile attitudes towards organized science. On the one hand, longitudinal trends show steadily increasing distrust towards organized science among conservatives with the rise of the American New Right and the Religious Right since the 1970s (Gauchat 2012). Mooney (2006) attributes this shift to several broad socio-political factors that affected both political and religious conservatives. First, much of the modern conservative movement has rallied around socially traditionalist values that it perceives as incompatible with rapid technological progress, which threatens the social status quo and cherished ways of life. Further, Mooney describes how the elite-driven New Right and Religious Right movements established a powerful national media presence via diverse outlets—including radio, publishing houses, cable television, and think tanks (and more recently, social media)—and thereby perpetuated the message among rank-and-file conservatives that their values are under fire from mainstream cultural, academic, and scientific institutions dominated by liberal biases. Gauchat (2012) also posits that conservatives—whose attitudes about science were more positive in the early postwar period—became less trusting with the growth of regulatory science in the 1970s, and the associated rise of a science advisory community perceived as hostile to corporate interests (including, e.g., the EPA and OSHA). These developments recast science as an extension of government bureaucracy and overreach, rather than a means for increasing production. While these socio-cultural changes do not overtly affect religious institutions and values, strong elective affinities between religious and conservative discourses over these

decades solidified their connection, and the modern Christian Right has become extremely successful in linking religious rationales to conservative political positions (Wald and Calhoun-Brown 2011, 210).

Still, trends in public opinion do not present a straightforward picture of the relationships between religion, attitudes about organized science, and beliefs about specific science issues. As a whole, the public expresses enthusiasm about science: 79% of citizens say that science has made life easier for most people, and the majority also say that science has had positive effects on the quality of health care, food, and the environment (Funk and Rainie 2015). When asked if science often conflicts with religion, 59% said it does and 38% said they are mostly compatible (Funk and Alper 2015). But interestingly, the respondents who were religiously unaffiliated or unobservant were especially likely to say there are conflicts between religion and science (76%). By comparison, about half of white evangelical Protestants said the two often conflict (45%), and about half said they are mostly compatible (49%). When asked if their personal religious beliefs conflict with science, a sizeable minority of Americans (30%) said yes. Among all Protestants, 34% said yes, and among white evangelical Protestants, 40% said yes. When these respondents were asked which of their specific religious beliefs conflict with science, the most common responses cited views on the creation of the universe and evolution (36%). Second most common, people mentioned broad differences over belief in God, facts vs. beliefs, and miracles (24%); and third, people brought up views about the beginning of life and abortion (11%). Just 2% mentioned conflicts over global warming or climate change (Funk and Alper 2015). This indicates that although religious identity is consequential for evangelical Christians' views about some scientific issues, they are not overtly opinionated about CC. Many also believe that their religious views are compatible with science.

Studies that ask respondents about scientific issues further indicate that religion impacts views about some issues more strongly than others. Blank and Shaw (2015) found negative relationships between religious variables (church attendance and Biblical literalism) and deference towards scientific expertise on sixteen different issues. But these effects were more consequential for hot-button issues with longstanding and clear relevance to religion—for instance, issues of teaching evolution, gay adoption, fetal viability, stem cell research, and birth control education—than they were for scientific expertise on global warming. In a national survey on religious “believers”<sup>7</sup> views about climate change, 76% of all believers and 65% of Evangelicals said that preventing climate change is an important goal (Kull et al. 2011). Most believers (66%) also said that CC poses at least a moderate risk to God’s creation, and this was 56% among Evangelicals. But when asked if dealing with CC is a “spiritual obligation,” most believers (85%) did not think of the issue in this way. Believers’ views about scientific consensus on CC were also divided, with 21% saying that most scientists do not think the problem is urgent and that not enough is known to take action; 38% said scientists’ views are pretty evenly divided (among Evangelicals, 43%); and 39% said that “most scientists think the problem is urgent” and that enough is known to take action (among Evangelicals, 31%).<sup>8</sup>

Taken together, these studies indicate that believers typically do not think their views conflict with science, and those who do are concerned about science’s ethical implications for some contentious issues, but generally not for climate change. While people of faith are more skeptical than other citizens about scientific expertise on the issue, they are not much more likely than others deny that climate change is happening. And although some evangelical Christians

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<sup>7</sup> “Believers” included those who believe in God and/or who said that “there are spiritual obligations to act in certain ways” (Kull et al. 2011).

<sup>8</sup> The study unfortunately did not include comparable figures for the general public.

advocate an ethos of faith-based “creation care,” believers generally do not associate climate change with a religious or spiritual imperative to be good stewards of God’s creation. In short, despite the strong rhetoric of some religious activists and organizations on the issue, most believers do not express similarly strong opinions about climate change. These diverse findings motivate the two research questions driving this study: First, do traditionalist or fundamentalist religious beliefs engender distrustful “anti-science” attitudes? Second, to the extent that religious beliefs are associated with contrarian attitudes towards science, do these attitudes in turn influence people’s opinions and beliefs about climate change?

The analyses below proceed in two stages corresponding to these questions. First, I examine the extent to which fundamentalist religious beliefs predict general attitudes about science. Two dependent variables measured how respondents felt about science’s impacts on society: a scale for science attitudes, and an item asking if society relies too heavily on science rather than faith.

Second, I examine how perceptions of climate change are related to fundamentalism, science attitudes, and political predispositions. Since climate change does not represent one particular issue but rather an “issue area,” the dependent variables in this section address several interrelated sub-issues. As in the previous chapter, these include people’s beliefs about GW’s existence, severity, and support for CC mitigation policies. Additionally, I investigate beliefs about GW’s causes because the previous chapter’s results indicated that these beliefs may be an important element of people’s CC views.

## **Analysis Part 1: Attitudes about Science**

### **Dependent Variables**

*Science attitudes.* Five items comprise the scale for attitudes about science's impact on everyday life. The items referred broadly to the social impacts of "science" and "technology," and responses indicate that Americans generally hold pro-science attitudes: (1) "Science and technology are making our lives healthier, easier, and more comfortable" (77% agreed); (2) "Because of science and technology, there will be more opportunities for the next generation" (76% agreed); (3) "With the application of science and technology, work will become more interesting" (half the sample agreed, 25% disagreed); (4) "Science makes our way of life change too fast" (50% agreed, 30% disagreed); and (5) "It is not important for me to know about science in my daily life" (72% disagreed).<sup>9</sup>

Thus, most people seemed to think that science and scientific knowledge have intrinsic social value, and thought that scientific progress will continue to benefit future generations. Though people were somewhat less likely to think that scientific progress will affect their everyday work, and half worried about rapid changes, overall their opinions about science were positive. The final scale from these items ranges from -3.4 to 5, with the lower end corresponding to negative science attitudes.<sup>10</sup> Only 4% of the sample scored below -1, indicating that they had very negative attitudes about science; in the middle, 29% scored between -1 and 1; and 67% had very optimistic attitudes about science (scoring above 1).

