Article

Perceived Social Consensus Can Reduce Ideological Biases on Climate Change

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Abstract

It is well established that conservatives in the United States are substantially less likely than liberals to accept that climate change is happening and is human caused and are less supportive of policies to limit climate change. However, it is likely that ideological differences in climate change beliefs, attitudes, and policy preferences are smaller when people have close friends and family members who care about climate change. Here, we use nine nationally representative survey samples (total $N = 16,168$) to evaluate this claim and test if perceived social consensus predicts a smaller difference in climate change beliefs between liberals and conservatives. We find that social consensus plays an important role in climate change beliefs, attitudes, and policy preferences for people across the ideological spectrum, but especially among conservatives. These findings provide important insights on how to bridge ideological divides in large social dilemmas such as climate change.

Keywords

climate change, social norms, ideology, polarization, consensus

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There is a strong scientific consensus that human-caused climate change is happening, and there is a significant threat to human societies and ecosystems worldwide (Cook et al., 2016). Although there is consensus among more than 97% of climate scientists that human-caused global warming is happening (Cook et al., 2016), many Americans do not believe that climate change is happening (30%) or that it is human caused (42%; Leiserowitz et al., 2018b). Political party and ideology currently have a strong influence on public opinion formation about climate change. For example, while 92% of registered Democratic voters believe climate change is real, only 51% of registered Republican voters do (Leiserowitz et al., 2018b). Including ideology, 95% of liberal Democrats believe climate change is real while only 40% of conservative Republicans do.

Does perceived social consensus—the degree to which people in one's social group are in agreement about an issue—predict the extent to which people believe in climate change? It is well established that the judgments of other people have a powerful influence on our own thoughts and behaviors (Asch, 1955; Deutsch & Gerard, 1955; Sherif, 1936), especially when people are uncertain about what to think or how to behave (Festinger, 1954). For example, people often change their views about other groups to be consistent with the in-group consensus about a stereotype (i.e., perceived agreement about the percent of people to whom a certain trait or attribute applies, Haslam et al., 1996; Sechrist & Stangor, 2001). Research in the context of climate change has demonstrated the importance of communicating descriptive social norms ("most people do x"). For example, van der Linden (2015) finds that perceived social consensus on the issue is a key determinant of public risk perceptions of climate change. Similarly, many studies show that descriptive norms can encourage conformity in energy conservation (Allcott, 2011; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) and other sustainable behaviors, such as recycling (Cialdini, Reno, & Kallgren, 1990), towel reuse (Goldstein, Cialdini, & Griskevicius, 2008; van der Linden & Chryst, 2017), meat consumption (Sparkman & Walton, 2017), and sustainable transportation (Kormos, Gifford, & Brown, 2015).

However, what remains less clear in the context of climate change—which is characterized by large intergroup conflict in the United States—is the extent to which perceived in-group consensus is associated with belief formation and policy support. For example, some research shows that exaggerated perceptions of political polarization on climate change can lead to false norms of partisan opposition (Van Boven, Ehret, & Sherman, 2018). The perception of a positive social consensus in one's close social network might help attenuate such intergroup pressures. In other words, are conservatives and liberals more likely to believe in climate change when (a) they perceive

a social in-group consensus about either what to believe (i.e., climate change is human caused) or (b) about which pro-climate policies to support? This question is of theoretical and practical importance considering that people often misperceive what others around them believe (e.g., Jost, 2018; Mildenberger & Tingley, 2017).

Misperceptions of Social Consensus

Because the beliefs of others are extremely influential to one's own beliefs, the misperception of what others believe presents a crucial barrier to action on climate change. For example, if people incorrectly believe most other people do not believe global warming is happening, then they likely will not believe it is happening either, and will be much less likely to perceive global warming as a serious risk or support policy action to reduce it. Mildenberger and Tingley (2017) investigated the extent to which people misperceived global warming beliefs in the United States and China. They found that participants in both countries tended to underestimate the extent to which people in their own country believe global warming is happening, human caused, and that most scientists believe human-caused global warming is happening. In a follow-up experiment, the researchers found that exposing U.S. respondents to information about the true proportion of Chinese people's pro-environment beliefs (much higher than that of the U.S.) led U.S. respondents to significantly increase their support for a global climate treaty.

The misperception of social consensus is especially consequential in the United States because a significant portion of the American population does not believe global warming is happening, particularly conservatives and Republicans (Leiserowitz et al., 2018b). Recent research demonstrates the importance of in-group messengers in shifting people's normative beliefs about climate change. For example, Ehret, Van Boven, and Sherman (2018) found that respondents were more likely to support a pro-climate policy when it was endorsed by elites from their own party, and this effect was mediated by perceptions of social consensus. That is, when Republican respondents, for example, saw that a member of the Republican elite endorsed the policy, they increased their perceptions that other Republicans were also supporting the policy, and therefore increased their own support for it.

In addition, inaccurate beliefs about what others believe can lead to *pluralistic ignorance*, whereby most people think that others hold the opposing viewpoint when they do not, leading people to self-silence. This phenomenon has been demonstrated across a broad range of topics including alcohol consumption (Prentice & Miller, 1993), sexual behavior (Lambert, Kahn, &

Apple, 2003), as well as climate change beliefs (Geiger & Swim, 2016; Leviston, Walker, & Morwinski, 2013).

