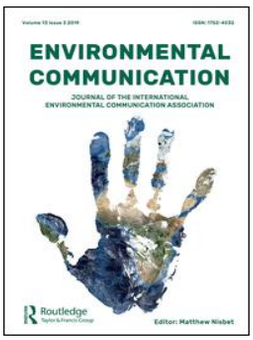

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ADVANCED REVIEW

A Research Agenda for Climate Change Communication and Public Opinion: The Role of Scientific Consensus Messaging and Beyond

Robin Bayes[a], Toby Bolsen[b] and James N. Druckman[a]

[a]Department of Political Science, Northwestern University, Evanston, IL, USA; [b]Department of Political Science, Georgia State University, Atlanta, GA, USA

ABSTRACT

That climate change has been accelerated by human activity is supported by a near-universal consensus of climate scientists. In this paper, we review many of the studies that have been done on the impact of communicating the scientific consensus to the general public. We discuss ongoing debates about these studies, but more importantly, we highlight complementary areas that we believe should define future research. We emphasize how a focus on processing motivations, context, and message variations may help resolve some of the debates about when scientific consensus messaging works. We then discuss ways to expand this research agenda by examining support for a broader range of outcomes across a wider range of populations, particularly those most vulnerable to the immediate impacts of climate change. Our goal is to provide a blueprint for expanding the work on climate change communication for scientific consensus messaging and beyond.

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Climate change is the essence of a wicked problem – that is, one where there exists substantial complexities, profound interdependencies, no clear solutions, and ever evolving challenges (Incropera, 2016; Levin et al., 2012). Yet, despite overwhelming agreement on the part of climate scientists that human activity is a primary cause of accelerated global warming (Cook et al., 2016), a non-trivial segment of the U.S. public underestimates the level of scientific consensus and expresses doubt about the role that human activity plays in the process (Egan & Mullin, 2017; Leiserowitz et al., 2018; Pew, 2019). While many technological challenges remain surrounding how to best respond to climate change, an equal or greater challenge will be building greater social and political consensus for action.

In this paper, we describe how communications can affect individuals' attitudes about climate change. People's attitudes often underpin their behaviors (e.g. Fishbein & Ajzen, 2010, p. 278), and can influence governmental actions needed to address climate change (e.g. Erikson et al., 2002). We focus on one particular type of message – a statement of the scientific consensus regarding human-caused climate change. We detail ongoing debates about the effectiveness of this approach for generating a consensus among the public for action; we also compare scientific consensus messaging to other communication tactics such as focusing on a social consensus or important values. We then discuss gaps in the scientific consensus messaging literature in terms of the narrow range of outcomes and populations on which the work has focused. Our goal is to provide a blueprint for expanding the work on climate change communication for scientific consensus messaging and beyond.

CONTACT Toby Bolsen tbolsen@gsu.edu Department of Political Science, Georgia State University, 38 Peachtree Center Avenue, Suite 1005, Atlanta, GA 30303, USA

The scientific consensus messaging approach

An obvious starting point when it comes to climate change communication is to consider how informing the public about the scientific consensus on human-caused climate change affects their perceptions and beliefs. Surveys consistently find that the U.S. public underestimates the extent of the expert consensus on climate change, likely due to the spread of misinformation and the politicization of climate science (Druckman, 2017). This perceptual gap between the views of scientists and the public can in theory be reduced by exposing people to accurate information about the level of scientific consensus. The idea is that when the public comes to recognize the overwhelming level of expert agreement it will lead to an increase in the percentage of people who believe that it is human-caused, which, in turn, will increase overall support for taking steps to address climate change.

The most notable model of climate consensus messaging is the Gateway-Belief-Model (GBM). It theorizes that a message stating that "97% of climate scientists believe in human-caused climate change" increases the accuracy of people's estimate of the level of expert consensus. This increased belief in the extent of the scientific consensus "predicts cascading changes in other key beliefs about the issue, such as the belief that climate change is happening, human-caused, and a worrisome risk that requires international coordination" (van der Linden, Leiserowitz, et al., 2019, p. 50; also see, Lewandowsky et al., 2013; van der Linden et al., 2015). van der Linden, Leiserowitz, et al. (2019) argue that a "*change* in perceived consensus acts as a 'gateway' in the sense that it predicts smaller subsequent changes in personal (private) beliefs and attitudes about climate change. In turn, changes in these central beliefs predict support for policy action" (p. 50, italics in the original). The GBM points to a straightforward piece of the puzzle to addressing climate change: successful communication of the scientific consensus could help combat misinformation campaigns and vitiate the ideological divide present in the United States (Cook, 2016).

Many empirical studies offer evidence consistent with the GBM, particularly the first step that emphasizing the extent of the scientific consensus on climate change increases people's perception of the level of scientific agreement (Bolsen & Druckman, 2018; Brewer & McKnight, 2017; Cook & Lewandowsky, 2016; Cook et al., 2017; Deryugina & Shurchkov, 2016; Ding et al., 2011; Goldberg, van der Linden, Ballew, et al., 2019; McCright et al., 2013; van der Linden et al., 2016). The finding is important given sustained efforts by numerous actors to undermine public confidence in the scientific consensus on climate change (Cook & Pearce, 2020; van der Linden, Leiserowitz, Rosenthal, et al., 2017). The evidence, however, for consensus messaging's effects on other beliefs and support for climate-friendly behaviors or policies is less well established. Several studies fail to find direct effects of communicating the scientific consensus on support for greater action to address climate change, especially when it comes to climate skeptics or Republicans (e.g. Bolsen & Druckman, 2018; Bolsen, Leeper, et al., 2014; Cook & Lewandowsky, 2016; Deryugina & Shurchkov, 2016; Dixon et al., 2017; Kahan, 2016). Moreover, the evidence presented to-date is insufficient to definitively show a mediated causal path from exposure to the scientific consensus message to support for pro-climate actions, as experimental manipulation of the mediator, belief in scientific consensus, is required to conclusively establish causality (Bullock & Ha, 2011).[1]

Challenges to scientific consensus messaging

The GBM has generated substantial debate and disagreement (Cook & Pearce, 2020; Kahan, 2016; Kerr & Wilson, 2018; Ma et al., 2019; Pearce et al., 2017). Kahan (2015) noted that, after two decades of efforts by scientists and scientific organizations to inform the public about the consensus on climate change, the existence of a persistent gap between the views of scientists and the public raises questions about the approach's overall efficacy. Despite scientific consensus messaging, many Republicans continue to underestimate the extent of that consensus, express skepticism about human-caused climate change, and oppose policies to regulate greenhouse gas emissions (Egan &

Mullin, 2017; Leiserowitz et al., 2018).[2] Even more challenging to the GBM is the finding that the consensus message can backfire and cause those who hold skeptical views about climate change to become less convinced that there is a consensus, more doubtful about the science, and less supportive of any actions to address the problem (Cook & Lewandowsky, 2016; Ma et al., 2019).

Backfire effects occur due to at least one of two motivation-driven processes. One mechanism involves the scientific consensus message generating psychological reactance, which is defined as an "oppositional response to perceived pressure for [belief] change that occurs when a person believes that a message threatens his or her agency or freedom" (Ma et al., 2019, p. 72). Psychological reactance is triggered when people feel that they are being manipulated or forced to adopt a particular point of view (Brehm & Brehm, 2013; Petty & Cacioppo, 1979). In this situation, people who are skeptical about climate change may reaffirm their need for autonomy by rejecting the message. Backfire effects may alternatively occur as a result of motivated reasoning (Taber & Lodge, 2006; Zhou, 2016). In such instances, those who do not have prior views consistent with the scientific consensus message may be motivated to generate counterarguments (i.e. a disconfirmation bias) and persuade themselves to become even more skeptical about climate change (Cook & Lewandowsky, 2016; Nisbet et al., 2015). Kahan (2015) suggests that a conformity motivation underlies this rejection of the scientific consensus message when it challenges existing beliefs or political identities, because people often care more about holding beliefs consistent with their fellow partisans than holding beliefs that reflect the views of scientists (Cialdini et al., 2015; Kahan et al., 2011). When it comes to climate change, for instance, Republicans may conform to follow what they believe other Republicans believe, as opposed to conforming their beliefs to the consensus view among climate scientists (Abeles et al., 2019). This uncertainty about which motivations underlie observed backfire effects – reactance or conformity – raises a question that is important for future work to address: *what goals are people striving to achieve when it comes to processing the scientific consensus message on climate change?*

Other critics of the GBM argue that communicating the scientific consensus does not inform the public about what to do about climate change and may close off more inclusive public dialogue about potential policy responses (Pearce, 2014; Pearce et al., 2017). Further, they argue that it ends up being a "self-defeating strategy" because it "encourages adversarial scrutiny and endless deconstruction of competing evidentiary claims" (Pearce et al., 2017, p. 725; also see, Jasanoff, 2010; Sarewitz, 2004).[3] Pearce et al. (2017) accentuates this point in stating that "scientific consensus does not necessarily beget policy progress. Equally policy progress is not dependent on acceptance of scientific consensus" (p. 726).[4] This critique highlights a second question for future work to address: *what specific beliefs or policy positions should researchers of climate change communication prioritize when studying public opinion?*

Other critics of the GBM point out that most tests of the model only account for individual variation across partisanship and ideology, neglecting other possible moderators, such as personal experiences with local warming or natural disasters, socioeconomic status, or racial identity (Ballew, Pearson, et al., 2020; Dixon, Bullock, et al., 2019). While the potential for backfire and null effects by party and ideology clearly matter, the larger point is that different types of people react to scientific consensus messaging in different ways. This leads to a third question for future work to address: *beyond partisanship and/or ideology, what other individual-level and contextual factors moderate the effect of the scientific consensus message across different populations?*

In the remainder of the paper, we address: (a) how motivations influence the processing of the scientific consensus message about climate change, (b) what beliefs, policy preferences, and other outcomes may be worth considering in both scientific consensus messaging and alternative messaging strategies, and (c) why it is important to study heterogeneous reactions to such messaging, particularly so as to include populations most vulnerable to the immediate effects of climate change. While our launching point is the consensus messaging approach, the research agenda we advance, as we will make clear, can be generalized to other climate change communication strategies.

