

Correcting Misinformation About Climate Change: The Impact of Partisanship in an Experimental Setting

Abstract:

Misperceptions of the scientific consensus on climate change are an important problem in environmental policy. These misperceptions stem from a combination of ideological polarization and statements from prominent politicians who endorse information contradicting or misrepresenting the scientific consensus on climate change. Our study tests a source credibility theory of correction using different partisan sources of information in a survey experiment. We find that corrections from Republicans speaking against their partisan interest are most likely to persuade respondents to acknowledge and agree with the scientific consensus on anthropogenic climate change. The extent of these effects vary by the partisanship of the recipient. Our results suggest that the partisan gap on climate change can be reduced by highlighting the views of elite Republicans who acknowledge the scientific consensus on anthropogenic climate change.

Authors:

Salil D. Benegal¹
Department of Political Science
DePauw University
Email: salilbenegal@depauw.edu

Lyle A. Scruggs
Department of Political Science
University of Connecticut
Email: lyle.scruggs@uconn.edu

This is a post-peer-review, pre-copyedit version of an article published in *Climatic Change*. This version differs from the final authenticated version, which is available at <http://doi.org/10.1007/s10584-018-2192-4>.

All replication materials for the study can be accessed at:
<http://dx.doi.org/10.7910/DVN/KV6S5V>

¹ Corresponding author address
Asbury Hall 107
100 E. Seminary St.
DePauw University
Greencastle, IN 46135

Introduction:

Elites and supporters of the Democrat and Republican parties have long argued over the importance of different social problems. However, partisan disagreements in recent years have been marked by divisions over facts rather than policy (Berinsky 2017, Nyhan et al. 2013). Climate change is a prime example of an issue where partisan disagreement about facts persists. Since the 1990s, Americans' attitudes about climate change and climate science have become polarized along partisan lines. Some point to disinformation campaigns by conservatives as the source of the polarization (Oreskes and Conway 2010, Boussalis and Coan 2016, Dunlap et al. 2016).

Opinion polls indicate that partisans disagree about (among other things) whether: climate change is occurring; it is caused by humans; scientists agree it is occurring because of humans; and mitigation should be a policy priority (Brulle 2014). The divide in attitudes is a significant barrier to policy action in the United States, and globally. Correcting misinformation about climate change tends to imply convincing conservatives of the scientific consensus, and is a priority for scientists and policymakers since conservatives are more likely to doubt climate change in many countries of the world (Pew Research Center 2015).

We examine the extent to which the *source* of corrective information counters misinformation about climate change and climate science. We present results from a survey experiment that varies the political affiliation of elites presenting information affirming the scientific consensus in response to a climate change misinformation statement. Results show that Republicans speaking against their expected partisan positions are most effective in increasing concern about and acknowledgement of the scientific consensus on climate change. We argue this is because Republicans who make such statements are engaging in more potentially costly

behavior that lend them additional persuasive value. While corrections from Democrats or “neutral” scientific experts also increase concern and agreement with the science, those effects are smaller.

Our findings have meaningful implications for environmental communication strategies to improve awareness about climate change. Citing Republican elites who endorse the scientific consensus on climate change may be the most effective way to persuade citizens that anthropogenic climate change is a real and important policy problem. This approach can also reduce identity-based processing or “cultural cognition” (Kahan et al. 2011) about climate change. These findings may also have broader implications for understanding how to correct misinformation and conspiracy theories in other political contexts.

Misinformation about climate change: Why does it persist, and how might we correct it?

Misperceptions about climate change have significant consequences: citizens that are unaware climate change is occurring or that it is a serious problem are less likely to support ameliorative environmental policies, or engage in pro-environmental behaviors (Krosnick et al. 2006). Furthermore, understanding the extent of scientific consensus on climate change is considered by many to be pivotal to convincing individuals of the need to address climate change (Lewandowsky et al. 2012, van der Linden et al. 2015, Ding et al. 2011). Correcting misinformation about climate change that can create or exacerbate misperceptions about the scientific consensus is thus a priority for those advocating actions to respond to climate change.