Perhaps even more importantly, little is known about the role of social consensus in one's *close* social group: family and friends. A large social psychological literature shows that close relationships are especially influential to one's beliefs. For example, Shared Reality Theory posits that people are motivated to tune their views to those of close others (i.e., share reality) to fulfill fundamental motives to understand the world and to affirm their sense of belonging (Hardin & Conley, 2001; Hardin & Higgins, 1996, also see Baumeister & Leary, 1995). As 61% of Americans say the issue of global warming is at least somewhat personally important, 69% say they rarely or never talk about it with family and friends (Maibach, Leiserowitz, Rosenthal, Roser-Renouf, & Cutler, 2016). There is a need to understand the role of close relationships in people's global warming beliefs.

Ideology and Social Consensus

Furthermore, does perceived social consensus predict beliefs about climate change equally for people across the political spectrum? As the need to identify and affiliate with others is a fundamental psychological drive (Baumeister & Leary, 1995), one might expect that the role of social influence in views about climate change is equivalent across the ideological spectrum. However, a large literature has identified core psychological and personality differences between liberals and conservatives (Caprara, Schwartz, Capanna, Vecchione, & Barbaranelli, 2006; Carney, Jost, Gosling, & Potter, 2008; Jost, 2017a; Jost, van der Linden, Panagopoulos, & Hardin, 2018; Stern, West, Jost, & Rule, 2014), suggesting that social consensus might play a more important role among conservatives.

Several studies find that conservatives place greater value on conformity and in-group loyalty than do liberals (Caprara et al., 2006; Graham, Haidt, & Nosek, 2009; Jost, 2017a; Jost et al., 2018; Piurko, Schwartz, & Davidov, 2011). For example, researchers investigated the extent to which liberal and conservative differences observed in previous research represented genuine differences in "basic personal values"—defined as "cognitive representations of desirable, trans-situational goals, varying in importance, that serve as guiding principles in the life of a person or group" (Piurko et al., 2011, p. 538). The researchers analyzed 17 countries on the value of conformity. The results were almost unanimously consistent: in 16 of 17 countries, the value of conformity predicted a conservative political orientation.

In addition, research on Moral Foundations Theory documents ideological differences in valuing in-group loyalty (Graham et al., 2009). Several studies using different methods find that conservatives more strongly value in-group loyalty than do liberals. Conservatives saw in-group loyalty as more morally relevant than liberals did, and in an additional study, were less willing than liberals to violate in-group loyalty when given a hypothetical moral conflict (van der Linden & Panagopoulos, 2019).

Although related, ideology is not the same as political party. However, ideology and political party voter registration are strongly correlated (Panagopoulos & van der Linden, 2016). In their study of voters in the 2001 Italian national election, Caprara and colleagues (2006) found that valuing conformity predicted voting for center-right over center-left candidates in the election. In the United States, political polarization in the past two decades has led to even greater overlap between ideology and political party (Pew Research Center, 2017; also see Abramowitz & Saunders, 2006). That is, 95% of Republicans are more conservative than the median Democrat and 97% of Democrats are more liberal than the median Republican.

Of particular importance to this study, conservatives and Republicans show a stronger desire than liberals and Democrats to adopt and share the same views with like-minded others (e.g., Benegal & Scruggs, 2018; Jost et al., 2018; Stern et al., 2014). For example, recent research showed participants an article highlighting misinformation about climate change and then randomly assigned them to read a correction of the information that came from NASA scientists, Democratic senators, or Republican senators (Benegal & Scruggs, 2018). The study found that when the message came from Republican senators, Republican respondents significantly increased their beliefs in the scientific consensus on climate change, that climate change is human caused, and that it is an important problem. Democratic respondents did not update their beliefs when the message came from Democratic senators. The results suggest that Republicans are more responsive to messages from their in-group than Democrats are.

In addition, while prior research has shown that perceived consensus among ideologically neutral outgroups, such as scientists, can help correct misperceptions and neutralize belief polarization (Goldberg, van der Linden, Ballew, Rosenthal, & Leiserowitz, 2019; Lewandowsky, Gignac, & Vaughan, 2013; van der Linden, Leiserowitz, & Maibach, 2018; Zhang et al., 2018), other research demonstrates that conservatives are often more influenced by the source of a message than the message itself (Jost & Krochik, 2014). Thus, based on a large body of previous research, we expect conservatives will have significantly lower pro-climate beliefs than liberals, and this ideological

difference will be significantly smaller for people in social groups that care about climate change (i.e., high social consensus). As political ideology and political party are highly related measures, we expect the same relationship for political party. That is, we test whether Republicans will have significantly lower pro-climate beliefs than Democrats, and whether this partisan difference will be significantly smaller for people with high social consensus in their close social group.

