# Anger Consensus Messaging Can Enhance Expectations for Collective Action and Support for Climate Mitigation

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**Abstract**

Media coverage of climate protests within the United States and internationally has shown growing public frustration about governmental responses to climate change. But what are the effects of conveying that people are angry? And how do they contrast with more traditional norm messages about climate policy support? Here, we investigate whether social norm messaging about collective anger can impact perceptions of consensus and public support for climate mitigation. In a pilot study and two survey experiments (total N=1529), we find that relative to control messages, normative appeals that convey growing public anger about U.S. inaction on climate change (i.e., dynamic anger consensus messaging) can enhance Americans' consensus estimates of other Americans' climate-related beliefs and support for mitigation policy, and expectations for future climate-mitigating collective action. Moreover, exposure to a dynamic anger consensus message led to similar estimates of Americans' policy support and belief in climate change as messages that explicitly conveyed public support for climate mitigation (Study 1) or consensus belief in anthropogenic climate change (Study 2). When tailored for a cross-partisan audience, anger consensus messaging was also effective in bolstering personal support for climate mitigation (Study 2). Notably, similar effects were observed across partisan groups. These findings suggest that, by signaling shared motivational states, emotion consensus appeals can enhance expectations for social change, with the potential to mobilize bipartisan support for climate mitigation.

**Keywords:** public opinion, emotion, normative influence, policy support

Highlights:

- Anger consensus appeals enhance perceived public support for climate mitigation
- Anger consensus appeals enhance perceived public belief in anthropogenic cause
- Dynamic anger consensus appeals can bolster personal support for mitigation
- Anger consensus appeals can convey public opinion and mobilize action intentions

## 1. Introduction

In September 2019, over four million youth around the world took to the streets to demand climate action. The global climate strikes, also known as the Global Week for Future, have since spread to over 150 nations, and were among the largest demonstrations in history (Sengupta, 2019). A growing body of research suggests exposure to expressions of public outrage may be particularly common and influential in the digital era, with expressions of outrage more likely to be re-shared online than neutral content (Brady et al., 2019; Crockett, 2017; Spring et al., 2018; Sunstein, 2019). In addition to appearing contagious, research finds that, as an approach-oriented emotion, collective anger can also signal impending collective action to remove perceived barriers to a shared goal (Carver & Harmon-Jones, 2009). Despite growing recognition of the spread and potential influence of collective emotions, such as anger, few studies have explored social psychological implications of exposure to emerging norms of collective anger and their potential impact on public opinion. What happens, for instance, when people perceive growing public anger about climate inaction? Might perceiving such anger as normative lead people to anticipate that collective action may soon follow, and if so, could normative messaging around collective anger bolster public support for climate mitigation? The present research explored these possibilities.

Psychological research has identified many influences on public support for climate mitigation, including characteristics of the source of climate-related information, message frames, and individual-level determinants. For example, research has found that people are more likely to support pro-climate policies like a carbon tax when conveyed by an ingroup partisan source (Fielding et al., 2020), and that Republicans and Democrats consider the issue to be more serious when it is termed “climate change” and “global warming”, respectively (Villar & Krosnick, 2011). Climate messaging from prominent religious leaders like Pope Francis can encourage people to view climate change as a moral issue (Maibach, 2015;

Schuldt et al., 2017), and leaders of youth movements may promote a sense of collective efficacy and interest in collective action (Sabherwal et al., 2021). Individual factors such as perceived risk, personal efficacy and environmental values also determine citizens' decisions to engage in collective climate action (Lubell et al., 2007). Additional work has focused on the impact of perceived social consensus within one's immediate social network (family and friends; Goldberg et al. 2019) and perceived consensus among scientists (van der Linden et al., 2015) on policy preferences. For instance, conveying the scientific consensus on anthropogenic climate change has been shown to bolster perceptions of scientific consensus and have downstream effects on individuals' own climate beliefs and support for climate action (van der Linden et al., 2015; van der Linden et al., 2019).

Whereas scientific consensus messaging communicates a consensus belief among experts (scientists), in the present research, we focus on consensus views among a different referent group–fellow Americans. Moreover, unlike work on social and scientific consensus which focuses on normative *beliefs* about climate change, here we examine a different and complementary class of consensus views, *emotion consensus* appeals, that may have unique implications for collective action. In the present studies, we define emotion consensus as a descriptive norm conveying a collective emotion shared by a majority of the public (here, Americans).

Psychological research on collective emotion suggests anger may be a particularly potent norm signal as it conveys a motivational state that may shape key inferences about what others believe about an issue, as well as inferences about what actions others might be likely to take to address an issue, including the types of policies that they may support (Carver & Harmon-Jones, 2009; Spring et al., 2018; Thomas & McGarty, 2009). In addition to descriptive information about how others feel, emotions such as anger may also convey injunctive information that may shape inferences about what others *ought to* do.

In the present research, we explored whether information conveying collective anger about climate inaction among a majority of the US public (i.e., anger consensus) impacts perceptions of not only others' emotional states, but also perceptions of other Americans' climate-related beliefs and collective action intentions (i.e., what others believe and are likely to *do*). Further, because such "second-order" beliefs –individuals' beliefs about the mental states of others – have been shown to impact personal support for pro-climate initiatives (Mildenberger & Tingley, 2019; Pearson et al., 2016), we also explored whether anger consensus messaging might influence individuals' own support for climate mitigation.

### 1.1 Anger as a Motivational Signal

Previous work has documented the power of mobilizing emotions like anger to increase collective action (van Zomeren et al., 2004), including pro-environmental behavioral intentions (Harth et al., 2013). The experience of anger typically reflects an approach-oriented motivational state, which can provoke behavior to address the cause of anger (Carver, 2004; Higgins, 1997), which may include collective action to remedy a perceived injustice. For instance, the extent to which people report being angry about the unfair treatment of disadvantaged groups (e.g., Iraqi citizens and Australian aborigines) predicts their intentions to take political action to remedy intergroup inequities (Iyer et al., 2007; Leach et al., 2006).

A growing body of empirical work suggests exposure to collective anger can also mobilize people to unite around a cause and take collective action (Spring et al., 2018). An analysis of crowd dynamics after the 2014 police shooting in Ferguson, Missouri, suggests that strategic actions taken by civil rights organizations and the Black Lives Movement emerged, in part, from spontaneous public anger over the incident (Kudesia, 2021). Thus, anger may motivate both immediate and long-term collective action. For instance, a study of

women's responses to gender-based discrimination found that when women learned that other women in the US were angry about gender-based discrimination, they reported greater personal anger towards discrimination and were more likely to endorse actions to reduce discrimination (Leonard et al., 2011). Moreover, some evidence suggests perceiving anger as normative may lead to conformity even without commensurate changes in privately held attitudes or beliefs. In a field experiment in Nigeria, researchers found that observing role models of corruption reporting in a film encouraged viewers to report corruption (Blair et al., 2019). Notably, the researchers posited that the film may have enhanced corruption reporting by shifting perceptions of the community's anger toward corruption, rather than by shifting perceptions of the desirability or prevalence of reporting.

Research on pro-environmental behavior has documented similar links between ingroup anger and behavioral intentions. Harth and colleagues (2013) found that messaging indicating ingroup culpability for environmental harm bolstered ingroup anger and intentions to punish environmental wrongdoing. Using Australian national survey data, Stanley et al. (2021) found that experiencing anger (vs. anxiety) about the climate crisis predicted higher well-being and more pro-climate activism. Moreover, communicating a norm of outrage about lack of access to safe water in developing nations can enhance collective action intentions by mobilizing public support for water conservation (Thomas & McGarty, 2009). In the context of climate change, climate marches, which frequently convey collective anger, can also prompt information-seeking (e.g., online searches about climate change; Sisco et al., 2021) and may bolster feelings of collective efficacy to mitigate climate change (Swim et al., 2019). Nevertheless, displays of collective anger might also hinder collective action. The ease with which outrage can be disseminated online over issues of varying importance may make it difficult for people to identify which expressions of outrage are worth mobilizing around (Brady & Crockett, 2019). Collective anger may also signal that a problem like climate

change is intractable, which may undermine a sense of collective efficacy (Jones & Davison, 2021).