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<sup>9</sup> Each item is coded on an 11-point scale ranging from -5 ("Completely disagree") to 5 ("Completely agree").

<sup>10</sup> Cronbach's Alpha = 0.65 ( $M = 1.89$ ,  $SD = 1.67$ ). Although this alpha value is somewhat low, I used principal components analysis to check if there is a consistent structure to responses on these items and found that one component structured most of the variance between and across the them (eigenvalue = 2.33,  $\varphi = 0.47$ ).

*Science vs. faith.* A second dependent variable elicited respondents' opinions about the statement "We depend too much on science and not enough on faith."<sup>11</sup> Responses clustered around the extremes and middle of the eleven-point response scale: 19% completely disagreed that we "depend too much on science," 21% scored near the middle, and 11% completely agreed that society relies too heavily on science.

## Independent Variables

*Fundamentalism.* As Idler *et al.* (2003) point out, "religiousness" is a complex concept that encompasses a number of behavioral aspects (e.g., attendance at worship services, solitary prayer, meditation, reading sacred texts) and attitudinal aspects (such as beliefs, values, and feelings). Thus any large-scale data analysis on the topic is, unfortunately, liable to neglect some of these dimensions of religious identity.

Since my aim in this section is to examine how religious worldviews influence attitudes about science, I am less concerned with denominational affiliation and church attendance (these are conventional, but weak, proxies for the intensity of people's religious beliefs) than with the beliefs that structure such worldviews. I constructed a scale for religious fundamentalism from items asking about religious beliefs that are associated with conservative Protestant theology and that are difficult to reconcile with scientific materialism. I use the term fundamentalism following Green's definition (2016, 29) of "fundamentalism, properly so called": that is, to refer to a "sectarian religious movement among Anglo-American Protestants that seeks to preserve traditional doctrines and practices," such as a literal interpretation of the Bible.

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<sup>11</sup> Responses are coded to range from -5 ("Completely disagree") to 5 ("Completely agree"),  $M = -0.55$ ,  $SD = 3.30$ . I analyze this item separately, rather than incorporating it into the science attitudes scale, because it invokes both science and religion.

The scale comprises three items. Respondents rated the following statements on an eleven-point scale: (1) “There is a personal God who hears the prayers of individual men and women” (approximately 70% agreed); (2) “Human beings were created by God as whole persons and did not evolve from earlier forms of life” (56% agreed); and (3) “The Bible is the actual word of God and is to be taken literally” (46% agreed).<sup>12</sup> Though the first item is not a strict measure of fundamentalism, it provides a baseline measure of religiosity that scales exceptionally well with the other two items (Cronbach’s  $\alpha = 0.86$ ), which mention specific traditionalist beliefs that characterize Evangelical fundamentalism. The fundamentalist movement has taken issue with evolutionary theory since its founding (the movement arose from a 1920s initiative to ban the teaching of evolution in public schools), and the belief that the Bible is the inerrant word of God is more pervasive among fundamentalists than among other evangelical Protestants and other Christian groups (Green 2016; Wald and Calhoun-Brown 2011). About a third of the sample (32%) fell on the secular end of the scale (between -5 and -1); in the middle, 12% fell between -1 and 1; and 56% expressed some degree of fundamentalism (1–5). At the fundamentalist extreme, 25% of the total sample scored 5. Thus, while the discussion above indicated that most Americans are enthusiastic about science, most also hold beliefs that are at least somewhat (if not very) religious, and many held traditionalist beliefs that are incompatible with scientific materialism.

*Political demographics and control variables.* The remaining independent and control variables include scientific knowledge, policy liberalism, partisanship, and education. The variable for scientific knowledge serves to distinguish between the effects of factual scientific information as opposed to science attitudes, since it is possible to have positive attitudes about

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<sup>12</sup> Each item is coded to range from -5 (“Completely disagree”) to 5 (“Completely agree”). The final scale also ranges from -5 to 5 ( $M = 1.10$ ,  $SD = 3.65$ ).

science without being particularly well informed or knowledgeable about it.<sup>13</sup> The policy liberalism variable, as in the previous chapter, is based on respondents' support for government action on five controversial policy issues. Principal components analysis revealed one major dimension to policy support, and the policy liberalism variable consists of scores computed for each respondent based on the five items and their loadings on the principal component. Respondents with higher scores have more liberal policy preferences. I use this variable in lieu of political ideology, as traditional measures of ideological self-placement are highly endogenous with partisanship, and also cannot reveal much about citizens' policy preferences and social values. Partisanship is represented by four dummy variables (for Democrats, Republicans, and Independent Democrats and Republicans), and represented by five categories.

## Models and results

Table 4.8 (page 110) displays the correlation coefficients between all variables used in this chapter (including those I introduce in Part 2 below). The correlation between the key independent variables—fundamentalism and science attitudes—is statistically significant but rather small ( $r = -0.13, p < 0.001$ ). This weak correlation indicates that the constructs likely correspond to separable attitude structures. There is, however, a more substantial association between fundamentalism and science knowledge ( $r = -0.41, p < 0.001$ ). Thus, although people with fundamentalist beliefs tended to know less about foundational scientific concepts, their attitudes about science were not particularly pessimistic.

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<sup>13</sup> The scientific knowledge score is similar to that used in the previous chapter, but I removed three items that could tap into religious beliefs (e.g., “The universe began with a huge explosion”).

*Science attitudes.* To perform a more conclusive analysis I regressed science attitudes on fundamentalism using a least squares estimator (see results in Table 4.1). The model also includes the other explanatory and control variables described above: education, scientific knowledge, partisanship, and policy liberalism. The results indicate that fundamentalism does not impact science attitudes ( $b = -0.01, ns$ ), which reinforces the supposition that the two measures are separable. This result echoes Ellison and Musick's (1995) finding that Biblical literalism and theological orthodoxy were essentially unrelated to people's views about whether "Science will solve our social problems like crime and mental illness."<sup>14</sup> Perhaps unsurprisingly, scientific knowledge had the biggest effect of any variable on science attitudes ( $b = 1.71, p < 0.001$ ), followed by education ( $b = 0.31, p < 0.001$ ).