The Current Research

Data

To address the current research questions, we draw primarily on data collected through the *Climate Change in the American Mind* (CCAM) project, which has conducted biannual nationally representative surveys from 2008 until the present. Data from this project are used to track key climate change beliefs over time (e.g., whether it is happening and human caused; see Leiserowitz et al., 2018a), gauge public opinion on relevant policies, and answer theory-based research questions. All samples from CCAM are nationally representative probability samples. Reports for each wave of CCAM are available online and contain demographic information for that specific sample and demonstrate that the data closely resemble U.S. population parameters (http://climatecommunication.yale.edu/publications/). As an additional robustness check, this study also includes an additional large national data set recruited from Qualtrics Panels (see sampling procedures in section "Participants").

Inclusion Criteria

We included all CCAM survey waves that included a variable measuring social consensus, plus the Qualtrics survey, leading to a total of nine data sets. Including all data sets across four different social consensus variables offered the advantage of larger sample sizes as well as preliminary tests of which conceptualizations of social consensus variables are strongest in predicting global warming beliefs as a function of political ideology (see Supplementary Table 1 for information on all variables included). In addition, due to the importance of replicability and reproducibility of scientific findings (Open Science Collaboration, 2015), it is important to conduct direct and conceptual replications. Direct replications validate the phenomenon of interest and conceptual replications validate the underlying theoretical concept (Earp & Trafimow, 2015). The current data sets allow for both.

Method

Participants

The total number of respondents was $N = 16{,}168$. Data for eight of the nine surveys used in this article were collected via biannual waves of nationally representative surveys on climate change ($n = 9{,}867$). The number of respondents for each variable is available in Supplementary Table 1. Respondents were American adults aged 18 and older and recruited from GfK's Knowledge Panel using probability sampling. Potential respondents were recruited using either random-digit dialing or address-based sampling techniques that cover nearly all resident phone numbers and addresses in the United States. Respondents who were recruited but did not have Internet access were loaned computers with access to the Internet, enabling their participation. We used an additional national data set of American adults (18+ years old), which was collected from Qualtrics panels (Qualtrics LLC, Provo, UT) in 2015 ($n = 6{,}301$). The sample used quotas to reflect the United States population for gender, age, region, education, and political party. All surveys and informed consent to participate in each survey were self-administered online by the respondent. All studies were approved by the Yale University Institutional Review Board and all procedures were carried out in accordance with their regulations.

Materials and Procedure

The data were drawn from eight waves of nationally representative surveys and one wave from a national survey (total $N = 16{,}168$) conducted between 2008 and 2017. In each survey, participants answered questions regarding global warming, including beliefs (e.g., do you think that global warming is happening?), policy preferences (e.g., how much do you support or oppose the following policies; "regulate carbon dioxide as a pollutant"), norm perceptions, political party, and ideology (1 = *Very liberal*, 5 = *Very conservative*). A full description of all questions used in this study is listed in Supplementary Table 1.

Participants were asked one of four different questions about their perception of the social consensus on climate change within their group of friends and family, depending on the wave of survey. For example, ". . . what percentage of people who are important to you (friends, family, etc.) believe that human-caused global warming is happening?" (0%-100%) and "How important is it to your family and friends that you take action to reduce global warming?" (1 = *Not at all important*, 5 = *Extremely important*). Several

dependent variables measured respondents' belief that climate change is happening and human caused, their level of worry about climate change, and support for climate policies (see Supplementary Table 1). All variables were standardized and then combined into a single data set (see details below).

Results

Analytic Strategy

We use multiple regression to (a) evaluate the relationship between perceived social consensus and climate change beliefs, worry, and policy preferences and (b) test if greater perceived social consensus is associated with a smaller ideological gap in climate change beliefs, worry, and policy preferences between liberals and conservatives. All regression models controlled for age, gender, and education, although results were the same whether or not these covariates were included in the models. Primary results are reported in the main text, whereas full regression tables with results of covariates are included in the supplementary information.

As our data set was comprised of nine waves of survey data, included four different social consensus questions, and there were no a priori predictions about which social consensus questions would yield the strongest results, we standardized all variables and combined all data sets. This was possible for the three primary dependent variables: the belief that global warming is happening, human caused, and worry about global warming. For the remaining dependent measures, we use data that were only available in select waves (seven waves for policy questions; one wave for the need for public action). In the following section, we explore differences in effect size based on the different social consensus questions used in different survey waves. To do this, we conducted random effects meta-analyses to determine the effect size across all four questions about social consensus. Next, we considered an alternative hypothesis and conducted two random effects meta-analyses to determine which model best explains the variability in the data.

Primary Analyses

First, we examined the relationship between ideology and each of three measures that were available in all nine survey waves ($N = 16,168$): belief that global warming is happening, human caused, and worry about global warming. As expected, ideology had a significant negative association with the belief that global warming is happening, ($\beta = -.39$, $SE = .01$) $p < .001$, 95% confidence interval (CI) [$-.40, -.38$], human caused, ($\beta = -.36$, $SE = .01$)

$p < .001$, 95% CI [–.37, –.35], and worry, ($\beta = -.42$, *SE* = .01) $p < .001$, 95% CI [–.43, –.41]. Policy questions were included in seven of nine survey waves (total *n*s > 8,200; see Supplementary Table 1 for exact sample sizes and years included). As expected, ideology had a significant negative association with support for regulating carbon as a pollutant, ($\beta = -.39$, *SE* = .01) $p < .001$, 95% CI [–.41, –.38], as well as support for regulating utilities, ($\beta = -.36$, *SE* = .01) $p < .001$, 95% CI [–.38, –.35]. Only the Qualtrics sample (*n* = 6,301) included a question that asked participants whether they think people should be doing more or less to reduce global warming (i.e., the need for public action). As expected, ideology had a significant negative association with the need for public action, ($\beta = -.31$, *SE* = .01) $p < .001$, 95% CI [–.33, –.28] (see Supplementary Tables 2A-2F).