### 1.2 Anger Consensus as a Dynamic Norm

Given contrasting perspectives on the effects of expressions of public outrage, whether and how a norm of anger might convey a consensus view within the politically polarized context of climate change, and particularly within the US, remains an open empirical question. Recent research finds that *dynamic* norms - messages suggesting that public views are changing – can often be more effective in generating conformity than messages conveying the actions of a static majority (Sparkman and Walton 2017). Moreover, such dynamic norm messages have been shown to elicit conformity across a variety of domains and interest groups even when a descriptive norm has low absolute consensus (i.e., non-majority) (Loschelder et al., 2019; Sparkman et al., 2020; Sparkman & Walton, 2019).

With respect to climate change, in addition to mirroring real-world trends in expressions of collective anger (Sengupta, 2019), messages indicating growing consensus might also be perceived as more believable than those emphasizing a static norm as they allow for the possibility that anger might not have been normative in the past; thus, potentially minimizing tendencies to dismiss such information among skeptics. Indeed, results from a pilot study and Study 1 showed that a lower proportion of our sample was skeptical about dynamic, compared to static, norm messaging (see Study 1 Method). Thus, the present studies employed *dynamic*, rather than static, consensus messages; specifically, normative messages that conveyed that public anger about climate inaction has grown to a point where, now, a majority of the US public is angry about inaction on climate change (see Figs. S2A-B and S3A-C).

### 1.3 The Present Research

Public opinion polls regularly track and communicate statistics such as belief in anthropogenic climate change and public support for mitigation efforts. For example, recent reports by the Yale Program on Climate Change Communication (YPCCC) suggest that more than half of Americans think global warming is mostly human-caused, and that roughly 3 in 4 Americans support regulating carbon dioxide as a pollutant (Leiserowitz et al., 2019). Similarly, opinion polls increasingly track and report emotional responses to climate change, including collective anger. In a nationally representative survey, 50% of Americans, and 54% of younger adults (aged 30-49), reported feeling angry when thinking about climate change (Hamel et al., 2019). Nevertheless, although effects of second-order beliefs about others' climate beliefs and policy support have been previously examined (e.g., Goldberg et al., 2019; Mildenberger & Tingley, 2017), consequences of exposure to *emotion* consensus information (e.g., a norm of collective anger) on climate change-related public opinion—the focus of the present research – have yet to be empirically explored.

Documenting the impact of anger consensus messaging on public opinion may have important practical implications. Climate change exemplifies a social problem that depends upon a willingness to undertake collective actions, but where social signals routinely fail to convey this prerequisite to action. Indeed, even when people are concerned about climate change, they may avoid discussing the issue with others if they underestimate others' concern about climate change, which they commonly do (Geiger & Swim, 2016). If an anger consensus message can bolster perceptions of public support for climate policies and expectations for collective action to mitigate climate change, then communicating anger consensus may be an effective way to overcome the social gridlock that hampers pro-climate political support and collective action.

In the present research, we investigated how information conveying growing public anger about climate inaction impacts consensus estimates of others' climate-related beliefs,

collective action tendencies, and mitigation policy support, as well as individuals' own support for climate mitigation. We anticipated that anger consensus messaging would convey additional normative information beyond collective anger, about what others are likely to *do* (i.e., their motivational states), which may inform other normative beliefs, such beliefs about what others think about a problem (e.g., consensus estimates of Americans' belief in anthropogenic climate change), perceptions of public support for mitigating it, and inferences about others' collective action intentions.

Additionally, we explored whether anger consensus messaging would influence expectations for collective action and bolster support for climate mitigation even within the hyper-polarized context of the United States. On the one hand, research on the political divide on climate change suggests that individuals might simply react in a partisan fashion toward climate change communication (Van Boven et al., 2018). When reasoning about a polarized issue such as climate change, people may avoid or dismiss information that conflicts with their political beliefs (Druckman & McGrath, 2019; Taber & Lodge, 2006). For example, messages advocating for greater governmental action on climate change can backfire among US Republicans, leading them to be more skeptical of climate mitigation (Zhou, 2016). People also tend to overestimate the extent to which their views about climate change are shared by others (Leviston et al., 2013). Thus, Republicans who are themselves not angry about climate inaction may underestimate public anger on the issue, and consequently show greater skepticism of information that conveys that a majority of Americans are angry about climate inaction. Therefore, an anger consensus message might backfire among some Republicans.

Alternatively, it is possible that an anger consensus message may be viewed as credible across partisan groups, and particularly when anger is conveyed as a changing or dynamic norm. Prior studies suggest that messaging conveying both public and scientific

consensus views around climate change, in some cases, can show similar effects across partisan groups ( see Goldberg et al., 2019; van der Linden et al., 2015, 2017) and particularly when participants are exposed to climate messages that highlight bipartisan agreement (Abeles, 2021). Moreover, given the prevalence of both online and offline collective anger about climate inaction (Clayton et al., 2017; Kaplan et al., 2019), a national norm of anger may not be easily dismissed. Finally, as noted above, a dynamic norm message acknowledges that anger may not have been normative in the past, which may reduce skepticism among those who might otherwise infer little or no consensus. Thus, despite persistent polarization of climate beliefs within the US, and evidence suggesting that partisans may interpret climate appeals differently (Singh & Swanson, 2017; Villar & Krosnick, 2011; Zhou, 2016), we explored the possibility that an anger consensus message might have similar effects across partisan groups.

### 1.4 Overview of Studies

In two survey experiments, we compared an anger consensus message to two other commonly communicated consensus estimates (i.e., norms) about the same referent group (i.e., the American public): Support for climate mitigation and consensus belief in anthropogenic climate change. We use the term consensus to refer to the response of a majority of the US public, including majorities of both Democrats and Republicans (e.g., we reported an anger consensus estimate of 53% to 80% among Republicans and Democrats in Study 1, and 67% national consensus in Study 2). We examined what people might infer from an anger consensus message about climate inaction. For instance, does an anger consensus message also convey public support for climate change mitigation and a norm of belief in climate change? Does it do so as (or more) effectively as messages explicitly conveying public support for climate mitigation or belief consensus around anthropogenic

climate change? And might anger consensus messages also bolster expectations for collective action? The present studies were designed to explore these questions.

In Study 1, we investigated the above questions by comparing the effects of an anger consensus message about US inaction on climate change to a message that explicitly conveyed public support for climate mitigation (support consensus), as well as a no-information control message. Although it may appear intuitive that people might infer support consensus from anger consensus, but not necessarily the inverse, here we empirically test this assumption as well as explore whether anger consensus appeals enhance expectations for collective action. In Study 2, we compared an anger consensus message to another key consensus belief (belief consensus), belief in anthropogenic climate change, to explore whether exposure to an anger consensus message might also bolster estimates of other Americans' belief in climate change and collective action intentions, as well as participants' own reported anger and support for climate mitigation. Additionally, based on pilot testing and results from Study 1, in Study 2, we identified key areas for improvement in our messaging to strengthen its perceived credibility across partisan groups.

We hypothesized that exposure to anger consensus messaging would bolster estimates of Americans' collective anger about climate change relative to a control or support consensus message (Study 1), as well as relative to a belief consensus message (Study 2). Moreover, as support for climate mitigation might be perceived as a precursor to expressing anger about inaction, we hypothesized that exposure to an anger consensus message would result in equal or higher estimates of public support for climate mitigation than a message that explicitly conveys support consensus (Study 1), and result in higher estimates of public support than a control or belief consensus message (Study 2).

Similarly, in Study 2, we hypothesized that exposure to an anger consensus message would lead to higher consensus estimates of Americans' belief in anthropogenic climate

change relative to a control message, and equal or higher estimates of belief consensus than an explicit belief consensus message. Finally, we hypothesized that, relative to a control or support consensus message (Study 1), or a belief consensus message (Study 2), exposure to an anger consensus message would also enhance expectations for collective action to address climate change.