**Table 4.1. OLS Regression analysis with science attitudes as dependent variable**

	B	SE
Democrat	-0.15	0.20
Independent Democrat	-0.25	0.25
Republican	0.27	0.20
Independent Republican	-0.09	0.25
Policy liberalism	-0.02	0.05
Education	0.31***	0.06
Science knowledge	1.71***	0.31
Fundamentalism	-0.01	0.02
Constant	-0.28	0.28
<i>N</i> = 704		
<i>R</i> <sup>2</sup> = 0.14		

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05

Dependent variable scale: -3.4 to 5

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<sup>14</sup> The authors draw a helpful distinction between this practical evaluation of science, and critiques of science that are made on moral grounds (e.g., the critique that science breaks down people's ideas of right and wrong). They did find a meaningful association between their measures of religiosity and *moral* critiques of science (Ellison and Musick 1995).

*Science vs. faith.* To consider the relationship between science attitudes and religious beliefs from another angle, I regressed the item asking about a conflict between science and faith on both the fundamentalism and science attitudes measures in a nested regression analysis. In contrast to the previous analysis, the results in Table 4.2 (Model 2) show that fundamentalism had a substantive impact when people evaluated whether “We depend too much on science and not enough on faith” ( $b = 0.54, p < 0.001$ ). This coefficient did not attenuate when I added the science attitudes measure in Model 3 (for science attitudes,  $b = -0.42, p < 0.001$ ). A comparison across the models in Table 4.2 also shows that the effect of scientific knowledge—which was substantial in Model 1—is largely accounted for by fundamentalism and science attitudes.

Thus, while the first analysis showed that orthodox religious beliefs did not typically incline people to hold overtly “anti-science” attitudes, here, both fundamentalism and science attitudes had direct, discrete effects when people thought about science and religion as having social tradeoffs. This could have important implications for the influence of media frames on citizens’ attitudes about scientific expertise: people may be less trusting of scientific expertise in general if it is framed to appear incompatible with deeply held religious beliefs. In the context of such frames, people also may become more skeptical of expertise on otherwise uncontroversial issues.

**Table 4.2. Nested regression analysis for tradeoff between science and faith**

	Model 1	Model 2	Model 3
Democrat	0.29 (0.40)	-0.19 (0.34)	-0.06 (0.33)
Ind. Democrat	0.78 (0.51)	0.73 (0.42)	0.64 (0.41)
Republican	0.47 (0.40)	-0.20 (0.34)	-0.07 (0.33)
Ind. Republican	0.55 (0.50)	0.01 (0.42)	-0.01 (0.41)
Policy liberalism	-0.36*** (0.11)	0.01 (0.09)	-0.00 (0.09)
Education	-0.38** (0.11)	-0.07 (0.10)	0.06 (0.10)
Science knowledge	-4.32*** (0.53)	-1.36** (0.53)	-0.64 (0.53)
Fundamentalism		0.54*** (0.03)	0.53*** (0.03)
Science attitudes			-0.42*** (0.06)
Constant	3.05*** (0.53)	0.11 (0.48)	-0.01 (0.46)
Observations	680	680	680
R <sup>2</sup>	0.15	0.41	0.44
F for nested model		0.25	0.04

Standard errors in parentheses.

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05

Dependent variable scale: -5–5

## Part 2

### Dependent Variables

The remaining analyses examine how fundamentalism, attitudes about science, and political factors are related to beliefs and opinions about climate change. The dependent variables measure people's beliefs about GW's causes, its existence, how bad it will be, if GW's dangers are exaggerated, and support for three climate change mitigation policies. The policies

would restrict power plant emissions, require carmakers to improve fuel economy in new cars, and increase gasoline taxes. Most of these variables are familiar from the previous chapter; those dealing with global warming’s causes and “politicization” are not, and I describe them below.

## Models and Analysis

### *Human and natural causes of GW*

Two binary outcome variables represent people’s beliefs about the causes of GW—an issue that in recent years has become more contentious than the question of whether GW exists.<sup>15</sup> One variable represents people who said GW has mostly human causes, and the other represents those who said it has mostly natural causes.<sup>16</sup> The reference group for each binary variable contains all remaining respondents (i.e., everyone who did *not* say that warming is due to human or natural causes, respectively). I did not create a third variable for the people who said rising temperatures are caused about equally by human activity and natural variation, and focus just on those whose stances more confidently contradicted or aligned with the scientific consensus on ACC.

Table 4.3 features the results of two probit analyses. On the left, the outcome variable is whether respondents cited natural causes, and on the right, attribution to human causes. To aid

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<sup>15</sup> Even The Cornwall Alliance’s rhetoric, which uses denialist appeals to oppose climate regulations, has evolved on this issue: the organization’s current stance, as articulated in its *Open Letter on Climate Change*, is that “Human-induced climate change, also known as anthropogenic global warming (AGW) is real.” (The statement goes on to explain that climate models are biased so as to “greatly exaggerate the warming effect of carbon dioxide” and therefore “provide no rational basis to forecast dangerous human-induced global warming and no rational basis for efforts to reduce warming...”) (Cornwall Alliance 2015)

<sup>16</sup> The item asking about causes was part of a series of branching questions that asked first if global temperatures are rising, and then about the causes of rising temperatures. People who initially said that temperatures are not rising were asked: “Assuming it’s happening, do you think a rise in the world’s temperatures would be caused mostly by things people do, mostly by natural causes, or about equally by things people do and by natural causes?”

interpretation of these results, I report average marginal effects in addition to the probit coefficients.<sup>17</sup>

