



Motivated reasoning and climate change

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Despite a strong scientific consensus, there remains a substantial partisan divide in the U.S. regarding belief in, and attitudes toward, human-caused climate change. A preeminent explanation of this phenomenon is directional ‘motivated reasoning’, in which new information is processed in service of reaching a pre-determined, desired conclusion. Much existing work theorizes that partisan polarization occurs because members of the two political parties are assimilating new information to fulfill different desired conclusions, rooted in different party norms, values, or prior standing beliefs. However, recent work challenges this account. The next generation of work on motivated reasoning and climate change beliefs must address these challenges by distinguishing between distinct motivations that may drive motivated reasoning—most significantly, by identifying when partisans are truly striving to reach a desired conclusion and when they are striving to be accurate.

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Although climate change represents a great scientific challenge, an equal, if not more significant, hurdle comes from its politics. Climate change inevitably invokes politics, given the magnitude of its impact on humanity and the public policies needed to address it. However, the politicization of climate change has now resulted in polarized opinions that hinder public policy, particularly in the United States. In this essay, we discuss the preeminent psychological theory invoked to explain this polarization: motivated reasoning. In the next section, we present aggregate data on climate change beliefs over time, and how scholars have used motivated reasoning to

explain those data. We then discuss how different motivations may guide motivated reasoning. In the penultimate section, we review recent work that questions the application of motivated reasoning to climate change opinions. We conclude with an agenda for future work.

Polarization and climate change

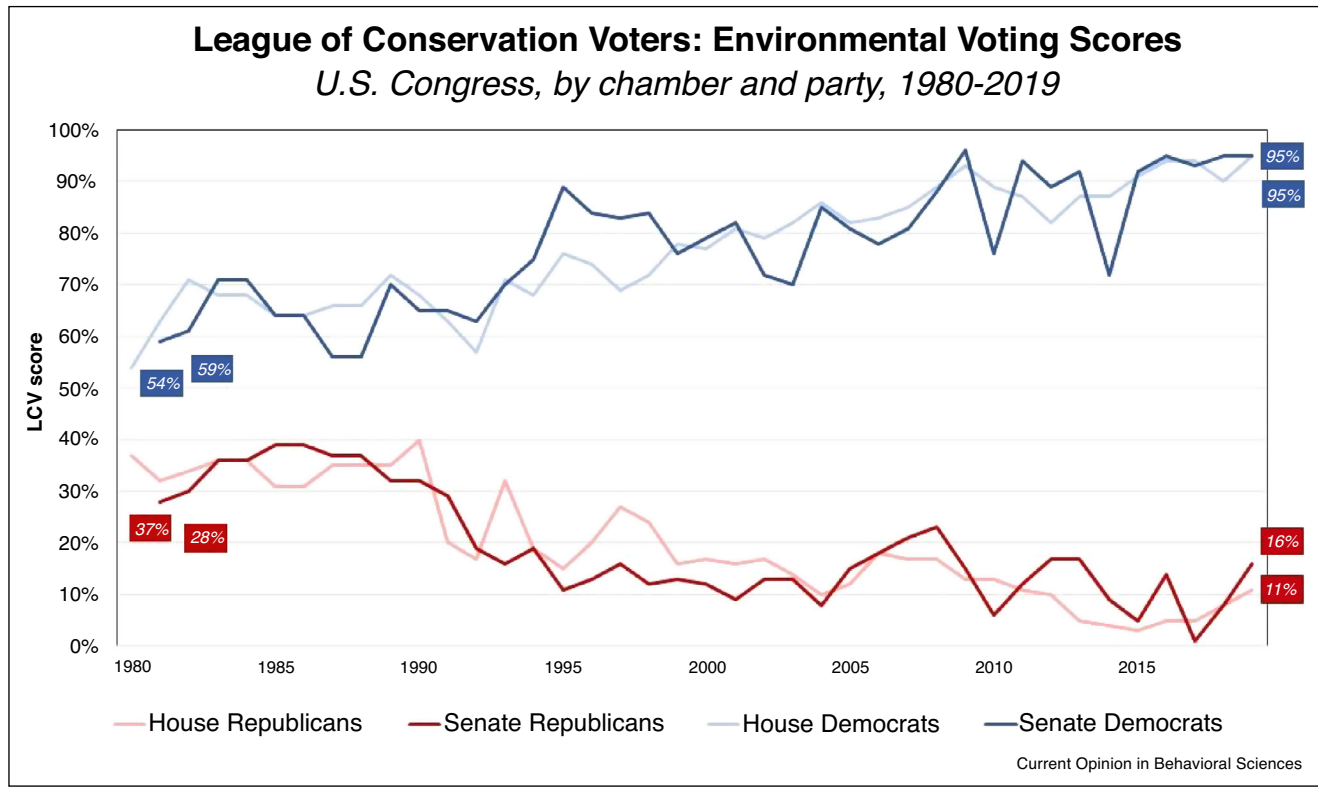
In the United States, partisan differences on environmental issues among political elites go back to at least the 1970s [1]. By the 1990s, a sizeable gap was evident in Congressional voting patterns. [Figure 1](#) illustrates this gap, showing the divide in environmental voting scores in Congress over time. While polarization on environmental issues among citizens lagged that of elites, what happened after the mid-1990s was dramatic; as one set of authors put it, “over the course of a little more than 20 years, the environment was transformed from the least to the most polarized issue . . .” [2] (p. 219).

