Received Date: 18/06/2014

Article Type: Original Article

Examining the Effectiveness of Climate Change Frames in the Face of a Climate Change Denial Counter-Frame*

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Keywords

climate change; framing; counter-framing; denial; experiment

Acknowledgements

This work was supported by a grant from the National Science Foundation (SES-1123762), by the National Oceanic and Atmospheric Administration's Climate Program Office through Grant NA10OAR4310213 with the Great Lakes Integrated Sciences and Assessments (GLISA) Center at Michigan State University and the University of Michigan, and by Michigan State University AgBio Research.

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Abstract

Prior research on the influence of various ways of framing anthropogenic climate change (ACC) do not account for the organized ACC denial in the US media and popular culture likely overestimating these frames' influence in the general public. We conducted an experiment to examine how Americans' ACC views are influenced by four promising frames for urging action on ACC (economic opportunity, national security, Christian stewardship, and public health)—when these frames appear with an ACC denial counter-frame. This is the first direct test of how exposure to an ACC denial message influences Americans' ACC views. Overall these four positive frames have little to no effect on ACC beliefs. But, exposure to an ACC denial counter-frame does significantly reduce respondents' belief in the reality of ACC, belief about the veracity of climate science, awareness of the consequences of ACC, and support for aggressively attempting to reduce our nation's GHG emissions in the near future. Further, as expected by the Anti-Reflexivity Thesis, exposure to the ACC denial counter-frame has a disproportionate influence on the ACC views of conservatives (than on those of moderates and liberals), effectively activating conservatives' underlying propensity for anti-reflexivity.

1. Introduction

Since the early 2000s, many anthropogenic climate change (ACC) communicators (e.g., climate scientists, environmental activists, environmental/science journalists, and sympathetic policy-makers) have come to realize that a more nuanced strategy than just conveying scientific facts is necessary for increasing public acceptance of the evidence of ACC and public support for dealing with ACC. A prominent aspect of such a communication strategy involves framing messages in ways that resonate with the general public—or certain segments of the general public (e.g., Gore, 2006; Moser & Dilling, 2004; Nisbet, 2009; Nisbet & Mooney, 2007; Revkin, 2009). At least some of the motivation for this interest in framing is a desire to counteract, or at least neutralize, the influence of organized ACC denial, which has become entrenched in the United States over the last two decades (Dunlap & McCright, 2010, 2011; McCright & Dunlap, 2010; Michaels, 2008; Oreskes & Conway, 2010).

Previous analyses of the influence of various ways of framing ACC (e.g., Lockwood, 2011; Myers et al., 2012) do not take into account the organized ACC denial widely present in the US media and popular culture (e.g., Antilla, 2005; Dunlap & McCright, 2011; McCright & Dunlap, 2010; Painter & Ashe, 2012), likely overestimating the influence that these frames may have in the general public. To address this, we conducted an experiment to examine how Americans' ACC views are influenced by four promising frames for urging action on ACC (economic opportunity, national security, Christian stewardship, and public health)—when these frames appear with an ACC denial counter-frame. As such, this is the first direct test of how exposure to an ACC denial message influences Americans' ACC views.

In the next section, we first elaborate on the recent call for more positively framing ACC to the American public before then reviewing those existing studies of the influence of ACC framing. We end the next section with a brief discussion of the Anti-Reflexivity Thesis (McCright & Dunlap, 2010), which explains the rise of ACC denial and which places our focus on the ACC denial counter-frame in theoretical context.

2. Background

In recent years, ACC communicators have embraced the potential of framing techniques for shifting Americans' ACC views. Moser and Dilling (2004, p. 41) assert the efficacy of framing in a rather matter-of-fact fashion, "If a problem and the actions people can take to help solve it are framed in ways that resonate with cultural values and beliefs, people are more likely to take the action than if they are not. For example, Americans deeply resonate with notions of competitiveness, leadership, ingenuity, and innovation." Nisbet (2009, p. 14) also captures this sentiment quite optimistically, "Reframing the relevance of climate change in ways that connect to a broader coalition of Americans—and repeatedly communicating these new meanings through a variety of trusted media sources and opinion leaders—can generate the level of public engagement required for policy action."

Maibach et al. (2008, p. 497) argue for using a targeted approach of employing different frames for communicating with different segments of the American public:

> Choosing message frames for climate change that are consistent with the values of target groups is one important way to make the recommended behaviors or policies easier to accept. Conservation messages, for example, can use an economic frame (*This is an excellent way to save money*); an energy independence frame (*This is a means for our country to free itself from dependence on foreign oil*); a legacy frame (*This is a way to protect our children's future*); a stewardship frame (*This is how I honor my moral obligation to protect the abiding wonders and mystery of life*); a religious frame (*This is a way to serve God by protecting His creation*); or a nationalist frame (*Innovative technology will keep our nation's economy strong*). Each of these frames is likely to resonate more effectively with the values of different segments of people in the U.S.

To that end, other ACC communicators employ—or at least argue for the use of—messages advocating action on ACC with such frames as economic opportunity (Nordhaus & Shellenberger, 2007), national security (Biello, 2013; CNA Corporation, 2007; Werrell & Femia, 2013), Christian stewardship (Evangelical Environmental Network, 2011; Goodstein, 2006), and public health (Physicians for Social Responsibility, 2009; Public Health Institute, 2010). To date, however, little research has examined directly the influence of these frames on Americans' ACC views.

2.1. Earlier Studies of ACC Framing

Social scientists recently have begun to test the effectiveness of the different frames that ACC communicators employ (e.g., Feinberg & Willer, 2011; Gifford & Comeau, 2011; Hart, 2011; Hart & Nisbet, 2012; Lockwood, 2011; Morton et al., 2011; Myers et al., 2012; Spence & Pidgeon, 2010). Briefly, these studies demonstrate that positive frames in messages about ACC have at best only a modest influence on people's concern about ACC and support for dealing with the problem.

