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The Impact of Message Source on the Effectiveness of Communications About Climate Change

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The Impact of Message Source on the Effectiveness of Communications about

Climate Change

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Abstract

We conducted a survey experiment in which we presented 1,850 respondents with one of two versions of an appeal emphasizing either the threats to the environment or threats to national security of the United States as a result of climate change. The messages were attributed to one of four sources: Republican or Democratic party leaders, military officials, or climate scientists. The results reveal that messages attributed to military leaders, or to Republican party leaders, can enhance the impact of the appeal. This finding underscores the importance that *the source* of any communication can have on its overall effectiveness.

Americans report deep divisions along partisan lines over fundamental beliefs about whether human-caused climate change is real, the level of threat it poses, and whether there is a need for action to reduce greenhouse gases. Despite an overwhelming scientific consensus that climate change is human-caused and presents a major threat to human societies and ecosystems (Cook et al., 2016), a significant percentage of Americans do not believe that climate change is occurring (30%) or that it is human-caused (42%) (Leiserowitz et al., 2018; also see, Egan & Mullins, 2017). Public discourse on climate change continues to be characterized by partisan and ideological divisions in the U.S. (Dunlap, McCright, & Yarosh, 2016; Feldman et al., 2012; Hamilton, 2016; Hart et al., 2015). For example, one recent survey reported that while 95% of liberal Democrats believe that human-caused climate change is real, only 40% of conservative Republicans say the same (Goldberg et al., 2019; Leiserowitz et al., 2018). An important challenge for science communicators is how to effectively engage individuals who reject information about climate change.

Varying the way that climate change messages are framed – that is, varying the words, phrases or images that highlight specific aspects of climate change – has been shown to affect the response of various audiences (Feldman & Hart, 2018; Lewandowsky, Gignac, & Vaughan, 2013; McCright et al, 2016; Myers, Nisbet, Maibach, & Leiserowitz, 2012; Nisbet & Mooney, 2007; van der Linden, Leiserowitz, & Maibach, 2019). For example, a communicator might bring attention to the environmental, economic, public health, or national security implications of climate change, providing an "interpretive storyline that set(s) a specific train of thought in

motion, communicating why an issue might be a problem, who or what might be responsible for it, and what should be done about it" (Nisbet, 2009, p.15).

A growing body of research has examined how exposure to issue, or emphasis, frames shape climate change beliefs (for a review, see Bolsen & Shapiro, 2017). Yet little work explicitly manipulates the *source of an appeal* focused on shifting public opinion on climate change.[1] Are framed messages more impactful when they are associated with an ostensibly credible source? Does the presence of a partisan source manipulation (e.g., in-group versus out-group) condition the impact of the message?

We extend research on issue framing and social identity theory to generate predictions about how the *presence of a source cue* (climate scientists, military leaders, Democratic Party leaders, or Republican party leaders) in an appeal highlighting either the *environmental* or *national security* effects of climate change conditions the effectiveness of an appeal. We implemented a survey experiment to test how the presence of different sources conditioned a frame's impact on individuals' climate-related beliefs. The results suggest that the presence of specific sources linked with frames highlighting different effects of climate change can *increase or decrease* the message's impact on individuals' related beliefs. This underscores the importance that *the source* of any strategic climate communication effort can have on its overall effectiveness, as well as the need for credible and trusted opinion leaders to convey messages who have the capacity to persuade skeptical audiences.

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[1] We discuss several exceptions below, including Benegal & Scruggs, 2018; Ehret, Van Boven, & Sherman, 2018a; Van Boven, Ehret, & Sherman, 2018b; Kousser & Tranter, 2018.

Issue frames and climate change beliefs

A growing body of research has explored how exposing people to frames that emphasize different aspects of climate change shape citizens' related beliefs and willingness to take actions that would reduce greenhouse gas emissions (Hart, 2011; Hart & Feldman, 2016; Hart & Nisbet, 2012; Maibach, Nisbet, Baldwin, Akerlof, & Diao, 2010; Leiserowitz, 2007; Myers, Nisbet, Maibach, & Leiserowitz, 2012; Nisbet, 2009; Villar & Krosnick, 2011). An issue or emphasis *framing effect* occurs when exposure to a communication causes an individual to place relatively greater "weight" on the emphasized consideration in the opinion formation process (Chong & Druckman, 2007).[2]

Exposure to framed messages may increase the availability, accessibility, and/or perceived applicability of specific aspects of the complicated issue of climate change. Myers et al. (2012), for instance, tested how exposure to one of three distinct frames associated with the effects of climate change – national security, environment, and public health – affected self-reported emotions among respondents with different levels of pre-existing skepticism about climate change. They found that exposure to the public health frame increased feelings of hope whereas the national security frame unexpectedly increased anger among "doubtful" and "dismissive" audience segments. Myers et al.

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[2] We focus exclusively on issue framing effects and not equivalency, or valence, framing effects that occur when positive or negative information unconsciously influences preferences as a result of a negativity bias in the encoding of stimulus information (Kahneman & Tversky, 1979; for a typology of framing effects, see Levin, Schneider, & Gaeth, 1998).

(2012) stated that one factor that might have accounted for this "boomerang effect"[3] was the lack of the congruence between the messenger and the frame. They posited that participants may have experienced anger at the *experimenters* for making claims about the national security implications of climate change, and called for future work to explore the role that the presence of *sources linked with specific frames* might have on different audiences.