Among the most notable environmental issues to polarize within the electorate was climate change, following concerted information campaigns from conservatives to undermine claims of climate change and humans’ role in it [3–5]. Even as the scientific consensus on human-caused climate change has become clear, partisans remain divided [6]. As shown in [Figure 2](#), data from the Pew Research Center on partisan climate change beliefs from 2006 to 2016 show that the division between Democrats and Republicans in 2006 was a non-trivial 25% (53%–28%) but grew to 46% by 2016 (69%–23%). In 2019, this gap has remained, if not grown [7]. Further, as [Figure 3](#) makes clear, there is an even larger partisan gap when it comes to prioritizing climate change than believing in it. Taken together, the three figures also suggest that elite polarization dwarfs polarization among citizens, a point to which we will return.

This is not a uniquely American dynamic: in a meta-analysis of 25 polls and 171 academic studies across 56 nations, Hornsey *et al.* [8] (p. 622) conclude that the “largest demographic correlate of climate change belief is political affiliation. People who intend to vote for more liberal political parties are more likely to believe in climate change than those who align themselves with relatively conservative political parties. . . . [The] effect is roughly double the size of any other demographic variable.”

This puzzling partisan divide during a period of scientific consensus has stimulated a sizeable literature exploring the underlying psychological processes. A prominent

Figure 1



Congressional voting on environmental issues.

Voting scores from environmental advocacy group League of Conservation Voters show a considerable partisan gap in Congressional voting on environmental issues that has grown consistently larger in the past few decades (Data source: League of Conservation Voters; URL: <https://scorecard.lcv.org/scorecard/archive>).