**Table 4.3. Probit average marginal effects of IVs on belief that GW has human or natural causes**

	<u>Natural</u>		<u>Human</u>	
	Probit coeffs.	Avg. marginal effects	Probit coeffs.	Avg. marginal effects
Democrat	0.05 (0.25)	0.01 (0.06)	0.03 (0.17)	0.01 (0.05)
Ind. Democrat		(omitted)	0.18 (0.22)	0.06 (0.07)
Republican	0.49* (0.23)	0.11* (0.05)	-0.31 (0.18)	-0.10 (0.06)
Ind. Republican	0.63* (0.26)	0.14* (0.06)	-0.52* (0.23)	-0.16* (0.07)
Education	0.01 (0.07)	0.003 (0.02)	0.02 (0.06)	0.01 (0.02)
Policy liberalism	-0.39*** (0.06)	-0.09*** (0.01)	0.31*** (0.05)	0.10*** (0.01)
Science knowledge	0.04 (0.34)	0.01 (0.10)	0.45 (0.29)	0.14 (0.10)
Science attitudes	0.10* (0.04)	0.02* (0.01)	-0.05 (0.03)	-0.02 (0.01)
Fundamentalism	0.06** (0.02)	0.01** (0.005)	-0.04* (0.02)	-0.01** (0.01)
Constant	-1.70*** (0.33)		-0.40 (0.25)	
Log likelihood		-249.11		-384.12
		LR $\chi^2$ (8)= 153.53		LR $\chi^2$ (9)= 154.70
% Correctly predicted		83.17%		71.57%
Observations		624		693

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<sup>17</sup> To estimate the marginal effects of all predictor variables, I used the command “`margins, dydx`” in STATA 12, which obtains margins of derivatives of responses. For comparison, I also estimated marginal effects at the means for all variables, and this did not substantively change the results.

Although fundamentalism had a statistically significant relationship with respondents' beliefs about human and natural causes, the effect was modest. In the context of the 11-point fundamentalism scale, the average marginal effect ( $b=0.01, p<0.01$ ) indicates that people at the extreme fundamentalist end of the scale were ten percentage points more likely to say GW has natural causes than people in the extreme secular position. One might expect fundamentalism to have had a greater impact since messages from some conservative elites frame GW's causes as a religious issue. A prominent instance is Senator James Inhofe's frequently stated views on the issue: i.e., that only God's intervention can affect the climate—and therefore, that "The arrogance of people to think that we, human beings, would be able to change what He is doing in the climate" is "outrageous" (Bruenig 2015).

Further, scientific knowledge was more important than science attitudes for believing that GW has human causes (though it is important to recognize that believing in human causes might be endogenous with scientific knowledge). While the effects of science attitudes were rather small for beliefs about GW's causes, the direction of these effects is unexpected: more positive attitudes were associated with believing GW is mostly natural, whereas more pessimistic attitudes about science were associated with thinking GW is mostly caused by humans. Though counterintuitive, these results could indicate that people who are enthusiastic about scientific progress also think that concerns about anthropogenic CC overstate the negative impacts of science and technology. Conversely, people with reservations about the consequences of scientific progress do not necessarily doubt scientific expertise about anthropogenic climate change; they may, in fact, be inclined towards more "alarmist" views on the issue. This is not an argument I have seen made elsewhere in studies on climate change beliefs, but the present results indicate that further investigation into the various dimensions of science attitudes is warranted, as

general optimism about scientific progress may not align in intuitive ways with trust in scientific expertise and views on scientific issues.

Compared to fundamentalism and attitudes about science, Republican partisanship and political ideology (as represented by policy liberalism) mattered more for beliefs about CC's causes. Republicans were 10 percentage points less likely than others to say that warming is caused "mostly by the things people do" ( $p = 0.07$ ) and 11% more likely to say it has natural causes ( $p < 0.05$ ). Independent Republicans took a stronger stance—they were 16% less likely to say humans cause GW ( $p < 0.05$ ) and 14% more likely to say it has natural causes ( $p < 0.05$ ). In contrast, Democrats and independent Democrats were not more likely than others to say GW has human causes. The issue of GW's causes thus seems to be particularly politicized among Republicans and Republican leaners—while the non-effects of Democratic partisanship indicate that Democratic elites (with notable exceptions like former Vice President Al Gore) may not be communicating as much or as effectively about the issue as Republican elites have with their constituencies.

Policy liberalism was, however, associated with beliefs about GW's causes, indicating that issue is "politicized" not only as a result of partisan Republican messaging, but that ideological predispositions also play a role. Each one-unit increment in the (5-point) liberalism index was associated with a 10% increased probability of saying GW has human causes, and a corresponding decrease in the probability of saying GW has natural causes. Put another way, a complete shift from the most extreme conservative to the most liberal position on the scale increased the probability a person would think GW is anthropogenic by 40% (and decreased the likelihood of attributing GW to natural causes by 36%).

### *Certainty that GW is happening*

Next, I use OLS regression to examine how the key independent variables affect people's certainty that global temperatures are (or are not) rising (Table 4.4). Since people's beliefs about the causes of GW may influence their beliefs about its existence, the regression model includes the two binary variables for attribution to human and natural causes as independent variables. Including these variables also helps distinguish between the effects of people's beliefs about climate change and their knowledge and attitudes about science more broadly.<sup>18</sup>

As in the previous analysis, fundamentalism and science attitudes had statistically significant but substantively small effects. More impressive were the effects of scientific knowledge ( $b = 1.43, p < 0.001$ ), of attributing GW (if it is happening at all) to natural causes ( $b = -1.24, p < 0.001$ ), and attributing it to human causes ( $b = 0.51, p < 0.01$ ). Since the scientific knowledge scale uses items about foundational concepts that people typically acquire through formal schooling, most adults will have acquired such knowledge before they evaluate specific issues like CC; its large coefficient here supports the idea that learning and knowing about basic scientific concepts equips people to understand, at least in basic terms, evidence for scientific discoveries like the anthropogenic greenhouse effect even if they are not experts on the topic.

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<sup>18</sup> Beliefs about CC's causes are, unfortunately, endogenous with beliefs about its existence. As I described earlier (footnote 12), the survey *first* asked respondents if they believe temperatures are rising, and secondly, about GW's causes. If a person has some cognitive incentive to doubt that GW is happening (for instance, they oppose regulatory climate policies), they probably will not say that GW could have human causes—as this could imply the need for humans to reduce fossil fuel emissions. To move forward with the analysis, nevertheless, the present model assumes that how people think about a problem's causes (in theory) influences their beliefs about whether the problem exists.

**Table 4.4. OLS Regression analysis predicting certainty that world temperature is rising**

	B	SE
Democrat	0.84***	(0.22)
Ind. Democrat	0.67*	(0.29)
Republican	0.09	(0.23)
Ind. Republican	0.74*	(0.29)
Policy liberalism	0.30***	(0.06)
Education	-0.02	(0.07)
Science knowledge	1.43***	(0.37)
Science attitudes	0.11**	(0.04)
Fundamentalism	-0.05*	(0.02)
Human causes	0.51**	(0.15)
Natural causes	-1.24***	(0.19)
Constant	0.32	(0.32)
<i>N</i> = 692		
<i>R</i> <sup>2</sup> = 0.36		

Standard errors in parentheses.