A few studies investigate the role of personal relevance regarding ACC by manipulating the physical or social distance from the effects of ACC (Hart & Nisbet, 2012; Spence & Pidgeon, 2010). While emphasizing local rather than distant impacts of ACC seems to have no influence on attitudes toward ACC mitigation, it actually decreases the perceived severity of ACC impacts (Spence & Pidgeon, 2010). Compared to a control condition, describing the potential victims of ACC as local and similar to you (low social distance) versus as distant and less similar to you (high social distance) has no overall influence on support for climate mitigation policy (Hart & Nisbet, 2012). Yet, examining the data more closely, Hart and Nisbet (2012) find that political party identification moderates the influence of message exposure on support for mitigation policy. Among Democrats, exposure to either low or high social distance messages increases support for climate mitigation policy. Among Republicans, exposure to a low social distance message has no influence on policy support, while exposure to a high social distance message decreases policy support—what Hart and Nisbet (2012) call a "boomerang effect."

Another study investigates the influence of two frames often employed in media stories.[1] In Hart's (2011) experiment, participants read a news story about the impact of ACC on polar bears, which was framed either episodically (i.e., about an individual polar bear) or thematically (i.e., with statistical evidence about polar bears more generally). Compared with exposure to an episodic frame, exposure to a thematic frame increases support for government policies to deal with ACC. Yet, this difference in framing has no influence on pro-environmental behavioral intentions.

Feinberg and Willer (2011) hypothesize that existing dire messages about ACC fail to increase concern and support for action because they threaten people's base need to believe the world is stable, ordered, and just. They find that exposing individuals to an optimistic message about ACC decreases their ACC skepticism. Also, exposing individuals to a dire message about ACC leads to increased ACC

[1] According to Iyengar (1991), issues are typically covered in news stories via an episodic frame (about how an issue affects a particular individual) or a thematic frame (about how an issue affects groups of individuals or society more generally).

skepticism, but only among those individuals who score high on an indicator measuring belief in a just world (Feinberg & Willer, 2011).

A few studies investigate the influence of emphasizing positive or negative attributes or outcomes of ACC (Gifford & Comeau, 2011; Morton et al., 2011; Spence & Pidgeon, 2010). Framing an ACC message in terms of the "gains" from mitigating ACC rather than the "losses" from not mitigating increases the perceived severity of ACC impacts and positive attitudes toward ACC mitigation (Spence & Pidgeon, 2010). Exposing individuals to a message highlighting the collective benefits of taking action on ACC rather than a message highlighting the individual sacrifice when taking action increases individuals' perceived competence to deal with ACC, ACC engagement, and behavioral intentions vis-à-vis ACC mitigation (Gifford & Comeau, 2011). Also, drawing upon risk perception scholarship, Morton et al. (2011) hypothesize that the relationship between how ACC uncertainty is presented and individuals' intentions to engage in ACC mitigation behaviors is moderated by whether a message highlights possible losses or the possibility of losses not happening. In a message highlighting possible losses from ACC, low uncertainty about ACC impacts produces a stronger willingness to act than does high uncertainty. In a message highlighting the possibility that losses will not occur, the level of uncertainty regarding ACC impacts does not influence individuals' intentions to act.

A final group of studies investigates the influence of different socio-cultural frames for promoting support for ACC action or renewable energy policy (Lockwood, 2011; Myers et al., 2012). Lockwood (2011) examines the efficacy of three frames (energy security, economic opportunity, and climate change) for promoting three related climate policies: the expansion of renewable energy, regulating for energy efficiency, and financial assistance for adaptation and mitigation in developing countries. Compared to a climate change frame (the control group), using an energy security frame or an economic opportunity frame has no influence on support for regulating for energy efficiency and for financial assistance for adaptation and mitigation in developing countries. Yet, compared to a climate change frame, an energy security frame increases and an economic opportunity frame decreases support for the expansion of renewable energy (Lockwood, 2011). Additional analyses suggests that the poor performance of the economic opportunity frame is likely due to skepticism that most of the jobs created would merely be outsourced to other countries. Myers et al. (2012) investigate the influence of three different frames that emphasize ACC risks to the environment, public health, or national security on individuals' feelings of hope and anger. A public health frame generates the most feelings of hope, followed by an environment frame, and then a national security frame; the order is reverse for generating feelings of anger (Myers et al., 2012).

However, none of the above studies test how positive frames for promoting concern about ACC or support for dealing with it perform in the face of an ACC denial counter-frame. This is a substantial

weakness since opponents of climate science and policy do not seem likely to sit idly by as proponents of climate policy employ new frames to influence public opinion (e.g., Dunlap & McCright, 2010, 2011; McCright & Dunlap, 2000, 2010; Oreskes & Conway, 2010). Only Aklin and Urpelainen (2013) investigate the performance of positive frames in the face of opposing counter-frames—albeit with a focus on messages about clean energy and not about ACC. They find that opposing counter-frames do indeed undermine the effects of positive frames.

Experiments to test the influence of positively framed ACC messages on the public's ACC views are likely to overestimate this influence unless they also include an ACC denial counter-frame likely to co-exist in the public discourse on ACC—especially in the U.S. context. Such an omission limits the external validity of earlier experiments, since the effects produced in a controlled context may not likely occur within the general public. We designed our experiment primarily with this in mind, so as to investigate the extent to which the anticipated effects of positive ACC frames withstand the opposing effects of a pervasive ACC denial counter-frame.

2.2. The Anti-Reflexivity Thesis and ACC Denial

Reflexive Modernization Theory (e.g., Beck, 1992; Cohen, 1997; Giddens, 1990; Mol & Spaargaren, 2000; see also Rosa, Renn, & McCright, 2014) characterizes the current era of late modernity as a distinct stage of advanced industrial capitalist society, where institutions suffer from legitimacy crises brought on by their inability to effectively solve the ecological and technological problems of modernization. Reflexive modernization scholars argue that a heightened level of reflexivity is necessary for getting past our current ecological and technological crises. In this sense, they define reflexivity as a form of critical self-evaluation—a self-confrontation with the unintended and unanticipated consequences of modernity's industrial capitalist system. Two prominent forces of reflexivity, which promote such societal self-confrontation, are social movements and science. Most notably, environmental activism and those scientific fields that examine ecological and health impacts of technologies and economic activities attempt to force societal recognition of, and action on, our major ecological and technological crises.