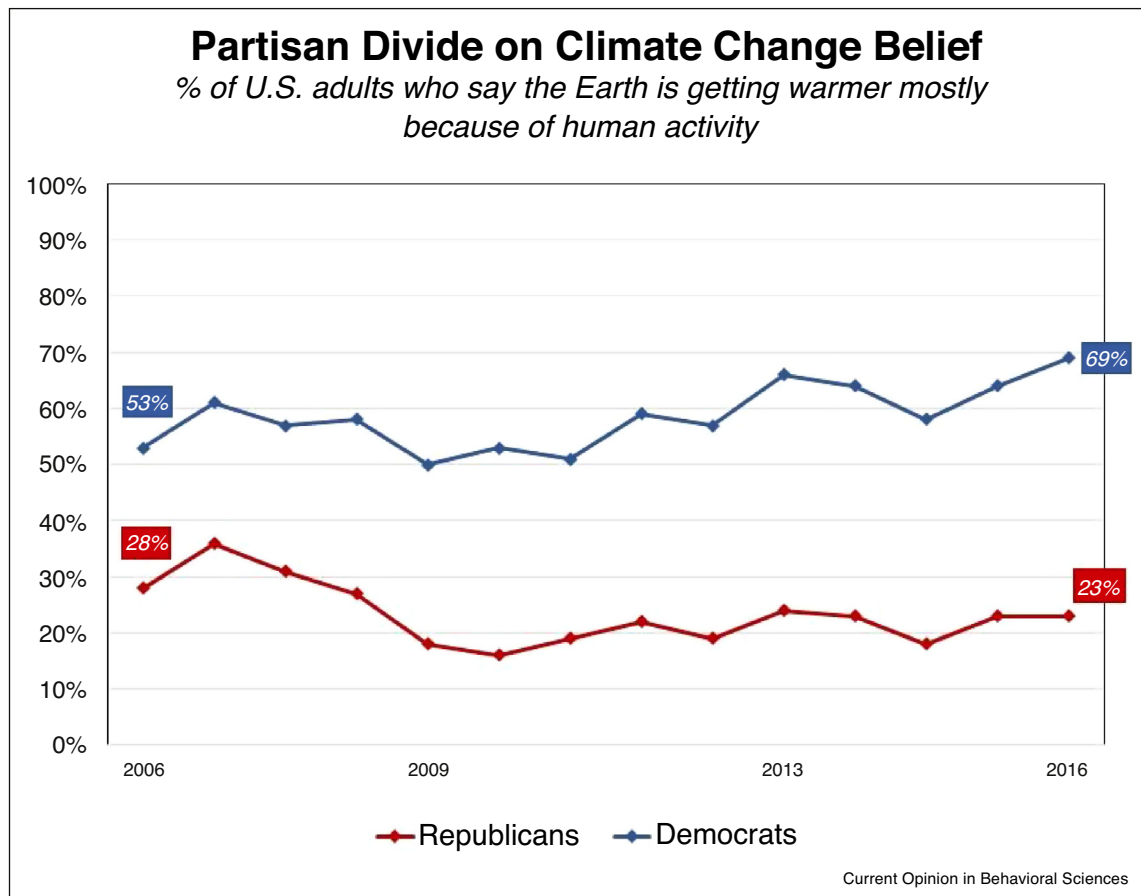
explanation is ‘motivated reasoning’, in which individuals evaluate new information and form opinions while pursuing one of two types of goals: directional or non-directional. Directional goals involve confirming a specific desired conclusion (e.g., that climate change is a natural process over which humans have little control, or that it is not occurring at all). Non-directional goals, in contrast, are independent from specific conclusions, involving instead a broader objective like forming an accurate or concise opinion (see Refs. [9,10]).

Although both directional and non-directional goals can influence judgments, researchers typically use the term ‘motivated reasoning’ to refer implicitly or explicitly to directional goals. Consider the three distinct processes in Taber and Lodge’s [11] analysis of motivated reasoning: The first is a confirmation bias, in which people selectively seek out and attend to information that coheres with a desired conclusion. The second is a prior attitude effect, in which people assess the quality of new information based on whether it contradicts or supports a desired conclusion. The third is a disconfirmation bias, in which people place greater scrutiny on,

or actively generate counterarguments against, information that undermines a desired conclusion. All are means by which people may pursue directional goals in opinion formation.

The motivated reasoning account provides a plausible explanation for politically polarized climate change attitudes. The complexity and uncertainty inherent in climate change projections make climate change beliefs especially vulnerable to the effects of elite cues and motivated reasoning [12,13]. Once political elites staked out distinct positions—in the U.S., with liberals and Democrats believing in human-induced climate change and conservatives and Republicans being skeptical—partisan citizens took elite cues and followed suit [14,15]. As the political context surrounding an issue becomes more combative, citizens are motivated by the desire to see their side ‘win’ the argument [16]. As new information about climate change emerges, they engage in directional motivated reasoning to defend their desired conclusion (e.g., [17–19]). For instance, Republicans may reject information about the scientific consensus on human-

Figure 2



Belief in human-caused climate change in the U.S.