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05

Dependent variable scale: -4 to 4

While scientific knowledge was associated with “correct” knowledge about GW’s causes (Table 4.3) and existence (Table 4.4), the variables for human and natural causes still had strong independent effects here. This indicates that among ordinary citizens, views about climate change do not just reflect “correct” or “incorrect” factual knowledge deduced from abstract scientific principles. Rather, people’s perceptions of the issue also represent what I have been referring to as “factual beliefs.” Though the directionality of these beliefs about CC (vis-à-vis one another) cannot be determined from the present dataset, it is clear that people tend to know what positions “go with” other positions on the issue: thus, people who thought GW is anthropogenic were also more certain it is happening, and, contrary to prevailing scientific consensus, Republicans, Independent Republicans, conservatives tended to say that GW has natural causes (Table 4.3), and those who attributed it to natural causes were much more skeptical about whether it is happening (Table 4.4). Taken together with the foregoing analysis,

the results here indicate that people's beliefs about GW's causes might be one component of a bigger bundle of issue-specific, endogenous beliefs about the issue that support or reinforce one another. In other words, causal explanations for GW are strongly related to people's judgments about whether GW is happening—but causal explanations might also inform (or more accurately, they might justify) beliefs about GW's existence, especially for those who are certain that GW is not happening and do not think it is anthropogenic.

#### *GW's severity*

Another multiple regression analysis examined people's judgments about how bad GW will be (Table 4.5).<sup>19</sup> This model uses the same independent variables as the previous analysis, with the addition of the variable for certainty about GW's existence.

Table 4.5 shows that fundamentalism had a statistically significant but very small, negative effect on people's judgments about how bad GW will be. Attitudes about science did not affect these judgments at all. As above, interestingly, people's attributions to human or natural causes were particularly important for their views about its severity. While the previous analysis (Table 4.4 above) found that the people who did *not* think humans cause GW were also very certain it is not happening, in the present model, the people who *do* think GW is anthropogenic were most opinionated or alarmed about its severity ( $b = 0.80, p < 0.001$ ). People with more scientific knowledge and Democrats were also more likely to think GW will be very bad (respectively,  $b = 0.54$  and  $0.33, p < 0.05$  for both). But these variables were less important

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<sup>19</sup> Respondents were asked if GW would be “good, bad, or neither good nor bad,” and then, if it would be slightly, moderately, or extremely good or bad. As in the previous chapter, response categories range from 0 (“Good” and “Neither good nor bad”) to 3 (“Extremely bad”). There were so few people who said that GW would be “good” that they were not coded as a discrete group.

than believing that GW has human causes—the effect of Democratic partisanship was almost 2.5 times smaller than that from attributing GW to human causes. It is also notable that the other political variables were only modestly associated with judgments about GW's severity.

**Table 4.5. OLS Regression analysis predicting perception of GW severity**

	B	SE
Democrat	0.33*	0.13
Ind. Democrat	0.19	0.16
Republican	0.16	0.13
Ind. Republican	0.14	0.17
Policy liberalism	0.02	0.04
Education	0.06	0.04
Science knowledge	0.54*	0.21
Science attitudes	0.01	0.02
Fundamentalism	-0.03*	0.01
Human causes	0.80***	0.09
Natural causes	-0.37**	0.12
GW happening	0.17***	0.02
Constant	0.39*	0.19
<i>N</i> = 692		
<i>R</i> <sup>2</sup> = 0.43		

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

Dependent variable scale: 0–3

Overall, then, the question of GW's severity seemed much more salient for people who think it is anthropogenic than for those who doubted it has human causes. As above, both GW “believers” and “skeptics” tended to hold beliefs that are mutually reinforcing. Those who think GW is happening and that humans are responsible had a heightened sense of GW's severity; and even those who do not think it is happening still denied that hypothetically, it might have human causes or that its consequences could be very bad.

### *Skepticism about GW's severity*

As a counterpoint to the measure asking “how bad” GW will be, I use another dependent variable asking about the dangers of GW, but that frames the issue in skeptical language. Respondents indicated if they agree that “The dangers of global warming are being overemphasized for political reasons” on an 11-point scale.<sup>20</sup> This wording echoes discourses that frame concern about CC as an alarmist facade for expanded government regulation. Though the statement explicitly invokes political motives, it presents a skeptical view that has been promulgated by both prominent religious leaders and conservative and partisan elites. I use this item as the dependent variable in an OLS regression to investigate how strongly this view is associated with religious beliefs, science attitudes, and political identity.

Table 4.6 displays the results. Compared to the previous analyses in which the dependent variables were worded more neutrally, here there was a bit more support for the hypothesis that fundamentalism deepens GW skepticism ( $b = -0.14, p < 0.001$ ). Comparing the most and the least fundamentalist respondents, the former tended to be more skeptical by 1.4 points (on the eleven-point scale). Science attitudes also played a bigger role here ( $b = 0.18, p < 0.01$ ) than they did above for beliefs about GW’s causes, existence, and severity. Comparing the extreme ends of the index (which ranges from -3.4–5), those with the most pessimistic attitudes about science were more skeptical about CC by about 1.5 points than people with the most positive science attitudes.

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<sup>20</sup> This item was reverse-coded to cohere with the coding scheme throughout the study, in which lower numbers correspond to skeptical stances. This variable ranges from -5 (Completely agree that GW is politicized) to 5 (Completely disagree that GW is politicized).

**Table 4.6. OLS Regression Analysis Predicting Perception that GW is Politicized**

	B	SE
Democrat	0.85*	0.33
Ind. Democrat	0.37	0.42
Republican	-0.08	0.33
Ind. Republican	-0.50	0.42
Policy liberalism	0.57***	0.10
Education	0.01	0.11
Science knowledge	-0.91	0.55
Science attitudes	0.18**	0.06
Fundamentalism	-0.14***	0.03
Human causes	1.48***	0.23
Natural causes	-1.91***	0.30
GW happening	0.35***	0.06
Constant	-0.61	0.47
N	662	
R <sup>2</sup>	0.56	

“The dangers of global warming have been overemphasized for political reasons” (Scale: -5 to 5)

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05

People’s beliefs about GW’s causes were more strongly related to GW skepticism than any of the other independent variables. Thinking GW has natural causes was associated with a 1.91-point shift towards the skeptical end of the response scale, and thinking it has human causes was associated with a 1.48-point shift in the less skeptical direction. (Since these variables are dichotomous, the coefficients are the same as the effect size.)