Given the previously noted mixed findings for moderating effects of political party observed in prior work examining effects of consensus messaging, we also explored whether effects of anger consensus messaging differed across partisan groups. Additionally, as second-order beliefs about others' feelings, beliefs, and actions may influence individual intentions (Mildenberger & Tingley, 2019), in each study we also explored whether the anger consensus message would bolster respondents' own reported anger towards climate inaction and personal support for climate mitigation relative to a control message.

## 2. Study 1

Study 1 compared the effects of a message conveying that a growing number of Americans are angry about climate inaction (i.e., a dynamic anger consensus message) to a dynamic support consensus message and a no-information control condition on participants' second-order beliefs about other Americans' anger, mitigation support, and collective action intentions. The research protocol for Studies 1 and 2 was approved by the Institutional Review Board's Human Subjects Protection Committee.

### 2.1 Method

#### 2.1.1 Sample

We recruited 522 U.S. adults on Amazon's Mechanical Turk to participate in a 3-5-minute survey about social issues. Our a priori exclusion criteria were based on performance

on the attention-check item, time taken to complete the survey, and disbelief in climate change. Our appeals were designed for the majority of the U.S. public who show some skepticism about climate change and its causes (Leiserowitz et al., 2019), rather than those expressing strong disbelief. Therefore, for all analyses across both studies, we excluded participants *a priori* who indicated strong disbelief in climate change ("I strongly believe that climate change is NOT happening"), 1.64% of the sample across the two studies. The pattern of results remained the same when including and excluding the 1.64% of the sample that expressed a strong disbelief in climate change (see the Supplemental Materials).

After applying these *a priori* exclusion criteria, 488 participants were included in the analysis (see Supplementary Material note 8 for details about a priori inclusion criteria and socio-demographic features of the sample). The mean age was 37.17 years ($SD$=11.60), the sample was approximately 50% female, and included 39% Democrats, 18% Republicans, 31% Independents, and 12% other or non-party affiliated. The racial composition was roughly 5% Asian or Asian American, 15% Black or African American, 3% Hispanic, Chicana/o, or Latina/o, 1% Native American, First Nation, or Alaskan Native, 74% White, Caucasian, or European American, and 2% Biracial, Multiracial, or unspecified. A majority of participants had a Bachelor's degree and reported an annual income between $20,000 and $40,000. Compared to the U.S. population, this sample is slightly younger, more educated and more liberal (U.S. Census Bureau 2019). We chose to collect 175 participants per condition for our *a priori* target sample size, aware that some might fail the attention check, with the goal of having sufficient power to detect small-to-medium effects with the final sample. The final sample yielded greater than 80% power (84%) to detect an estimated small-to-medium effect size of $\eta_p^2$=0.022 (i.e., f = 0.15) and 80% power to detect a Cohen's $d$ = .32. For reference, the median effect size in social psychology is $d$ = .36 (Lovakov & Agadullina, 2021).

### 2.1.2 Procedure and measures

Participants were randomly assigned to one the of three conditions: Anger consensus (*n* = 165: 60 Democrat, 51 Republican, 52 Independent and 2 having no or other political party affiliations), support consensus (*n* = 159: 65 Democrat, 39 Republican, 51 Independent and 4 having no or other political party affiliations), or no-information control (*n* = 164: 67 Democrat, 46 Republican, 49 Independent and 2 having no or other political party affiliations) (see Supplementary Material Fig. S2A,2B for consensus messages in each condition). After receiving the consensus message corresponding to their condition and completing a filler task (see Supplementary Material note 9 for details), participants provided consensus estimates of Americans' anger about climate change inaction and support for climate mitigation using the items, "To the best of your knowledge, what percentage of Americans are angry about U.S. inaction regarding climate change?" and "To the best of your knowledge, what percentage of Americans support the U.S. taking greater action to reduce climate change?" Participants answered both questions on a scale ranging from 0% to 100%.

Participants then indicated their anticipation of future collective action to mitigate climate change on a 7-point, 8-item collective action scale (1=extremely unlikely to 7=extremely likely; see Supplementary Material note 9 for all items) adapted from previous research on collective action (Iyer et al., 2007). Items included estimates of how likely Americans are to take a range of actions, such as to "Sign a petition to take steps to reduce climate change" and to "Join the email list of an environmental advocacy group."

Next, participants reported their personal level of anger (A scale comprised of 3 items asking them to report how "angry", "enraged" and "furious" they were about climate incation,11-point scale, 0=Not at all, 10=Extremely), personal mitigation support (1 item asking the extent to which they "support the US taking greater action to reduce climate change", 11-point scale 0= I absolutely do not support, 10=I absolutely support), personal

climate change beliefs (2 items assessing the extent to which they believe climate change is happening and is human caused) and personal action intentions toward mitigating climate change (the 8-item, 7-point scale used for measuring anticipated collective action was adapted to measure individual intent to take action).

Participants then provided demographic information, including age, gender, party affiliation, political ideology, education, ethnicity, and income. Lastly, participants in the consensus conditions reported the perceived accuracy of the consensus information by rating how accurate the statistic presented seemed on a scale from 1 (definitely inaccurate) to 5 (definitely accurate). See Supplementary note 9 for Complete items. See Table 1 for means, standard deviations and scale reliabilities.

**Table 1** Means, standard deviations, and scale reliabilities of Study 1 measures (*n*=488)

| Measure | *M* | *SD* | Alpha |
|---|---|---|---|
| 1. Age | 37.17 | 11.60 | - |
| 2. Perceived Anger Consensus | 54.04% | 20.17% | - |
| 3. Perceived Support Consensus | 61.28% | 17.59% | - |
| 4. Anticipated Collective Action | 4.43 | 1.21 | 0.907 |
| 5. Personal Mitigation Support | 7.68 | 2.67 | - |
| 6. Personal Anger | 4.08 | 3.21 | 0.956 |
| 7. Personal Intent to Take Collective Action | 4.12 | 1.69 | 0.943 |
| 8. Perceived Accuracy of Message | 3.56 | 1.02 | - |

### 2.1.3 Experimental treatments and pilot testing

Study 1 employed dynamic norm messages depicting a trend of either growing public anger about climate change inaction in the U.S. (titled "% who feel angry about U.S. inaction on climate change") or growing public support for taking action to reduce climate change (titled "% who support action to reduce climate change") visualized in line graphs across political parties to bolster message credibility across partisans. A text description was included with the graph, conveying that recent research has found that "more and more

Americans are feeling angry about climate change/ support action to reduce climate change" and that the "trend of increasing anger/support…is observable across party lines" (see Supplementary Material note 7 for treatment descriptions).

Our decision to use a dynamic rather than static norm was supported by results from a pilot study (N = 479 US adults) conducted prior to Study 1, which used a static anger consensus norm. A lower percentage of participants were "somewhat" or "definitely" skeptical of the dynamic consensus message used in Study 1 (19.44%) compared to the static consensus message in the pilot study (31.13%) (see Supplementary Material note 5). In our pilot study, we also collected baseline anger consensus estimates ($M$=44.43%, $SE$=19.48). In Study 1, to ensure that participants would perceive anger as normative, we used a relatively high level of anger consensus (81%, 70%, and 53% among Democrats, Independents and Republicans respectively). This level of consensus is also similar to the percentage of partisans who express support for climate change mitigation efforts (Leiserowitz et al., 2019), which allowed us to standardize the consensus estimates shown to participants across both the anger and mitigation support consensus treatment conditions. This level of consensus was also higher than the baseline anger consensus estimate provided by participants in the pilot study to further ensure that participants would perceive anger as normative.[1]

**2.1.4 Analytic procedure**

All analytical models included experimental condition, party, and their interaction terms as predictors in 3 (Condition) X 3 (Party: Democrat, Republican, Independent/Other) analyses of variance. Unless otherwise specified, for all analyses, we report main effects of consensus message and unweighted marginal means, partialing effects of party, as well as test and report significant interactions. Unless we note a significant interaction between condition

[1] See the manipulation design in Study 2 for a discussion of the possible shortcomings of this approach, along with revisions to the norm message employed in Study 2.

and party, similar treatment effects were observed across partisan groups and the non-significant interaction is recorded in the Supplementary Material. In a table (Table 2), we also report pairwise comparisons of observed means and standard deviations across conditions

## 2.2 Results

### 2.2.1 Anger consensus estimate

Consistent with our hypothesis that the anger consensus message will bolster estimates of Americans' collective anger towards climate change inaction, the anger consensus message enhanced estimates of Americans' anger about climate inaction relative to the control and support conditions, $F(2,479)=29.74$, $p<0.001$, $\eta_p^2=0.11$. As expected, those who received the anger consensus message estimated greater consensus in anger about climate change inaction among the U.S. public ($M=62.75\%$, $SE=1.47\%$) than those who received a mitigation support consensus message ($M=50.27\%$, $SE=1.53\%$) or no message ($M=47.58\%$, $SE=1.49\%$), $ps<0.001$ (Fig. 1; Table 2). Similar effects were found across partisans.