Next, we examined the unique effects of perceived social consensus while also controlling for ideology. Social consensus was significant and positively associated with the belief that global warming is happening, ($\beta = .36$, *SE* = .01) $p < .001$, 95% CI [.34, .37], human caused, ($\beta = .36$, *SE* = .01) $p < .001$, 95% CI [.34, .37], a stronger sense of worry about global warming, ($\beta = .41$, *SE* = .01) $p < .001$, 95% CI [.40, .42], support for carbon regulation, ($\beta = .24$, *SE* = .01) $p < .001$, 95% CI [.22, .26], regulation of utilities, ($\beta = .22$, *SE* = .01) $p < .001$, 95% CI [.20, .24], as well as the need for public action, ($\beta = .53$, *SE* = .01) $p < .001$, 95% CI [.51, .55] (see Supplementary Tables 3A-3F).

To test whether perceived social consensus is associated with a smaller ideological gap in climate change beliefs, worry, and policy preferences, we tested the ideology × perceived social consensus interaction for each dependent variable. The PROCESS macro in SPSS was used to parse all interactions (Hayes, 2013). The expected interaction was significant in predicting whether participants believed global warming is happening ($\beta = .11$, *SE* = .01) $p < .001$, 95% CI [.09, .12]. For people with low social consensus (–1*SD*), ideology (i.e., higher = more conservative) had a negative and significant relationship with the belief that global warming is happening, ($\beta = -.39$, *SE* = .01) $p < .001$, 95% CI [–.41, –.37], and this relationship was negative and significant but substantially weaker (less than half in magnitude) for people with high social consensus (+1*SD*), ($\beta = -.18$, *SE* = .01) $p < .001$, 95% CI [–.20, –.16]. The interaction was also significant for the belief that global warming is human caused, ($\beta = .09$, *SE* = .01) $p < .001$, 95% CI [.07, .10]. For people with low social consensus (–1*SD*), ideology was significant and negative in predicting belief in human causation, ($\beta = -.34$, *SE* = .01) $p < .001$, 95% CI [–.36, –.32], and this relationship remained negative and significant but again was less than half in magnitude for people with high social consensus (+1*SD*), ($\beta = -.16$, *SE* = .01) $p < .001$,
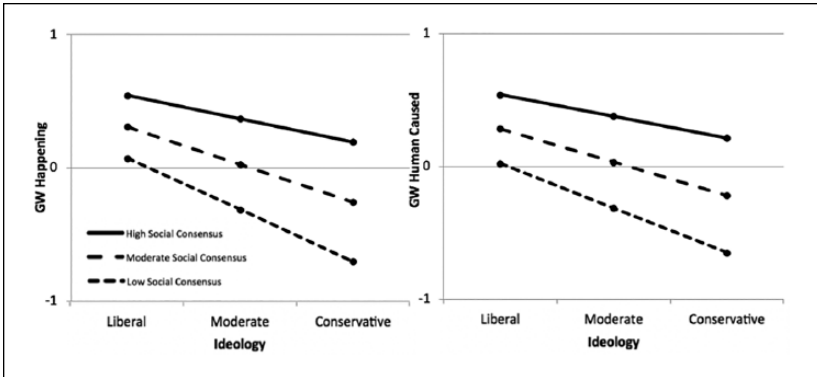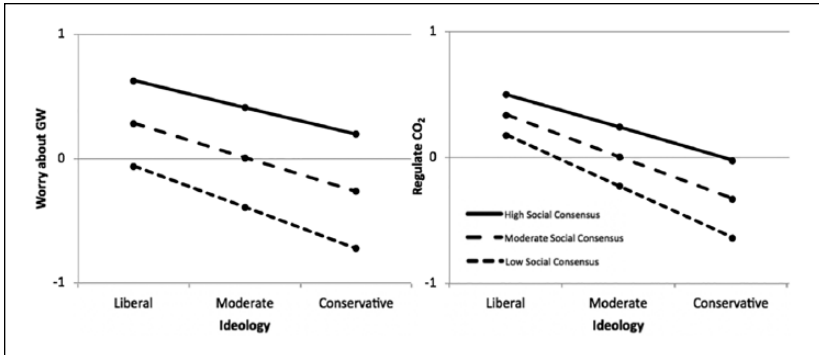
Figure 1. Global warming beliefs (happening and human causation) as a function of ideology and social consensus.
Note. Plots present standardized regression coefficients adjusted for age, gender, and education. Includes all nine survey waves.