In light of the skeptical wording of the dependent variable (which echoes conservative elites messages) it is interesting that Democrats rejected the statement more strongly than Republicans endorsed it. (Looking back at Table 4.3, it may be that the present effects of Republican partisanship are moderated by the belief that GW has mostly natural causes.) Policy liberals were also significantly less likely to think that GW is politicized ( $b = 0.57, p < 0.001$ ).

Overall, these results reinforce the idea that people's causal attributions for GW are enmeshed with their opinions about other dimensions of the issue. The directionality of these opinions, however, has an ambiguous chicken-and-egg quality. As we saw above (Table 4.5), people who attributed GW to human causes also had more severe judgments of its consequences. Here, people who said GW has natural causes were more convinced that its dangers are overblown. Some respondents may simply believe that natural GW is less hazardous than anthropogenic GW; but for many, the perception that GW is politicized appears to come hand-in-hand with skepticism about human causes.

### *Policy opinions*

Lastly, I examine the effects of the IVs on support for the three hypothetical emissions policies I described in the previous chapter.<sup>21</sup> Table 4.7 displays the results of three OLS analyses corresponding to the three policies. Overall, fundamentalism was only weakly associated with policy support. It was strongest with regard to the gas tax, and as one would expect in light of the policy's general unpopularity, there was a negative relationship between the two ( $b = -0.06, p < 0.05$ ). Science attitudes did not have any notable effects—and thus, people's general enthusiasm or pessimism about science does not appear to influence how they think about policies to deal with the particular scientific issue of climate change.

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<sup>21</sup> Responses on the policy questions are coded to range from -3 ("Oppose a great deal") to 3 ("Favor a great deal").

**Table 4.7. OLS regression analyses predicting support for GW mitigation policies**

	Cap power plant emissions	Improve fuel economy	Raise gas taxes
Democrat	0.31 (0.20)	0.02 (0.16)	0.36 (0.26)
Ind. Democrat	0.09 (0.25)	0.02 (0.21)	-0.23 (0.33)
Republican	0.35 (0.20)	-0.13 (0.17)	-0.11 (0.26)
Ind. Republican	0.41 (0.25)	0.08 (0.21)	0.28 (0.33)
Policy liberalism	0.31*** (0.06)	0.26*** (0.05)	0.27*** (0.07)
Education	-0.03 (0.06)	0.03 (0.05)	0.42*** (0.08)
Science knowledge	0.30 (0.32)	-0.03 (0.27)	0.96* (0.42)
Science attitudes	0.04 (0.04)	-0.03 (0.03)	0.01 (0.05)
Fundamentalism	0.01 (0.02)	0.04* (0.02)	-0.06* (0.02)
Human causes	-0.14 (0.14)	-0.26* (0.12)	0.35 (0.19)
Natural causes	-1.00*** (0.17)	-0.75*** (0.15)	-0.56* (0.23)
GW happening	0.08* (0.03)	0.08** (0.03)	-0.01 (0.05)
GW will be bad	0.37*** (0.06)	0.27*** (0.05)	0.07 (0.08)
Constant	0.79** (0.28)	1.96*** (0.23)	-3.49*** (0.37)
<i>N</i> = 692			
<i>R</i> <sup>2</sup>	0.34	0.31	0.24

Standard errors in parentheses.

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05

Dependent variable scaled -3 to 3.

People who did not attribute GW to human causes also opposed all three policies.

Interestingly, while the general sample supported the measures to cap industrial emissions and improve fuel economy, and opposed higher gas taxes, the people who said GW has natural

causes opposed the policies affecting power plants ( $b = -1.00, p < 0.001$ ) and automakers ( $b = -0.75, p < 0.001$ ) more strongly than they opposed the gas tax ( $b = -0.56, p < 0.05$ ). It is logical that respondents who do not think anthropogenic emissions cause GW also do not support policies to reduce such emissions. Yet it is less obvious why they are more strongly opposed to the policies that would target industries than the one that would impact consumers directly. People who anticipated more severe consequences from GW supported the policies to reduce industrial and tailpipe emissions ( $b = 0.37$  and  $0.27$  respectively,  $p < 0.001$  for both), but they stopped short of supporting the gas tax. Thus, whatever risks these citizens associated with CC may be too distant from their daily lives to make them willing to pay personal costs for CC mitigation. Interestingly, as in the previous chapter, the only variable that had a notably positive impact on all three policies was policy liberalism. Further, as in the foregoing chapter, scientific knowledge and education were particularly relevant for supporting the gas tax, but were not consequential for the other policies.

## **Discussion and Conclusion**

While Christian fundamentalists perennially clash with scientific experts on some issues (like evolution vs. creationism), the present findings indicate that they do not have disproportionately negative attitudes about general scientific progress. When these believers consider whether science and technology have positive social consequences, they are unlikely to oppose organized scientific inquiry. This finding coheres with Funk and Alper's study (2015) in which most people of faith, including those known to be most conservative (white evangelical Protestants), did not think their personal religious beliefs conflict with science. The items used to measure science attitudes here (e.g., "Science and technology are making our lives healthier,

easier, and more comfortable") evoke scientific progress in a way that most citizens do not find objectionable, especially outside the context of specific science controversies. Thus, most people of faith—including fundamentalists with relatively orthodox beliefs—seem able to take an accommodationist position that allows religion and scientific discovery to coexist without facing undue cognitive dissonance.

This indicates the need to complicate the idea of what, exactly, “anti-science” beliefs and attitudes are. As Coyne argues, accommodationist views are often self-serving attempts to make the irreconcilable ontological and epistemic assumptions of science and faith appear compatible (2015). I do not take issue with Coyne’s central argument that the public welfare suffers when faith-based rhetoric obstructs policymaking processes that should be based on the best available scientific expertise. But this chapter’s analyses indicated that many citizens are enthusiastic about scientific discovery even if they hold beliefs that are logically incompatible with scientific materialism.