Frames that accentuate scientific consensus among climate scientists regarding the existence of human-caused climate change have been found to increase belief in human-caused climate change and support among Americans for policy action to address the problem (Lewandowsky et al., 2012; van der Linden, 2015; van der Linden et al., 2019). Other studies have demonstrated that highlighting its local impacts, for instance through visual images showing flooding that would occur as a result of sea level rise in coastal communities, can increase public concern and support for actions to address the problem (Bolsen, Kingsland, & Palm, 2018). However, response to otherwise credible and persuasive information can be undermined when presented in competition with rhetoric that politicizes climate science, for instance by actors seeking to cast doubt on the existence of a scientific consensus. (Bolsen & Druckman, 2018; Druckman, 2017; McCright & Dunlap, 2011; McCright et al., 2016; van der Linden et al., 2017).

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[3] Hart and Nisbet (2012, p. 704) state, "A boomerang effect occurs when a message is strategically constructed with a specific intent but produces a result that is the opposite of that intent"; (for other examples of such effects in climate communication studies, see Cook & Lewandowsky, 2016; Myers et al., 2012; Zhou, 2016).

Source credibility, trust, and persuasion

While a number of experiments have documented the impact of exposure to strategic frames on Americans' climate beliefs, few studies have varied the presence of *sources* linked with a pro-climate action message to determine if such information moderates a frame's impact on individuals' climate beliefs. Research on environmental risk communication and issue-framing makes clear that the effectiveness of any message depends crucially on the audience's trust in and perception of credibility toward its source (Brewer & Ley, 2013; Druckman, 2001a; 2001b; Liu & Priest, 2009; Priest, 2001; Renn & Levine, 1991). Perceptions about the competence, expertise, objectivity, impartiality, and fairness of a message's source determine its persuasive impact, as well as other more peripheral factors such as the attractiveness of the source, sympathy or empathy toward the source, and social status of the source (Renn & Levine, 1991).

The "elaboration-likelihood model of persuasion" (ELM) has been applied by social scientists across disciplines to understand the mechanisms by which risk communication can generate persuasion (Petty & Cacioppo, 1986). The ELM distinguishes between *central and peripheral routes of persuasion*. The *peripheral route* involves the use of heuristics – such as the perceived credibility of a messenger – in determining whether or not to accept a particular message; the *central route* is characterized by more effortful information processing triggered by the motivation of an individual to actively process the information (Brewer & Ley, 2013; Eagly & Chaiken, 1993; Renn & Levine, 1991).

Finally, empirical research has demonstrated the credibility of "scientists" as generally credible sources. Surveys conducted in both the U.S. and among British

citizens has demonstrated that "scientists" tend to be among the most trusted sources for providing accurate information about environmental issues in general and on climate change in particular (Bickerstaff et al., 2008; Malka, Krosnick, & Langer, 2009; Nisbet & Myers, 2007).[4]

Based on this literature, we hypothesize:

> *The presence of a credible source linked with a frame congruent with the expertise attributed to this source will increase the frame's impact on individuals' beliefs. Specifically, climate scientists linked with a frame highlighting climate change's environmental effects will increase the frame's impact on individuals' related beliefs.* (**Hypothesis 1**)
>
> Similarly, military leaders *linked with a frame that emphasizes climate change's effects on U.S. national security will increase the frame's impact on individuals' related beliefs.* (**Hypothesis 2**)

Social identity theory and climate change beliefs

People derive their self-concept, in part, from the social groups and categories to which they belong (Hogg & Reid, 2006; Huddy, 2001; Huddy, Mason, & Aaroe, 2015; Kahan, 2016). These group attachments play a powerful role in shaping determinations about the credibility and trust of any information source (Lenz, 2012; McCright,

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[4] Partisanship, however, increasingly plays a role in perceptions about the credibility of scientific information (Benegal & Scruggs, 2018; Gauchat, 2012; Motta, 2017), so it may be that on a polarized issue such climate change some groups (e.g., Republicans) may not find scientists to be the most effective source of any pro-climate appeal.

Dentzman, Charters, & Dietz, 2013; Renn & Levine, 1991). Identity-based motivated reasoning can lead audiences to interpret information about climate change in a biased manner as a way to protect their existing beliefs or group attachments (Hart & Nisbet, 2012; Kahan et al., 2011).

One form of protection of social identity is the use of partisan motivated reasoning (for a review, see Druckman, Leeper & Slothuus, 2018; Taber & Lodge, 2013; Kahan, 2015). This process can occur when people possess strong opinions that guide their reasoning strategies, or because of partisan cue-taking that simplifies and reduces the amount of information and effort necessary to form an opinion in a given context (Bartels, 2002; Bolsen, Druckman, & Cook, 2014; Cohen, 2003; Goren et al., 2009; Guber, 2017; Kunda, 1990; Lelkes, Malka, & Bakker, 2019; Malka & Lelkes, 2010). Partisans in pursuit of value-affirming information may therefore turn to sources who share their group identity or cultural worldviews in seeking out or interpreting any new information about climate change (Benegal & Scruggs, 2018; Feinberg & Willer, 2013; Hmielowski et al., 2014; Kahan, Jenkins-Smith, & Braman, 2011)

Perception of consensus, particularly within ones' close social network, also influences people to align their beliefs with what they perceive to be the majority point-of-view (Goldberg et al., 2019; Jost, 2018; van der Linden 2015). However, Americans tend to underestimate the actual level of social consensus about human-induced climate change (Mildenberger & Tingley, 2017). Empirical research has identified the power of social consensus messages particularly among conservatives and Republicans. These groups show a stronger drive for conformity to in-group norms and greater willingness to adopt and share like-minded views with other Republicans (Benegal & Scruggs, 2018;

Goldberg et al., 2019; Jost, van der Linden, Panagopoulos & Hardin, 2018). In a recent experiment that varied sources associated with a ballot proposal, Republicans were more likely to support a climate proposal when it was endorsed by Republican party elites, and perceptions that other Republicans also supported the initiative was a key mediating belief (Ehret, Van Boven, & Sherman, 2018). In another recent study, a message sponsored by Republican senators led Republican respondents to reject misinformation about climate change, increase their belief in the existence of a scientific consensus, and increase their belief that it is human-caused (Benegal & Scruggs, 2018). In these cases, the partisan membership of the person delivering the message plays a powerful role in the degree to which an appeal persuades any audience (Benegal & Scruggs, 2018; Ehret, Van Boven, & Sherman, 2018; Kousser & Tranter, 2018; Li et al., 2016; Maibach et al., 2015; Van Boven, Ehret, & Sherman, 2018).