95% CI [–.18, –.14]. The ideology × perceived social consensus interaction was significant for worry, ($\beta = .06$, $SE = .01$) $p < .001$, 95% CI [.05, .07], such that ideology was negative and significant for people with low social consensus, ($\beta = -.33$, $SE = .01$) $p < .001$, 95% CI [–.35, –.31], but substantially less so for people with high social consensus, ($\beta = -.22$, $SE = .01$) $p < .001$, 95% CI [–.24, –.20] (see Figures 1 and 2 and Supplementary Tables 4A-4F).

Next, we tested the same interaction predicting policy preferences as well as the need for public action. The interaction was significant for policy support for regulating carbon as a pollutant, ($\beta = .07$, $SE = .01$) $p < .001$, 95% CI [.05, .09], where the relationship between ideology and policy support was significant and negative for people with low social consensus, ($\beta = -.41$, $SE = .01$) $p < .001$, 95% CI [–.44, –.38], but this relationship was weaker for people with high social consensus, ($\beta = -.26$, $SE = .01$) $p < .001$, 95% CI [–.29, –.24]. The significant interaction and same pattern of results emerged for policy support for regulating utilities, ($\beta = .05$, $SE = .01$) $p < .001$, 95% CI [.03, .07]. Conservatives were significantly less supportive of the policy than liberals when they perceived low social consensus, ($\beta = -.35$, $SE = .01$) $p < .001$, 95% CI [–.38, –.32], but this relationship was substantially weaker for people who perceived high social consensus, ($\beta = -.25$, $SE = .01$) $p < .001$, 95% CI [–.28, –.22]. Finally, we replicated this same relationship for the need for public action with a significant ideology × perceived social consensus interaction, ($\beta = .10$, $SE = .01$) $p < .001$, 95% CI [.08, .11],

Figure 2. Worry and support for CO2 regulation as a function of ideology and social consensus.
*Note.* Plots present standardized regression coefficients adjusted for age, gender, and education. Worry includes all nine survey waves; policy question included in seven waves.

whereby ideology predicted lower declared need for public action among people with low social consensus, ($\beta = -.28$, $SE = .02$) $p < .001$, 95% CI [$-.31$, $-.25$], and this relationship was much weaker among those with high social consensus, ($\beta = -.08$, $SE = .01$) $p < .001$, 95% CI [$-.11$, $-.06$].

To test if this pattern of results was consistent when examining political party, we used the same model to test the party ($0 = Democrat$, $1 = Republican$) × perceived social consensus interaction for each dependent variable. All effects remained significant with the same pattern of results as those reported for ideology. For example, Republicans were significantly less likely than Democrats to believe global warming is happening when they perceived low social consensus, but this difference was substantially diminished when they perceived high social consensus (see Supplementary Figure 1 for a forest plot of all interaction effect sizes).

Exploring Differences Among Social Consensus Questions

As we had no a priori predictions about which social consensus questions would be strongest in predicting weaker ideological biases against climate change, we tested each question individually to explore differences in the magnitude of the relationship for each social consensus question. Models were restricted to dependent measures that were in all data sets: the belief that global warming is happening, human caused, and worry about global warming. As our primary effect of interest is the ideology × perceived social consensus interaction, which denotes the extent to which social consensus
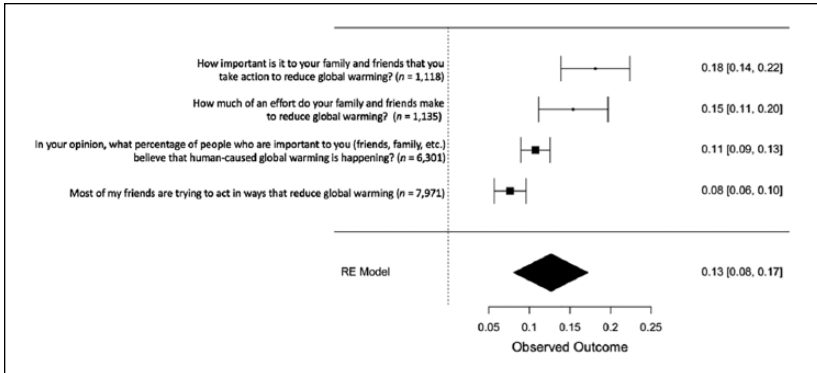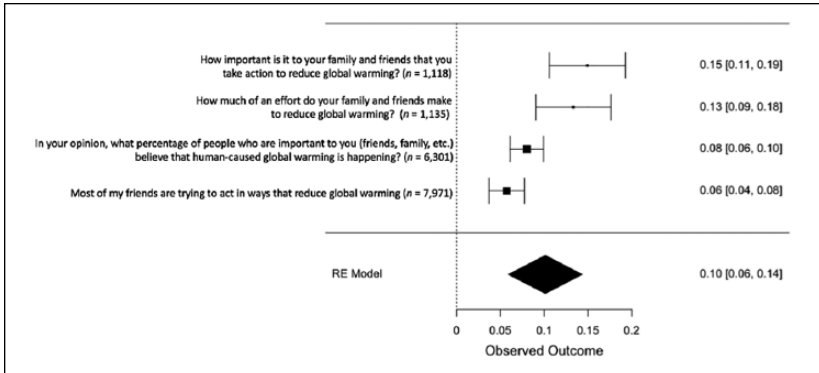
Figure 3. Comparing social consensus effect sizes for the belief that global warming is happening.