### 2.2.2 Mitigation support consensus estimate

Moreover, as per our hypothesis that exposure to the anger consensus message would lead to higher or equal estimates of public support for climate mitigation than an explicit support consensus message, and higher estimates of public support relative to the control, a main effect of condition on perceived support consensus emerged, $F(2,479)=8.33$, $p<0.001$, $\eta_p^2=0.034$, such that those in the anger consensus condition ($M=64.38\%$, $SE=1.34\%$) estimated greater public support for climate mitigation than those in the control condition ($M=56.73\%$, $SE=1.35\%$), $p<0.001$ (Fig. 1, Table 2); and similar levels of support as those who received the explicit mitigation support consensus message ($M=61.69\%$, $SE=1.39\%$), $p=0.243$.

A significant Condition x Party interaction, $F(4,479)=2.86$, $p=0.023$, $\eta_p^2=0.023$, indicated that effects of anger consensus messaging on perceived mitigation support were stronger among Democrats and Independents than Republicans. Among Democrats, those in the anger consensus condition ($M_{DAnger}$=68.85%, $SE$=2.21%) estimated significantly greater support consensus for climate mitigation than those in the control condition ($M_{DControl.}$=59.34%, $SE$ =2.09%), $p=0.001$. Democrats in the support consensus condition ($M_{DSupport}$=63.52%, $SE$=2.12%) did not estimate significantly greater support than those in the control. Among independents, those in the anger consensus ($M_{IAnger}$=61.57%, $SE$=2.33%) and support consensus conditions ($M_{ISupport}$ =65.27%, $SE$=2.31%) estimated significantly greater support than those in the control condition ($M_{IControl}$=52.14%, $SE$=2.40%), $p=0.004$ and $p<0.001$, respectively. No significant effect of condition was found for Republicans, $F(2,133)=1.22$ $p=0.299$, $\eta_p^2=0.018$.

The effect of condition on estimates of mitigation support remained significant when controlling for major demographic factors: participants' age, gender, income and political orientation, $F(4,481)=8.93$, $p<0.001$, $\eta_p^2=0.036$.

**2.2.3 Anticipated collective action**

Contrary to the hypothesis that the anger consensus message would bolster expectations of collective climate action relative to the control and support consensus conditions, no effect of either the anger or support consensus message on anticipated collective action was observed relative to the control condition, $F(2,479)=1.38$, $p=0.252$, $\eta_p^2=0.006$. No other significant treatment effects were obtained for secondary measures including participants' own anger and mitigation support (see Supplementary Material note 10).

**Table 2** Pairwise comparison effect sizes for primary measures in Study 1.

| Outcome Measure | Anger v Control[a b] | Anger v Support | Support v Control |
|---|---|---|---|
| Anger consensus estimate | *d*=0.78*** [10.68, 18.86] | *d*=0.64*** [7.93, 16.18] | *d*=0.14 *ns.* [-1.42, 6.85] |
| Support consensus estimate | *d*=0.43*** [3.95, 11.36] | *d*=0.13 *ns.* [-1.51, 5.96] | *d*=0.31** [1.69, 9.17] |
| Anticipated collective action | *d*=0.19† [-0.04, 0.49] | *d*=0.11 *ns.* [-0.13, 0.40] | *d*=0.07 *ns.* [-0.18, 0.35] |

Note: †$p<0.10$; *$p<0.05$; **$p<0.01$; *** $p<0.001$. Brackets indicate 95% confidence intervals.
[a] Cohen's *d* compares observed means and standard deviations across conditions.
[b] *d* and *p*-values are for pairwise comparisons and 95% confidence intervals of the mean difference.

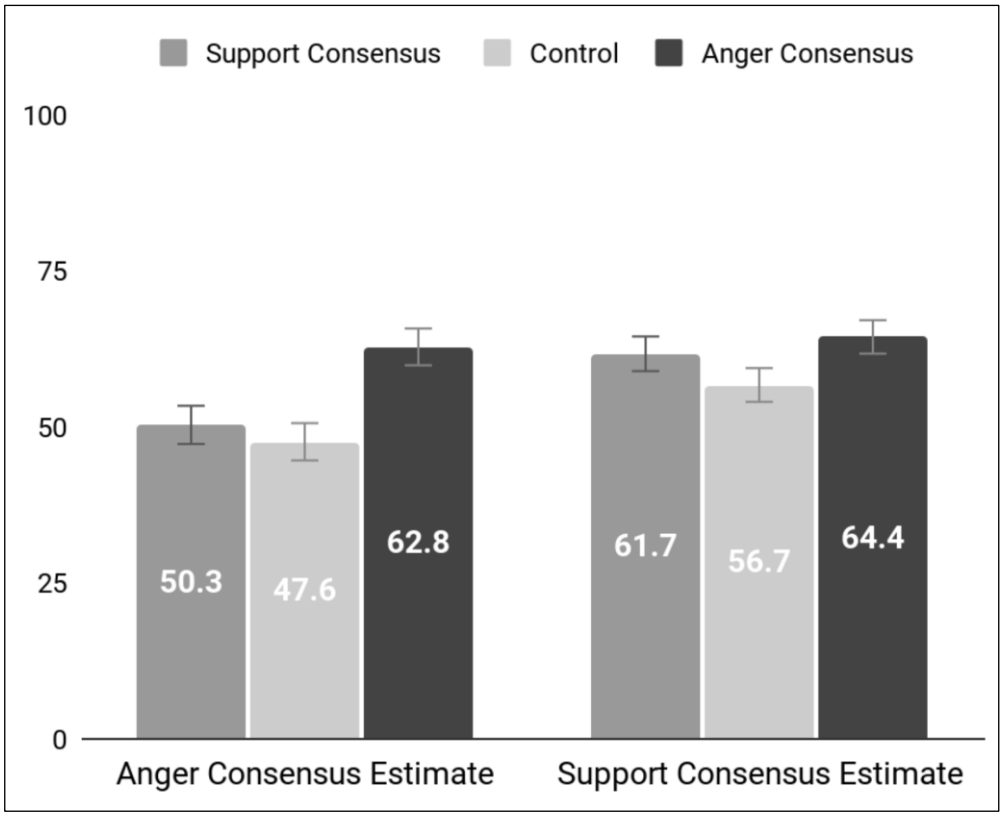


**Fig 1** Mean estimates of the percentage of Americans who are angry about US inaction on climate change and who support greater effort by the US to reduce climate change across experimental conditions in Study 1. Means are marginal means; error bars represent 95% confidence intervals.

### 2.3 Discussion

In Study 1, we found that an anger consensus message enhanced perception of public support for climate mitigation, relative to a no-information control group, and was as effective as a normative message that explicitly conveyed support for climate mitigation—the consequences of which we further explore in Study 2. Furthermore, we found that norm messaging that conveys growing public anger about climate inaction enhanced perceptions of collective anger across partisans relative to both the control group and an explicit mitigation support consensus message, suggesting that emotion consensus messaging conveys unique, emotion-specific information, not communicated by a message conveying public support for climate mitigation. However, contrary to our hypothesis, exposure to the anger consensus message did not enhance expectations for collective action. One reason for this null result might be that roughly 1 in 5 participants were skeptical about the accuracy of the anger consensus message, potentially lessening its persuasiveness (Pornpitakpan, 2004). Additionally, highlighting partisan trends in our stimulus may have inadvertently weakened the consensus message by making partisan identities and disagreements salient (Diamond, 2020; Geiger et al., 2020; Hart & Nisbet, 2012). In Study 2, we revised the anger consensus message with the aim to further bolster message credibility across partisan groups.