During these times of fundamental societal change, other sectors of society—for ideological and/or material reasons—mobilize to challenge the shift toward societal self-confrontation. Gleeson (2000) refers to this as a mobilization of "anti-reflexivity," because it attempts to defend the legitimacy of the industrial capitalist social system against the open-ended transformation of reflexive modernization. More specifically, this mobilization directly opposes those forces of reflexivity that identify problems caused by the industrial capitalist system and urge government action to deal with them.

The Anti-Reflexivity Thesis (McCright & Dunlap, 2010) has emerged in recent years to explain why certain sectors of advanced industrial society mobilize to defend the industrial capitalist system against

the claims of environmentalists and some environmental scientists that may lead to further government intervention into markets. A key strategy of anti-reflexivity is "manufacturing uncertainty," whereby defenders of the industrial capitalist system attempt to undermine or obfuscate public recognition of the scientific knowledge and methods that justify governmental regulation of economic activity (Dunlap & McCright, 2011; McCright & Dunlap, 2010; Michaels, 2006, 2008; Oreskes & Conway, 2010). To date, the Anti-Reflexivity Thesis has been utilized primarily to explain ACC denial activism (Dunlap & McCright, 2011; McCright & Dunlap, 2000, 2003, 2010), low levels of public acceptance of the reality and seriousness of ACC among self-identified conservatives and Republicans in the United States (McCright, 2011; McCright & Dunlap, 2011a, 2011b; McCright, Dunlap, & Xiao, 2013, 2014), and the ideological divide on trust in different areas of science (McCright, Dentzman, Charters, & Dietz, 2013).[2]

McCright and Dunlap (2010, 2011a, 2011b) argue that the most prominent manifestation of anti-reflexivity in the United States is the mobilization of the American conservative movement and fossil fuels industry to deny the reality and seriousness of ACC. This is likely because dealing with ACC poses a more fundamental challenge to the industrial capitalist system than does dealing with more localized problems of air and water pollution. The last two decades in the United States have seen an enduring conflict between those defining ACC as real and characterizing it as problematic (the scientific community, environmental organizations, and many Democratic policy-makers) and those defending the industrial capitalist system by challenging climate science and denying the seriousness of ACC (fossil fuels industry organizations, conservative think tanks, contrarian scientists, and many Republican policy-makers) (Lahsen, 2005, 2008; McCright, 2007; McCright & Dunlap, 2000, 2003, 2010; Michaels, 2008; Oreskes & Conway, 2010).

Turning to the general public, the Anti-Reflexivity Thesis explains why Right-leaning citizens more strongly embrace and promote anti-reflexivity than do Left-leaning citizens. Compared to liberals, conservatives more strongly justify and defend the existing industrial capitalist system against the claims of scientists and environmentalists that this system has produced significant problems—like ACC—in need of governmental solution (e.g., Feygina et al., 2010; Jost et al., 2008). The stronger embrace of anti-reflexivity on the Right than on the Left explains the well-known relationship between political orientation and ACC views in the US public. Self-identified conservatives and Republicans in the US general public are less accepting of the reality and seriousness of ACC than are their liberal and

[2] Further, the Anti-Reflexivity Thesis recently has been extended to climate politics in Canada and Australia (Young & Couthinho, 2014) and to conflicts over food safety in the United States (Stuart & Worosz, 2012).

Democratic counterparts (Borick & Rabe, 2010; Dietz et al., 2007; Hamilton, 2011; McCright, 2009; McCright & Dunlap, 2011b; McCright, Dunlap, & Xiao, 2013, 2014)—and this political divide has increased over time with growth of organized ACC denial efforts in the United States (McCright & Dunlap, 2011b). A similar pattern appears in Australia (Tranter, 2011), the United Kingdom (Clements, 2012; Poortinga et al., 2011; Whitmarsh, 2011), and a range of other countries around the world (Kvaløy et al., 2012; Tjernström & Tietenberg, 2008).

Despite suggestive results from earlier studies (e.g., Corner et al., 2012; Feldman et al., 2012; McCright & Dunlap, 2011a, 2011b), to date there has been no direct test of the extent to which the claims of organized ACC denial activists influence Americans' ACC views (see Ranney and Clark, 2015). Ours is the first experiment to do so. In the process, we test a specific claim of the Anti-Reflexivity Thesis, which expects that self-identified conservatives are more receptive to an ACC denial message than are moderates and liberals. That is, the Anti-Reflexivity Thesis predicts that exposure to an ACC denial counter-frame will have a disproportionate influence on the ACC views of self-identified conservatives by activating their latent propensity for anti-reflexivity.

3. The Study

3.1. The Sample

We administered a survey-based experiment via SurveyMonkey to U.S. residents recruited via Amazon Mechanical Turk (MTurk). MTurk is a crowdsourcing website where "requesters" solicit "workers" to perform human intelligence tasks (HITs) for pay. In recent years MTurk has emerged as a practical way for recruiting a large number of respondents for online experiments from a reasonably wide cross-section of the general public—considerably more diverse than the traditional experiment recruitment pool of university undergraduates (Berinsky et al., 2012; Buhrmester et al., 2011; Paolacci et al., 2010). According to Amazon Web Services (2013), MTurk has over 500,000 workers; according to Paolacci et al. (2010), 47% of them reside in the United States.

To solicit a broad cross-section of research participants and minimize self-selection by MTurk workers highly interested in ACC, we advertised an MTurk HIT titled "Your Attitudes about Important Social Issues in the US." We limited participation to adults residing in the United States. We paid participants $0.50 for completing the survey, which took slightly more than nine minutes on average. Compared to a representative sample of the US general public, our MTurk sample is more male, more highly educated, less religious, and more liberal/Democratic (see Table 1). The sample contains 1591 respondents who completed the entire survey (of the 1620 who began it) between February 28 and March 16, 2014. Only one item (income) had any non-response. For the 15 respondents (less than 1% of the sample) who did not answer our income question, we assigned them to that variable's median category.