Motivation and scientific consensus messaging

One must consider the *motivation*, or goal, of any individual when processing the scientific consensus message to understand how it affects his/her beliefs about climate change (Druckman & McGrath, 2019). Motivated reasoning theory identifies two primary goals – accuracy/non-directional and directional – that people strive to achieve when evaluating new information. In the case of an accuracy goal, individuals process new information so as to form a "correct" belief, regardless of whether or not their existing belief must change due to the new information. In the case of a directional goal, individuals process new information in a way to reach a particular conclusion, such as upholding one's existing belief or group identity (Bolsen & Palm, 2019; Druckman, 2012; Kunda, 1990; Molden & Higgins, 2012).

A widely discussed explanation for the continued existence of a gap between scientific consensus on climate change and belief in that consensus is that people engage in directional motivated reasoning when processing scientific consensus messaging (e.g. Dietz, 2013; Druckman, 2015; Hart & Nisbet, 2012; Kahan, 2015; Palm et al., 2017). Republicans, for instance, may reject the message so as to uphold their standing oppositional beliefs or to conform to their group identity as a Republican (Brulle et al., 2012; McCright & Dunlap, 2011; Tesler, 2018). Democrats, on the other hand, may do the opposite, accepting the message, as it does not challenge their in-group's position and instead bolsters their existing beliefs and group's standing.[5]

This type of motivational dynamic – directional motivated reasoning – coheres with the observed partisan polarization on climate change. Yet, this same polarization could be the result of an accuracy motivation where partisans evaluate the scientific consensus message with the goal of forming a correct belief. Specifically, it may be that Republicans strive for accuracy when processing the message, but they have more trust in the signals they receive from their party leaders – who often express skepticism about climate change – than in the signals they receive from climate scientists (Druckman & McGrath, 2019). In this case, individuals are not rejecting scientific consensus messages with the goal of defending a standing belief or partisan identity, but rather because they do not believe the message is credible.[6] As Leeper and Slothuus (2014) explain,

> While 'motivated reasoning' has become a convenient label to apply to any study of bias or partisan differences, use of the label requires evidence that motivations – indeed, the putative directional /defensive motivations – are at work … evidence of motivated reasoning from seminal observational studies … should be read with some skepticism. (pp. 148–149)

In short, it is difficult to determine what type of motivated reasoning is at play, as it requires either manipulating or measuring a person's precise motivation when processing the message, and extant designs have not done so (although see Bayes et al., 2020).

To see why isolating motivations matters for understanding the effects of scientific consensus messaging, consider the following possibilities for motivated responses to the message (Druckman & McGrath, 2019). First, it may be that the message is seen as a credible piece of evidence (Cook & Pearce, 2020, pp. 129–130). If people aim to form an accurate belief, the message could lead them to learn about scientists' views and shift their own beliefs to align with those of experts. Second, the message could work as the GBM theorizes – that is, people may view it as a descriptive norm that provides an expert source cue. In this instance, people learn that scientists hold particular beliefs about climate change and conform their own views to those of experts. This perspective, at least implicitly, assumes directional motivations to hold beliefs that cohere with those who are seen as influential (Cialdini et al., 2015). Complicating matters further, perceiving the existence of a *scientific consensus* differs from perceiving a *social consensus* on an issue. A social consensus refers to "a consensus among nonscientists' group members, including one's social network members, such as family, friends, and acquaintances (social network consensus) and ordinary people in a society (public consensus)" (Kobayashi, 2018, p. 64). A third possible response to scientific consensus messaging, then, considers this motivation to conform beliefs with those of relevant peers: individuals may be

directionally motivated to process information and express beliefs that maximize the likelihood of social approval (e.g. Dwyer et al., 2015; Fielding & Hornsey, 2016; Gerber & Rogers, 2009). In this case, people might reject the scientific consensus message because they think their social groups would reject it as well.[7] A final possibility is that responses to scientific consensus messaging efforts are influenced by a directional motivation to uphold one's values. For example, individuals who value loyalty, sanctity and patriotism were more responsive to a message that resonated with those values (Wolsko et al., 2016). As Kahan et al. (2015) state, "framing climate change science with identity-affirming meanings can mitigate [motivated] resistance" (p. 207) to sound scientific information (also see Feinberg & Willer, 2013). Our bottom line is that the motivations driving responses to the scientific consensus message remain understudied. These motivations may involve a desire for accuracy, a desire to follow an expert consensus, a desire to follow an in-group social consensus, or a desire to confirm one's values.

Isolating motivations matters because one cannot understand whether or not communicating the scientific consensus will alter people's beliefs about climate change without having a sense of their underlying motivation when they encounter this information. Furthermore, accuracy and directional motivations suggest different foci and future directions for persuasive climate change communication "because in the directionally motivated case, opinion change would require altering the individual's motivations or satisfying their goals … whereas in the accuracy-motivated case it would require meeting (or altering) their standards of credibility" (Druckman & McGrath, 2019, p. 133). To further demonstrate how lack of knowledge about which motivational state is at work can lead to debate and disagreement, we next consider specific studies that test the GBM and come to different conclusions about its utility.

Applying motivational lessons to scientific consensus messaging debates

In a recent article published in this journal, Ma et al. (2019) tested the extent to which communicating the scientific consensus on human-caused climate change generated psychological reactance. The authors conducted a survey experiment on a sample of 661 respondents recruited from an online panel (SSI). They randomly assigned participants to one of three conditions: (1) the scientific consensus message about climate change that stated, "Did you know? 97% of climate scientists have concluded that human-caused climate change is happening"; (2) a basic message about climate change that stated, "Did you know? Human-caused climate change is happening"; or, (3) a control condition. They measured reactance with three items that asked respondents "whether they felt pressure to think about climate change a certain way"; "whether they feel others are trying to force their opinions on them"; and "whether they are being manipulated to form a certain view about climate change." Although they found no increased reactance in the scientific consensus message condition relative to the control or basic message conditions, those who held skeptical prior beliefs about climate change and were exposed to the consensus message reported increased levels of reactance. Further, psychological reactance was concentrated among respondents exposed to the consensus message who identified as Republican or Independent and who were skeptical about the existence of climate change. Based on these findings, the authors concluded that communicating the scientific consensus "may be doing more harm than good" in terms of persuading skeptical audiences (p. 82).

In another recent article published in this journal, van der Linden, Maibach, et al. (2019) disputed Ma et al.'s conclusion based on a distinct survey experiment in which the authors "attempted to replicate the findings from Ma et al. (2019)" (p. 3).[8] To do so, van der Linden, Leiserowitz, et al. (2019) recruited 6,301 adults from an online panel (Qualtrics) for a survey experiment in which some respondents received a scientific consensus statement similar to that employed by Ma et al. (2019) – i.e. "97% of climate scientists have concluded that human-caused global warming is happening," while a control condition completed an unrelated task. For both groups, they measured reactance by providing the consensus statement and then asking respondents to evaluate the extent

to which the statement was manipulative on a 7-point response scale. Consistent with Ma et al. (2019), they found no significant main effect of the consensus message on eliciting psychological reactance. However, contrary to Ma et al. (2019), they found no evidence that the treatment condition interacted with either party identification or prior beliefs about climate change to produce reactance. van der Linden, Leiserowitz, et al. (2019) reported that although Republicans and those with pre-existing skeptical views about climate change were indeed more likely to rate the consensus statement as manipulative, these differences existed at equal levels in the control and treatment conditions.

Dixon, Hmielowski, et al. (2019) noted in a published response that *everyone* in van der Linden, Leiserowitz, and Maibach's study was exposed to the consensus message immediately before they were asked to rate the extent to which the statement was manipulative. In other words, although respondents in the control condition were not exposed to the consensus message earlier in the survey, they were exposed to it immediately prior to responding to the authors' measure of reactance. Therefore, they argue that the van der Linden, Leiserowitz, et al. (2019) study can only assess the degree to which *repeated exposure* to the consensus message (i.e. in the treatment condition) increased the belief that the statement is manipulative relative to a single exposure to the same treatment (i.e. in the control). This difference in design may partly account for the discrepant findings. Further, as Dixon, Hmielowski, et al. (2019) explain, differences in the item(s) used to assess psychological reactance across the studies may also partly explain the contrasting results. Ma et al. (2019) measured, *in general*, whether respondents feel others are trying to force their climate change opinions on them (p. 76). This measure can be used on respondents randomly assigned to the basic message and control conditions. In contrast, van der Linden, Leiserowitz, et al. (2019) measured psychological reactance as the degree to which the consensus statement itself is perceived as manipulative. While this question more closely measures the potential reactance effect of the consensus statement itself, it also requires everyone to read the statement regardless of experimental condition, which precludes a direct comparison between Ma et al.'s and van der Linden, Leiserowitz, and Maibach's results.