Based on the findings of these studies, we hypothesize that:

> *The presence of an in-group (i.e., in-partisan) source regardless of the frame with which it is associated will increase the frame's impact on in-partisans' related beliefs.*
>
> (**Hypothesis 3**)

Data and methodology

We conducted a survey of 1,850 unique respondents recruited using Amazon's Mechanical Turk (MTurk) service in July 2018.[5] Each participant was randomly

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[5] MTurk samples offer greater diversity than student or other convenience samples and have been used to replicate numerous studies across disciplines (Berinsky et al., 2012;

assigned to one of ten conditions that varied the content of an appeal accentuating either the environmental or national security risks of climate change (i.e., environmental or national security frame). Two treatments were defined: one based on the threat that climate change poses to the national security of the United States, and the second that climate change poses for environmental sustainability. The national security treatment emphasized the effects of climate change on human migration patterns and potential "conflict over land ownership or water use that could result in war," while the environmental treatment emphasized coastal flooding due to sea-level rise and an increased frequency of droughts and wildfires. In addition to highlighting these effects, both treatments advocated action "to promote energy efficiency and renewable energy to substantially decrease our greenhouse gas emissions."[6] We selected the environmental frame given its dominance in climate discourses and the national security frame given the and the call to link it with a credible source (e.g., Myers et al., 2012). The frames also matched the domain of expertise for two of the sources we manipulated in the study.

To test the impact of the source, we assigned respondents to one of five groups. For instance, the headline above the article in the no source (baseline) condition stated, "Call for Action on Climate" and did not explicitly mention a source, whereas the other conditions linked the appeal to a specific source – e.g., "Climate Scientists, Republican Party Leaders, Democratic Party Leaders, or Military Leaders." The appeal itself stated

Mullinix et al., 2015). Descriptive statistics for the sample are available in a supplementary file available upon request.

[6] The complete wording of the stimuli for each condition and the survey instrument is available upon request.

that "Democratic Party leaders," "Republican Party leaders," "military leaders," or "climate scientists" were the ones highlighting these effects of climate change and calling for policy action to reduce greenhouse gas emissions.

We measured how exposure to the treatments affected individuals' beliefs about: (a) the level of threat that climate change presents to national security (1-5 scale, none at all / a great deal); (b) the level of threat that climate change presents to a sustainable environment (1-5 scale, none at all / a great deal); and, (c) support for laws that promote energy efficiency and renewable energy as a way to combat climate change (1–7 strongly oppose / strongly support). The information that was employed across experimental conditions highlighted one of these threats and called for a greater reliance on renewable energy. As such, these measures serve as our primary dependent variables to evaluate how message sources condition an appeal's impact.

We also included several additional post-treatment measures. First, we measured fundamental beliefs about climate change: (d) whether or not they believe climate change is happening (1-7 Definitely not happening / definitely happening) and (e) the extent to which they agreed with a statement that a scientific consensus exists regarding climate change happening primarily as a result of human activity (1-7 strongly disagree / strongly agree). Because our experiment explicitly manipulated the source of the message highlighting the threats of climate change and need for policy action, we measured respondents' perceptions about (f) the degree to which political motives are a driver of scientific research on climate change (1-7 strongly disagree / strongly agree). We anticipate that audiences predisposed toward climate skepticism (e.g., Republicans) may view messages from in-group sources about climate change as "less politicized"

compared to the same message without a source (or when attributed to an out-party leader). Last, we measured respondents' agreement with the statement (g) that the idea climate change is primarily due to human activity is a hoax or a conspiracy (1-7 strongly disagree / strongly agree). We included this item given the literature showing that motivated reasoning processes appear to drive the expression of this relatively widespread belief held by many Americans (i.e., estimated between 20%–40%) regarding climate change (e.g., see Miller, Saunders, & Farhart, 2016; Uscinski, Klofstad, & Atkinson, 2016; Uscinski & Parent, 2014). We anticipate similar dynamics resulting from the source manipulation on climate hoax belief as with the other key measures – i.e., credible sources, or in-group/out-group sources, linked to an appeal highlighting the threats of climate change will condition the impact of each message. Although belief in conspiracies is a general predisposition (Lewandowsky, Oberauer, & Gignac, 2013; Oliver & Wood, 2014), political ideology is strongly associated with which conspiracies an individual will endorse (Uscinski & Parent, 2014). We expect that in-group sources linked with a message highlighting climate change's threats will decrease climate hoax beliefs, whereas out-group sources may increase such beliefs among skeptical audiences (i.e., Republicans who receive a message sponsored by Democratic Party leaders) as a result of partisan motivated reasoning. We measured party identification on a 7-point Likert scale, and then created a series of dummy variables for respondents who identified as Democrat, Independent, or Republican.

Before turning to the results of our analyses, we include a condensed description of our research design. Table 1 presents the framework of our experimental design, a

description of the treatments provided to respondents in each condition, and a restatement of our hypothesized expectations.