—Table 1 about here—

3.2. The Experiment

After providing their consent to participate in our research study, respondents were randomly assigned to one of ten fabricated news articles about ACC (described below). After reading their news article, respondents answered three open-ended, comprehension questions asking them to identify the main point of the article and briefly summarize the reasons presented for why we should or should not deal with ACC. On the next page, respondents answered several sets of questions about the reality and seriousness of ACC. On a subsequent page, respondents answered a series of conventional social, demographic, and political background questions. On the final page, we thanked respondents for their participation and debriefed them about our research question.

Our experiment has a 5*2 factorial design with ten conditions. One factor is the presence of one of four positive frames for dealing with ACC: control condition (no frame), economic opportunity frame, national security frame, Christian stewardship frame, and public health frame. The control condition briefly mentioned a recent Intergovernmental Panel on Climate Change report and stated that many scientists, policy-makers, and other groups are urging us to reduce our greenhouse gas (GHG) emissions.

The four remaining conditions contained this control text plus a longer section with three detailed arguments for why dealing with ACC would be good for our national economy (303 words), national security (306 words), stewardship of God's creation (302 words), and public health (301 words), respectively. We formed the arguments in these four positive frames from ones actually employed by those ACC communicators we cited at the end of section 2 above.

The other (dichotomous) factor is the absence (control condition) or presence of an ACC denial counter-frame. The ACC denial text (142 words), which was located after the text for the first factor, briefly summarized the major claims promoted by ACC denial activists (e.g., McCright & Dunlap, 2000, 2003, 2010). The supplementary materials file contains the ten fabricated news articles used in the experiment.

3.3. The Variables

Table 2 contains key information on the wording and coding of the items used to create the outcome variables in our analyses. We employed four single-item indicators and four composite indicators. The four single-item indicators measure beliefs about the effects of policies to reduce our nation's GHG emissions on different aspects of our society. We asked respondents to indicate the effect ("extremely negative"=1 to "extremely positive"=7) that such policies would have on our *national economy*, our *national security*, our *stewardship of God's creation*, and our *public health*.

—Table 2 about here—

The four composite indicators measure more general ACC views. The survey items we used to create these indexes are all Likert-like items ranging from "strongly disagree" (1) to "strongly agree" (7). Individual items are coded or reverse-coded so that larger numerals represent similar attitudes or beliefs. *Beliefs about climate change* (Cronbach's alpha=.89) is a five-item index that measures the extent to which respondents believe in the reality of ACC. *Beliefs about climate science* (Cronbach's alpha=.91) is a five-item index that measures the extent to which respondents accept the scientific evidence for ACC and believe that scientists agree on ACC. *Awareness of climate change consequences* (Cronbach's alpha=.96) is a five-item index that measures the extent to which respondents are aware of the consequences of ACC for themselves, their families, other humans, and other species of plants and animals. *Support for greenhouse gas emissions reductions* (Cronbach's alpha=.91) is a six-item index that measures the extent to which respondents believe we should be aggressively attempting to reduce our nation's GHG emissions in the near future.

Our key predictors are dummy variables representing the experimental conditions to which respondents are exposed, with the control condition as a reference category. Central also are two indicators of political orientation. *Political ideology* is measured on a 7-point scale from "extremely conservative" (1) to "extremely liberal" (7), with "moderate" (4) in the middle. *Party identification* is measured on a 7-point scale from "strong Republican" (1) to "strong Democrat" (7), with "Independent" (4) in the middle.

We also employ eight demographic and social variables as statistical controls in our analysis. Four are dummy variables: *female* for gender ("male"=0; "female"=1); *white* for race ("non-white"=0; "white"=1); and *Christian* and *non-Christian* (with non-religious as the reference category) for religious affiliation. *Age* is measured with eight categories: "18-19"=1 to "80 and over"=8. *Education* is measured by the highest degree earned: "less than high school diploma or equivalent"=1 to "graduate/professional degree"=6. *Income* is measured as approximate yearly household income: "less than $25,000"=1 to "$100,000 or more"=5. *Religiosity* is measured as the frequency of attendance of religious services: "never"=1 to "more than once a week"=9.

3.4. Analytical Techniques

We first examine the effect of the four positive frames on the specific beliefs that policies to reduce our nation's GHG emissions will have a positive effect on key aspects of our society. Employing OLS regression analyses, we examine the extent to which each of the positive frames has an influence on its respective outcome variable, in the face of an ACC denial counter-frame and while controlling for potential correlates of ACC views. We initially analyze this in the full subsample for each combination of

experimental conditions. We then repeat our analyses on subsamples of respondents for whom the respective positive frames are likely most salient: economic heads of households for the economic opportunity frame; members of military families for the national security frame; self-identified Christians for the Christian stewardship frame; and respondents responsible for making most of their household's health care decisions (primary health care deciders) for the public health frame.

We then turn our attention to the four composite measures of general ACC views. Again, employing OLS regression analyses, we first examine the influence of the four positive frames on these ACC views before focusing in greater depth on the direct and indirect effects of the ACC denial counter-frame. That is, we not only examine the direct effect of exposure to an ACC denial counter-frame on these deeper ACC views, but we also examine the extent to which such exposure disproportionately triggers the anti-reflexivity of self-identified conservatives—as the Anti-Reflexivity Thesis predicts.

4. Results and Discussion

4.1. The Effectiveness of Four Positive Frames

Table 3 reports the results of OLS regression models predicting beliefs that policies to reduce our nation's GHG emissions will positively affect our national economy, our national security, our stewardship of God's creation, and our public health, respectively. Respondents exposed to the economic opportunity frame report that policies to reduce our nation's GHG emissions will have a stronger positive effect on our national economy than do respondents exposed to the control message. This effect seems to endure when respondents are also exposed to an ACC denial counter-frame.[3]

Respondents exposed to the national security frame report that GHG emissions reduction policies will more positively affect our national security than do respondents exposed to the control message, though this effect is weakened when respondents are also exposed to an ACC denial counter-frame.[4] These results suggest that either an economic opportunity frame or a national security frame might hold promise

[3] An F-test of the equality of coefficients shows that the coefficient for exposure to both the economic opportunity frame and the denial counter-frame is not significantly smaller than the coefficient for exposure only to the economic opportunity frame with p=0.06; F(1, 477)=3.62. While this does approach the conventional critical value of 0.05, we do note that across the study we are testing several dozen hypotheses about framing. Thus, it seems prudent to be relatively strict about a p value of 0.05, especially given current thinking on the use of probability levels (e.g., Johnson, 2013).