Both sides make reasonable points. For us, perhaps the most useful lesson is how this specific debate accentuates the importance of context, as well as choices regarding experimental design and measures, in comparing the results from very similar studies. We suspect differences in observed results across studies of scientific consensus messaging reflect the reality that the effects may not generalize not only across measures, but also across times, contexts, or even seemingly minor variations in the wording of the climate consensus statement. Timing, context, and variations in treatments and measures are crucial dimensions of external validity, despite being typically dwarfed by discussions of sample generalizability (Druckman & Kam, 2011; Shadish et al., 2002). An increased focus on isolating the motivations behind responses to scientific consensus messages must be accompanied by attention to these dimensions, as a large body of prior work demonstrates that variations along these dimensions may incite different motivations in respondents and, hence, distinct reactions (Chong & Druckman, 2007; Druckman, 2012; Druckman & Leeper, 2012; Druckman et al., 2013; Bolsen, Druckman, et al., 2014).

First, the timing (and concomitant context) of a climate change consensus messaging experiment matters. Consider that the general backfiring effect discovered by Ma et al. (2019) seems to be fragile: some work finds it (e.g. Nyhan & Reifler, 2010; Peter & Koch, 2016) but the bulk of the recent evidence does not (e.g. Bayes et al., 2020; de Benedictis-Kessner et al., 2019; Guess & Coppock, 2018; Nyhan et al., 2020; Walter & Tukachinsky, 2020; Wood & Porter, 2019). Part of this inconsistency may be due to the timing of the studies. Ma et al. collected their data in 2017, shortly after one of the warmest Februarys on record that generated considerable conversation about climate change (e.g. CBS News, 2017). That may have stimulated some defensiveness among climate skeptics who sought to counter-argue that the unusually warm weather suggested larger trends. That, combined with the recent inauguration of President Trump, who boldly denied climate change, may have led to psychological reactance among climate skeptics and Republicans who were exposed to the scientific

consensus message. In contrast, the van der Linden, Leiserowitz, and Maibach data come from 2016, prior to the Presidential election (personal communication 9/16/19), during a time of ostensibly less media coverage and attention to the issue. This difference in context may have altered the motivation of respondents when they evaluated the scientific consensus message and partially explain the different results across the studies. In short, it is crucial for all experimental researchers to consider how context and timing may affect any specific study's results (Druckman & Leeper, 2012).

Also of relevance to this debate is slight differences in the wording included in the scientific consensus message in the two studies. Ma et al.'s (2019, p. 76) message stated, "Did you know? 97% of climate scientists have concluded that human-caused climate change is happening." This subtly differs from van der Linden, Leiserowitz, et al. (2019, p. 51), who simply stated the consensus on "global warming" (as opposed to "climate change"), without the "Did you know?" preface. The phrase "did you know?" could itself cause reactance among those who did not know and are not inclined to trust the authority of climate scientists (or survey researchers). More generally, the theoretical application of reactance theory seems unclear, as much of that work focuses on attitudinal and behavioral directives (i.e. "you should do or believe in something") that lead respondents to have negative cognitive and emotional reactions (e.g. Dillard & Shen, 2005). In the case of van der Linden, Leiserowitz, and Maibach's consensus treatment, it is not clear that the consensus message provides a directive; however, perhaps the "Did you know?" preface to the consensus message in Ma et al.'s study caused respondents to feel as if they "should have known."

The larger point is that we have little understanding about the ways in which variations in the wording of consensus messages, as well as the context and timing of any study, shape the effectiveness of the overall strategy. If these slight changes in the treatments used to communicate the scientific consensus on climate change do in fact alter reactions, one may question whether any effects are particularly meaningful; however, in this case, that would be a mistake, given the sizeable literature on how linguistic alterations can alter understandings in the survey context (e.g. Tourangeau et al., 2000). This is true even in the case of labeling the issue "climate change" as opposed to "global warming" in comparing differences in outcomes across studies (e.g. Schuldt, 2016). This is not to suggest that any minor differences in stating the scientific consensus would generate differential responses; rather, in this case, the distinct treatments may be so different from one another as to stimulate varying reactions.

The lack of direct evidence on motivational processes – neither study directly manipulates motivation – do *not* undermine the distinct results found by Ma et al. and van der Linden, Leiserowitz, and Maibach per se. Yet, they may explain the differences. The precise treatments and context for Ma et al. may have sparked feelings of threat and directional defensiveness to protect one's standing beliefs. Those conditions differed for van der Linden, Leiserowitz, and Maibach, where the underlying motivations may have been a desire to conform to the scientific consensus or form accurate opinions. Consideration of treatments and contexts and how they connect to motivations – be them an accuracy motivation or a directional motivation to maintain autonomy, cohere with a social consensus, affirm an in-group identity, or assert one's values – is an important next step for future research.

Which opinions to study?

The main outcome studied in scientific consensus messaging is perception of the level of scientific consensus, with the main downstream variables being – at least, in the GBM – belief in global warming, belief in human activity causing global warming, worry about global warming, and support for public action (e.g. should people be doing more or less to reduce global warming?). A question that should guide the future of scientific consensus messaging research is the extent to which these typical outcome measures are relevant for addressing the climate change problem, and what other important outcomes have been heretofore neglected.

This is a complicated question with multiple avenues to consider. First, a prominent avenue of change is, of course, implementation of government policy. Although climate policy support is a well-studied outcome in climate messaging work (Bolsen & Shapiro, 2017; van der Linden, 2017), a crucial follow-up question has been largely neglected: to what types of public opinions do policymakers typically respond? Generally, it does seem that environmental and climate policy activity corresponds to the level of public opinion demanding it. Controlling for factors like average state ideology (e.g. as measured by state-level survey responses; see Erikson et al., 1993) and characteristics of the legislator/legislature, a host of correlational studies looks on a state-by-state basis and reports a relationship between public opinion and policy implementation in the U.S., both on general environmental issues like water pollution (Brace et al., 2002; Johnson et al., 2005) and climate change in particular (Bromley-Trujillo & Poe, 2020; Vandeweerdt et al., 2016). The question, though, is: what precise opinions are policymakers considering? Conceivably, the outcome variables studied in the GBM – i.e. whether people should be doing more or less to reduce global warming – may not be the same opinions to which policymakers attend, since they do not involve precise policies. The point is not to demean the GBM; rather, future work needs to trace the link from scientific consensus messaging to individual belief change to support for specific policies (or individual actions) to governmental action. In so doing, one needs to attend to whether other types of messages are more efficacious in generating support for specific climate policies to which governments can effectively respond. For example, Bolsen and Druckman (2018) and Bayes et al. (2020) find that scientific consensus messaging, while sometimes affecting beliefs, has no direct effect on support for specific climate mitigation polices. Then, Campbell and Kay (2014) offer another option, showing that when it comes to moving *policy* opinions, sometimes an effective approach is to appeal to solutions that resonate with the audience's ideological leaning, such as focusing on free-market solutions among conservatives.

A second important set of outcome variables for future research involves private politics. Private politics refers to when individuals and activists express themselves in the private realm via boycotting businesses and/or buycotting products. They often do this to bypass formal democratic (legislative) practices and induce companies to alter their behaviors or reward them for supporting a favored political position. As Baron and Diermeier (2007) state, "private interests such as activists … target private agents, often in the institution of public sentiment" (p. 600; also see Baron, 2003). This approach has become more feasible as non-governmental organizations (NGOs) exploit communication technologies to orchestrate boycotting and/or buycotting efforts (e.g. Abito et al., 2019; Baron & Diermeier, 2007; Druckman & Valdes, 2019; Reid & Toffel, 2009). Examples of successful protest efforts that have led companies to change their environmental practices include Nestle's efforts to end deforestation, Staples' increased usage of recycled paper, and Zara clothing stores eliminating fur products (Roser-Renouf, Maibach, et al., 2016; also see Reid & Toffel, 2009; Hiatt et al., 2015). Roser-Renouf, Maibach, et al. (2016) reported that nearly a third of Americans rewarded companies that address climate change by buying their products more than once in the last year (2016), while about 20% said they had avoided products from companies with poor climate practices. In private politics, it is not public opinion and policy support per se that is the outcome of interest, but rather market behaviors and individuals' purchasing decisions (Endres & Panagopoulos, 2017). Here, scientific consensus messaging by itself is unlikely to be sufficient; such communications would have to be conjoined with messages that emphasize the potential efficacy and the normative importance of taking action via private politics (Roser-Renouf, Atkinson, et al., 2016, p. 4777). This is not to downplay the role scientific consensus messaging can play, but when it comes to generating action, people also need to feel they can make a difference and/or feel they can meet normative expectations.

Finally, individual behaviors might matter too, and a sizeable literature studies factors that lead to climate-friendly behaviors such as recycling, purchasing fuel efficient products, lowering thermostats, and using alternative transportation (e.g. Attari et al., 2011). These studies suggest that these behaviors can make a difference when it comes to climate change (Rare and California Environmental Associates, 2019), but messaging to induce these behaviors remains complicated. For

example, in Levine and Kline (2019), two experiments demonstrate the effects of gain- and loss-frames in messaging on behaviors. In a field experiment, over 100,000 members of a social network site were randomly assigned to receive an email message with either (1) a loss frame about the harms to public health that would be reduced with climate action, (2) a gains frame about the health benefits that would occur with climate action, or (3) a control message advocating for clean energy. In an analogous online survey experiment, 526 Amazon Mechanical Turk workers were randomly assigned to receive similar messages. The key outcome of interest for both experiments was a behavioral measure of political activism: joining an organization in the field experiment and joining an email listserv in the survey experiment. Both studies found that gain-frames were more successful at mobilizing behavior relative to the control. However, loss-frames were *demobilizing* in the field experiment, while in the survey experiment, they were demobilizing only among those experiencing a health hardship and thus facing a material constraint against spending resources on activism that the loss frame made salient. This suggests that extreme care needs to be taken when it comes to considering how alternative messaging strategies impact individual behaviors to avoid what is, in essence, a distinct type of backfire effect.