Unfortunately, correcting misinformation is much harder than simply providing “facts,” especially when incorrect information is repeatedly transmitted or endorsed by elites. The effectiveness of new information through a correction or counter-frame may be contingent upon

perceptions of a source's credibility, the quality of information within the new/counter-frame, or the strength of individuals' original opinions (Druckman 2001, Chong and Druckman 2007, Druckman and Lupia 2016). As a result, new information is not always processed, and existing misperceptions persist. For example, false rumors about the Affordable Care Act creating "death panels" or Barack Obama not being born in the United States have proven hard to correct despite public corrections by news media and fact checking agencies. (Berinsky 2017, Nyhan et al. 2013, Uscinski and Parent 2014).

Motivated reasoning is a primary explanation for the persistence of misinformation and the limited effectiveness of corrections on some issues. Through this process, individuals construct attitudes to align with other strongly-held predispositions (Kunda 1990, Kahneman and Tversky 1996). These predispositions are often culturally based, in that they are strongly oriented around one's social or group identity such as a partisan affiliation or particular ideology. Individuals with strong ideological or partisan views will frequently process information in a biased manner that ensures it aligns with or reinforces existing identities (Kahan et al. 2011). When faced with information that is incongruent with their values, individuals may actively discount it through a method of disconfirmation bias, for example by judging the new information more critically in order to discount it (e.g. Ditto and Lopez 1992, Bastardi et al. 2011). Partisanship has been shown to influence individuals' perceptions of objective facts on issues such as the economy, crime, or the climate (Achen and Bartels 2016). Strong partisans engaging in motivated reasoning will often selectively process or recall information that supports their biases, while actively discounting counter-arguments or incongruent facts.

However, information content is not the only factor in persuasion: opinions are also affected by the source of information (Petty and Cacioppo 1986). Individuals that seek value-

affirming information often turn to sources that share their partisanship or other cultural associations (Lodge and Taber 2013, Kahan et al. 2011). Partisans may thus pay attention not only to the message, but also the messenger in interpreting new information, evaluating the source's credibility and authority before processing new information (Lupia and McCubbins 1998). As a result, misinformation is more likely to persist among strong partisans despite efforts to correct or debunk incorrect statements (Thorson 2016).

Which sources of information then are the most effective in persuading individuals to reject misinformation and accept new, correct information? For science issues such as climate change, we might expect scientists to be a credible and neutral authority that can persuade all individuals with scientific facts. However, partisanship increasingly influences perceptions of scientific credibility (Gauchat 2012, Motta 2017), so scientists may not necessarily be the most effective source of a persuasive message. Instead, we should expect partisans who speak against their own interests to be more powerful persuasive sources on highly polarized issues. This may be particularly true on climate change, where many Democrats and Republicans disagree on both scientifically supported facts and policy solutions (Dunlap and Jacques 2013, Brulle 2014, Guber 2013, Layzer 2012). As a result, we should expect citizens to perceive climate change as a partisan matter, where politicians debate over both facts and policies, rather than one where there is overwhelming scientific consensus on the issue.

A Republican acknowledging climate change publicly constitutes a “surprising” source, giving them greater potential to correct misinformation on about climate. This may be true for several reasons. First, citizens expect politicians to make statements that align with their party's views (Lupia and McCubbins 1998). Their unexpectedness may attract more attention. Second, breaking with the group could be seen as costly (e.g. they may be disincentivized by campaign

financing support (Skocpol and Hertel-Fernandez 2016), making corrections by unexpected sources appear more honest and credible “statements against interest” (Berinsky 2017, Priester and Petty 1995). Speaking against apparent interests may also make a stronger impression than the same information coming from a source that was expected to make such a statement (Calvert 1985).

Second, if citizens perceive climate change to be an issue of partisan debate, a Republican politician speaking out about climate change may significantly change this perception by providing a signal of bipartisan consensus. This may lead individuals to significantly update prior beliefs: a Democrat or a climate scientist speaking out about climate change may be consistent with expectations for those individuals, but a Republican making the same statement may lead individuals to update their perceptions of elites’ climate beliefs. Third, for Republicans engaging in identity-protective cognition and rejecting the scientific consensus due to incongruence between their identities or existing values (Kahan et al. 2011, Kahan 2015), seeing other Republicans acknowledge climate change may be a signal that their values are compatible with acceptance of climate science.

Our study tests this source credibility theory of correction in addressing climate change skepticism. We vary the source of a corrective message about the scientific consensus on climate change, providing corrections attributed to either Democrats, Republicans, or climate scientists. We expect a Republican politician to be more effective in delivering information to correct misinformation about climate change than a scientist or a Democratic politician. Furthermore, we expect the effects of such messages to be strongest among Republican respondents, who would be most likely to trust a Republican source and process their message.