[4] These two coefficients are significantly different from each other: F(1, 467)=4.80; p=0.03.

for shifting Americans' ACC views—at least beliefs about the effects of GHG emissions reduction policies—in way that may withstand the opposing influence of ACC denial activism.

—Table 3 about here—

The other two positive frames do not have such an effect. Exposure to the Christian stewardship frame alone has no statistically significant influence on respondents' belief that GHG emissions reduction policies will be good for our stewardship of God's creation. But unexpectedly, the co-presence of this positive frame and the ACC denial counter-frame does have a positive influence.[5] Additional analysis shows that this effect is found only among non-religious respondents (who are overrepresented in our sample). That is, non-religious respondents seem to find this Christian stewardship frame particularly convincing, but only when juxtaposed against an ACC denial counter-frame. Future work is needed to make sense of this result, which may just be an anomaly of our sample.

While exposure to the public health frame alone has a statistically significant effect on respondents' belief that GHG emissions reduction policies will have a positive influence on our public health, this effect is no longer statistically significant in the co-presence of the ACC denial counter-frame.[6] These results suggest that neither a Christian stewardship frame nor a public health frame hold promise for shifting Americans' ACC views.

Earlier scholarship suggests that the influence of frames is positively related to their salience (e.g., Benford & Snow, 2000). That is, frames most likely produce their intended effect on individuals for whom the frames are highly salient. To investigate this, we ran an identical set of models on subsamples of respondents for whom the respective positive frames are likely salient. These are economic heads of households for the economic opportunity frame, members of military families for the national security frame, self-identified Christians for the Christian stewardship frame, and primary health care deciders for the public health frame. Table SM1 in the Supplementary Materials reports the full results of these models.

The effects of the economic opportunity frame and the national security frame on subsamples of economic heads of households and members of military families, respectively, are similar to what was found in the full subsamples discussed above. The positive influence of exposure to a positive frame on Americans' views of GHG emissions reduction policies does withstand the influence of exposure to an ACC denial counter-frame among citizens for whom the frame is likely most salient. This is further evidence of the potential of these two positive frames for dealing with ACC. Among self-identified

[5] These two coefficients are significantly different from each other: $F(1, 498)=4.57$; $p=0.03$.

[6] These two coefficients are not significantly different from each other: $F(1, 482)=0.86$; $p=0.35$.

Christians and primary health care deciders, respectively, exposure to a likely salient positive frame has no influence on Americans' belief about the effect of GHG emissions reduction policies.

The performance of the other variables in Table 3 deserves attention. As a group, the social and demographic controls have little influence. Indeed, only gender and the Christian dummy variable have statistically significant effects. Women believe that policies to reduce our nation's GHG emissions will have a stronger positive effect on our national economy, our national security, and our public health than do men. Also, self-identified Christians believe that such policies will have a stronger positive effect on our stewardship of God's creation than do non-religious respondents. As expected, the political orientation indicators have statistically significant effects in multiple models. Liberals believe that GHG emissions reduction policies will have a stronger positive effect on our national economy, our national security, and our public health than do their conservative counterparts, and Democrats believe that such policies will have a stronger positive effect on our national security and our stewardship of God's creation than do their Republican counterparts.

We next turn to the influence of the four positive frames on our composite measures of general ACC views: beliefs about climate change; beliefs about climate science; awareness of climate change consequences; and support for GHG emissions reductions. Our results, which are presented in Table SM2, indicate that these general ACC views are relatively resistant to manipulation with a single-dose message. Respondents exposed to the economic opportunity frame do report greater support for aggressively attempting to reduce our nation's GHG emissions in the near future than do respondents not exposed to this positive frame—additional evidence that speaks to the potential of an economic opportunity frame in shifting Americans' ACC views. However, in no other model does exposure to a positive frame have a statistically significant positive effect on any of the ACC views. In other words, the overall potential of these positive frames for influencing Americans' ACC views is limited at best.

4.2. The Effect of an ACC Denial Counter-Frame

The models in Table 4 contain not only the direct effect of the ACC denial counter-frame but also a key indirect effect: an interaction effect (denial counter-frame*political ideology) expected by the Anti-Reflexivity Thesis. This interaction effect captures the Anti-Reflexivity Thesis prediction that exposure to an ACC denial counter-frame has a disproportionate influence on the ACC views of self-identified conservatives by activating their latent propensity for anti-reflexivity.

—Table 4 about here—

As expected, exposing respondents to an ACC denial counter-frame significantly reduces their belief in the reality of ACC, their belief about the veracity of climate science, their awareness of the consequences of ACC, and their support for aggressively attempting to reduce our nation's GHG

emissions in the near future. These effects remain even when controlling for important political, social, and demographic characteristics. This is direct evidence that speaks to the power of ACC denial activism on Americans' ACC views, which otherwise tend not to be all that susceptible to modification via single-dose messages. The consistent effect of exposure to the ACC denial counter-frame on each of the four ACC views likely stems from the ubiquity of ACC denial in popular culture and Americans' familiarity with its message.

As expected by the Anti-Reflexivity Thesis, Right-leaning citizens (conservatives and Republicans) report weaker belief in the reality of ACC, weaker belief in the veracity of climate science, lesser awareness of the consequences of ACC, and lesser support for policies to reduce our nation's GHG emissions than do Left-leaning citizens (liberals and Democrats). This pattern is likely caused by conservatives more strongly justifying and defending the existing industrial capitalist system than liberals (e.g., Feygina et al., 2010; Jost et al., 2008; McCright & Dunlap, 2011b). Such a difference in anti-reflexivity is likely accentuated by the fundamental challenge that ACC poses to the legitimacy of this industrial capitalist system.