The partisan gap in belief in human-caused climate change among U.S. adults has grown from 2006 to 2016 (Data source: Pew Research Center; URLs: <https://www.pewresearch.org/science/2016/10/04/public-views-on-climate-change-and-climate-scientists/>; <https://www.pewresearch.org/politics/2013/11/01/gop-deeply-divided-over-climate-change/>).

induced climate change in favor of maintaining a skeptical position [15,20,21]. In fact, some studies find that Republicans become even more skeptical after receiving such information due to increased counterarguing [22,23,24]. In contrast, when provided the same information, Democrats accept it because it does not challenge their desired conclusion of believing in human-induced climate change.

Partisans also seek out and attend to different information; for instance, liberals pay more visual attention to increasing temperatures, leading them to engage in climate friendly actions [25,26]. As a result of these dynamics, beliefs polarize along partisan lines, regardless of the scientific consensus. This type of polarization, albeit on a distinct issue, immigration, has even been documented in the neural activity of liberals and conservatives. Specifically, those with varying political

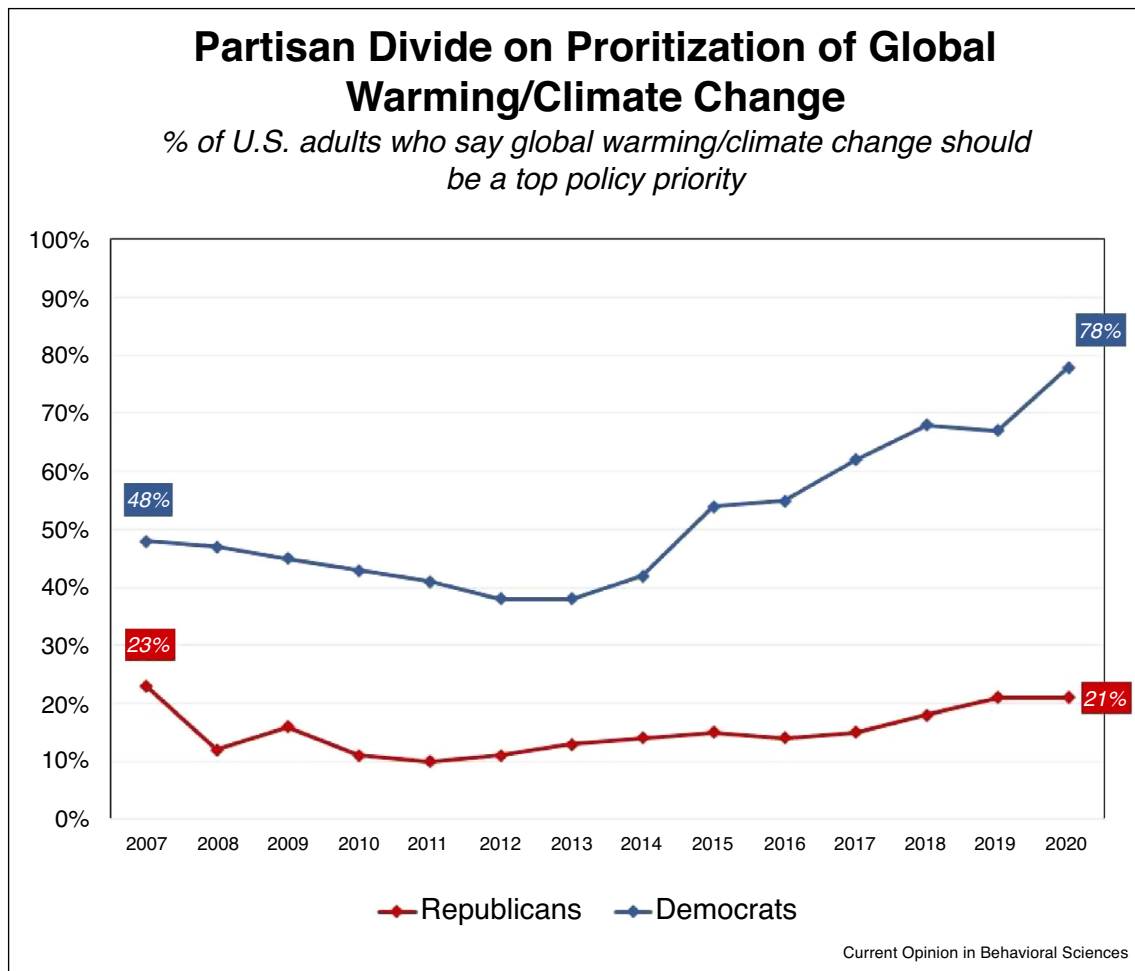
leanings process the content of messages differently, particularly when those messages invoke risk or morality [27]. That these themes frequently appear in discussions of climate change suggest the possibility of similar processing dynamics.