Note. The size of the square for each effect size represents the weight of the corresponding effect size in determining the overall effect size estimate (as a result of sample size and the width of the corresponding confidence interval). Effect sizes for each social consensus variable are the standardized regression coefficients for the ideology × perceived social consensus interaction term. Error bars reflect 95% confidence intervals. Covariates = age, gender, and education.

predicts weaker ideological biases against climate change, our analyses compare the effect sizes of the interaction terms. For the ease of comparison, and to determine the overall effect size estimate across social consensus questions for the corresponding dependent measure, we used the JASP statistical software program to conduct random effects meta-analyses and displayed the results in forest plots in Figures 3 to 5. Across all dependent measures, the strongest social consensus effect was for whether participants believed that their friends and family thought it was important for *the respondent* to take action to reduce global warming. In the discussion section, we speculate about what might explain the variability in effect sizes across social consensus questions.

The Effect of Survey Wave

As data were collected in years ranging from 2008 to 2017, it is necessary to explore whether our primary analyses of interest vary depending on survey year. Thus, we tested the ideology × perceived social consensus × survey wave interaction treating wave as a continuous variable. In predicting whether participants believed global warming is happening, the three-way interaction was significant, ($\beta = .01$, $SE = .001$) $p < .001$, 95% CI [.003, .007], such
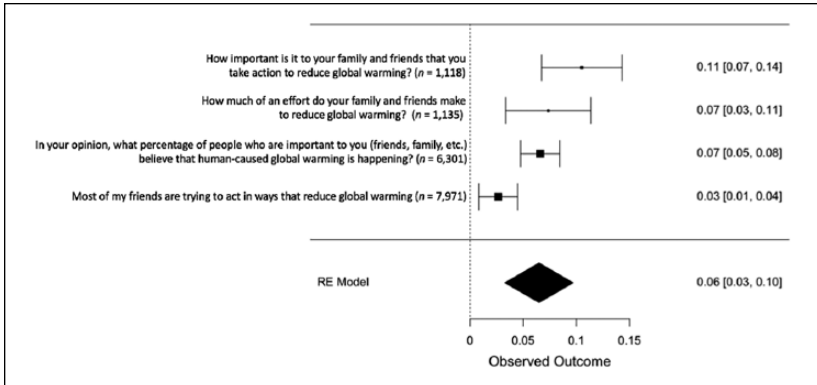
Figure 4. Comparing social consensus effect sizes for the belief that global warming is human caused.
Note. The size of the square for each effect size represents the weight of the corresponding effect size in determining the overall effect size estimate (as a result of sample size and the width of the corresponding confidence interval). Effect sizes for each social consensus variable are the standardized regression coefficients for the ideology × perceived social consensus interaction term. Error bars reflect 95% confidence intervals. Covariates = age, gender, and education.

that the ideology × social consensus interaction got stronger as survey wave got closer to the present day. For example, the ideology × social consensus interaction that was significant for data collected in the earliest waves (one wave in 2008 and two waves in 2010), ($\beta = .07$, $SE = .01$) $p < .001$, 95% CI [.05, .09], gets stronger for data collected in later waves (two in 2011 and two in 2012), ($\beta = .10$, $SE = .01$) $p < .001$, 95% CI [.09, .11], and then gets even stronger for data collected closest to the present (one in 2015 and one in 2017), ($\beta = .13$, $SE = .01$) $p < .001$, 95% CI [.11, .15]. The three-way interactions were also significant for the belief that global warming is human caused, ($\beta = .004$, $SE = .001$) $p = .002$, 95% CI [.001, .006], as well as for worry about global warming, ($\beta = .004$, $SE = .001$) $p < .001$, 95% CI [.002, .006]. The pattern of results was the same for all three dependent measures, although the effect of survey wave was very small.

Testing an Alternative Hypothesis

The hypotheses reported in this article propose that ideological biases are weaker because of social influence (i.e., Social Influence hypothesis), particularly because conservatives are more motivated to conform to the views of like-minded others. It is plausible instead, however, that people who believe climate change is happening, human caused, worry about it, and support
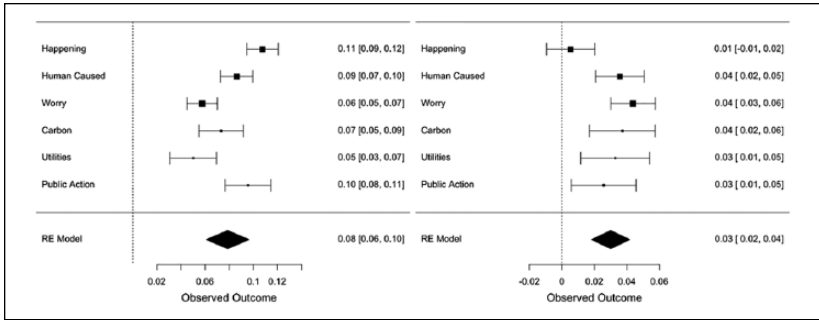
Figure 5. Comparing social consensus effect sizes for worry about global warming.