[*Insert Table 1 here*]

Results

We evaluate the impact of the experimental treatments by regressing each dependent variable on the experimental conditions, omitting the no-source appeal as the baseline for each distinct appeal.[7] Our design allows us to evaluate the effects of the presence of two ostensibly credible, "expert" sources associated with each frame as well as the impact of Republican and Democratic Party leaders.

The first column in Figure 1 reports the impact of the experimental conditions on belief that climate change presents a threat to U.S. national security. First, in support of *Hypothesis 1*, military leaders as the source of the message emphasizing climate change's threats to national security significantly increase the belief that climate change is a national security threat across all respondents in the sample relative to the no-source baseline ($p = .04$). We did not anticipate any effect of military leaders as the source of the *environmental message* (Column 2, Figure 1) on beliefs that climate change presents a threat to national security; however, as Figure 1 reports, military leaders linked with this frame also significantly increased beliefs that climate change is a threat to national security relative the no-source baseline ($p = .01$). Military leaders did not have an effect on perceptions about the degree to which climate change presents an environmental threat

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[7] We report the means and standard deviations for each condition across all of the dependent variables in a supplementary file available upon request from the corresponding author.

relative to the no-source baseline for that message. This suggests that the impact of a source may depend on the degree to which the belief measured is in a domain in which the source is perceived as an expert. Interestingly, in the full sample, military leaders linked with a national security frame had no effect on support for a greater reliance on renewable energy to reduce greenhouse gas emissions (*Support Laws)*, as well as other beliefs we measured such as the belief climate change is happening, that a scientific consensus exists, or that climate change is a hoax.

[*Insert Figure 1 here*]

The right side of Figure 1 reports the effects of the experimental conditions on respondents' belief that climate change presents a threat to a sustainable environment. *Hypothesis 2* predicted that climate scientists linked with an environmental message would increase this message's impact relative to the no source baseline. We find no support for this hypothesis. We also find that when climate scientists are the source of a message about the threat that climate change presents to *national security* and linked with a call for policy action, respondents significantly *reduced* the strength of their beliefs about the environmental threat climate change poses ($p = .03$), support for laws to promote renewable energy ($p = .04$), belief that climate change is happening ($p = .01$), and belief that a scientific consensus exists ($p = .01$).

The effects are even more dramatic when partisan information sources are compared with the no-source baseline on the full sample. First, when *Republican Party leaders* are the source of the *national security climate message*, respondents increase their support for polices that would promote renewable energy to reduce greenhouse gases (*Support Laws*) ($p = .08$). Republican sources linked with a *national security*

message reduced the perception that climate change research is driven primarily by political motivations ($p = .01$). Further, Republican sources linked with this frame and call for action also significantly decreased respondents' perception that human induced climate change is a hoax by nearly a one-half point shift on the five-point response scale ($p = .02$). Source effects were more prominent in the national security frame conditions compared to the environmental frame conditions. Nonetheless, when the environmental message was attributed to Republican sources, respondents' perceptions that a scientific consensus exists on human-caused climate change increases ($p = .09$). On the other hand, when the source of the national security message and call for action is attributed to Democratic leaders, respondents became significantly less likely to see climate change as a security threat ($p = .10$) and significantly less likely to say that climate change is occurring ($p = .03$) or that a scientific consensus exists ($p = .06$).

To evaluate *Hypothesis 3* regarding how in-group versus out-group partisan sources may condition the impact of the experimental conditions on our dependent measures, we replicate the analyses separately for Republican and Democrats in our sample.[8] First, we found very few significant treatment effects resulting from the source manipulations when comparing Democrats in the no-source baseline condition to

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[8] We chose this modeling approach rather than testing models with interaction effects because we are interested (theoretically) in testing for source-effects associated with the frames we introduce on Democrats (Republicans) in each condition relative to Democrats (Republicans) in the No-Source baseline condition to examine within-subgroup effects. We lack clear theoretical expectations for other estimation approaches that would rely on Independents in the No-Source condition as a baseline for our hypothesis tests.

Democrats across all other conditions (see Table 2 and Figure 2). There are a few

exceptions, such as military leaders having a significant positive effect on Democrats'

perceptions climate change is a national security threat, but the overall picture is that

Democrats in the baseline condition (and all source conditions) report highly skewed

beliefs that resulted in ceiling effects with little room for additional movement on many

of the response scales.

[*Insert Table 2 and Figure 2 here*]

Republicans tend to be more skeptical about climate change and less supportive of

laws to reduce greenhouse gases. However, we find that when Republican Party leaders

are the source of the environmental threat message, Republican respondents significantly

increased their belief that climate change is an environmental threat (Table 3, Model 2, *p*

= .03), that a scientific consensus exists (Table 3, Model 6, *p* = .04), and support for

polices that would increase a reliance on renewable energy to decrease greenhouse gas

emissions (Table 3, Model 4, *p* = .09). When Republican Party leaders are linked with

the national security message it significantly reduced Republicans' perceptions that

climate change research is politically motivated by nearly a full point on the response

scale (Table 3, Model 1, *p* = .01) and decreased perceptions among Republicans that

evidence regarding climate change is a conspiracy or hoax (Table 3, Model 1, *p* = .09).

[*Insert Table 3 here*]

On the other hand, we find that when Democratic Party leaders are linked with the

environmental threat appeal, Republican respondents report significantly greater

perceptions that climate change research is politically motivated (Table 3, Model 1, *p* =

.05), and become significantly *more* convinced that climate change a hoax (Table 3, Model 1, $p = .05$). In contrast, when Republican Party leaders are associated with the national security message, Republican respondents were significantly *less* likely to perceive climate science research as driven by political motivations (Table 3, Model 1, $p = .01$).