## 3. Study 2

Study 2 compared the effects of an anger consensus message with another important climate-related norm about Americans—a message that emphasized the growing number of Americans who believe in anthropogenic climate change (*belief consensus*). Study 2 assessed participants' estimates of consensus for Americans' anger about climate change inaction, belief in anthropogenic climate change, support for climate mitigation, as well as participants' expectations for collective action. We also explored treatment effects on

personal anger, mitigation support, and collective action intentions. To further standardize our messaging, for the control condition, we employed a dynamic norm message about an irrelevant topic (trends in television subscriptions within the US). We also modified our message format from Study 1 to further enhance message credibility across partisans and added specific policy measures of perceived public support (see Methods, below, for details). In improving our messaging, we aimed to reduce the salience of partisan identity cues by emphasizing a single national (vs. partisan) consensus, as partisan cues have been shown to polarize environmental issues (Diamond, 2020; Geiger et al., 2020; Hart & Nisbet, 2012).

### 3.1 Method

#### 3.1.1 Sample

We recruited 589 U.S. adults to participate in a survey "investigating public opinion on relevant social issues" via Amazon Mechanical Turk, of whom 27 were excluded from analyses for not satisfying the a priori inclusion criteria used in Study 1; see Supplementary Material note 12). The final sample consisted of 562 US adults, with an average age of 38.88 years ($SD$=11.65). The sample was 49% female and included 43% Democrats, 27% Republicans, 27% Independents, 3% party unspecified. The racial/ethnic composition of the sample was 6% Asian or Asian American, 9% Black or African American, 4% Hispanic, Chicana/o, or Latina/o, 0.4% Middle Eastern or North African, 0.4% Native American, First Nation, or Alaskan Native, 78% White, Caucasian or European American, and 2.5% Biracial or Multiracial. A majority of the participants reported having a Bachelor's degree, and an annual income of $20,000 to $40,000. As in Study 1, while the sample was not fully representative of the U.S. population, it provided sufficient sample heterogeneity to investigate our research question. The final sample size yielded 80% power to detect a small-

to-medium effect of $\eta_p^2$=0.015 (≈ f=0.13) or a Cohen's $d$ = .29. For reference, the median effect size in social psychology is $d$ = .36 (Lovakov & Agadullina, 2021).

### 3.1.2 Measures and procedure

Participants were randomly assigned to one of three conditions: Anger consensus ($n$ = 189: 82 Democrat, 42 Republican, 61 Independent and 4 indicating other or no affiliations), belief consensus ($n$ = 189: 81 Democrat, 58 Republican, 44 Independent and 6 having other political party affiliations), or the unrelated control ($n$ = 184: 79 Democrat, 50 Republican, 49 Independent and 6 indicating other affiliations). The anger consensus, belief consensus and control messages were line graphs indicating the US public's growing anger about climate inaction, growing belief in anthropogenic climate change, and growing "cord-cutting" behaviour respectively (see section 3.1.3, "Experimental Treatments" for details). After receiving the consensus message, participants used slider scales ranging from 0% to 100% to report their consensus estimates about the percentage of Americans who are angry about climate change inaction (anger consensus estimate), support climate change mitigation (support consensus estimate), and believe that climate change is mostly caused by human activities (belief consensus estimate). Next, we assessed participants' anticipation of future collective action using the collective action scale from Study 1 asking participants to rate the likelihood that Americans would participate in 8 activities such as "Recruit others to be involved in the activities of an environmental advocacy group" using a 7-point scale (1=extremely unlikely, 7=extremely likely; see Supplementary Material note 13). As an additional measure of anticipated collective action, participants were also asked about anticipated political mobilization, measured through their estimate of the "percentage of voters who view climate change as one of the top five issues when deciding whom to vote for", and perceived political support measured by asking participants to rate the extent to which "American voters prefer political candidates who seek to reduce climate change" (2

items to indicate estimates in the present and future, 1=Not at all, 5=Very much).

To provide a more comprehensive measure of public support for climate mitigation, in Study 2, we added a perceived policy support index adapted from prior public opinion research in which participants were asked to rate how likely other Americans were to support four different mitigation policies (1=Not at all likely to 5=Extremely likely) (Leiserowitz et al., 2019). The policy support index comprised the following policy items: "Setting strict carbon dioxide emission limits on existing coal-fired power plants to reduce climate change," "Requiring states to produce at least 50% of their energy using renewable energy sources such as solar and wind power by the year 2050," "Reducing subsidies from the fossil fuel industry (coal, oil, natural gas) and transferring these to the renewable energy industry (wind, solar, biomass, etc.) to develop cleaner forms of energy," and "Increasing fuel efficiency standards for automobiles from 33 miles to 54 miles per gallon."

Next, participants were asked about their personal anger, personal mitigation support and personal collective action intentions with items used in Study 1 (see Supplementary Material note 13 for all items). Finally, participants indicated their endorsement of prescriptive norms, or extent to which Americans *should* take certain actions to reduce climate change (measured by adapting the 8-item, 7-point anticipated collective action scale from Study 1) (See Supplementary Material note 13 for all items and Table 3 for means, standard deviations, and scale reliabilities).

**Table 3**
Means, standard deviations, and scale reliabilities of Study 2 measures (*n*=562)

| Measure | *M* | *SD* | Alpha |
|---|---|---|---|
| 1. Age | 38.88 | 11.65 | - |
| 2. Perceived Anger Consensus | 51.37% | 19.46% | - |
| 3. Perceived Support Consensus | 59.08% | 17.41% | - |
| 4. Perceived Belief Consensus | 62.15% | 16.35% | - |
| 5. Anticipated Collective Action | 4.35 | 1.35 | 0.92 |
| 6. Personal Mitigation Support | 7.65 | 2.78 | - |
| 7. Personal Anger | 3.60 | 3.10 | 0.95 |
| 8. Personal Intent | 3.89 | 1.73 | 0.95 |
| 9. Perceived Policy Support (Index) | 3.17 | 0.86 | 0.83 |
| 10. Personal Carbon Policy Support | 3.10 | 1.13 | 0.85 |
| 11. Climate Change as Top-5 Priority | 40.68% | 21.18% | - |
| 12. Perceived Voting Preferences, at Present | 2.80 | 0.82 | - |
| 13. Perceived Voting Preferences, in the Future | 3.38 | 0.98 | - |
| 14. Prescriptive Norm | 4.69 | 1.49 | 0.95 |

### 3.1.3 Experimental treatments

To assess participants' perceptions of the consensus messages in Study 1, we assessed their perceived accuracy, time spent viewing the message, and free responses after completing the survey. We found that roughly 1 in 5 participants (19.44%) in Study 1 perceived the anger consensus message as either "somewhat' or "definitely" inaccurate. Participants also spent a relatively short amount of time viewing the consensus message (*M*=45.31s, *SD*=101.24). Moreover, post-survey open-ended comments indicated that many participants may have attended to between-party differences visualized in the trend lines, and, thus, focused on partisanship rather than the general upward trend of consensus across partisans. Therefore, even though our treatments in Study 1 were ecologically valid, they may have increased the salience of partisan differences rather than consensus.

In Study 2, we further modified the treatment prompts to address these limitations. The experimental prompts included a line graph displaying a trend in the U.S. public's anger toward climate inaction (anger consensus message), growing belief in anthropogenic climate

change (belief consensus message), or growing "cord-cutting" (i.e., declines in cable television viewership; dynamic norm control condition). Furthermore, although we continued to note that trends were present across partisan groups within the message prompt (see supplementary material), rather than convey separate trends across parties, for all three conditions, the line graph conveyed a single trend of growing national consensus (67%). We did so to draw participants' attention to a public consensus, rather than party differences. Thus, participants could primarily attend to the central message of a national trend of Americans increasing anger about US inaction on climate change. This level of consensus was chosen to match the percentage of Americans who express belief in anthropogenic climate change (Leiserowitz et al., 2019). As in Study 1, the level of consensus was again higher than the baseline anger consensus estimate provided by participants in the pilot study but allowed us to standardize the consensus estimate shown to participants across all conditions.