Hypothesis 1: Republican elites correcting misinformation about climate change will be more effective than neutral or Democrat sources in increasing understanding of and agreement with the scientific consensus that climate change is a real and important problem impacted by human activity.

Hypothesis 2: The effect of a Republican-source correction will be larger among Republicans. As a result, corrections from Republican elites will be most effective in reducing the partisan gap on climate change opinion.

Research Design

To evaluate how different sources of corrective information affect attitudes towards climate change, we conducted a survey experiment with randomly assigned corrective treatments to an article highlighting misinformation about climate change. Our design is similar to those employed by Nyhan and colleagues (2010, 2013) and Berinsky (2017), and is based on a pilot conducted in April 2015, details of which are in the appendix². The survey was administered in September 2016 to respondents recruited through the online crowdsourcing marketplace Amazon Mechanical Turk (AMT)³. Descriptive statistics and MTurk recruitment details are in the appendix.

Partisanship, ideology, and other demographics were measured at the beginning of the survey. Respondents were then randomly assigned to read one of four different versions of an

² While the results from the pilot and the experiment reported in this paper are consistent in terms of the significance of effects, this pilot did not control for the content of the correction message.

³ AMT participant pools offer more demographic diversity than student or in-person convenience samples (Paolacci and Chandler 2014). Although this population is more liberal, irreligious, and interested in politics than the average American, AMT samples have been used to replicate well-established findings in social psychology and political science (e.g. Berinsky et al. 2012). Recognizing that sources like AMT are different from conventional techniques for estimating dynamics of public opinion, our study seeks to gauge differences in responses to randomized treatments applied to an array of participants, rather than inferring differences in observed population frequencies from a sample.

article that emphasized misinformation about climate change, using (authentic) quotations from Republican Senator James Inhofe proclaiming anthropogenic climate change a hoax.⁴ A control group received no further corrective information. The other three groups received short correction statements appended to the misinformation article highlighting findings from a recent report from the Intergovernmental Panel on Climate Change (IPCC). The three treatment conditions varied on the source favorably citing the IPCC report: a) Republican Senators, b) Democrat Senators, or c) scientists from NASA.⁵ Our correction statements named specific Congressional representatives who support the scientific consensus in order to enhance the authenticity of the statements, but did not use nationally prominent personalities (e.g. those who took part in the 2016 Presidential primaries).

Respondents then completed a short post-treatment survey about their environmental attitudes, which included measures for an understanding that scientists agree that climate change is occurring, whether climate change is anthropogenic, and whether it is a serious problem. An attention check was included in the post-treatment survey to filter out respondents who had not read the article. The full wording of treatments and questions is in the online appendix. A total of 1,341 respondents completed the study satisfactorily, and were included in the final data analysis. The breakdown of respondents in each treatment group is below.

[Table 1 about here]

⁴ McCright et al. (2016) find that an “ACC denial” treatment significantly reduces MTurk respondents’ reported agreement with climate science. Our denial statement is of similar length and phrasing (155 words, compared to 142 words in McCright et al.) to expose respondents to the misinformation.

⁵ In our pilot study used actual quotes from real politicians from the two parties (or a climate scientist). We found similar results and comparable effects sizes as those we report here. However, because the content and source of the messages co-varied, the pilot could not isolate the source effect.

Results

We first discuss aggregate trends in climate change opinion based on party identification.⁶ Our dependent variables are the responses to three questions that asked about agreement that (1) there is strong scientific consensus on climate change, (2) climate change is (at least) mostly due to human activity, and (3) climate change is a serious issue. Responses were registered on a 10-point scale, with 10 indicating the highest level of agreement.

[Table 2 about here]

Table 2 shows a gap in the average responses of Republicans and the Democrats under each experimental condition. Regardless of treatment condition, we find that the average group response from Democrats is always higher than the average for Independents or Republicans. The partisan gap is higher for the human attribution and seriousness questions than it is for the question about the scientific consensus. For Democrats, average scores under the control condition were 8.9 for the question on the scientific consensus, 8.4 for attributing climate change to human activity, and 8.5 for issue seriousness. The averages for all Republican respondents were 8.3, 6.7, and 6.4; and for Independents, 8.6, 7.7, and 7.7, respectively.