When it comes to scientific consensus messaging, it may seem as if our discussion of private politics and other types of individual behavior is tangential. While existing research on scientific consensus includes consideration of "political action" outcomes broadly speaking, we do not claim that scientific consensus messaging constitutes the best approach for achieving these outcomes, relative to alternative messaging strategies available. That said, insufficient attention to scientific consensus messaging here may be a missed opportunity. Other work shows that people hold widely inaccurate perceptions of what others think about climate change – for example, Abeles et al. (2019) reported that in 2018, "Americans perceived only 57% of other Americans to think global warming had been happening while 74% of Americans actually thought that." Moreover, "71 percent of Americans inaccurately estimated that the majority of Republicans did not believe that global warming had been happening" (p. 123). These second-order beliefs are related, not only to private beliefs, but also intentions to engage in climate activism (Ballew, Rosenthal, et al., 2020). When these misperceptions are corrected, and people learn that a majority, or, in some cases, a near consensus, hold a particular belief, they change their own environmental/climate beliefs and behaviors (e.g. Bayes et al., 2020; Mildenberger & Tingley, 2019; Jachimowicz et al., 2018; Schuldt et al., 2019). This is even true at the elite level, as Congressional staffers underestimate the number of Americans who support governmental regulation of carbon dioxide emissions (Mildenberger & Tingley, 2019). As Jost (2018) states,

> the mass media and other cultural institutions do have some work to do when it comes to educating citizens and experts alike about the extent to which a consensus exists about the occurrence of climate change — among scientists and citizens, in the US and elsewhere. (p. 190)

The point is that, regardless of whether GBM is itself the most effective way to change policies and behaviors, emphasizing the existence of a consensus – or even a majority perspective – can powerfully impact individuals' beliefs about climate change. Put another way, it is not just scientific consensus messaging that could matter, but also messaging that others believe in that consensus, and even further, what others are doing with regard to climate change. This can potentially help move the needle when it comes to efficacy and social norms as well.

Whose opinions to study?

Distinct from the question of *which* attitudes, beliefs, and behaviors one should study when it comes to consensus messaging are *whose* opinions researchers should study. Most existing research generalizes in an effort to study message effects among the "mass public," with the main variation concerning ideology and partisanship. One of the central research questions, as intimated, is whether the scientific consensus message increases belief in the consensus among Republicans and conservatives,

or, conversely, backfires on them. This focus follows from the reality that climate change has become a polarized political issue on which partisan elites have staked out distinct positions (Bolsen et al., 2015; McCright & Dunlap, 2011). Yet, one under-explored aspect is whether studying the opinions and beliefs of certain sub-populations are of special interest. Here, two inter-connected questions emerge:

- Do some people's opinions matter more than others for policy change, and, if so, what climate change communications (e.g. scientific consensus messages) would be most effective when it comes to the most influential subsets of the population?
- On the other hand, we already know that some people are more vulnerable to the harms posed by climate change than others (IPCC, 2014); how do these most vulnerable subsets of the population react to scientific consensus messages and other types of climate change communications?

On the first question, there is reason to believe that some sub-populations are more influential than others in determining climate policy. Although topic-specific research on the responsiveness of climate policy to public opinion is in its infancy, there is much work on representation that suggests that policy activity in general is more responsive to high-income and other elite segments of the public (e.g. Bartels, 2018; Gilens & Page, 2014). Investigating whether income, education, or other variables moderate reactions to scientific consensus messaging, for example, would form the basis of a research agenda that would be highly useful for showing how such messages affect support for different climate policies. The same can be said for looking more at how interest group or think tank leaders react to these messages (e.g. Domhoff, 2002; Goldberg, Marlon, et al., 2020). On first glance, it may seem that scientific consensus messaging would not be worthwhile here due to a common misperception that these groups already may be informed of the scientific consensus – but, as cited above, even experts seem to not always recognize the extent of the scientific and social consensus on climate change (Jost, 2018). And even if it turns out that scientific consensus messaging is not the most effective route for generating support for specific policies among elite and influential sub-populations, it might facilitate the identification of what types of communications *do* work. In other words, if scientific consensus messaging does not work among these groups, understanding why could lend insight into what may work.

The second question addresses who will be most affected by the consequences of climate change. Much research has already been done to identify the most vulnerable sub-populations on both the global (e.g. IPCC, 2014; Chaplin-Kramer et al., 2019) and national levels (USGCRP, 2018).[9] Recent work uses a broad conception of what constitutes a climate change consequence, encompassing not only environmental but also economic, infrastructural, health, and even crime and other social impacts (Watts et al., 2018; White, 2017). With so many potential impacts, the scope of vulnerability is correspondingly broad. As IPCC (2014) states,

> People who are socially, economically, culturally, politically, institutionally, or otherwise marginalized are especially vulnerable to climate change … . This heightened vulnerability is rarely due to a single cause. Rather, it is the product of intersecting social processes that result in inequalities in socioeconomic status and income, as well as in exposure. Such social processes include, for example, discrimination on the basis of gender, class, ethnicity, age, and (dis)ability. (p. 54)

Similarly, USGCRP (2018) identifies vulnerable sub-populations in the United States specifically. While almost everyone will be exposed to different kinds of climate change impacts, certain sub-populations who are most sensitive to disturbances and least able to adapt to them will suffer most. These include

> poor people in high-income regions, minority groups, women, pregnant women, those experiencing discrimination, children under five, persons with physical and mental illness, persons with physical and cognitive disabilities, the homeless, those living alone, Indigenous people, people displaced because of weather and climate, the socially isolated, poorly planned communities, the disenfranchised, those with less access to healthcare, the

> uninsured and underinsured, those living in inadequate housing, and those with limited financial resources to rebound from disasters. (USGCRP, 2018, p. 548)

With regards to scientific consensus messaging, a crucial point is that these vulnerable segments of the public are the least likely to have access to information, and least likely to have a voice in climate planning and governance (USGCRP, 2018). As a result, these sub-populations present various challenges for research that has been relatively silent on these groups to date.[10] Here, we identify some important paths for future work.

First, little is known about the extent to which vulnerable sub-populations receive communications about climate change, such as scientific consensus information. Existing data on exposure to general science information, interest in science, and science literacy is a place to start, but there has been little focus on vulnerable sub-populations here thus far. Exposure to science information, for example, is measured primarily in polls about science news consumption or visits to science institutions that do not segment out vulnerable sub-populations (the General Social Survey Science Indicators module; Pew, 2017). Many studies focusing on children and young adults find that gender, race, income, and their intersections play a role in maintaining their interest in the sciences as they develop (e.g. Perry et al., 2012), but adult data are limited (although see Miller et al., 1997, who find that education level matters for science interest). Findings on science literacy suggest that gaps exist between adults with high and low levels of formal education, and between whites and blacks, and whites and Hispanics (Miller et al., 1997; Allum et al., 2018), but more work is needed on intersectional dynamics. This is an important path for future research, given that intersectional membership in multiple vulnerable groups heightens overall vulnerability. The first step to understanding how vulnerable sub-populations engage with climate change communications is to measure their exposure to such communications. A straightforward extension of the GBM approach would be to study access to scientific consensus information among these particular subgroups.

A second path for future research could investigate how vulnerable sub-populations process the science information with which they do engage. Hearkening back to our earlier discussion, what are the motivations most prevalent among these subgroups? Do subgroups differ in their motivated responses to scientific consensus messages and/or credibility assessments of the scientific community? Here, again, gender, race, income, and education are predictors (Anderson et al., 2012; Plutzer, 2013), but intersectional dynamics are not well-studied. Furthermore, do subgroups differ meaningfully in the thinking style that they might bring to processing scientific information? For example, Oliver and Wood (2018) find that the Intuitionist thinking style, characterized by superstitious and conspiracy thinking, is correlated with lower education and income. How these differences are distributed within vulnerable sub-groups and their effects on the processing of communications about climate change remains an open question.

Third, focusing on vulnerable sub-populations in future research is a natural corollary to incorporating concerns about adaptation, which have been largely neglected in the scientific consensus messaging literature thus far.[11] Climate change poses an injustice in that the groups who are most able to mitigate future harms are not the same groups who will most need to adapt to those harms. While questions about mitigation may be most relevant when studying elite and influential sub-populations, questions of adaptive capacity are central to studying vulnerable sub-populations. Therefore, future consensus messaging research should address, not only attitudes relevant to reducing emissions, but also attitudes that enable resilience to harm caused by past emissions. Whether scientific consensus messaging helps build belief structures that generate adaptive behaviors is untested, but of crucial importance for this research agenda to have broader reach.