To gain a better understanding of how science and religion function as cultural, public authorities, it would be helpful to extend the analysis in the first part of this study to evaluate how people of faith think about other dimensions of organized science, including the moral implications scientific advances. Religious fundamentalists might express more skeptical attitudes than I found here if they were asked about their trust in scientists, scientific institutions, and the proper role of scientific expertise in policymaking. Further, when I analyzed the item that framed science and faith as tradeoffs, people with stronger fundamentalist beliefs were significantly more likely to say that society depends too much on science rather than faith. Thus while these respondents did not have negative attitudes about scientific progress, they seemed aware of, and less comfortable with, tensions between scientific and religious worldviews.

The second part of this chapter showed that by and large, traditionalist religious worldviews did not account for skepticism about climate change's existence, causes, and severity, or opinions about climate policies. Thus, although there are well-documented tensions between Christian communities and scientific experts on issues that more clearly challenge Christian moral ideals, fundamentalist beliefs do not strongly influence how people perceive all issues that are province of scientific and technical expertise. People's attitudes about science also did not determine their beliefs and opinions about climate change. There was one exception to this: people who were more optimistic about science were somewhat more certain that global temperatures are rising.

The key findings here, rather, have to do with the ways in which people's opinions and beliefs about climate change "go together," and how they are related to support for CC mitigation policies. There were strong relationships between people's beliefs about CC's causes and their views about whether it is happening, how bad it will be, if the issue is exaggerated, and climate policies. Whether or not people's factual beliefs aligned with the current scientific consensus, both skeptical and "convinced" positions tended to go together in systematic ways. People who were relatively certain that global temperatures are *not* rising were also very unlikely to say that, even hypothetically, GW could have human causes (Table 4.4). In turn, those who attributed GW to natural (rather than human) causes also tended to say that the dangers of warming are overemphasized for political reasons, and to oppose mitigation policies. On the other side, respondents who attributed CC to human causes thought it would have more severe consequences, and did not think these consequences have been politicized.

These results indicate that people tend to hold a set of mutually reinforcing views about climate change—and the tenor of these views (i.e., whether one is more skeptical as opposed to

concerned about the issue) is anchored in causal attributions for the phenomenon. There is, however, an interesting asymmetry between “believers” and skeptics in terms of the relationship between their CC beliefs and support for climate policies. As described above, people who thought GW has natural causes also opposed all three mitigation policies. This makes logical sense: regardless of whether these respondents thought CC is happening, they should not see any reason to limit anthropogenic greenhouse gases. But respondents who said GW has mostly human causes had weaker and less straightforward opinions about the policies (see Table 4.7). Surprisingly, they did not support the (otherwise popular) policies to reduce emissions from power plants and new cars, but they did show a little bit of support for higher gas taxes. Among CC skeptics, then, there was a clearer connection between beliefs about the issue and policy opinions.

These results, I believe, give credence to the metaphor of political reasoning as a two-way street on which reasoning operates both forwards and backwards (Sniderman et al. 1986). As I argued in previous chapter, skeptical discourses about climate change often invoke scientific uncertainty—but the real stakes of these controversies have less to do with scientific certitude, and more to do with partisan and ideological opposition to proposed climate policies. From the standpoint of motivated cognition, citizens who are ideologically opposed to regulatory climate policies are unlikely to “reason forwards” from factual or scientific information about the problem’s causes to opinions about proposed solutions. Rather, their beliefs about the problem’s causes and consequences more likely fall into line to maintain consistency with the preferred solution. That this is less readily apparent among people who think CC is real, anthropogenic, and problematic is not to say that they are less ideologically motivated. But since these citizens’ beliefs align with mainstream scientific consensus on the issue, it is harder to tell apart those

whose views are motivated by symbolic cues or affective factors from those who reason forward from factual scientific knowledge. Still, this chapter’s final analysis (Table 4.7) and the previous chapter’s SEM analyses provide support for the view that motivated reasoning informs opinions about CC and related policies: people who scored higher on the policy liberalism index supported all three CC mitigation policies. The SEM analysis above showed that these are the direct effects of policy liberalism, and not the indirect effects of prior beliefs about GW’s existence and severity.

There is a further reason that among CC “believers,” domain-specific beliefs about the issue are not related to policy opinions as systematically as among skeptics. For conservatives, climate policies contain cues that serve as affective heuristics—for instance, they might associate the proposal to limit power plant emissions with the negative political outcome of expanded regulation of private industries. But while liberals are more likely to believe CC is real and concerning, it is unlikely that this is *because* they support the policy solutions that conservatives oppose. Rather, more liberal citizens might have broad pro-environmental attitudes that extend to climate change; or, they may associate climate change with corporate irresponsibility and emissions from big industries, even if they do not have clear opinions about what should be done to mitigate these problems.

Chapter 4 Appendix

**Table 4.8: Correlation coefficients of all variables used in Chapter 4**

## **Chapter 5: Conclusion**

This dissertation's theoretical and empirical investigations have several implications for those engaged in political outreach and public communication about climate change. Notably, the data examined here indicate that what was once a more contested dimension of the issue—that is, whether climate change exists—has become more socially accepted over time. The ANES data used in Chapters 3 and 4 showed that in 2008, 86% of Americans thought that global temperatures are probably rising. The data also indicated that while there is some disagreement over climate change's severity, about two-thirds of Americans said GW would be at least slightly, if not moderately or extremely, bad (and almost no one said that global warming would be good). As with many environmental issues, then, the public expresses a generalized concern about climate change. But it is important to keep in mind that environmental problems, and especially an invisible one like climate change, do not command a sizeable issue public that prioritizes these issues over other national concerns. Thus, pro-mitigation messages that focus on climate change's existence or its distant consequences may temporarily bring the issue into citizens' minds. Yet such messages might also be a wasted opportunity to interact with the public by addressing those aspects of the issue that are more disputed or salient for ordinary citizens.

Indeed, the results presented in this project indicated that while most people thought GW is happening and expressed at least some concern about its consequences, these views did not always translate into heightened support for emissions reduction policies intended to mitigate climate change. The strength of citizens' support for these policies, rather, was related to the policies' associated costs. Of the three policies examined in Chapters 3 and 4, most citizens were unwilling to support the one that had direct and immediate costs for consumers. The notable exception to this trend, however, was among people who have a working store of scientific

knowledge. In Chapter 4, I verified that it is scientific knowledge, and not a general pro- or anti-science sentiment, that impacted people's GW views: regardless of their scientific knowledge, most citizens held science in high regard when asked about its everyday and future social impacts. But this approval did not predict beliefs about GW or support for emissions policies.