Hypothesis 1

[Figure 1 about here]

Figure 1 displays the difference of means (treatment versus control) for each source for the correction statement. The results show that all correction sources mean scores are higher than the control, though not all differences are statistically significant. As hypothesized, the

⁶ All results discussed include leaners as party identifiers.

Republican-source correction has the largest, clearest corrective effect. However, the “expert” (scientist) correction also has a significant impact on the first two questions,. This result is consistent with the idea that a “surprising” source of pro-climate information (Republicans) has a more persuasive effect. But it is notable that even the science (non-partisan) correction matters. The Democratic correction is arguably discounted by all respondents. We speculate that there are several reasons for this: first, given in response to a Republican misinformation statement, it is plausible that all respondents (even Democrats) view the denial and correction as mere partisanship. When the source is at least neutral, the correction may be viewed as more than partisan arguing. At the very least, the result suggests that even co-partisans discount the supportive communication that simply reinforces “their” side.

Hypothesis 2

Figure 2 displays the difference of means (from control) by climate change question, correction source and respondent party affiliation. This results in 27 different comparisons. The “x”, “•” and “o” represent the point estimates for Democrat, Republican and Independent respondent groups; the lines show the 95% confidence interval. There is a separate graph for each survey question.

[Figure 2 here]

We first see that corrections raise the mean group ratings over the control, regardless of partisan source. Moreover, the results strongly support Hypothesis 1: corrections from the

unexpected (Republican) source have the largest impact on groups' ratings, regardless of respondents' partisanship.

For Republican respondents (•), there is consistent evidence that a correction statement from all three sources leads to increases in conformity with the scientific consensus. Compared with the control, treatments generally raise Republican support by more than 1 point on the ten-point scale. These differences are statistically significant in 4 of 8 comparisons. For the first question on the scientific consensus, Republicans responded strongly to corrections from either scientist (diff=.80 $p<.032$ $n_{\text{treated}}=90$) or Republican (diff=1.2, $p<.001$ $n_{\text{treated}}=93$) sourced corrections. They are basically non-responsive to Democrats (diff=.08, $p<.825$ $n_{\text{treated}}=106$). On the human attribution question (top right panel), corrections from all three sources have a corrective effect; the difference is quite clear for the Republican-sourced correction (diff=1.42, $p<.002$), and large (though more uncertain) for corrections from Democrats (diff=.73 $p<.083$) and Independents (diff=.76 $p<.101$). For the third question, importance, the Republican correction statement significantly increases agreement by more than a point compared to control (diff=1.12 $p<.016$). The Democratic and scientist-sourced corrections also produce increased agreement among Republican subjects, but the results are smaller and not statistically significant. (respectively, diff =.56, $p<.201$ and diff=.23, $p<.619$). The results for Republican respondents are consistent with the notion that co-partisan misinformation tends to be corrected by presentation of factual information. There is no evidence of a backfire effect. However, consistent with work on health care by Berinsky (2017), corrections are more effective when they come from fellow Republicans. Neutral sources may have a positive impact, but these effects are weaker.

For the survey respondents who are Democrats (×'s in Figure 1), the average treatment effect on understanding or agreement with the scientific consensus is (almost) always smaller

than it is for Republicans or Independents. In three of the nine comparisons, the effect of the correction is at least marginally statistically significant. For human attribution and problem seriousness, corrections by Republicans significantly raise responses relative to control, (Human Attribution: $\text{diff}=.43$, $p<.017$ $n_{\text{treated}}=192$; Seriousness $\text{diff}=.33$, $p<.060$). The third significant effect among Democrats is the scientist-source correction on the scientific consensus question ($\text{diff}=.39$, $p<.012$ $n_{\text{treated}}=185$). It is possible that a ceiling effect accounts for the weaker results for Democrats—their agreement under the control condition averages over 8.4 (out of 10).

Finally, respondents who are Independents (o's in Figure 2) are more responsive to Republican-sourced corrections than to correction from scientists or Democrats. On all three climate change questions, the Republican-source has an effect on Independents that is similar to the effect on Republican respondents: scientific consensus ($\text{diff}=1.01$ $p<.015$ $n_{\text{treated}}=46$); human attribution ($\text{diff}=1.40$ $p<.005$) and importance ($\text{diff}=.95$ $p<.044$).