Discussion and Conclusions

The U.S. public remains polarized along partisan and ideological lines on the issue of human-induced climate change. Science communicators and others who seek to build greater consensus thus face challenges both in securing the public's attention to important information (Lupia, 2013), as well as motivating skeptical audiences to evaluate information in an "even-handed" manner with the goal of arriving at an "accurate," or correct, conclusion (Druckman, 2013; Druckman & Lupia, 2017).

We investigated an approach to communicating information about climate change that involved manipulating the source of a message, while holding the content of the message constant. We find that the presence of military leaders as a source of a pro-climate appeal can significantly strengthen its persuasive impact, especially in the case of an appeal emphasizing the effects of climate change on U.S. national security. Republican Party leaders also enhanced the effectiveness of a frame both on average and among in-group respondents, perhaps due to the surprising effect that unconventional or unexpected sources of information can have in terms of its persuasive impact. Partisans making statements that do not align with their perceived group's position may draw greater attention to the frame's content, may be seen as a "costly" signal thereby enhancing its perceived honesty and credibility, or may reduce identity protective forms

of motivated reasoning that would otherwise lead to the rejection of arguments related to a polarized and highly salient issue such as climate change (Bengal & Scruggs, 2018; Druckman & McGrath, 2019; Kahan et al., 2011; Kahan, 2015).

On the other hand, we found a perhaps surprising impact of one information source: climate scientists. When climate scientists were linked with the national security message it significantly *reduced* respondents' perceptions about the threat of climate change to national security, support for policy action, and perceptions of a scientific consensus. Indeed when messages were attributed to climate scientists, they either had no effect on most of the variables we tested, or their effect was a negative one. The call by the American Meteorological Society for *more* engagement in policy communication by climate scientists (https://amspolicyforum.org/index.cfm/amspolicyforum/), suggests the need for more interdisciplinary communication between climate scientists and those who study the efficacy of message communication. Dissonant science messages may threaten in-group identity (Dixon, Hmielowski, & Ma, 2017), leading to resistance and a greater distrust and negative affect toward scientists, and less support for action to address climate change (Dixon & Huber, 2018; Nisbet et al., 2015). Targeted frames, however, that emphasize free-market solutions have been found to increase acceptance of climate science among conservatives (Campbell & Kay, 2014; Dixon et al., 2017).

We also find that there are circumstances under which skeptical audiences will be more open to climate change policy information. Republicans who received an environmental threat message sponsored by Republican Party leaders increased the strength of their belief that climate change poses a threat to sustainable environment, their support for laws to reduce greenhouse gas emissions, and their beliefs that a scientific

consensus exists regarding human activities being the primary cause of climate change. Similarly, Republicans who received a national security threat message sponsored by Republican Party leaders were less likely to state that climate change research is driven by political considerations, and reported significantly lower perceptions that climate change is a conspiracy or hoax. This clearly demonstrates the power that trusted in-group (i.e., in-party leaders) sources could play in overcoming hurdles posed by partisan polarization on climate change. On the other hand, we find that when the source of the environmental threat message is Democratic Party leaders, Republicans become significantly more likely to report that climate change research is driven by political motivations and more likely to say that climate change is a hoax. The *source of an identical appeal* thus has a powerful impact on how the information affects individuals' beliefs not only about the threats that climate change presents and willingness to support policy action, but also on broader perceptions about the motivations of climate change research, and even beliefs that climate change is a hoax. This is a finding that should prompt further exploration.

Future research should also explore the generalizability of our findings and the impact of varied sources associated with climate change information across different populations and using different content messages (e.g., highlighting the source of information on scientific consensus reports or public health considerations). The results we report are encouraging insofar as we show that sources perceived to be credible and trusted and that deliver climate change messages to skeptical audiences can break through the barriers that impede communication efforts.

This paper highlights the role that credible sources can play in shaping skeptical audiences views about climate change and overcoming partisan barriers that impede efforts to generate greater consensus among the U.S. public. The finding that Republican Party leaders, and military leaders, had the strongest effect, on average, at enhancing the framed messages suggests that source credibility may increase when an "unconventional" position is taken by group leaders (Prior, Partridge, & Plant, 2014). The finding that climate scientists had little effect, or at worst a negative effect, also needs further attention. More exploration is necessary to understand the efficacy of source credibility linked with distinct arguments on climate change as well as the duration and persistence of efforts to overcome polarization and foster consensus and climate engagement.

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Table 1. Experimental Design and Predictions

Condition	Treatment	Predicted outcome
National Security **(No source)** *(N=184)*	Some groups have recently argued that droughts and flooding caused by climate change are a threat to the security of the United States…	*National Security Baseline*
Military Leaders (N=184)	A group of military leaders including generals and homeland security officers have recently argued that droughts and flooding caused by climate change are a threat to the security of the United States…	**H1**: increase the frame's impact.
Democratic Party Leaders (N=178)	A group of Democratic leaders in the House and Senate have recently argued that droughts and flooding caused by climate change are a threat to the security of the United States….	**H3**: increase impact for Dems, no effect on Repubs.
Republican Party Leaders (N=183)	A group of Republican leaders in the House and Senate have recently argued that droughts and flooding caused by climate change are a threat to the security of the United States…	**H3**: increase impact for Repubs., no effect on Dems.
Climate Scientists (N=184)	A group of climate scientists have recently argued that droughts and flooding caused by climate change are a threat to the security of the United States…	No prediction relative to baseline.
Environment **(No source)** *(N=192)*	Some groups have recently argued that climate change is a threat to the environment the United States…	*Environmental Baseline*
Military Leaders (N=187)	A group of military leaders including generals and homeland security officers have recently argued that climate change is a threat to the environment of the United States…	No prediction relative to baseline.
Democratic Party Leaders (N=189)	A group of Democratic leaders in the House and Senate have recently argued that climate change is a threat to the environment of the United States.	**H3**: increase impact for Dems, no effect on Repubs.
Republican Party Leaders (N=183)	A group of Republican leaders in the House and Senate have recently argued that climate change is a threat to the environment of the United States.	**H3**: increase impact for Repubs., no effect on Dems.
Climate Scientists (N=184)	A group of climate scientists have recently argued that climate change is a threat to the environment of the United States.	**H2**: increase the frame's impact.