As in Study 1, the line graphs were accompanied by text stating that, "more and more Americans are feeling angry about climate inaction/endorsing the belief that climate change is mostly caused by human activities/have stopped using cable TV." In the anger and belief consensus conditions, the text further emphasized that, "the number is lower for Republicans …(but) a majority of Republicans (53%) …and a larger proportion of younger Republicans (63%) express anger about climate change inaction/belief that climate change is caused mostly by human activities" (see supplementary note 11 for the complete stimuli).To increase participants' engagement with the consensus message, strengthen the potential impact of the normative messages, as well as bolster belief certainty in the statistics presented (Smith et al., 2008), we included an elaboration prompt in which participants were asked to list possible reasons for the trends that they observed (for prompt wording, see Supplementary Material note 11).

Through these modifications to the experimental treatment messages, we were able to improve the consensus message in Study 2. Compared to Study 1, fewer participants (14.23%) found the consensus message to be "somewhat" or "definitely" inaccurate. On average, participants also spent more time engaging with the consensus message ($M$=124.22s, $SD$= 109.21*)*. Further, participants' responses on the cognitive elaboration task indicated that they focused more on the reasons for anger about climate inaction/belief in anthropogenic climate change, than on party-based differences in consensus percentages. For all the above reasons, we consider the anger consensus manipulation used in Study 2 to be more effective in emphasizing public consensus than the one used in Study 1.

### 3.1.4 Analytic procedure

Study 2 followed the same analytic procedure as Study 1.

## 3.2 Results

### 3.2.1 Anger consensus estimate

Those who received the anger consensus message indicated significantly higher anger consensus ($M$=61.77%, $SE$=1.32%) than those who received the belief consensus ($M$=46.49%, $SE$=1.29%; $p$<0.001) or control message ($M$=43.31%, $SE$=1.31%; $p$<0.001), $F(2,553)=56.42$, $p<0.001$, $\eta_p^2=0.169$ (Fig. 2; Table 4). This effect was again found across political parties. Thus, as in Study 1, and consistent with our hypothesis, the anger consensus message conveyed unique, emotion-specific information not inferred from a climate belief or a mitigation support consensus message.

### 3.2.2 Belief consensus estimate

Further, consistent with the hypothesis that exposure to an anger consensus message would lead to equal or higher estimates of Americans' belief in anthropogenic climate change relative to the belief consensus message, and higher estimates of belief consensus relative to the control, there was also a significant effect of condition on estimated belief consensus,

$F(2,553)=6.20$, $p=0.002$, $\eta_p^2=0.097$. The anger ($M=64.11\%$, $SE=1.21\%$) and belief ($M=62.77\%$, $SE=1.19\%$) consensus messages led to significantly higher estimates of anthropogenic belief consensus relative to a dynamic norm control message ($M=58.99\%$, $SE=1.20\%$), $ps=0.002$ and 0.009, respectively (Fig. 2; Table 4).

Notably, we found that the anger consensus message was especially effective in bolstering anthropogenic belief consensus among Republicans. A significant condition by party interaction on estimated belief consensus, $F(4,553)=2.50$, $p=0.042$, $\eta_p^2=0.018$, revealed that among Republicans, the anger consensus ($M=65.45\%$, $SE=2.47\%$), but not the belief consensus message ($M=58.67\%$, $SE=2.10\%$), bolstered estimates of consensus in belief in anthropogenic climate change relative to the control group ($M=52.26\%$, $SE=2.26\%$), $ps=0.001$ and 0.084, respectively. This finding suggests that an anger consensus message may be as effective (and, among Republicans, potentially more effective) in communicating consensus beliefs about climate change than a message that explicitly conveys that a growing majority of Americans believe in anthropogenic climate change.

**3.2.3 Mitigation support consensus estimate**

As per our hypothesis that the anger consensus message would enhance estimates of public support for climate mitigation relative to the other two conditions, both the anger ($M=64.59\%$, $SE=1.23\%$) and belief ($M=59.02\%$, $SE=1.21\%$) consensus messages also enhanced perceptions of mitigation support consensus compared to the control message ($M=51.27\%$, $SE=1.22\%$), $ps<0.001$, main effect of condition: $F(2,553)=29.75$, $p<0.001$, $\eta_p^2=0.097$. Notably, those who received the anger consensus message estimated significantly greater support for climate mitigation among the U.S. public than did those who received the belief consensus message ($p=0.002$) (Fig. 2; Table 4). This effect was similar across partisans (See Supplementary Material note 14 for analysis).

Similar effects were obtained when using the 4-item policy support index such that there was a main effect of condition on estimates of the American public's support of 4 pro-climate policies, $F(2,553)=5.24$, $p=0.006$, $\eta_p^2=0.019$. Those who received the anger consensus message ($M=3.36$, $SE=0.06$) perceived greater mitigation policy support among the U.S. public compared to those who received the belief consensus ($M=3.07$, $SE=0.06$; $p=0.001$) or control message ($M=3.04$, $SE=0.06$; $p=0.001$) (Fig. 2; Table 4). There was no significant difference between the policy support estimated by those in the belief and control consensus conditions. This effect was again similar across parties. See Supplementary Material Table S4 for treatment effects on individual scale items.

**3.2.4 Anticipated collective action**

Finally, consistent with our hypothesis that exposure to the anger consensus message will enhance expectations of collective action relative to the other two conditions, those who received the anger consensus message estimated a higher likelihood that Americans would engage in collective action to address climate change in the future ($M=4.49$, $SE=0.10$), compared to those who received the control message ($M=4.05$, $SE=0.10$; $p=0.004$), $F(2,553)=5.22$, $p=0.006$, $\eta_p^2=0.019$, (Fig. 2; Table 4). No significant difference in anticipated collective action was found between the belief consensus ($M=4.35$, $SE=0.10$) and control or anger consensus conditions. Similar effects were obtained across partisan groups (see Supplementary Material note 14 and Table S5 for treatment effects on individual scale items).

These effects also extended to perceptions of political mobilization to mitigate climate change: Those in the anger consensus condition ($M=44.55\%$, $SE=1.55\%$) estimated a higher percentage of Americans as prioritizing climate change (as one of their top-5 priorities) when deciding whom to vote for than those in the belief consensus ($M=38.90\%$, $SE=1.52\%$; $p=0.017$) or control conditions ($M=36.01\%$, $SE=1.54\%$; $p<0.001$), $F(2,553)=7.92$, $p<0.001$,

$\eta_p^2$=0.028. Those in the anger consensus condition also perceived greater public support for political candidates who would seek to mitigate climate change both at present (*M*=2.89, *SE*=0.06) and in the future (*M*=3.49, *SE*=0.07) compared to those in the control condition (present: *M*=2.65, *SE*=0.06, *p*=0.005; future: *M*=3.15, *SE*=0.07, *p*<0.001), and marginally greater than those in the belief consensus condition (present: *M*=2.75, *SE*=0.06, *p*=0.08; future: *M*=3.34, *SE*=0.07, *p*=0.07) (main effect of condition: present: *F*(2,553)=3.92, *p*=0.020, $\eta_p^2$=0.014; future: *F*(2,553)=6.00, *p*=0.003, $\eta_p^2$=0.021). Similar effects were again obtained across partisan groups.

These findings supported our hypotheses: Compared to a dynamic control message, the anger consensus message bolstered estimates of other Americans' collective anger, mitigation support, expectations for collective action, and belief in anthropogenic climate change (see Table 4 for pairwise comparisons).

**3.2.5 Personal affect and attitudes about climate change**

We also explored whether these perceptions might have downstream implications for how participants personally respond to climate change. Those who received the anger consensus message (*M*=3.88, *SE*=0.22) reported higher levels of personal anger about climate change inaction than those who received the control (*M*=2.95, *SE*=0.22; *p*=0.006), or belief consensus message (*M*=3.26, *SE*=0.21, *p*=0.048) (Table 4), *F*(2,552)=4.72, *p*=0.009, $\eta_p^2$=0.017. Those in the belief consensus message reported comparable levels of personal anger as the control group. Similar effects were again observed across partisan groups.