Because our survey apparatus automates randomized assignment to treatment, we expect that our results are robust to any selection effects. However, Table 2 presents multivariate regression results in which we control for basic demographic features of the respondents along with their media usage and ideology. We treat the question items as continuous variables.

The regression equation is:

$$Y_{cc} = a + b_1\text{Sex} + b_2\text{White} + \sum b_i \text{ideol}_i + \sum b_a \text{age}_a + \sum b_e \text{educ}_e + \sum b_{pt} \text{party}_{p\#\#\text{treat}_t} + e$$

Y_{cc} responses to each of the three questions about *scientific consensus on climate change*, *human attribution*, and *seriousness* (each question is estimated in separate regression);

i indexes the five ideology categories;

a indexes four age categories;

e indexes four education categories;

p indexes respondent's party;

t indexes the four treatment conditions (no correction, Republican correction, Democrat correction and Scientist correction);

indicates that all interaction possibilities between these indices are estimated

In the model, the baseline case is an ideologically moderate, under 30, non-white male with a four-year college degree, who is a Republican and received no correction.

[Table 3 about here]

Table 3 presents the regression results for each climate change questions. Notably, respondent ideology generally has an (expected) effect on answers to all three questions. With one other exception, i.e., males have a slightly lower agreement that climate change can be attributed to humans, there is no systematic impact of the controls on the estimates. Accounting for ideology mainly serves to halve the impact of being a Democrat on answers to all three questions. Otherwise, there are few large differences in the coefficients compared with the main cross-effects of party ID and treatment that were visible in Figure 1. The Republican-sourced correction raises responses by 1.15 points on the belief question ($p < .001$), 1.39 points on the human attribution question ($p < .001$), and 1.12 points on the seriousness question ($p < .01$), columns 2,4,6 respectively). However, the Republican source effect is reduced substantially among Democrats to less than .25 points for the belief question (1.15-.97) and seriousness question (1.12-.88), and about .35 points for the human attribution question (1.39-1.04).

Furthermore, only for the human attribution question is the estimated effect of a Republican-sourced correction for Democrats statistically significant, reflecting results in Figure 2 (what we would anticipate given random assignment to treatment)⁷ By extension, i.e., observing small and statistically insignificant estimates for the interaction term Independent respondent × Republican-sourced correction, the estimates in Table 3 show that Independents and Republicans are persuaded roughly to similar degrees by the Republican-sourced correction.

In summary, Republican-sourced corrections to climate change misinformation consistently and significantly shift opinion towards understanding of, and agreement with, the scientific consensus. Recipients of these corrections are likely to accept that there is scientific consensus on climate change, agree that climate change is affected by human activity, and view climate change as a more serious problem. These effects transcend the partisan leanings of our test subjects - Democrats are more persuaded by the Republican-sourced corrections than by neutral or Democratic-sourced corrections. Importantly, however, the effects are much stronger for Republicans, who tend to be more skeptical of climate change. As a result, the gap between Democrats and Republicans is smallest within this treatment group for all questions on climate change. This suggests that highlighting Republicans who express concern about climate change might be a step forward in reducing the partisan gap in public opinion about climate change.

What about the Republican-sourced correction message makes it more persuasive? Our main argument is that partisan polarization among political elites is relatively well-known, but probably overestimated, by the general public (Ahler 2014). All three correction messages confront respondents with an equally strong argument against the initial statement, and all, on average, bring respondents more in line with the facts about climate change. However, the

⁷ The coefficient differences and their 95% confidence intervals are estimated using the “margins, contrast” procedure in Stata 14.2, and the (default) delta method of standard error estimation.

Republican-sourced correction is surprising, because it is an argument against partisan self-interest (Berinsky 2017, Lupia and McCubbins 1998). It is much easier to dismiss a Democratic correction, or perhaps even a climate scientist's statement as an expected source of correction. (With respect to the Democratic correction, it might even reinforce the "simply partisan" nature of the issue.)

How can we evaluate this claim? The idea that a Republican-sourced correction is more of a statement against interest requires that respondents perceive an existing partisan divide on the issue. There are at least three reasons this assumption is safe for climate change. First, there is already a substantial partisan divide on climate change in the general public, the division is quite large throughout the country (Egan and Mullin 2017), and polarization seems to be conditional on exposure to elite cues (Guber 2013). Second, there is a general public overestimation of partisan polarization (Ahler 2014), which our respondents might extend to any issue; so even those without specific knowledge about the true partisan divide on climate change could safely project general assumptions about partisanship (Levendusky and Malhotra 2016). A final reason is that our experiment provides a denial prime statement from a Republican, signaling a partisan positioning on the climate issue (i.e., that Republicans are less likely to believe climate change is a real, important issue.)