Variations in motivated reasoning

Above, we suggest that motivated reasoning occurs when partisans evaluate new information in service of reaching a desired conclusion. But where do these desired conclusions come from? This question receives distinct answers in the literature in the form of specific directional goals. Table 1 displays five non-exhaustive and non-exclusive examples of such goals from the literature on climate change opinions.

Among directional goals investigated in the context of climate change, the ones most prevalent in the literature

Figure 3



Public opinion in the U.S. on prioritizing climate change.

While 78% of U.S. adults who are Democrats or lean Democrat think addressing climate change should be a top priority for the government in 2020, only 21% of Republicans and Republican leaners do (Data source: Pew Research Center, January Political Surveys: Public's Policy Priorities, 2007–2020; accessible at URL: https://www.pewresearch.org/politics/?post_type=dataset).

relate to concerns about social connection to others [28]. Perhaps most notable is the desire to maintain a sense of identification with personally important social groups—in this case, one's political party (i.e., the first entry in Table 1, social identity protection). When individuals recognize that both party elites and fellow partisans hold particular views on climate change (i.e., skeptical Republicans and accepting Democrats), they are motivated to stick with those views to “protect their connection to others with whom they have important material and emotional ties” [17] (p. 26) (see also Refs. [22*,23,29**]).

Another directional goal related to social connection is alignment with the social consensus among friends, family, or the general public. This differs from the social identity protection goal just discussed, in which

individuals conform their beliefs to a group norm to bolster in-group belonging. Instead, in aligning with the social consensus, individuals see informational value in the views of their social networks or peers, especially under conditions of conflicting or ambiguous information. Thus, social consensus can exert an influence on science opinions independent of scientific consensus, as Kobayashi [30**] experimentally demonstrates across multiple science issues. Since individuals' social groups often consist of fellow partisans, relying on social consensus in the context of climate change can contribute to polarization. That said, social consensus may, at times, work in concert with scientific consensus; Goldberg *et al.* [31] find that discussion with friends and family leads to learning about the scientific agreement on human-caused climate change, which, in turn, affects climate change beliefs.

Table 1

Directional goals

Type	Goal	Climate change example sources
Social Identity Protection	To maintain a feeling of identity or status within a particular social group	Kahan [17]
Social Consensus Seeking	To maintain consistency with social network members (e.g., family, friends, and acquaintances)	Kobayashi [30**]
Scientific Consensus Seeking	To maintain consistency with scientific norms and beliefs	van der Linden <i>et al.</i> [60**]
Value Affirmation	To maintain a moral belief system	Wolsko <i>et al.</i> [36**]
Belief Consistency Seeking	To maintain a prior standing belief	Ma <i>et al.</i> [24*], Feldman <i>et al.</i> [61]

Apart from consensus with one's social network for informational or belonging purposes, directional goals can also involve finding agreement with a group to which one does not directly belong. In the case of scientific issues, individuals may wish to align their beliefs with scientists (c.f. [17,32]). Consistent with this proposition, in support of the well-known Gateway Belief Model, van der Linden and colleagues [33,34] find that scientific consensus messages are evaluated positively and shift beliefs regardless of partisanship, values, or social networks. Thus, not all directional goals necessarily produce polarization; the goal of cohering with scientific consensus can result in converging beliefs. Under this approach, today's polarization is evidence that either citizens are not sufficiently aware of the scientific consensus or that there would counterfactually be even more polarization in the absence of existing consensus messaging.