Note. The size of the square for each effect size represents the weight of the corresponding effect size in determining the overall effect size estimate (as a result of sample size and the width of the corresponding confidence interval). Effect sizes for each social consensus variable are the standardized regression coefficients for the ideology $\times$ perceived social consensus interaction term. Error bars reflect 95% confidence intervals. Covariates = age, gender, and education.

climate change mitigation policies also think their social network members feel the same way. That is, people may project their own views onto their social group members (i.e., Social Projection Hypothesis). Thus, for people who have pro-climate beliefs and policy preferences, liberals, and conservatives alike would believe that their social group members also care about climate change. On the other hand, for people who do *not* have pro-climate beliefs, conservatives should believe more than liberals that their friends and family members also do *not* have pro-climate beliefs. Put simply, if conservatives are indeed projecting their climate change beliefs onto friends and family, then they should believe their friends and family have pro-climate beliefs when the respondents themselves do more than when they do not.

To test this hypothesis, we used standardized variables from the combined data set of all nine survey waves in a multiple regression analysis to test the interaction between ideology and each climate change belief (e.g., happening and human caused) predicting perceived social consensus. Next, we ran two random effects meta-analyses, which allowed for side-by-side comparisons of Social Influence and Social Projection models for each dependent measure (see Figure 6). The Social Projection models are significant in all but one case. However, in all model comparisons, the Social Influence model is better at explaining the variability in the corresponding dependent measure. In addition, the meta-analytic effect is

Figure 6. Random effects meta-analyses for Social Influence (left panel) and Social Projection models (right panel).
Note. The size of the square for each effect size represents the weight of the corresponding effect size in determining the overall effect size estimate. Effect sizes for each variable are the standardized regression coefficients for the ideology $\times$ perceived social consensus interaction term for each measure. Error bars reflect 95% confidence intervals. Covariates = age, gender, and education.

significantly stronger for the Social Influence model than for the Social Projection model because the confidence intervals do not overlap (Cumming, 2009). We revisit the possibility of both causal pathways in the discussion section.

Gauging the Size of the Conservative Population With High Social Consensus

Gauging the size of the conservative population that perceives high social consensus has high practical importance because it can help (a) identify and mobilize pro-climate action among conservatives and (b) encourage people to talk about global warming more frequently to foster higher social consensus among conservative family and friends. To measure the size of this population, we use our most recent nationally representative data (June 2017; $n = 1,118$) and weight it to match census parameters on age, gender, race/ethnicity, geographic region, education, and income. We find that about 35% of conservative survey participants have family and friends that think it is at least moderately important that *the respondent* take action on global warming. Thus, these results should apply to a substantial portion of the American population.

Discussion

Together, these results suggest an important role of perceived social consensus in climate change beliefs and support for mitigation policies. Perceived

social consensus is associated with a higher percentage of people who believe climate change is real and human caused. The same pattern emerges for worry and climate policy support. Perceived social consensus remains a strong predictor even when controlling participant ideology as well as demographic variables.

Importantly, perceived social consensus appears to be particularly important for predicting the views of conservatives. This is consistent with prior research that finds conservatives place greater value on in-group loyalty, conformity, and desire to identify with others (Caprara et al., 2006; Jost, 2017a; Jost et al., 2018; Stern et al., 2014). In particular, these findings suggest the importance of norm-perception as a means for social change, as (mis)perceptions of group norms are often easier to change than deep-seated private beliefs and worldviews (Tankard & Paluck, 2017; van der Linden et al., 2018).

In addition, we observed the same pattern of results when examining political party. That is, for people who perceived low social consensus, Republicans had significantly lower pro-climate beliefs than did Democrats, but this difference was substantially smaller for people who perceived high social consensus. These findings, together with those on ideology, have implications for how to use social identity as a messaging strategy. For example, while there is substantial overlap between those who are conservative and those who identify with the Republican party, it is likely that some people more strongly identify with one of the two groups (i.e., conservatives vs. Republicans). Thus, it would be fruitful for future research to investigate the extent to which appeals to people's conservative versus Republican identity are more effective in communicating about climate change.

We also used random effects meta-analyses to explore the extent to which some measures of social consensus were stronger than others in predicting weaker ideological biases. First, results from social consensus questions that asked about friends *and* family were clearly stronger than the question that only included friends. Second, and perhaps more interesting, results consistently showed that ideological biases became weakest (i.e., interaction was strongest) when respondents perceived that their friends and family thought it was important *for the respondent* to take action on global warming. These findings suggest that this conceptualization of social consensus might be most intuitively salient to participants (e.g., Cialdini et al., 1990). That is, it might be easier to bring to mind what one's family and friends find important, as opposed to what they are doing or what percentage of one's social group believe human-caused global warming is happening. While this explanation is plausible and deserves attention in future research, the available data in this study make it difficult to draw firm conclusions on which way of measuring social consensus is most informative. For example, the

strongest effects were observed in the most recent survey waves, thus it is difficult to know whether the stronger social consensus results were due to data being closer to the present or because this conceptualization of social consensus is most informative.