Conclusion:

This study examined how changing the partisan source of corrective information affects three important attitudes towards climate change; understanding of the scientific consensus, acknowledgement of humans as a primary cause, and concern about its seriousness. We used a survey experiment in which respondents were exposed to misinformation denying anthropogenic

climate change that came from prominent Republican politicians. This misinformation was corrected by factual information from different sources stating the presence of broad scientific consensus that climate change is underway, and attributable to human activity, with corrections being randomly attributed either to Republicans, Democrats, or non-partisan climate scientists.

We first found a partisan gap between Democrats and Republicans in their stated opinions on climate change exists across all experimental conditions, with Democrats generally expressing the highest levels of concern and agreement with the scientific consensus on anthropogenic climate change. However, we found that this partisan gap and self-reported attitudes about climate change are also influenced by corrective information. When all respondents, regardless of partisanship, were provided with factual corrections after reading a statement denying climate change, we found that they were to varying extents more likely to report increased concern about climate change, or greater understanding of and agreement with the scientific consensus of anthropogenic climate change.

Most importantly, effect sizes varied by the source of the information: we show that the most effective corrections come from other Republicans, rather than non-partisan climate scientists or Democrats. This transcends partisan leanings. However, Republicans are persuaded to the greatest extent by Republican corrections. Smaller effects among Democrats are may be due to a ceiling effect. While our results confirm that attitudes towards climate change are shaped by partisan motivated reasoning with partisan identity remaining a powerful predictor of climate change attitudes, a rather modest co-partisan correction leads Republicans and true Independents to express much higher support for the scientific consensus on climate change.

We suggest that this is the result of widely held priors about elites' stated positions and divisions over climate change. Republican elites and media sources are *more* likely to dismiss

and deny the scientific consensus on anthropogenic climate change, and Republican political identity is (now) perhaps associated with climate change denial. As such, a Republican elite engaging in pro-climate change discourse is more “surprising” to all citizens, as the Republican is engaging in a costly behavior considering their expected partisan position while a similar statement may be expected from Democrats or non-partisan scientists. Consequently, the surprising source of information carries greater persuasive power here and may indicate to all citizens a higher extent of elite consensus that is bi-partisan, making respondents more likely to agree with the scientific consensus about climate change.

The generalizability of our results is limited by certain factors related to the experimental design. First, as this is a single stage survey experiment, we are not able to determine the persistence of these effects. Second, other factors - uncontrolled for within this experiment - explain the different effect sizes of the Republican-sourced correction on Republicans and Democrats. One explanation is that Democrats have lower trust in Republicans. Another is that a ceiling effect since mean scores by Democrats are near the top end of the scale. A third limitation is the extent to which we can generalize the impact of non-partisan or less explicitly partisan (e.g. conservative think tanks) sources of correction. It is also possible that our effects are influenced by the fact that the initial denial statement has an explicit (Republican) association. Whether the same claim attributed to an unknown political elite would produce the same result is impossible to say, although we would argue that the general partisan positions on this issue are well-known.

Another possible limitation is that our Mechanical Turk participants are not nationally representative. Our sample is younger, more liberal, and better-educated than the national adult population, which may limit external validity. However, multiple recent studies find similarity

between experimental treatment effects on Mechanical Turk and nationally representative samples (Coppock 2018, Mullinix et al. 2015). Our treatment effects are also robust to controls for the major demographic differences between these groups. Mechanical Turk users may, however, be more accustomed to survey experiments or have different motivations to participate in these studies (see Mullinix et al. 2015), thus we still encourage further experiments to better understand these source effects. Finally, we have not evaluated the impact of these corrections on policy preferences. This should be an important direction for future research, since correcting misperceptions may not necessarily affect policy preferences (Nyhan et al. 2018).