Beyond group concerns, people may also hold more self-focused directional goals, such as affirming important personal values. Research suggests that, relative to people with more liberal ideologies, people with more conservative political ideologies prioritize the *binding* moral concerns in Moral Foundations Theory: in-group loyalty, purity, and respect for authority [35]. Wolsko *et al.* [36**] find that conservatives who received a message framing climate change in terms of binding moral concerns believed more in and became more concerned about climate change. Because this message helped facilitate a directional goal of value affirmation, it was more easily accepted (see also Refs. [37,38**,39*,40]). Under this approach, polarization persists either because framing climate change using conservative values is rare, or because many conservative values clash with climate policies [41].

A final directional goal involves seeking belief consistency and stability, a motivation long studied in psychology (for a recent overview, see Ref. [42]). In this context, both climate change believers and skeptics work to maintain their preexisting beliefs by dismissing oppositional messaging, sustaining polarization. For example, Ma *et al.* [24*] report that respondents with skeptical prior beliefs about climate change reacted

negatively to a message about the scientific consensus, feeling more strongly that others were trying to force them to change their beliefs.

However, as mentioned, the list in Table 1 is neither exhaustive nor exclusive. In terms of the former, other directional motivations have received less attention in the climate change literature. These include fundamental motivations such as a need for to preserve self-esteem and a need for control [10]. In terms of the latter, at times, individuals may be multiply motivated. For instance, a conversation with a friend who holds a different view may prompt an individual to process new information from the conversation with both a social consensus goal — to fit in with the friend — and a social identity protection goal — to avoid losing a sense of belonging to the larger group. How individuals juggle such multiple motivations remains understudied.

Challenges to the motivated reasoning account

While the motivated reasoning account ostensibly explains partisan polarization on climate change and is consistent with various empirical studies, questions remain [43]. For one, little work assesses which of the directional motivations discussed above is at work and when. One exception is Bayes *et al.* [38**], who distinguish between a values goal and a partisan social identity goal by randomly assigning and experimentally inducing these motivations before providing participants with climate change messaging designed to appeal to one of these motivations. Since the authors manipulated the motivations, they were in a strong position to make causal claims about their effects. They find that participants believed more in climate change when they received a message that facilitated the pursuit of the specific motivation induced in them (e.g., those with a values goal were more persuaded by a moral values message); this indicates that a 'match' between messaging and motivation is key, regardless of the goal. Interestingly, control participants, who received no motivation induction, were most persuaded by a message facilitating social identity protection, suggesting that partisan belonging concerns may predominate as a default.

Understanding which motivation is driving opinion formation matters for effectively communicating about climate change. However, existing work cannot sufficiently distinguish between various motivations. Of particular significance is the problem that, although much of the data are consistent with directional goal pursuit, it can also be consistent with a non-directional goal: accuracy.

An accuracy goal is to form the opinion that is the “correct or otherwise best conclusion” [11] (p. 756) (see also Refs. [9,10]). What such a conclusion entails is not always clear. However, accuracy motivated individuals are expected to use strategies such as (a) dedicating a substantial amount of time and effort to information search, (b) carefully evaluating the information’s provenance and the strength of the facts or arguments it presents, and (c) attempting to suppress biases arising from standing beliefs or affiliations (e.g., [44*,45,46]). Partisan polarization of climate change beliefs may occur despite accuracy motivation: Republicans may strive for accurate beliefs, but have more trust in their party leaders, who often express skepticism about climate change, than in climate scientists [44*,47]. In this case, they do not reject the scientific consensus due to a directional goal, but because they do not believe it is credible.