Figure 1. Message Source Effects Relative to No Source Appeal's Baseline

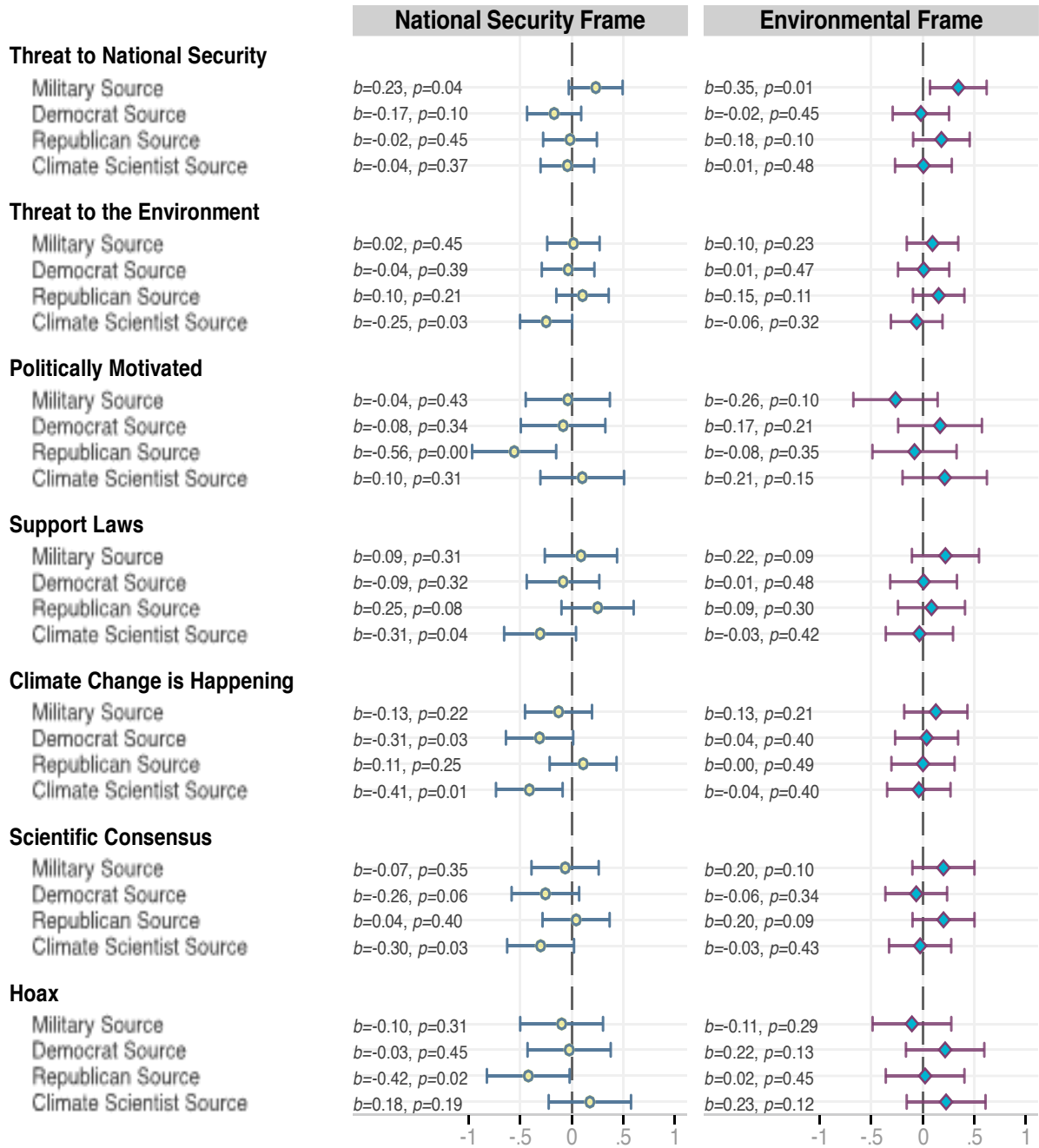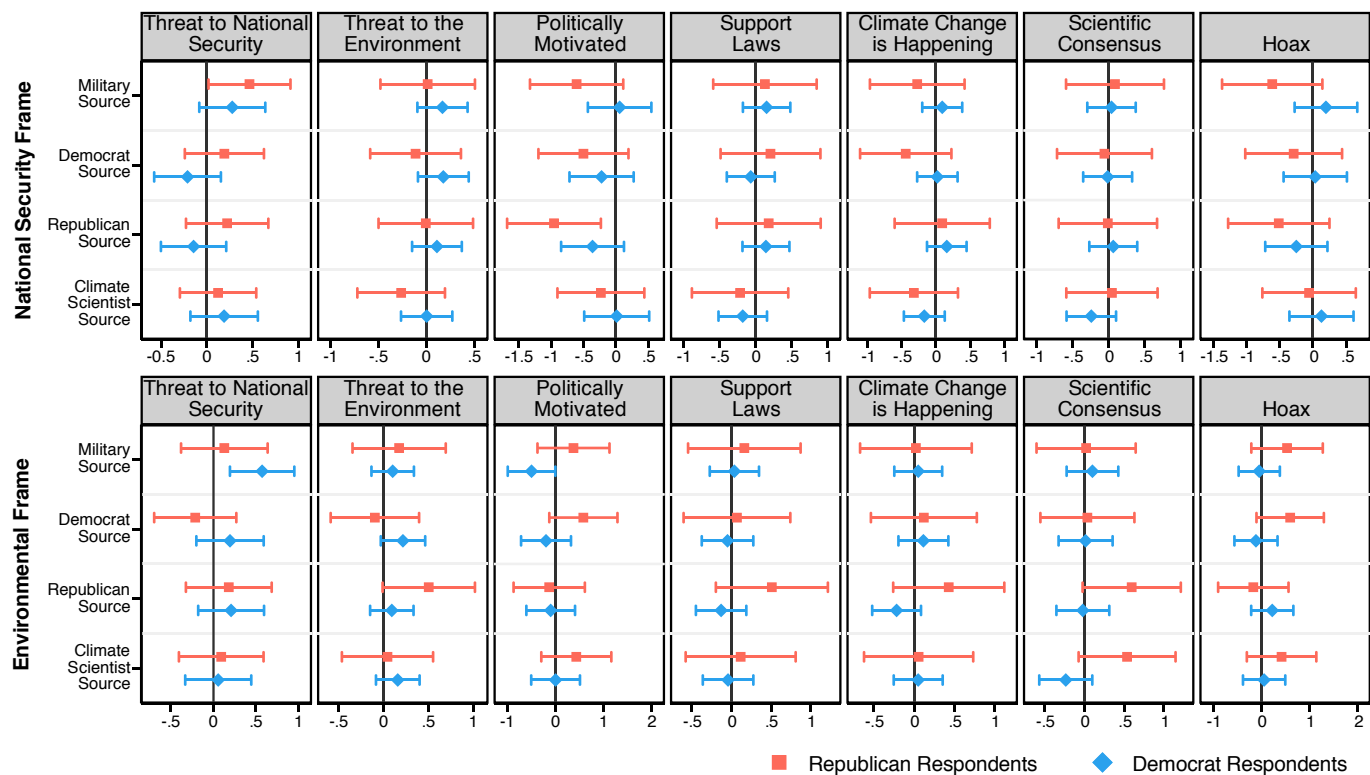|	National Security Frame	Environmental Frame
Threat to National Security		
Military Source	b=0.23, p=0.04	b=0.35, p=0.01
Democrat Source	b=-0.17, p=0.10	b=-0.02, p=0.45
Republican Source	b=-0.02, p=0.45	b=0.18, p=0.10
Climate Scientist Source	b=-0.04, p=0.37	b=0.01, p=0.48
Threat to the Environment		
Military Source	b=0.02, p=0.45	b=0.10, p=0.23
Democrat Source	b=-0.04, p=0.39	b=0.01, p=0.47
Republican Source	b=0.10, p=0.21	b=0.15, p=0.11
Climate Scientist Source	b=-0.25, p=0.03	b=-0.06, p=0.32
Politically Motivated		
Military Source	b=-0.04, p=0.43	b=-0.26, p=0.10
Democrat Source	b=-0.08, p=0.34	b=0.17, p=0.21
Republican Source	b=-0.56, p=0.00	b=-0.08, p=0.35
Climate Scientist Source	b=0.10, p=0.31	b=0.21, p=0.15
Support Laws		
Military Source	b=0.09, p=0.31	b=0.22, p=0.09
Democrat Source	b=-0.09, p=0.32	b=0.01, p=0.48
Republican Source	b=0.25, p=0.08	b=0.09, p=0.30
Climate Scientist Source	b=-0.31, p=0.04	b=-0.03, p=0.42