Fourth, future research on scientific consensus messaging should expand beyond the primarily Western populations on which it currently focuses. Vulnerable sub-populations can be defined within-nation due to factors like income, education, or social status, but the dynamic between powerful versus vulnerable groups at the nation level is also nested within an analogous global-

level dynamic involving relatively powerful developed countries versus relatively vulnerable developing countries (e.g. Chaplin-Kramer et al., 2019). While powerful and vulnerable sub-populations may be distinct, they are both important to study for different reasons, and special attention to these sub-populations of interest should guide future research on climate change messaging effects at both the U.S. and global levels. It very well may be that some groups in developing nations would react positively to scientific consensus messaging regarding both mitigation and adaptation – and recent efforts to measure trust in science in populations around the world, such as the Wellcome Global Monitor survey, indicate that this understudied area may hold promise. But even if scientific consensus messaging does not turn out to be the most effective approach, as with the aforementioned more powerful subpopulations, research on reactions among the most vulnerable would still allow for the identification of what types of messaging approaches *do* work.

To be clear, we do not mean to dismiss the potential of scientific consensus messaging with these groups; rather, we urge scholars to focus on studying these groups and whether scientific consensus messaging does matter. In so doing, a useful approach is to assess how different communities process distinct messages – for example, Song et al. (2020) show that non-white and low-income respondents have a broader conceptualization of environmental issues than white and high-income respondents. In addition, it will be crucial to work with "boundary spanning" organizations that explore how scientific information is transmitted and received among distinct groups in order to understand the broader cultural, social, and economic contexts that shape information practices (Safford et al., 2017).

One final note is that in embarking on research on vulnerable populations, researchers need to take care to attend to ethical considerations. The principles of the Belmont Report suggest some best practices when working with vulnerable sub-populations: researchers must articulate the risks involved in research in a way that participants can understand and provide informed consent, researchers should not subject participants to unnecessary risk without direct benefit, and researchers should ensure that findings from research conducted using vulnerable participants will be used, in turn, to benefit the vulnerable sub-populations from which they were drawn (e.g. Teele, n.d.). Although certainly not exhaustive, this list can provide guidance to researchers so that future research empowers vulnerable sub-populations rather than inadvertently contributing to their continued marginalization.[12]

Back to consensus messaging

The scientific consensus on climate change provides a valuable foundation for effective messaging. While the research program looking at such messaging has demonstrated some success, it also has generated considerable debate. We believe these disagreements – concerning scientific consensus messaging – are important. However, we also offered a way forward by advocating more focus on motivational processes and how the context and timing of exposure to the consensus message may condition its impact. We also implore those studying scientific consensus messaging and climate change communication more generally to expand their research program to other outcome variables and various crucial subpopulations. Even if it turns out that consensus messaging is not the primary approach to be taken on these questions – and indeed, the authors of the GBM model state that they do not view consensus messaging as a "magic bullet" (Cook & Pearce, 2020, p. 134) – it does provide a useful baseline for which to compare other communication approaches (e.g. Bayes et al., 2020).

Changing behavior and policy is itself a wicked problem; there is no straightforward, one-size-fits-all solution, and even when effective approaches are found, encouraging adoption of them can be difficult. With this in mind, however, social scientists have a crucial role to play: we cannot move forward to encouraging adoption of effective communication strategies without first delineating the boundaries of those strategies, by looking at what motivates people when they form beliefs about climate change, within which populations, and with what outcomes.

Notes

1. van der Linden, Leiserowitz, et al. (2019) acknowledge that highlighting the scientific consensus does not directly lead to policy support, and therefore, communicating the consensus primarily will have first-order effects on beliefs about the nature of the consensus. They further acknowledge, "we cannot fully ascertain a temporal chain where cascading changes in key beliefs (M) *cause* higher support for public action (Y) as separate experiments would need to be conducted to independently manipulate the M to Y paths" (p. 57).
2. One counterargument to this point is that there is no relevant counterfactual. That is, sans the consensus messaging efforts to date, there could be even larger segments of the public who underestimate the scientific consensus; moreover, longitudinal data suggest increased public knowledge of the consensus (Hamilton, 2016).
3. That said, some research contends there are inoculation methods to address dissenting voices (van der Linden, Leiserowitz, Rosenthal, et al., 2017).
4. Pearce et al. acknowledge that "there are occasions where this consensus is worth stating. However, there will always be public voices of dissent, and drowning them out with consensus messaging is implausible" (2017, p. 737; also see Aklin & Urpelainen, 2014).
5. Motivated reasoning theory suggests that directional processes may be stronger for more sophisticated individuals (e.g. Taber & Lodge, 2006); consistent with this pattern, knowledgeable partisans are more polarized than their less knowledgeable counterparts with respect to their belief in human-caused climate change (e.g. Bolsen et al., 2015; Kahan et al., 2012).
6. It is possible, of course, that their evaluation of the credibility of any scientific source reflects directional motivated reasoning itself (e.g. Pasek, 2018). However, just as with the formation of climate change beliefs, establishing that would require isolating precise motivational states, which extant work has not done. For a more detailed discussion, see Bayes et al. (2020), Druckman and McGrath (2019), and Tappin et al. (2020).
7. It is possible that a social consensus also exerts an informational (accuracy) influence independent of its normative (directional) influence, if individuals find their social network to be a credible source of information (Goldberg, van der Linden, et al., 2020).
8. Notably though, their study was not initially designed as a replication but rather "to replicate van der Linden et al." (2015) and "model the downstream effects of consensus messages on geographic subunits" (p. 4).
9. Vulnerability to climate change is defined by three dimensions: (1) exposure of a given system or group to climatic stressors, (2) sensitivity, or degree to which the subject will respond to such stressors, and (3) adaptive capacity, or the subject's ability to adapt to the resulting changes (IPCC, 2014). Of those exposed to climatic stressors, more sensitive subjects are more vulnerable; holding sensitivity constant, those with the lowest adaptive capacity are most vulnerable.
10. That said, it is important to note that several vulnerable communities have been leaders in calling for climate justice (e.g. the Standing Rock protests around the Dakota pipeline). Indeed, some data suggest people of color in the U.S. are more concerned than whites about climate change (e.g. Ballew, Maibach, et al., 2020). We thank an anonymous reviewer for this point.
11. As a comparison point, consider the sizable literature on climate change risk perceptions that focuses on factors influencing climate change attitudes relevant for adaptation, particularly among non-Western populations (e.g. Debela et al., 2015; Roco et al., 2015).
12. We thank Reviewer 2 for suggesting inclusion of this discussion.

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References

Abeles, A. T., Howe, L. C., Krosnick, J. A., & MacInnis, B. (2019). Perception of public opinion on global warming and the role of opinion deviance. *Journal of Environmental Psychology*, *63*, 118–129. https://doi.org/10.1016/j.jenvp.2019.04.001

Abito, J. M., Besanko, D., & Diermeier, D. (2019). *Corporate reputation and social activism: Strategic interaction, Firm behavior, and social welfare*. Oxford University Press.

Aklin, M., & Urpelainen, J. (2014). Perceptions of scientific dissent undermine public support for environmental policy. *Environmental Science & Policy*, *38*, 173–177. https://doi.org/10.1016/j.envsci.2013.10.006

Allum, N., Besley, J., Gomez, L., & Brunton-Smith, I. (2018). Disparities in science literacy. *Science*, *360*(6391), 861–862. https://doi.org/10.1126/science.aar8480

Anderson, A. A., Scheufele, D. A., Brossard, D., & Corley, E. A. (2012). The role of media and deference to scientific authority in cultivating trust in sources of information about emerging technologies. *International Journal of Public Opinion Research*, *24*(2), 225–237. https://doi.org/10.1093/ijpor/edr032

Attari, S. Z., DeKay, M. L., Davidson, C. I., & de Bruin, W. B. (2011). Changing household behaviors to curb climate change: How hard can it be? *Sustainability: The Journal of Record*, *4*(1), 9–11. https://doi.org/10.1089/SUS.2010.9724

Ballew, M., Maibach, E., Kotcher, J., Bergquist, P., Rosenthal, S., Marlon, J., & Leiserowitz, A. (2020). Which racial/ethnic groups care most about climate change? Yale Program on Climate Change Communication. https://climatecommunication.yale.edu/publications/race-and-climate-change/

Ballew, M. T., Pearson, A. R., Goldberg, M. H., Rosenthal, S. A., & Leiserowitz, A. (2020). Does socioeconomic status moderate the political divide on climate change? The roles of education, income, and individualism. *Global Environmental Change*, *60*, 102024. https://doi.org/10.1016/j.gloenvcha.2019.102024

Ballew, M. T., Rosenthal, S. A., Goldberg, M. H., Gustafson, A., Kotcher, J. E., Maibach, E. W., & Leiserowitz, A. (2020). Beliefs about others' global warming beliefs: The role of party affiliation and opinion deviance. *Journal of Environmental Psychology*, *70*, 101466. https://doi.org/10.1016/j.jenvp.2020.101466

Baron, D. P. (2003). Private politics. *Journal of Economics & Management Strategy*, *12*(1), 31–66. https://doi.org/10.1162/105864003321220724

Baron, D. P., & Diermeier, D. (2007). Strategic activism and nonmarket strategy. *Journal of Economics & Management Strategy*, *16*(3), 599–634. https://doi.org/10.1111/j.1530-9134.2007.00152.x

Bartels, L. M. (2018). *Unequal democracy: The political economy of the new gilded age*. Princeton University Press.