In other words, polarization in the U.S. could be a result of accuracy motivated partisans following trusted party elites, even when those elites spread misinformation. Elites have indeed played a consequential role in establishing public opinion on climate change in the U.S., as the elite divide on climate change is larger than the public divide (Figures 1–3). As mentioned, conservatives have made concerted efforts to undermine evidence about climate change, and it is clear that the public has followed; as one author states, “Americans would be less skeptical of manmade global warming if more Republicans in Congress believed in it” [15, p. 306]. When accuracy seeking Republicans receive misinformation from elites and are misled about the science, it is observationally equivalent to the result of a partisan social identity directional goal. Furthermore, Republican voters also take cues from Democrats; hearing that the opposing party believes the scientific consensus on human-induced climate change, they may do the opposite [14,48]. Here, again, the result of an accuracy motivation to do the opposite of those you distrust is observationally equivalent to that of a directional motivation to reject contrary evidence. In short, it is not possible to derive whether an accuracy or directional motivation is at work by looking at the outcome alone.

Bago *et al.* [49] pose another challenge to identifying motivation. Theoretically, greater deliberation during directional motivated reasoning increases coherence between individuals’ judgments and their desired conclusions [11]. Therefore, the fact that more knowledgeable or

scientifically literate partisans are more polarized on climate change [29**,50] is often taken as evidence of a partisan social identity directional goal. However, because partisanship is confounded with prior beliefs on climate change, this pattern is also consistent with using prior beliefs to assimilate new information. The authors distinguish the effects of prior beliefs and partisanship and find that deliberation increases coherence between judgments and prior beliefs but *not* partisanship. This is inconsistent with motivated reasoning guided by a partisan directional goal and may instead be consistent with accuracy motivated Bayesian rationality if individuals, that is, climate change skeptics, doubt the credibility of the information they encounter.

Accuracy motivation may play a role in climate change beliefs especially when climate change is a salient personal issue. When people form opinions on topics that are personally important or have meaningful consequences for their own outcomes, accuracy motivation tends to prevail [51]. Consistent with this, people who directly experience climate anomalies perceive them somewhat accurately: Ripberger *et al.* [52] find that, over 11 consecutive seasons, perceptions of departures from average precipitation and temperature track closely with objective measures, with partisanship having a marginal effect. Furthermore, Milfont *et al.* [53] show that such direct experiences can impact opinions. Those who live closer to shorelines, where the effects of climate change are more dramatic, exhibit greater belief in climate change and more support for climate policies regardless of their economic situation and political orientation (see also Refs. [54,55]). That said, partisan bias also matters in these situations; for instance, in reaction to extreme weather events, community discussion about the event’s link to climate change is much more likely to occur in Democratic communities [56].

A way forward

Addressing climate change requires public policies and international coordination [57]. Achieving this, in turn, depends on public attitudes about the climate [2]. The partisan gap has been a substantial hurdle to gaining public support, and closing this gap requires understanding the psychological processes that drive opinion formation. The theory of motivated reasoning provides insight, but to fully grasp which messages will resonate, much work remains to be done. Scholars and practitioners must causally identify which motivations are at work and when, with more careful distinction between directional and non-directional ones (see Ref. [58]). They might also consider techniques to alter individuals’ motivations, such as making climate change a more salient personal issue to incite accuracy motivation. This requires documentation of cognitive processes — as in the aforementioned work isolating neural processes [27] — and how situational factors shape those processes. In short, the

future of effective climate change communication requires shedding assumptions about individuals' goals and, instead, gaining a more detailed understanding of what these goals are, when they are activated, and what, if any, biases result [59].

Conflict of interest statement

Nothing declared.

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- of special interest
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Similar to past studies (see Ref. [43]), the authors find that ideological polarization on beliefs about the degree of scientific consensus on human-caused climate change is greatest among those with higher levels of education. Importantly, though, they also find that providing information about the true scientific consensus is effective in reducing this

polarization. Both liberals and conservatives update their beliefs about the scientific consensus in line with the information provided, eliminating the interaction between ideology and education level. This challenges the motivated reasoning account that factual information will necessarily always increase polarization; however, it should be noted that this finding is limited to the perceived scientific consensus on human-caused climate change as the outcome.

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