Moreover, compared to the belief consensus (*M*=7.24, *SE*=0.18) and control messages (*M*=7.03, *SE*=0.18), the anger consensus message (*M*=7.90, *SE*=0.18) uniquely enhanced participants' personal support for climate mitigation (*p*=0.003 and *p*<0.001,

respectively) (See Fig. 2, Table 4), $F(2,553)=6.12$, $p=0.002$, $\eta_p^2=0.022$[2]. Similar treatment effects were observed across partisans (see Supplementary Materials).

Finally, when asked to indicate their level of agreement with prescriptive norms indicating actions Americans *should* take to mitigate climate change, Republicans (but not Democrats or Independents) who received the anger ($M=4.51$, $SE=0.21$) or belief ($M=4.25$, $SE=0.18$) consensus message endorsed stronger prescriptive norms favoring collective action to mitigate climate change than those who received the control message ($M=3.47$, $SE=0.20$), *ps*=0.002 and 0.011, respectively). No other significant treatment effects were obtained for secondary measures including participants' reported personal action intentions and donation to a pro-climate cause (see analyses in Supplementary Material note 14).

[2] Treatment main effects on personal mitigation support did not extend to personal support for some specific climate policies, such as a carbon tax or brownout (see Supplementary Material note 14); however, significant effects were found among Republicans: Republicans in the anger consensus condition ($M=2.87$, $SE=0.16$) reported significantly stronger support for a carbon tax than did those in the control condition ($M=2.21$, $SE=0.15$; $p=0.004$).

**Table 4** Pairwise comparison effect sizes for Study 2 measures.

| Outcome Measure | Anger vs Control[a,b] | Anger vs Belief | Belief vs Control |
|---|---|---|---|
| Anger consensus estimate | *d*=1.05*** [14.74, 21.57] | *d*=0.95*** [11.76, 18.80] | *d*=0.14 [-0.81, 6.29] |
| Belief consensus estimate | *d*=0.28** [1.78, 8.28] | *d*=0.05 [-2.55, 3.91] | *d*=0.27** [1.09, 7.59] |
| Support consensus estimate | *d*=0.75*** [9.51, 16.14] | *d*=0.36** [2.04, 8.62] | *d*=0.42*** [4.18, 10.80] |
| Support consensus estimate (Policy Index) | *d*=0.32** [0.11, 0.45] | *d*=0.33** [0.11, 0.45] | *d*=0.002 [-0.17, 0.17] |
| Anticipated collective action | *d*=0.29** [0.13, 0.67] | *d*=0.06 [-0.19, 0.35] | *d*=0.23* [0.05, 0.58] |
| Political consensus estimate (top 5 priority) | *d*=0.37*** [3.78, 12.10] | *d*=0.24* [0.89, 9.17] | *d*=0.14 [-1.26, 7.08] |
| Perceived political support at present | *d*=0.29** [0.07, 0.40] | *d*=0.19† [-0.02, 0.30] | *d*=0.11 [-0.07, 0.26] |
| Perceived political support in future | *d*=0.36*** [0.15, 0.53] | *d*=0.19† [-0.01, 0.36] | *d*=0.17† [-0.02, 0.36] |
| Personal anger | *d*=0.27** [0.24, 1.41] | *d*=0.19* [0.01, 1.17] | *d*=0.07 [-0.35, 0.82] |
| Personal support | *d*=0.34*** [0.41, 1.40] | *d*=0.27** [0.25, 1.23] | *d*=0.06 [-0.33, 0.66] |

Note: †$p<0.10$; *$p<0.05$; **$p<0.01$; *** $p<0.001$. Brackets indicate 95% confidence intervals.
[a]Cohen's *d* compares observed means and standard deviations across conditions.
[b]*d* and *p*-values are for pairwise comparisons and 95% confidence intervals of the mean difference.

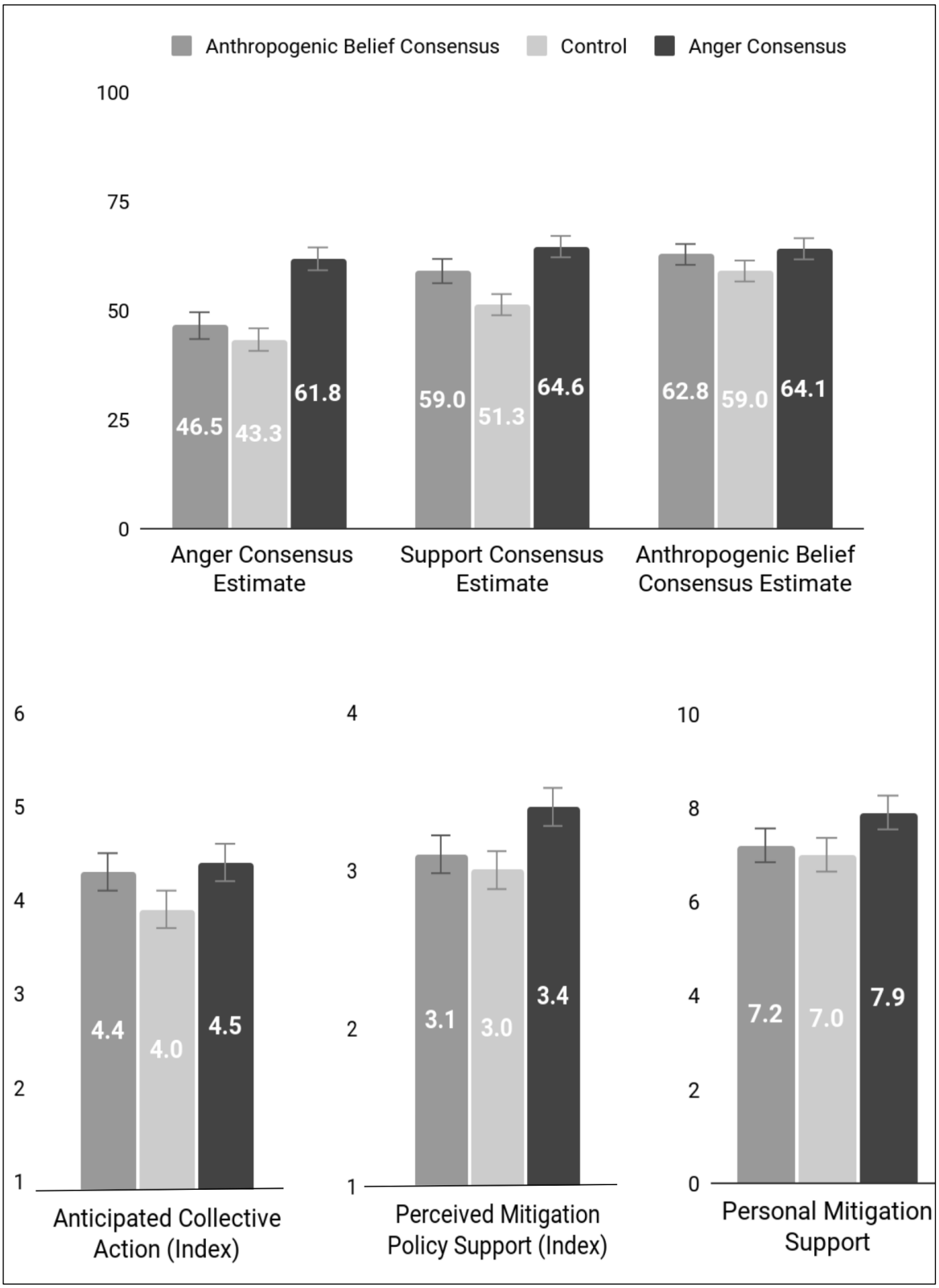


**Fig 2** Mean estimates of public anger about climate inaction (0%-100%), public support for climate mitigation (0%-100%), and public belief in anthropogenic climate change (0%-100%); and anticipated collective action (8-item index; 1-7 scale), perceived support for mitigation policy (4-item index; 1-5 scale), and personal support for climate mitigation (0-10 scale), across experimental conditions in Study 2. Means are marginal means rounded to one decimal place and error bars represent 95% confidence intervals.