Also as expected by the Anti-Reflexivity Thesis, exposure to the ACC denial counter-frame has a stronger influence on the ACC views of conservatives than on those of moderates and liberals. Note that since liberals receive high scores and conservatives low scores, negative coefficients on the interaction effects indicate that, consistent with the Anti-Reflexivity Thesis, the counter-frame has a greater effect on conservatives (and smaller effect on liberals). The "denial counter-frame*political ideology" interaction term has a statistically significant effect and the expected sign in each of the four models in Table 4. It seems reasonable that exposure to the ACC denial counter-frame activates conservatives' underlying propensity for anti-reflexivity. Fig. 1, which reports the effect of the interaction term on each of the four ACC views, illustrates this pattern. The plot lines in the four panels in Fig. 1 are created by holding at their mean all variables in the models in Table 4, except for exposure to the denial counter-frame, political ideology, and the interaction term. These panels show that exposure to an ACC denial message has a moderate influence on the ACC views of conservatives but no such influence on the ACC views of liberals. These results in Table 4 and Fig. 1 are consistent with much earlier work demonstrating that conservatives and Republicans process information about ACC differently than do liberals and Democrats (e.g., Hamilton, 2008, 2011; Hamilton & Keim, 2009; Malka et al., 2009; McCright, 2009, 2011; McCright & Dunlap, 2011b).

—Fig. 1 about here—

The performance of the other variables in the models in Table 4 also deserves attention. Compared to non-religious respondents, self-identified Christians report lesser belief in the reality of ACC, lesser belief in the veracity of climate science, lesser awareness of the consequences of ACC, and weaker support for

aggressively attempting to reduce our nation's GHG emissions in the near future. Compared to males, females report greater belief in the reality of ACC, greater awareness of the consequences of ACC, and stronger support for policies to reduce our nation's GHG emissions. Finally, younger adults and more highly educated adults report greater belief in the veracity of climate science than do their older and lesser educated counterparts. These findings are consistent with those of recent studies (e.g., Borick & Rabe, 2010; Dietz et al., 2007; McCright, 2010; McCright & Dunlap, 2011b).

5. Conclusion

We conducted an experiment to investigate the extent to which four promising ACC frames influence Americans' ACC views in the face of an ACC denial counter-frame. This study represents an advance over previous ACC framing analyses that likely overestimate the influence of different ACC frames by not accounting for the organized ACC denial widely present in the US media and popular culture. Also, this study is the first direct test of how exposure to an ACC denial message influences Americans' ACC views.

We found that an economic opportunity frame and a national security frame—but not a Christian stewardship frame or a public health frame—influenced Americans' beliefs about the positive effects of policies to reduce our nation's GHG emissions. This effect holds not just among those for whom such frames are likely salient but also across the general public more broadly. Yet, none of these four positive frames have a consistent effect on beliefs about the reality of ACC, the veracity of climate science, ACC consequences, and aggressively pursuing GHG emissions reduction policies. Overall then, these four positive frames likely have limited potential for influencing Americans' ACC views.

Despite suggestive results from earlier studies (e.g., Corner et al., 2012; Feldman et al., 2012; McCright & Dunlap, 2011a, 2011b), there has been no direct test of the extent to which the claims of organized ACC denial activists influence Americans' ACC views. Our study offered the first experimental results in this regard. We found that exposure to an ACC denial counter-frame significantly reduced respondents' belief in the reality of ACC, belief about the veracity of climate science, awareness of the consequences of ACC, and support for aggressively attempting to reduce our nation's GHG emissions in the near future. These robust effects speak to the power of ACC denial activism on Americans' ACC views.

The Anti-Reflexivity Thesis posits that, compared to liberals, conservatives more strongly justify and defend the existing industrial capitalist system against the claims from scientists and environmental activists about large-scale problems such as ACC, which fundamentally challenge the legitimacy of this system (McCright & Dunlap, 2010). As expected by the Anti-Reflexivity Thesis, conservatives (and Republicans) reported weaker belief in the reality of ACC, weaker belief in the veracity of climate

science, lesser awareness of the consequences of ACC, and lesser support for policies to reduce our nation's GHG emissions than do liberals (and Democrats). Also as expected by the Anti-Reflexivity Thesis, exposure to the ACC denial counter-frame had a disproportionate influence on the ACC views of conservatives (than on those of moderates and liberals), effectively activating conservatives' underlying propensity for anti-reflexivity.

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Figure 1. Interaction Effect of Political Ideology (horizontal axis) and Exposure to an ACC Denial Message (not exposed=solid line; exposed=dashed line) on Four ACC Views

Notes: Lines are predicted values from the regression models in Table 4, holding variables at their mean. The coding for the indexes for ACC views ranges along the vertical axis as “I’m not sure”=4, “slightly agree”=5, and “moderately agree”=6.

Table 1. Descriptive statistics of the study sample. Standard deviation is given in parentheses

	Sample Description
Political ideology (1-7 scale: "extremely conservative" to "extremely liberal")	4.68 (1.56)
Party identification (1-7 scale: "strong Republican" to "strong Democrat")	4.60 (1.69)
Gender (% female)	45.88
Age (1-8 scale: "18-19" to "80 or higher")	2.96 (1.23)
Race (% white)	79.32
Educational attainment (% at least bachelor's degree)	54.37
Household income (1-5 scale: "less than $25K" to "$100K and more")	2.54 (1.29)
Religiosity (1-9 scale: "never attend religious services" to "more than once a week")	3.00 (2.49)
Religious affiliation	
(% Christian)	46.07
(% non-Christian)	9.49
(% non-religious)	44.44
Economic head of household (% who are the primary income earner in household)	47.39
Member of military family (% who have served in the military or have immediate family members who have served in the military)	46.89
Primary health care decider (% who make most of the health-related decisions in	