Bayes, R., Druckman, J. N., Goods, A., & Molden, D. C. (2020). When and how different motives can drive motivated political reasoning. *Political Psychology*. Advance online publication. https://doi.org/10.1111/pops.12663

Bolsen, T., & Druckman, J. N. (2018). Do partisanship and politicization undermine the impact of a scientific consensus message about climate change? *Group Processes & Intergroup Relations*, *21*(3), 389–402. https://doi.org/10.1177/1368430217737855

Bolsen, T., Druckman, J. N., & Cook, F. L. (2014). The influence of partisan motivated reasoning on public opinion. *Political Behavior*, *36*(2), 235–262. https://doi.org/10.1007/s11109-013-9238-0

Bolsen, T., Druckman, J. N., & Cook, F. L. (2015). Citizens', scientists', and policy advisors' beliefs about global warming. *The ANNALS of the American Academy of Political and Social Science*, *658*(1), 271–295. https://doi.org/10.1177/0002716214558393

Bolsen, T., Leeper, T. J., & Shapiro, M. A. (2014). Doing what others do: Norms, science, and collective action on global warming. *American Politics Research*, *42*(1), 65–89. https://doi.org/10.1177/1532673X13484173

Bolsen, T., & Palm, R. (2019). Motivated reasoning and political decision making. In *Oxford research encyclopedia of politics*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228637.013.923

Bolsen, T., & Shapiro, M. A. (2017). Strategic framing and persuasive messaging to influence climate change perceptions and decisions. In *Oxford research encyclopedia of climate science*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228620.013.435

Brace, P., Sims-Butler, K., Arceneaux, K., & Johnson, M. (2002). Public opinion in the American states: New perspectives using national survey data. *American Journal of Political Science*, *46*(1), 173–189. https://doi.org/10.2307/3088421

Brehm, S. S., & Brehm, J. W. (2013). *Psychological reactance: A theory of freedom and control*. Academic Press.

Brewer, P. R., & McKnight, J. (2017). "A statistically representative climate change debate": Satirical television news, scientific consensus, and public perceptions of global warming. *Atlantic Journal of Communication*, *25*(3), 166–180. https://doi.org/10.1080/15456870.2017.1324453

Bromley-Trujillo, R., & Poe, J. (2020). The importance of salience: Public opinion and state policy action on climate change. *Journal of Public Policy*, *40*(2), 280–304. https://doi.org/10.1017/S0143814X18000375

Brulle, R. J., Carmichael, J., & Jenkins, J. C. (2012). Shifting public opinion on climate change: An empirical assessment of factors influencing concern over climate change in the US, 2002–2010. *Climatic Change*, *114*(2), 169–188. https://doi.org/10.1007/s10584-012-0403-y

Bullock, J. G., & Ha, S. E. (2011). Mediation analysis is harder than it looks. In J. N. Druckman, D. P. Green, J. H. Kuklinski, & A. Lupia (Eds.), *Cambridge handbook of experimental political science* (pp. 508–522). Cambridge University Press.

Campbell, T. H., & Kay, A. C. (2014). Solution aversion: On the relation between ideology and motivated disbelief. *Journal of Personality and Social Psychology*, *107*(5), 809–824. doi:10.1037/a0037963. https://doi.org/10.1037/a0037963

CBS News. (2017, March 9). The numbers are in on this freakishly warm February. https://www.cbsnews.com/news/february-2017-warm-temperatures-climate-change/

Chaplin-Kramer, R., Sharp, R. P., Weil, C., Bennett, E. M., Pascual, U., Arkema, K. K., Brauman, K. A., Bryant, B. P., Guerry, A. D., Haddad, N. M., Hamann, M., Hamel, P., Johnson, J. A., Mandle, L., Pereira, H. M., Polasky, S., Ruckelshaus, M., Shaw, M. R., Silver, J. M., … Daily, G. C. (2019). Global modeling of nature's contributions to people. *Science*, *366*(6462), 255–258. https://doi.org/10.1126/science.aaw3372

Chong, D., & Druckman, J. N. (2007). Framing public opinion in competitive democracies. *American Political Science Review*, *101*(4), 637–655. https://doi.org/10.1017/S0003055407070554

Cialdini, R. B., Martin, S. J., & Goldstein, N. J. (2015). Small behavioral science–informed changes can produce large policy-relevant effects. *Behavioral Science & Policy*, *1*(1), 21–27. https://doi.org/10.1353/bsp.2015.0008

Cook, J. (2016). Countering climate science denial and communicating scientific consensus. In *Oxford research encyclopedia of climate science*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190228620.013.314

Cook, J., & Lewandowsky, S. (2016). Rational irrationality: Modeling climate change belief polarization using Bayesian networks. *Topics in Cognitive Science*, *8*(1), 160–179. https://doi.org/10.1111/tops.12186

Cook, J., Lewandowsky, S., & Ecker, U. K. (2017). Neutralizing misinformation through inoculation: Exposing misleading argumentation techniques reduces their influence. *PLoS One*, *12*(5), e0175799. https://doi.org/10.1371/journal.pone.0175799

Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R., Verheggen, B., Maibach, E. W., Carlton, J. S., Lewandowsky, S., Skuce, A. G., Green, S. A., Nuccitelli, D., Jacobs, P., Richardson, M., Winkler, B., Painting, R., & Rice, K. (2016). Consensus on consensus: A synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*, *11*(4), 048002. https://doi.org/10.1088/1748-9326/11/4/048002

Cook, J., & Pearce, W. (2020). Is emphasizing consensus in climate science helpful for policymaking? In M. Hulme (Ed.), *Contemporary climate change debates: A student primer* (pp. 127–145). Routledge.

de Benedictis-Kessner, J. A., Baum, M. A., Berinsky, A. J., & Yamamoto, T. (2019). Persuading the enemy: Estimating the persuasive effects of partisan media with the preference-incorporating choice and assignment design. *American Political Science Review*, *113*(4), 902–916. https://doi.org/10.1017/S0003055419000418

Debela, N., Mohammed, C., Bridle, K., Corkrey, R., & McNeil, D. (2015). Perception of climate change and its impact by smallholders in pastoral/agropastoral systems of Borana, South Ethiopia. *SpringerPlus*, *4*(236), 1–12. https://doi.org/10.1186/s40064-015-1012-9

Deryugina, T., & Shurchkov, O. (2016). The effect of information provision on public consensus about climate change. *PLoS One*, *11*(4), e0151469. https://doi.org/10.1371/journal.pone.0151469

Dietz, T. (2013). Bringing values and deliberation to science communication. *Proceedings of the National Academy of Sciences*, *110*(Supplement 3), 14081–14087. https://doi.org/10.1073/pnas.1212740110

Dillard, J. P., & Shen, L. (2005). On the nature of reactance and its role in persuasive health communication. *Communication Monographs*, *72*(2), 144–168. https://doi.org/10.1080/03637750500111815

Ding, D., Maibach, E. W., Zhao, X., Roser-Renouf, C., & Leiserowitz, A. (2011). Support for climate policy and societal action are linked to perceptions about scientific agreement. *Nature Climate Change*, *1*(9), 462–466. https://doi.org/10.1038/nclimate1295

Dixon, G., Bullock, O., & Adams, D. (2019). Unintended effects of emphasizing the role of climate change in recent natural disasters. *Environmental Communication*, *13*(2), 135–143. https://doi.org/10.1080/17524032.2018.1546202

Dixon, G., Hmielowski, J., & Ma, Y. (2017). Improving climate change acceptance among U.S. Conservatives through value-based message targeting. *Science Communication*, *39*(4), 520–534. https://doi.org/10.1177/1075547017715473

Dixon, G., Hmielowski, J., & Ma, Y. (2019). More evidence of psychological reactance to consensus messaging: A response to van der Linden, Maibach, and Leiserowitz (2019). *Environmental Communication*, 1–7. https://doi.org/10.1080/17524032.2019.1671472

Domhoff, G. W. (2002). The power elite, public policy, and public opinion. In: J. Manza, F. L. Cook, & B. I. Page (Eds.), *Navigating public opinion: Polls, policy, and the future of American democracy* (pp. 124–137). Oxford University Press.

Druckman, J. N. (2012). The politics of motivation. *Critical Review*, *24*(2), 199–216. https://doi.org/10.1080/08913811.2012.711022

Druckman, J. N. (2015). Communicating policy-relevant science. *PS: Political Science & Politics*, *48*(S1), 58–69. https://doi.org/10.1017/S1049096515000438

Druckman, J. N. (2017). The crisis of politicization within and beyond science. *Nature Human Behaviour*, *1*(9), 615–617. https://doi.org/10.1038/s41562-017-0183-5

Druckman, J. N., & Kam, C. D. (2011). Students as experimental participants. In J. N. Druckman, D. P. Green, J. H. Kuklinski, & A. Lupia (Eds.), *Cambridge handbook of experimental political science* (pp. 41–57). Cambridge University Press.

Druckman, J. N., & Leeper, T. J. (2012). Learning more from political communication experiments: Pretreatment and its effects. *American Journal of Political Science*, *56*(4), 875–896. https://doi.org/10.1111/j.1540-5907.2012.00582.x

Druckman, J. N., & McGrath, M. C. (2019). The evidence for motivated reasoning in climate change preference formation. *Nature Climate Change*, *9*(2), 111–119. https://doi.org/10.1038/s41558-018-0360-1

Druckman, J. N., Peterson, E., & Slothuus, R. (2013). How elite partisan polarization affects public opinion formation. *American Political Science Review*, *107*(1), 57–79. https://doi.org/10.1017/S0003055412000500

Druckman, J. N., & Valdes, J. (2019). How private politics alters legislative responsiveness. *Quarterly Journal of Political Science*, *14*(1), 115–130. https://doi.org/10.1561/100.00018066

Dwyer, P. C., Maki, A., & Rothman, A. J. (2015). Promoting energy conservation behavior in public settings: The influence of social norms and personal responsibility. *Journal of Environmental Psychology*, *41*, 30–34. https://doi.org/10.1016/j.jenvp.2014.11.002

Egan, P. J., & Mullin, M. (2017). Climate change: US public opinion. *Annual Review of Political Science*, *20*(1), 209–227. https://doi.org/10.1146/annurev-polisci-051215-022857

Endres, K., & Panagopoulos, C. (2017). Boycotts, buycotts, and political consumerism in America. *Research & Politics*, *4*(4), 1–9. https://doi.org/10.1177/2053168017738632

Erikson, R. S., MacKuen, M. B., & Stimson, J. A. (2002). *The macro polity*. Cambridge University Press.