By and large, then, citizens do not express skepticism about GW or about science more broadly. But the varying levels of public support for different emissions policies indicates that although people express abstract concern about GW's consequences, the problem is not imminent or pressing enough that they feel compelled to pay for mitigation. Their views about the problem of climate change, in other words, are somewhat distinct from their stances on policies to deal with the problem.

These conclusions have both positive and negative implications for social and environmental advocates who seek public support for short-term action on climate change. On the positive side, although public polarization over climate change has followed the direction of elite political polarization over time, Republican citizens are not overwhelmingly receptive or attuned to Republican elites' skeptical messages on the issue. That is, at the mass level, partisan polarization over CC does not reflect the intensity of stark Congressional partisan divides on the issue. It is also encouraging that despite the politicization of climate science (in which pro- and anti-mitigation camps battle over whose interpretation of scientific evidence is more legitimate), scientific consensus on CC's reality and severity has nevertheless become more publically accepted, and less contested, over time.

On the negative side, the analyses presented above indicate that both political predispositions and personal self-interest are important for how people perceive solutions to climate change, and most likely, for how they even define the problem. Thus, if people do not

feel personally threatened by climate change—or feel threatened only episodically in the wake of record temperatures or severe weather events—it will be difficult to engage them on the issue if proposed solutions levy personal costs, or if they are perceived to have political, geopolitical, or economic tradeoffs. Though these conclusions pose formidable challenges for environmental advocates, I will conclude with three final observations or recommendations relevant to the success of communications and public deliberations about climate change.

First, people are more likely to register and perceive such communications as important to the extent that they are address not just climate change, but also more visible local problems. Ansolabehere and Konisky (2014) found that people's preferences for particular energy sources are more strongly associated with the proximal, observable costs of energy production than with a source's potential to reduce climate change. Though their longitudinal survey data (like my cross-sectional data) found consistent public concern about climate change, people's environmental priorities were nevertheless more focused on local environmental harms such as air and water pollution. Citizens were also more concerned about local health risks from the "co-pollutants" of carbon that are present in many fuels (e.g., particulates, sulfur, and mercury), and supported legislative action to restrict these pollutants—even when they reduced the use of coal and oil. As the authors put it, "[t]he public today cares much more about local environmental harms from the energy system precisely because the social cost of those harms far exceeds the present value to society of the cost climate change in decades to come. The advocates of climate policy have been so focused on this problem unto itself that they often miss this important insight" (Ansobalabehere and Konisky 2014, 198). Or, more concisely: "Energy is the climate problem, but climate is not an energy problem" (154). Thus, if energy and emissions policies promise not only to mitigate climate change but also to alleviate local or regional environmental

and health problems, it is important for local environmental advocates identify and emphasize these benefits to the public.

Secondly and relatedly, to the extent that energy policies can be crafted to provide citizens with economic benefits, rather than costs, they will garner broader public support. Alaska's popular "cap and dividend" system, for instance, yields direct economic benefits for ordinary citizens: this model taxes carbon-based energy producers and importers, and redistributes the revenue via "dividend" checks to each Alaskan citizen (Skocpol 2013, 123-4). Because lower-income families' dividends add up to a greater proportion of their income than more privileged families, Alaska has one of the most equal income distributions in the country. Thus Skocpol points out that "[p]opularly rooted organizations like labor unions, churches, and old people's associations might rally behind such an approach, because it is economically just in its impact," rather than pursuing approaches that reinforce public views of environmentalists as appealing "mostly to white, upper-middle-class educated citizens" (2013, 125-6). Moreover, offering citizens concrete economic help "makes it possible to speak with average citizens about what they might gain as well as pay during the transitional period of increasing prices of energy from carbon sources" in a way that "would not have to rest only on pie-in-the sky green energy jobs," the promise of which may not be powerful enough to counter skeptical messages or inspire widespread political support (Skocpol 2013, 125-6).<sup>1</sup>

Lastly, I found that scientific knowledge had a strong, direct on citizens' support for increased gasoline taxes, which indicates that such knowledge is important not only for public opinion, but for citizens' behavioral intentions and their willingness to pay for CC mitigation. At

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<sup>1</sup> A major difficulty to implementing such an approach, however, is that elected officials do not typically support initiatives that require them to relinquish autonomy over public funds (Skocpol 2013).

the same time, the results of this project indicated that educating citizens about climate change's existence and severity, or encouraging them to adopt pro-science attitudes, is unlikely to substantially elevate support for policies that would raise taxes. Environmental advocates thus face the systemic educational challenge of how to foster widespread and publically shared knowledge about foundational scientific concepts. Commenting on the knowledge needed to understand contemporary scientific debates, Miller (2004; 2010) defines "civic scientific literacy" as requiring the level of understanding necessary to read and comprehend the Tuesday science section of the *New York Times* or science reporting in a comparable major paper. More specifically, this requires understanding the following key concepts: the nature of scientific inquiry (e.g., understanding the scientific processes that delineate science from pseudo-science), the meaning of experimentation (e.g., the logic underlying experimental designs with treatment and control groups), a basic understanding of probability (e.g., to understand the results of medical research and diagnoses presented in probability terms), and a nominal understanding of core science constructs such as radiation, DNA, the nature of the universe, and the structure of matter (Miller 2004).

Though no scientific policy issue that enters the public arena will require people to know about all of these concepts, together they comprise a basic scientific vocabulary that facilitates how well one is able to understand what is at stake in major policy debates over issues like climate change, stem cell research, genetically modified food, or the siting of radioactive waste facilities (Miller 2004; 2010). Such a basic inventory of knowledge is also important for understanding the importance of news about scientific discoveries like the recent and unprecedented direct detection of gravitational waves. Although ordinary citizens cannot be expected to understand such discoveries on a deep astrophysical or metaphysical level,

possessing a baseline level of “civic scientific literacy” would make clearer the transformational magnitude of such scientific advances.

It is beyond the scope of this project to delve deeper into the means by which childhood and adult science education might attain the ideal of such far-reaching civic scientific literacy. But until such an ideal can be achieved and potentially bring about longer-term changes in citizens’ views about anthropogenic climate change, large-scale shifts in public beliefs and behaviors are most likely to result from communications that make the issue more locally relevant, and that identify and directly address the symbolic and economic costs that citizens associate with extant climate change mitigation policies.

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