household)	55.37

Table 2. Measures of key outcome variables in the study

Variable	Survey Items	Coded Responses
National Economy **National Security** **Stewardship of God's Creation** **Public Health**	Please indicate whether you think that policies to reduce our nation's greenhouse gas emissions will have a negative, neutral, or positive effect on the following aspects of our society:	1=extremely negative; 2=moderately negative; 3=slightly negative; 4=probably neutral; 5=slightly positive; 6=moderately positive; 7=extremely positive
Beliefs about Climate Change (Alpha=0.89) (italicized items are reverse-coded)	Over the last 50 years, the earth's climate has been changing very quickly. Over the next 50 years, the earth's climate will change very quickly. The earth's climate is changing primarily because of human activities. *Human activities are not powerful enough to change the earth's climate.* *What some people call climate change is just natural variation.*	1=strongly disagree; 2=moderately disagree; 3=slightly disagree; 4=I'm not sure; 5=slightly agree; 6=moderately agree; 7=strongly agree
Beliefs about Climate Science (Alpha=0.91) (italicized items are reverse-coded)	The scientific evidence that the climate is changing is very solid. The scientific evidence that the climate is changing because of human activities is very solid. *Claims that the climate is changing are based more on politics than on science.* *Many scientists do not believe the climate is changing.* *Many scientists do not believe we are experiencing climate change caused primarily by human activities.*	1=strongly disagree; 2=moderately disagree; 3=slightly disagree; 4=I'm not sure; 5=slightly agree; 6=moderately agree; 7=strongly agree
Awareness of Climate Change Consequences (Alpha=0.96)	Climate change will be a problem for me and my family. Climate change will be a problem for the United States. Climate change will be a problem for other countries. Climate change will be a problem for other species of animals and plants and for the environment.	1=strongly disagree; 2=moderately disagree; 3=slightly disagree; 4=I'm not sure; 5=slightly agree; 6=moderately agree; 7=strongly agree

	Climate change will be a problem for future generations.	
Support for Greenhouse Gas Emissions Reductions (Alpha=0.91) (italicized items are reverse-coded)	*It's prudent to wait for results of more research before we reduce our nation's greenhouse gas emissions.*	1=strongly disagree; 2=moderately disagree; 3=slightly disagree; 4=I'm not sure; 5=slightly agree; 6=moderately agree; 7=strongly agree
	We should be aggressive in our attempts to reduce our nation's greenhouse gas emissions.	
	Overall, trying to reduce our nation's greenhouse gas emissions will be bad for our nation.	
	President and Congress should make reducing our nation's greenhouse gas emissions a top priority in next 2 years.	
	Trying to reduce our nation's greenhouse gas emissions will help us also deal with other important problems.	
	We have too many problems to deal with to try to reduce our nation's greenhouse gas emissions.	

Table 3: Unstandardized Coefficients (and Standard Errors) from OLS Regression Models Predicting the Beliefs that Policies to Reduce Our Nation's Greenhouse Gas Emissions Will Have a Positive Effect on Four Aspects of Our Society: The Effects of Exposure to a Positive Frame and an ACC Denial Counter-Frame

Predictors	**National Economy** (N=490)	**National Security** (N=480)	**Stewardship of God's Creation** (N=511)	**Public Health** (N=495)
Positive frame	1.16***	1.00***	.12	.36*
	(.17)	(.14)	(.16)	(.16)
Positive frame and Denial counter-frame	.83***	.66***	.47**	.21
	(.17)	(.15)	(.16)	(.16)
Political ideology	.32***	.15*	-.03	.23**
	(.07)	(.06)	(.07)	(.07)
Party identification	-.00	.15**	.18**	.05
	(.07)	(.06)	(.06)	(.06)
Female	.48**	.35**	.26	.42**
	(.15)	(.12)	(.14)	(.13)
Age	-.09	-.04	.10	-.01
	(.06)	(.05)	(.06)	(.06)
White	-.14	-.12	.11	-.03
	(.18)	(.15)	(.16)	(.17)
Education	-.11	.02	-.00	.02
	(.06)	(.05)	(.06)	(.06)
Income	.03	-.03	-.07	-.03
	(.06)	(.05)	(.05)	(.05)
Religiosity	.00	-.04	.06	.06
	(.04)	(.03)	(.04)	(.03)
Christian	-.02	.11	.62**	-.32
	(.20)	(.17)	(.19)	(.18)

Non-Christian	.14	.01	.20	-.47
	(.25)	(.22)	(.25)	(.26)
Constant	3.07***	2.96***	3.21***	3.96***
	(.42)	(.27)	(.39)	(.38)
Adjusted R^2	.18	.21	.09	.10

Note: The reference category for the experimental condition dummy variables is the control condition.