Erikson, R. S., Wright, G. C., & McIver, J. P. (1993). *Statehouse democracy: Public opinion and policy in the American states*. Cambridge University Press.

Feinberg, M., & Willer, R. (2013). The moral roots of environmental attitudes. *Psychological Science*, *24*(1), 56–62. https://doi.org/10.1177/0956797612449177

Fielding, K. S., & Hornsey, M. J. (2016). A social identity analysis of climate change and environmental attitudes and behaviors: Insights and opportunities. *Frontiers in Psychology*, *7*, 121–132. https://doi.org/10.3389/fpsyg.2016.00121

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior. An introduction to theory and research*. Addison-Wesley.

Gerber, A. S., & Rogers, T. (2009). Descriptive social norms and motivation to vote: Everybody's voting and so should you. *The Journal of Politics*, *71*(1), 178–191. https://doi.org/10.1017/S0022381608090117

Gilens, M., & Page, B. I. (2014). Testing theories of American politics: Elites, interest groups, and average citizens. *Perspectives on Politics*, *12*(3), 564–581. https://doi.org/10.1017/S1537592714001595

Goldberg, M. H., Marlon, J. R., Wang, X., van der Linden, S., & Leiserowitz, A. (2020). Oil and gas companies invest in legislators that vote against the environment. *Proceedings of the National Academy of Sciences*. https://doi.org/10.1073/pnas.1922175117.

Goldberg, M. H., van der Linden, S., Ballew, M. T., Rosenthal, S. A., Gustafson, A., & Leiserowitz, A. (2019). The experience of consensus: Video as an effective medium to communicate scientific agreement on climate change. *Science Communication*, *41*(5), 659–673. https://doi.org/10.1177/1075547019874361

Goldberg, M. H., van der Linden, S., Leiserowitz, A., & Maibach, E. (2020). Perceived social consensus can reduce ideological biases on climate change. *Environment and Behavior*, *52*(5), 495–517. https://doi.org/10.1177/0013916519853302

Guess, A., & Coppock, A. (2018). Does counter-attitudinal information cause backlash? Results from three large survey experiments. *British Journal of Political Science*, 1–19. https://doi.org/10.1017/S0007123418000327

Hamilton, L. C. (2016). Public awareness of the scientific consensus on climate. *Sage Open*, *6*(4), 215824401667629. https://doi.org/10.1177/2158244016676296

Hart, P. S., & Nisbet, E. C. (2012). Boomerang effects in science communication: How motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. *Communication Research*, *39*(6), 701–723. https://doi.org/10.1177/0093650211416646

Hiatt, S. R., Grandy, J. B., & Lee, B. H. (2015). Organizational responses to public and private politics: An analysis of climate change activists and U.S. Oil and gas firms. *Organization Science*, *26*(6), 1769–1786. https://doi.org/10.1287/orsc.2015.1008

Incropera, F. P. (2016). *Climate change: A wicked problem: Complexity and uncertainty at the intersection of science, economics, politics, and human behavior*. Cambridge University Press.

IPCC. (2014). *Climate change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, 151 pp.

Jachimowicz, J. M., Hauser, O. P., O'Brien, J. D., Sherman, E., & Galinsky, A. D. (2018). The critical role of second-order normative beliefs in predicting energy conservation. *Nature Human Behaviour*, *2*(10), 757–764. https://doi.org/10.1038/s41562-018-0434-0

Jasanoff, S. (2010). A new climate for society. *Theory, Culture & Society*, *27*(2-3), 233–253. https://doi.org/10.1177/0263276409361497

Johnson, M., Brace, P., & Arceneaux, K. (2005). Public opinion and dynamic representation in the American states: The case of environmental attitudes. *Social Science Quarterly*, *86*(1), 87–108. https://doi.org/10.1111/j.0038-4941.2005.00292.x

Jost, J. T. (2018). Underestimating belief in climate change. *Nature Climate Change*, *8*(3), 189–190. https://doi.org/10.1038/s41558-018-0082-4

Kahan, D. M. (2015). Climate-Science communication and the *Measurement problem*. *Political Psychology*, *36*(S1), 1–43. https://doi.org/10.1111/pops.12244

Kahan, D. M. (2016). The 'gateway belief' illusion: Reanalyzing the results of a scientific-consensus messaging study. *Journal of Science Communication*, *16*(5), 1–20. http://dx.doi.org/10.2139/ssrn.2779661

Kahan, D. M., Jenkins-Smith, H., Tarantola, T., Silva, C. L., & Braman, D. (2015). Geoengineering and climate change polarization: Testing a two-channel model of science communication. *The Annals of the American Academy of Political and Social Science*, *658*(1), 192–222. https://doi.org/10.1177/0002716214559002

Kahan, D. M., Jenkins-Smith, J., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, *14*(2), 147–174. https://doi.org/10.1080/13669877.2010.511246

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature Climate Change*, *2*(10), 732–735. https://doi.org/10.1038/nclimate1547

Kerr, J. R., & Wilson, M. S. (2018). Perceptions of scientific consensus do not predict later beliefs about the reality of climate change: A test of the gateway belief model using cross-lagged panel analysis. *Journal of Environmental Psychology*, *59*, 107–110. https://doi.org/10.1016/j.jenvp.2018.08.012

Kobayashi, K. (2018). The impact of perceived scientific and social consensus on scientific beliefs. *Science Communication*, *40*(1), 63–88. https://doi.org/10.1177/1075547017748948

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, *108*(3), 480–498. https://doi.org/10.1037/0033-2909.108.3.480

Leeper, T. J., & Slothuus, R. (2014). Political parties, motivated reasoning, and public opinion formation. *Political Psychology*, *35*, 129–156. https://doi.org/10.1111/pops.12164

Leiserowitz, A. A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. (2018). *Climate change in the American mind*. University of Washington.

Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Sciences*, *45*(2), 123–152. https://doi.org/10.1007/s11077-012-9151-0

Levine, A. S., & Kline, R. (2019). Loss-framed arguments can stifle political activism. *Journal of Experimental Political Science*, *6*(3), 171–179. https://doi.org/10.1017/XPS.2018.28

Lewandowsky, S., Gignac, G. E., & Vaughan, S. (2013). The pivotal role of perceived scientific consensus in acceptance of science. *Nature Climate Change*, *3*(4), 399–404. https://doi.org/10.1038/nclimate1720

Ma, Y., Dixon, G., & Hmielowski, J. D. (2019). Psychological reactance from reading basic facts on climate change: The role of prior views and political identification. *Environmental Communication*, *13*(1), 71–86. https://doi.org/10.1080/17524032.2018.1548369

McCright, A. M., & Dunlap, R. E. (2011). The politicization of climate change and polarization in the American public's views of global warming, 2001–2010. *The Sociological Quarterly*, *52*(2), 155–194. https://doi.org/10.1111/j.1533-8525.2011.01198.x

McCright, A. M., Dunlap, R. E., & Xiao, C. (2013). Perceived scientific agreement and support for government action on climate change in the USA. *Climatic Change*, *119*(2), 511–518. https://doi.org/10.1007/s10584-013-0704-9

Mildenberger, M., & Tingley, D. (2019). Beliefs about climate beliefs: The importance of second-order opinions for climate politics. *British Journal of Political Science*, *49*(4), 1279–1307. https://doi.org/10.1017/S0007123417000321

Miller, J. D., Pardo, R., & Niwa, F. (1997). *Public perceptions of science and technology: A comparative study of the European Union, the United States, Japan, and Canada*. Fundación BBV-Chicago Academy of Sciences.

Molden, D. C., & Higgins, E. T. (2012). Motivated thinking. In K. J. Holyoak & R. G. Morrison (Eds.), *The Oxford handbook of thinking and reasoning* (pp. 390–409). Oxford University Press.

Nisbet, E. C., Cooper, K. E., & Garrett, R. K. (2015). The partisan brain: How dissonant science messages lead conservatives and liberals to (dis) trust science. *The ANNALS of the American Academy of Political and Social Science*, *658*(1), 36–66. https://doi.org/10.1177/0002716214555474

Nyhan, B., Porter, E., Reifler, J., & Wood, T. J. (2020). Taking fact-checks literally but not seriously?: The effects of journalistic fact-checking on factual beliefs and candidate favorability. *Political Behavior*, *42*, 939–960. https://doi.org/10.1007/s11109-019-09528-x

Nyhan, B., & Reifler, J. (2010). When corrections fail: The persistence of political misperceptions. *Political Behavior*, *32*(2), 303–330. https://doi.org/10.1007/s11109-010-9112-2

Oliver, J. E., & Wood, T. J. (2018). *Enchanted America: How intuition and reason divide our politics*. University of Chicago Press.