Furthermore, the confounding effects of survey wave and social consensus questions make it difficult to interpret the effect of survey wave. We observed that the ideology × perceived social consensus interaction got stronger as survey wave got closer to the present day. This makes sense in light of the increase in ideological and partisan polarization in the United States (Pew Research Center, 2017). That is, as people become more aligned with their ideological and partisan in-groups, social consensus can become even more predictive of weaker ideological biases on climate change when biases are larger to begin with. However, we view this finding as preliminary because of the reasons described above as well as the relatively small effect of survey wave.

It is important to note the limitations of this study. First, these data cannot demonstrate causality. As the data are not experimental, we take the next best approach and attempt to rule out plausible alternative explanations. The primary alternative explanation for these data is that conservatives who believe climate change is happening, human caused, worry about it, and support mitigation policy are predisposed to believe that the rest of their own social group feels the same way, or perhaps choose friends that feel the same way. To compare the support for this Social Projection hypothesis and the Social Influence hypothesis (i.e., the primary hypothesis in this article), we conducted two random effects meta-analyses to determine which models better explained the variability in the data. Results consistently showed more support for the Social Influence hypothesis and showed that the meta-analytic effect was significantly stronger than for the Social Projection hypothesis. In addition, experimental findings demonstrate that manipulating perceived *scientific* consensus can shift private beliefs and support for action (van der Linden, Leiserowitz, Feinberg, & Maibach, 2015) and that climate change messages from in-group Republicans are seen as more persuasive (Benegal & Scruggs, 2018), which increases confidence in the Social Influence explanation. Importantly, however, the majority of the effects were significant for the Social Projection models. Thus, it is plausible that causality among these variables is bidirectional, albeit at different magnitudes. It would be fruitful for future research to investigate both causal pathways in experimental or longitudinal research.

Importantly, although establishing causality has important practical implications for applied research, the contribution of the current findings is not entirely contingent on demonstrating causality. For example, we used our most recent data, weighted to census parameters, to show that more than one

third of conservatives perceived at least moderately high social consensus about climate change among their friends and family. From a strategic standpoint, this is important for identifying conservatives that are likely to be pro-climate, which is a crucial step toward encouraging them to take action.

An important consideration in interpreting the current findings is the extent to which the results observed here are driven by ideological differences in conformity and in-group loyalty. That is, the results may be explained by the larger opportunity for conservatives' beliefs to vary as a function of social consensus rather than fundamental differences in ideological values. Although the current data cannot definitively answer this question, a large literature shows that—compared to liberals—conservatives have a stronger motivation to affiliate with in-group members. This ideological asymmetry is evident in basic differences in life values across individuals from many different countries (Piurko et al., 2011), in moral judgments (Graham et al., 2009), and even in consumer behavior (Fernandes & Mandel, 2014; for a review see Jost, 2017b). Thus, the current findings are consistent with a large body of previous research documenting ideological asymmetries.

An unanswered question that remains in this line of research is what level of agreement is perceived as a "persuasive" consensus. That is, it remains unclear whether a majority of one's friends and family members (e.g., 51%) qualifies as a majority consensus or whether people only perceive high social consensus when it is extremely high like the consensus on climate change observed among climate scientists (i.e., 97%). The psychological "threshold" for what level of consensus is regarded as persuasive likely depends on a person's experience and motivations. For example, for someone who is motivated to reject climate science, it may take extremely high consensus to move their beliefs. Whereas for someone who is simply disengaged from the issue of climate change, it may only take a slim majority to move their beliefs. Future research should address these open questions and determine the extent to which social context and individual differences moderate the effects of different levels of social consensus.

Another avenue by which to extend the current research is by measuring the political identity of people's close friends and family. Those data were not available in this study, but likely would contribute to a greater understanding of the boundaries of social consensus effects. Social consensus should be more influential when, for example, conservatives are part of a social network of pro-climate conservatives than when they are part of a network of pro-climate liberals.

The results from this study have important practical implications. For example, from a social identity perspective, most conservatives likely affiliate and identify more strongly with their own friends and family than conservatives as a broad category (i.e., outside their own social group) because people in their immediate social network are more important to their daily

lives and identity. Thus, if their own friends and family care about climate change, they are more likely to care as well. These results align with the suggestion that communicators could try to engage people based on non-political identities (Pearson, Schuldt, Romero-Canyas, 2016), such as hunting and fishing, or parenting and grandparenting, which may enable more constructive conversations about climate change than partisan discourse.

The research reported here underscores the importance of encouraging people, especially conservatives, to talk about climate change and their support for climate policies. Most Americans say the issue of global warming is personally important, yet rarely hear about it from their friends and families (Maibach et al., 2016). This dynamic can lead to lower climate policy support simply because people may mistakenly believe that other important people in their lives do not care about climate change. Thus, our results highlight the importance of breaking the silence on climate change (Maibach et al., 2016).

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Supplemental Material

Supplemental material for this article is available online.

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