Climate Change is Happening		
Military Source	b=-0.13, p=0.22	b=0.13, p=0.21
Democrat Source	b=-0.31, p=0.03	b=0.04, p=0.40
Republican Source	b=0.11, p=0.25	b=0.00, p=0.49
Climate Scientist Source	b=-0.41, p=0.01	b=-0.04, p=0.40
Scientific Consensus		
Military Source	b=-0.07, p=0.35	b=0.20, p=0.10
Democrat Source	b=-0.26, p=0.06	b=-0.06, p=0.34
Republican Source	b=0.04, p=0.40	b=0.20, p=0.09
Climate Scientist Source	b=-0.30, p=0.03	b=-0.03, p=0.43
Hoax		
Military Source	b=-0.10, p=0.31	b=-0.11, p=0.29
Democrat Source	b=-0.03, p=0.45	b=0.22, p=0.13
Republican Source	b=-0.42, p=0.02	b=0.02, p=0.45
Climate Scientist Source	b=0.18, p=0.19	b=0.23, p=0.12

Figure 2: Treatment Effects by Partisan Sugroups

Note: Markers present coefficient estimates. Error bars represent the 95% confidence interval.
Estimates reflect the difference in means relative to copartisans in the no-source baseline.
In the conditions recieving the National Security(Environmental) frame, Republican (Democrat) respondents
are compared to Republican (Democrat) respondents in the no-source National Security (Environmental) baseline.