Palm, R., Lewis, G. B., & Feng, B. (2017). What causes people to change their opinion about climate change? *Annals of the American Association of Geographers*, *107*(4), 883–896. https://doi.org/10.1080/24694452.2016.1270193

Pasek, J. (2018). It's not my consensus: Motivated reasoning and the sources of scientific illiteracy. *Public Understanding of Science*, *27*(7), 787–806. https://doi.org/10.1177/0963662517733681

Pearce, W. (2014). Scientific data and its limits: Rethinking the use of evidence in local climate change policy. *Evidence & Policy: A Journal of Research, Debate and Practice*, *10*(2), 187–203. https://doi.org/10.1332/174426514X13990326347801

Pearce, W., Grundmann, R., Hulme, M., Raman, S., Hadley Kershaw, E., & Tsouvalis, J. (2017). Beyond counting climate consensus. *Environmental Communication*, *11*(6), 723–730. https://doi.org/10.1080/17524032.2017.1333965

Perry, B. L., Link, T., Boelter, C., & Leukefeld, C. (2012). Blinded to science: Gender differences in the effects of race, ethnicity, and socioeconomic status on academic and science attitudes among sixth graders. *Gender and Education*, *24*(7), 725–743. https://doi.org/10.1080/09540253.2012.685702

Peter, C., & Koch, T. (2016). When debunking scientific myths fails (and when it does not): The backfire effect in the context of journalistic coverage and immediate judgments as prevention strategy. *Science Communication*, *38*(1), 3–25. https://doi.org/10.1177/1075547015613523

Petty, R. E., & Cacioppo, J. T. (1979). Issue involvement can increase or decrease persuasion by enhancing message-relevant cognitive responses. *Journal of Personality and Social Psychology*, *37*(10), 1915–1926. https://doi.org/10.1037/0022-3514.37.10.1915

Pew Research Center. (2017). Science news and information today. Survey conducted May 30–June 12, 2017. https://www.journalism.org/2017/09/20/science-news-and-information-today/

Pew Research Center. (2019). U.S. public views on energy and climate change. Survey conducted Oct. 1–13, 2019. https://www.pewresearch.org/science/2019/11/25/u-s-public-views-on-climate-and-energy/

Plutzer, E. (2013). The racial gap in confidence in science: Explanations and implications. *Bulletin of Science, Technology & Society*, *33*(5-6), 146–157. https://doi.org/10.1177/0270467614528902

Rare and California Environmental Associates. (2019). *Changing behaviors to reduce U.S. emissions: Seven pathways to achieve climate impact*.

Reid, E. M., & Toffel, M. W. (2009). Responding to public and private politics: Corporate disclosure of climate change strategies. *Strategic Management Journal*, *30*(11), 1157–1178. https://doi.org/10.1002/smj.796

Roco, L., Engler, A., Bravo-Ureta, B. E., & Jara-Rojas, R. (2015). Farmers' perception of climate change in Mediterranean Chile. *Regional Environmental Change*, *15*(5), 867–879. https://doi.org/10.1007/s10113-014-0669-x

Roser-Renouf, C., Atkinson, L., Maibach, E., & Leiserowitz, A. (2016). Climate and sustainability: The consumer as climate activist. *International Journal of Communication*, *10*, 4759–4783. https://ijoc.org/index.php/ijoc/article/view/4702

Roser-Renouf, C., Maibach, E., & Leiserowitz, A. (2016). Consumer activism on global warming. Yale University Program on Climate Change Communication. https://climatecommunication.yale.edu/publications/consumer-activism-global-warming/

Safford, H. D., Sawyer, S. C., Kocher, S. D., Hier, J. K., & Cross, M. (2017). Linking knowledge to action: The role of boundary spanners in translating ecology. *Frontiers in Ecology and the Environment*, *15*(10), 560–568. https://doi.org/10.1002/fee.1731

Sarewitz, D. (2004). How science makes environmental controversies worse. *Environmental Science & Policy*, *7*(5), 385–403. https://doi.org/10.1016/j.envsci.2004.06.001

Schuldt, J. P. (2016). "Global warming" versus "climate change" and the influence of labeling on public perceptions. In *Oxford research encyclopedia of climate science*. https://oxfordre.com/climatescience/view/10.1093/acrefore/9780190228620.001.0001/acrefore-9780190228620-e-309

Schuldt, J. P., Yuan, Y. C., Song, Y., & Liu, K. (2019). Beliefs about whose beliefs? Second-order beliefs and support for China's coal-to-gas policy. *Journal of Environmental Psychology*, *66*, 101367. https://doi.org/10.1016/j.jenvp.2019.101367

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.

Song, H., Lewis Jr., N. A., Ballew, M. T., Bravo, M., Davydova, J., Gao, H. O., Garcia, R., Hiltner, S., Naiman, S. M., Pearson, A. R., Romero-Canyas, R., & Schuldt, J. P. (2020). What counts as an "environmental" issue?: Differences in issue conceptualization by race, ethnicity, and socioeconomic status. *Journal of Environmental Psychology*, *68*, 101404. https://doi.org/10.1016/j.jenvp.2020.101404

Taber, C. S., & Lodge, M. (2006). Motivated skepticism in the evaluation of political beliefs. *American Journal of Political Science*, *50*(3), 755–769. https://doi.org/10.1111/j.1540-5907.2006.00214.x

Tappin, B. M., Pennycook, G., & Rand, D. G. (2020). Thinking clearly about causal inferences of politically motivated reasoning: Why paradigmatic study designs often undermine causal inference. *Current Opinion in Behavioral Sciences*, *34*, 81–87. https://doi.org/10.1016/j.cobeha.2020.01.003

Teele, D. L. (n.d.). Virtual consent: The bronze standard for experimental ethics. In J. N. Druckman & D. P. Green (Eds.), *Advances in experimental political science*. Cambridge University Press.

Tesler, M. (2018). Elite domination of public doubts about climate change (not evolution). *Political Communication*, *35*(2), 306–326. https://doi.org/10.1080/10584609.2017.1380092

Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response*. Cambridge University Press.

U.S. Global Change Research Program (USGCRP). (2018). Reidmiller, D., Avery, C. W., Easterling, D. R., Kunkel, K. E., Lewis, K., Maycock, T. K., & Stewart, B. C. (Eds.). *Impacts, risks, and adaptation in the United States: Fourth national climate assessment, volume II*. https://doi.org/10.7930/NCA4.2018

van der Linden, S. (2017). Determinants and measurement of climate change risk perception, worry, and concern. In M.C. Nisbet, M. Schafer, E. Markowitz, S. Ho, S. O'Neill, & J. Thaker (Eds.), *The Oxford encyclopedia of climate change communication*. Oxford University Press.

van der Linden, S. L., Leiserowitz, A. A., Feinberg, G. D., & Maibach, E. W. (2015). The scientific consensus on climate change as a gateway belief: Experimental evidence. *PLoS One*, *10*(2), e0118489. https://doi.org/10.1371/journal.pone.0118489

van der Linden, S., Leiserowitz, A., & Maibach, E. (2019). The gateway belief model: A large-scale replication. *Journal of Environmental Psychology*, *62*, 49–58. https://doi.org/10.1016/j.jenvp.2019.01.009

van der Linden, S., Leiserowitz, A., & Maibach, E. W. (2016). Communicating the scientific consensus on human-caused climate change is an effective and depolarizing public engagement strategy: Experimental evidence from a large national replication study. *Social Science Research Network*.

van der Linden, S., Leiserowitz, A., Rosenthal, S., & Maibach, E. (2017). Inoculating the public against misinformation about climate change. *Global Challenges*, *1*(2), 1600008. https://doi.org/10.1002/gch2.201600008

van der Linden, S., Maibach, E., & Leiserowitz, A. (2019). Exposure to scientific consensus does not cause psychological reactance. *Environmental Communication*, 1–8. https://doi.org/10.1080/17524032.2019.1617763

Vandeweerdt, C., Kerremans, B., & Cohn, A. (2016). Climate voting in the US Congress: The power of public concern. *Environmental Politics*, *25*(2), 268–288. https://doi.org/10.1080/09644016.2016.1116651

Walter, N., & Tukachinsky, R. (2020). A meta-analytic examination of the continued influence of misinformation in the face of correction: How powerful is it, why does it happen, and how to stop it? *Communication Research*, *47*(2), 155–177. https://doi.org/10.1177/0093650219854600

Watts, N., Amann, M., Ayeb-Karlsson, S., Belesova, K., Bouley, T., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Chambers, J., Cox, P. M., Daly, M., Dasandi, N., Davies, M., Depledge, M., Depoux, A., Dominguez-Salas, P., Drummond, P., Ekins, P., … Costello, A. (2018). The lancet countdown on health and climate change: From 25 years of inaction to a global transformation for public health. *The Lancet*, *391*(10120), 581–630. https://doi.org/10.1016/S0140-6736(17)32464-9

White, R. (2017). *Transnational environmental crime*. Routledge.

Wolsko, C., Ariceaga, H., & Seiden, J. (2016). Red, white, and blue enough to be green: Effects of moral framing on climate change attitudes and conservation behaviors. *Journal of Experimental Social Psychology*, *65*, 7–19. https://doi.org/10.1016/j.jesp.2016.02.005

Wood, T., & Porter, E. (2019). The elusive backfire effect: Mass attitudes' steadfast factual adherence. *Political Behavior*, *41*(1), 135–163. https://doi.org/10.1007/s11109-018-9443-y

Zhou, J. (2016). Boomerangs versus javelins: How polarization constrains communication on climate change. *Environmental Politics*, *25*(5), 788–811. https://doi.org/10.1080/09644016.2016.1166602