## 4. Discussion

Public outrage is easily expressed and rapidly transmitted in the digital age (Brady et al., 2019; Crockett, 2017; Fan et al., 2016). Here, we find that, when conveyed in a believable fashion (e.g., via information suggesting *growing,* rather than uniformly high public anger), normative appeals that convey growing public anger about climate inaction can influence perceptions of public mobilization to address climate change across partisan groups and convey a broad range of social information, including information about others' affective responses toward climate change, beliefs, support for mitigation efforts, as well as their likelihood of taking action. Further, we find evidence that, by influencing inferences about the collective beliefs and behavioral intentions of others, well-honed and credible messages about anger consensus can also influence personal anger about climate inaction and support for mitigating climate change.

Although past research has established the potency of anger norms in conveying collective action intentions (Leonard et al., 2011), our findings complement and extend this literature in several ways. First, we compared the effects of the anger consensus message to explicit support consensus and belief consensus messages to show that the anger consensus message not only conveys unique information about collective emotion, but also bolsters consensus estimates of others' climate beliefs and mitigation support as effectively as explicit messages conveying this information. Further, the anger consensus message was also effective in conveying collective action intentions and, among Republicans, bolstered endorsement of prescriptive norms favoring collective action to mitigate climate change. Our results suggest that collective anger may, thus, be a potent norm signal, as it may convey not only how others are feeling, but also influence a wide range of second-order beliefs, including inferences about others' motivational states (i.e., what actions people are likely to take, including what issues they are likely to prioritize when voting, and policies they may

support), as well as other key consensus beliefs, such as belief in anthropogenic climate change, that may be presumed to underlie these preferences.

Notably, moving beyond prior research, we find that an anger consensus norm can impact second-order beliefs even within a highly politically polarized context. Despite the well-documented political divide within the US (Ballew et al., 2020; Van Boven et al., 2018), we found no evidence of reactance to an anger consensus message among Republicans. Moreover, when a national consensus (i.e., conveying a single national trend versus parallel trends across parties) was emphasized, as in Study 2, the anger consensus message was effective in bolstering participants' personal support for climate mitigation across partisan groups and uniquely enhanced Republicans' consensus estimates of Americans' belief in climate change and endorsement of prescriptive norms favoring collective action to mitigate climate change. Together, these findings suggest that when communicated as a single consensus rather than as similar partisan trends, anger consensus messaging may be effective in mobilizing support for climate mitigation across partisan groups.

These findings have implications for how information about climate change can be communicated. As second-order beliefs can shape individual beliefs, attitudes, and action intentions (Mildenberger & Tingley, 2019), the effects of an anger consensus message may impact personal beliefs and mitigation support. Indeed, our findings show that when conveyed in a believable format that emphasizes national consensus (in Study 2), an anger consensus message can bolster individuals' mitigation support, anger towards climate inaction, and pro-climate prescriptive norms (in the case of Republicans).

### 4.1 Limitations and Future Directions

We note some limitations with the present research that may guide future work. First, although we compared anger consensus information to two additional forms of consensus messaging (belief in anthropogenic climate change and public support for mitigation), we did

not examine other types of consensus messaging, such as scientific consensus beliefs, that have been similarly shown to influence public opinion but rely on substantially higher consensus estimates (e.g., 97%) (van der Linden et al., 2015). Additionally, scientific and anger consensus messaging emphasize different referent groups (scientists versus public consensus, the referent group examined in the present set of studies). In the present research, we aimed to standardize both the referent group (i.e., Americans) as well as the statistics reported across consensus messages – nevertheless, future work might explore how other types of consensus messaging might be used, separately or in tandem with the messaging used here, to shape second-order beliefs and personal mitigation support.

Additionally, compared to the findings for perceived pro-climate norms, we find more mixed evidence for effects of anger consensus messaging on individual outcomes in the present studies. Although the anger consensus message increased perceived public support for climate mitigation relative to a control message, it did not impact participants' reported pro-climate action intentions in Study 1. However, in Study 2, when a national consensus (vs. partisan trends) was emphasized, the anger consensus message bolstered participants' personal anger, mitigation support, and endorsement of prescriptive norms (among Republicans). Research on normative influence suggests that perceived norms can be effective in motivating behavior change without prompting commensurate changes in individual attitudes or beliefs (Paluck & Green, 2009; Sunstein, 2019; Tankard & Paluck, 2016). Thus, messaging that shapes perceptions of group norms relating to climate change may influence some downstream behavior without directly impacting pro-climate action intentions. In the present studies, dynamic norms were employed signaling *growing* consensus over time, which may drive *future* behavioral conformity (Sparkman et al., 2021; Sparkman & Walton, 2019). Future research might explore this possibility.

By modifying our treatment message to increase its perceived credibility, as well as heighten the salience of the national consensus, we found that the anger consensus appeal's effectiveness was significantly enhanced. For instance, although we did not find that the anger consensus message enhanced expectations for collective action in Study 1, using revised stimuli, we did observe this effect in Study 2. In Study 2, we introduced an elaboration task and presented a single national consensus estimate to reduce partisan identity cues (Diamond, 2020) and enhance the salience of the message's central argument (Pornpitakpan, 2004; Yalch & Elmore-Yalch, 1984). Moreover, by acknowledging that consensus among Republicans, though a majority, was still lower than that among Democrats and Independents, we sought to lessen perceived discrepancy between the message's claim and participants' prior opinions about political polarization on climate change (Bochner & Insko, 1966). Given the results of Study 2, we infer the improvements in message believability bolstered the impact of the message and consistency of findings across measures in Study 2, however, future research might identify additional barriers that may limit the perceived credibility and efficacy of anger consensus appeals, particularly across partisan groups.

We also found that political party did not moderate the effect of the anger consensus message for most outcomes. Generally, the pattern of treatment effects we document did not markedly differ in magnitude between Democrats and Republicans across many of the key dependent variables, and was typically similar in valence, indicating more convergence than divergence across partisan groups. For instance, in Study 2, the effect of the anger consensus (vs. control) message on personal support for climate mitigation among Democrats and Republicans was $d = 0.41$ and 0.46, respectively. Nevertheless, future studies might seek to

obtain larger partisan samples to examine moderating effects of political affiliation, as well as to capture smaller treatment effects within partisan groups[3].

Future research might also explore how normative displays of anger shape other psychological processes that may fuel collective action, such as feelings of collective efficacy - the belief that working together with others, one can help to mitigate climate change (Fritsche et al., 2018). Indeed, recent findings suggest bystanders' collective efficacy beliefs increased after two large-scale climate protests in 2017 – events which often include visible displays of collective anger about climate inaction (Swim et al., 2019). Thus, learning that others are angry about climate inaction may bolster expectations that people can work together to address climate change, which may further motivate participation in collective action (Roser-Renouf et al., 2014; van Zomeren et al., 2004, 2010).

Finally, in the present studies, we demonstrate effects of anger consensus as conveyed through statistics captured in opinion polls and commonly reported in media stories, rather than overt emotion displays, such as imagery shown in media coverage of protests. Future work might explore these factors as well as other collective emotions, such as fear, anxiety, or guilt, that may signal different motivational states, such as avoidance or culpability (Ferguson & Branscombe, 2014; Harth et al., 2013).

## 5. Conclusion

As a growing number of young people demand climate action, displays of public anger are becoming increasingly common. In two large-scale survey experiments with U.S. adults, we find consistent evidence that exposure to normative messages conveying growing public anger about climate inaction impact a broad array of second-order beliefs across

[3] In the present studies, for tests of within-party treatment effects, the smallest partisan samples (Republicans) afforded 80% power to detect medium-sized effects (Cohen's *d*s in the range of 0.57 to 0.60, in Studies 2 and 1)

partisan groups, including inferences about others' support for climate mitigation, collective action intentions, and belief in anthropogenic climate change. Moreover, when conveyed in a believable manner, we find that anger consensus messaging also bolsters individuals' own support for climate change mitigation. Given historically low grassroot mobilization and persistent political divide on climate change in the US, communications signaling that a broad consensus of Americans are angry about climate change inaction may be a potent tool to mobilize support for collective action across partisan groups.

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