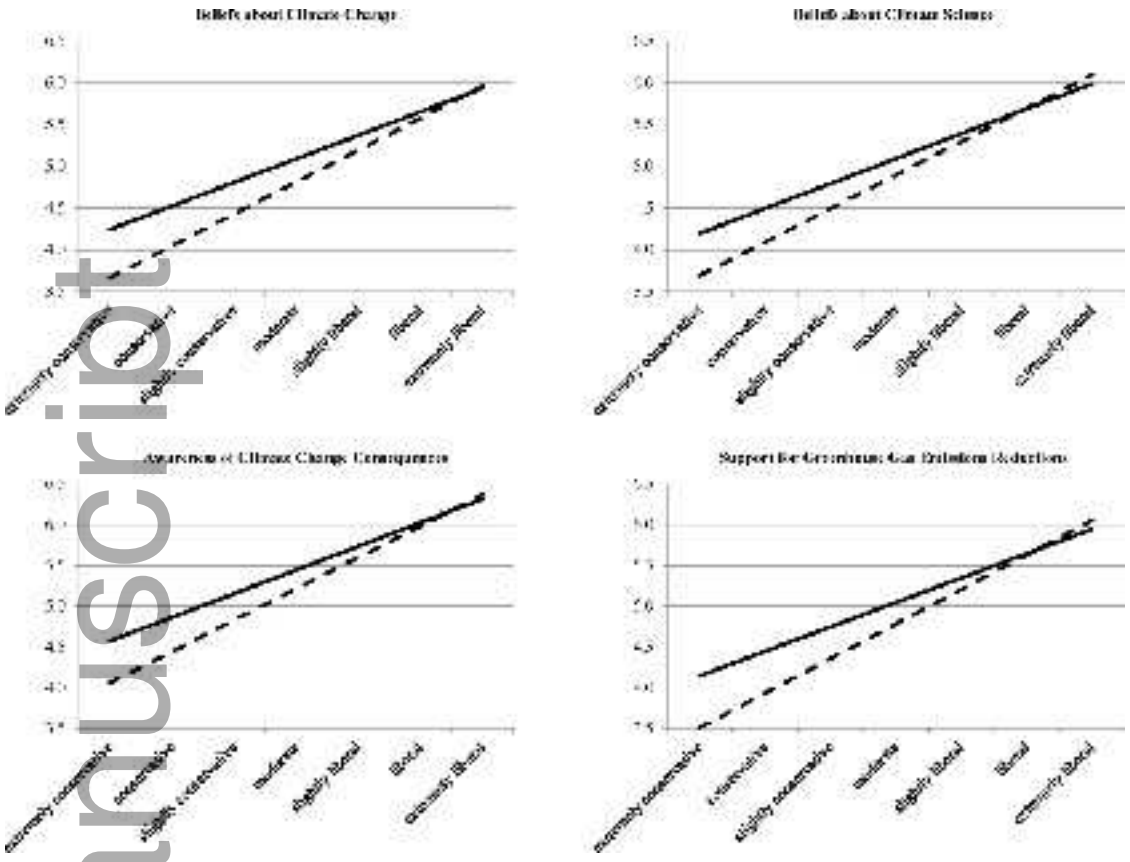
* p<.05 ** p<.01 *** p<.001

Table 4: Unstandardized Coefficients (and Standard Errors) from OLS Regression Models Predicting ACC Views: The Effect of Exposure to an ACC Denial Counter-Frame (N=1591)

Predictors	**Beliefs about Climate Change**	**Beliefs about Climate Science**	**Awareness of Climate Change Consequences**	**Support for Greenhouse Gas Emissions Reductions**
Denial counter-frame	-.68***	-.61**	-.61**	-.76***
	(.19)	(.19)	(.20)	(.19)
Political ideology	.28***	.30***	.29***	.30***
	(.04)	(.04)	(.04)	(.04)
Denial counter-frame X Political ideology	.10**	.10**	.09*	.12**
	(.04)	(.04)	(.04)	(.04)
Party identification	.14***	.17***	.12***	.14***
	(.03)	(.03)	(.03)	(.03)
Female	.23***	.10	.26***	.20**
	(.06)	(.06)	(.07)	(.06)
Age	-.03	-.10***	-.01	.01
	(.03)	(.03)	(.03)	(.03)

White	-.02	.07	-.03	.13
	(.08)	(.08)	(.08)	(.08)
Education	.04	.07*	.01	.04
	(.03)	(.03)	(.03)	(.03)
Income	-.01	.02	-.01	.00
	(.02)	(.03)	(.03)	(.02)
Religiosity	.00	.01	.02	.02
	(.02)	(.02)	(.02)	(.02)
Christian	-.18*	-.38***	-.23*	-.32***
	(.08)	(.09)	(.09)	(.08)
Non-Christian	.05	-.06	.09	.07
	(.11)	(.11)	(.12)	(.11)
Constant	3.23***	3.16***	3.77***	2.93***
	(.19)	(.20)	(.21)	(.19)
Adjusted R^2	.30	.34	.26	.33

Note: * p<.05 ** p<.01 *** p<.001



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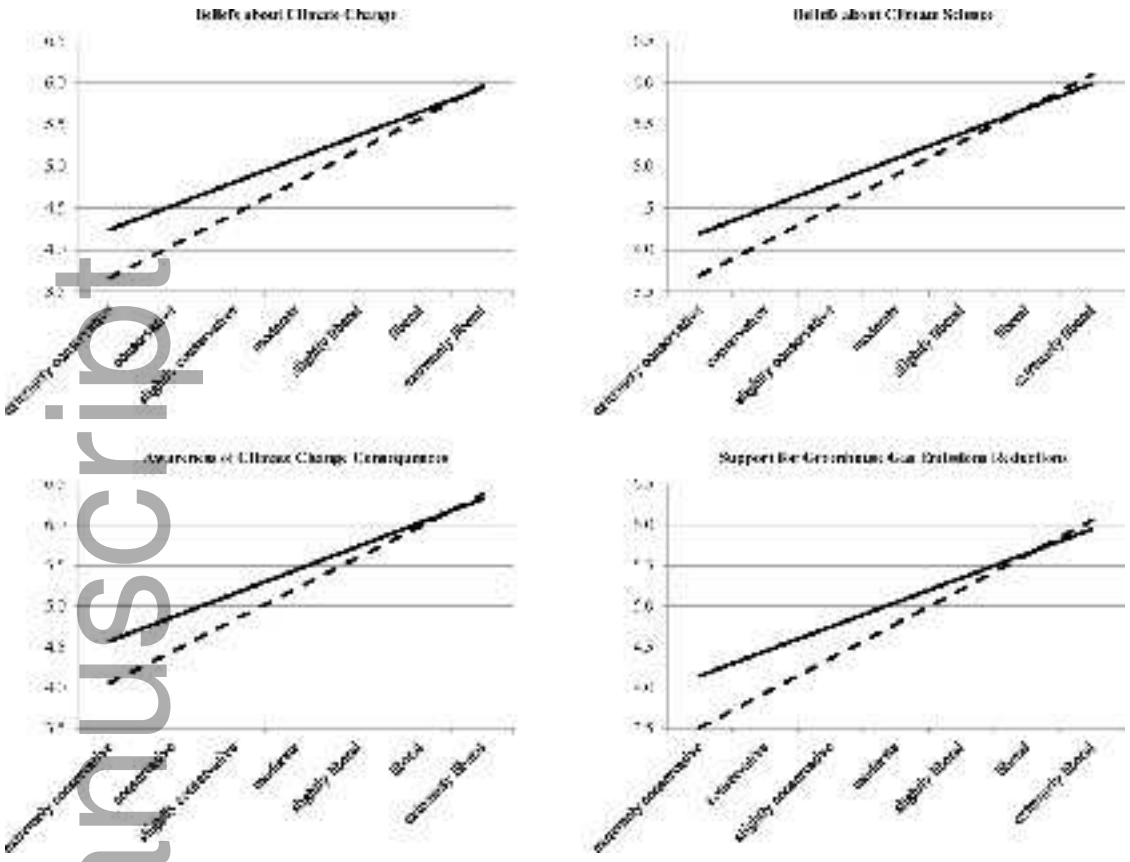

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