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Table 2: Main Effects (Democrats only)

National Security Frame	Threat Nat. Sec. (*Model 1*)	Threat Env. (*Model 2*)	Politically Motivated (*Model 3*)	Support Laws (*Model 4*)	Happening (*Model 5*)	Scientific Consensus (*Model 6*)	Hoax (*Model 7*)
Military Leaders	0.28*	0.17	0.06	0.15	0.09	0.04	0.19
	(0.18)	(0.13)	(0.25)	(0.17)	(0.15)	(0.17)	(0.24)
Democrat Leaders	-0.21	0.18*	-0.22	-0.07	0.02	-0.01	0.03
	(0.19)	(0.13)	(0.25)	(0.17)	(0.15)	(0.17)	(0.24)
Republican Leaders	-0.15	0.11	-0.36*	0.14	0.16	0.06	-0.25
	(0.18)	(0.13)	(0.25)	(0.17)	(0.15)	(0.17)	(0.24)
Climate Scientists	0.19	0.00	0.01	-0.18	-0.17	-0.24*	0.13
	(0.19)	(0.14)	(0.25)	(0.17)	(0.15)	(0.17)	(0.24)
Constant (No-Source Nat. Sec.)	3.33***	4.38***	2.41***	6.43***	6.47***	6.31***	1.84***
	(0.12)	(0.09)	(0.17)	(0.11)	(0.10)	(0.12)	(0.16)
N	392	392	392	392	392	392	391
Environmental Frame							
Military Leaders	0.57***	0.10	-0.49**	0.04	0.05	0.10	-0.04
	(0.19)	(0.12)	(0.25)	(0.16)	(0.15)	(0.16)	(0.22)
Democrat Leaders	0.19	0.22**	-0.19	-0.05	0.12	0.02	-0.11
	(0.20)	(0.13)	(0.26)	(0.17)	(0.16)	(0.17)	(0.23)
Republican Leaders	0.21	0.09	-0.09	-0.13	-0.22*	-0.02	0.23
	(0.20)	(0.12)	(0.26)	(0.16)	(0.15)	(0.17)	(0.22)
Climate Scientists	0.06	0.16*	0.01	-0.04	0.05	-0.23*	0.06
	(0.20)	(0.12)	(0.26)	(0.16)	(0.15)	(0.17)	(0.22)
Constant (No-Source Env.)	3.22***	4.42***	2.55***	6.45***	6.44***	6.26***	1.76***
	(0.14)	(0.09)	(0.18)	(0.11)	(0.11)	(0.12)	(0.16)
N	422	422	421	422	421	422	422

Note: Cell entries are OLS coefficient estimates, with standard errors in parentheses. Conditions receiving the national security frame are compared to the No-Source National Security baseline; conditions receiving the environmental frame are compared to the No-Source Environmental condition. Asterisks represent one-tailed *p*-values. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$

Table 3: Main Effects (Republicans only)

	Threat Nat. Sec.	Threat Env.	Politically Motivated	Support Laws	Happening	Scientific Consensus	Hoax
National Security Frame	(*Model 1*)	(*Model 2*)	(*Model 3*)	(*Model 4*)	(*Model 5*)	(*Model 6*)	(*Model 7*)
Military Leaders	0.47**	0.01	-0.61**	0.13	-0.27	0.09	-0.61*
	(0.23)	(0.25)	(0.37)	(0.36)	(0.35)	(0.34)	(0.38)
Democrat Leaders	0.19	-0.11	-0.50*	0.20	-0.44*	-0.06	-0.29
	(0.22)	(0.24)	(0.35)	(0.35)	(0.34)	(0.33)	(0.37)
Republican Leaders	0.22	-0.01	-0.96***	0.18	0.09	-0.01	-0.51*
	(0.23)	(0.25)	(0.37)	(0.37)	(0.35)	(0.35)	(0.39)
Climate Scientists	0.12	-0.26	-0.23	-0.22	-0.32	0.05	-0.06
	(0.21)	(0.23)	(0.34)	(0.34)	(0.33)	(0.32)	(0.36)
Constant (No-Source Nat. Sec.)	2.09***	3.16***	4.82***	4.55***	4.91***	4.85***	4.07***
	(0.16)	(0.17)	(0.25)	(0.25)	(0.25)	(0.24)	(0.27)
N	287	287	288	288	288	287	287
Environmental Frame							
Military Leaders	0.13	0.17	0.38	0.16	0.02	0.02	0.54*
	(0.26)	(0.26)	(0.38)	(0.36)	(0.35)	(0.32)	(0.38)
Democrat Leaders	-0.21	-0.10	0.59*	0.07	0.12	0.04	0.60**
	(0.25)	(0.25)	(0.36)	(0.34)	(0.33)	(0.30)	(0.36)
Republican Leaders	0.18	0.50**	-0.12	0.51*	0.43	0.60**	-0.16
	(0.26)	(0.26)	(0.38)	(0.36)	(0.35)	(0.31)	(0.37)
Climate Scientists	0.09	0.05	0.44	0.11	0.06	0.54**	0.43
	(0.25)	(0.26)	(0.37)	(0.35)	(0.34)	(0.31)	(0.37)
Constant (No-Source Env.)	2.48***	3.08***	4.24***	4.76***	4.80***	4.82***	3.52***
	(0.18)	(0.19)	(0.27)	(0.26)	(0.25)	(0.22)	(0.27)
N	274	274	271	273	273	274	273

Note: Cell entries are OLS coefficient estimates, with standard errors in parentheses. Conditions receiving the national security frame are compared to the No-Source National Security baseline; conditions receiving the environmental frame are compared to the No-Source Environmental condition. Asterisks represent one-tailed *p*-values. * $p < 0.10$ ** $p < 0.05$ *** $p < 01$.