Even acknowledging these limitations, our findings have important implications for communicating climate change, other divisive science and technology issues, and addressing misperceptions or misinformation in media. The results suggest that corrective information is most persuasive when it comes from individuals in the groups associated with the “other side” of the issue, rather than when it comes from “neutral” authoritative sources or an opposing side. Thus, efforts to persuade Republicans or to correct misinformation about climate change would do well to promote positions of Republicans who support the scientific consensus and environmental action, rather than non-partisan climate scientists or Democrats. Using the well-known advocates of that position may risk representing the issue as an element of mere partisan debate.

Our results also point to several other avenues for further research on environmental public opinion, motivated reasoning, and fact-checking campaigns. Our study focused on a specific partisan issue on which scientific consensus has been adopted by Democrats, but challenged by many Republicans. Future research might examine other topics where widely held misinformation is held by people on both sides of the partisan line (e.g. GMOs, nuclear power),

or issues where Democrats or Independents are more likely to disagree with facts or neutral expertise. Our intervention also does not explicitly convey the “balance” of co-partisan opinion. Since there is evidence that people tend to judge balance of elite or scientific agreement based on the relative percentage of positions they hear, future studies might improve external validity by emphasizing the relative frequency of competing positions among co-partisan elites (e.g. Chong and Druckman 2007), perhaps by indicating that Republican elites who believe the scientific consensus on climate change are outnumbered by those who claim there is no such consensus.

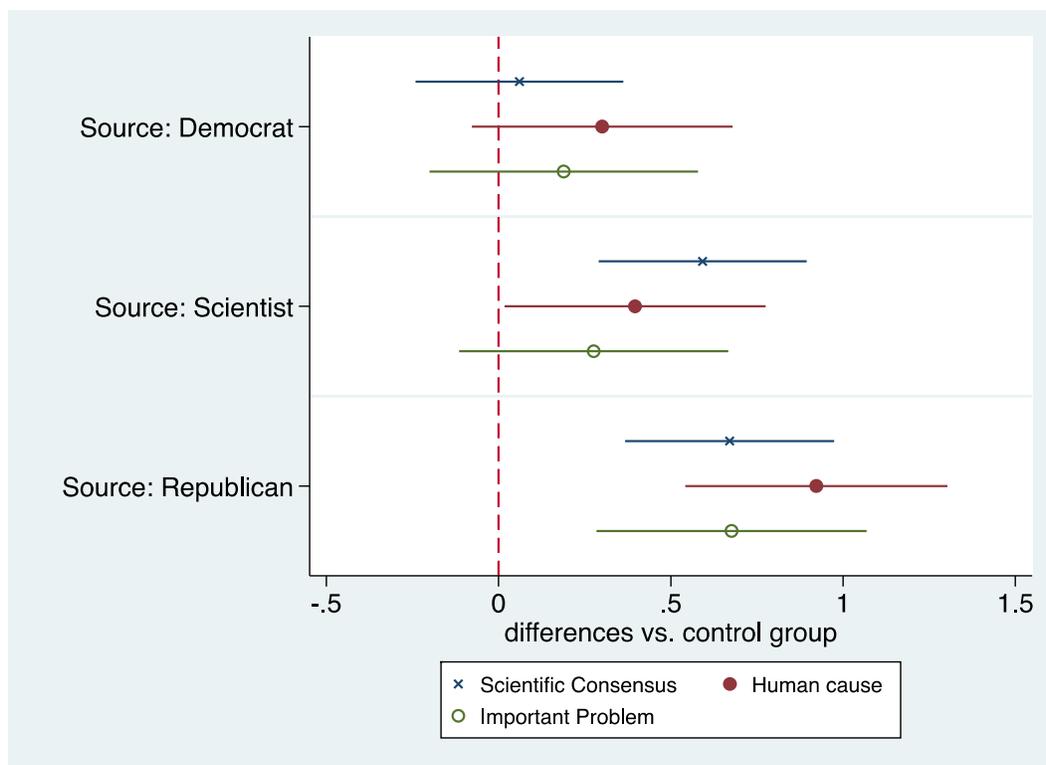
Acknowledgements:

We thank Adam Berinsky, Thomas Hayes, Paul Herrnson, Blair Johnson, Matto Mildenerger, Megan Mullin, Brendan Nyhan, Mike Shor, Matthew Singer, Gabriela Tafoya, Steven Webster, participants in the UConn Political Economy Workshop, and the editors and reviewers at *Climatic Change* for their feedback on this study.

Funding support for the survey experiments came from the University of Connecticut and DePauw University.

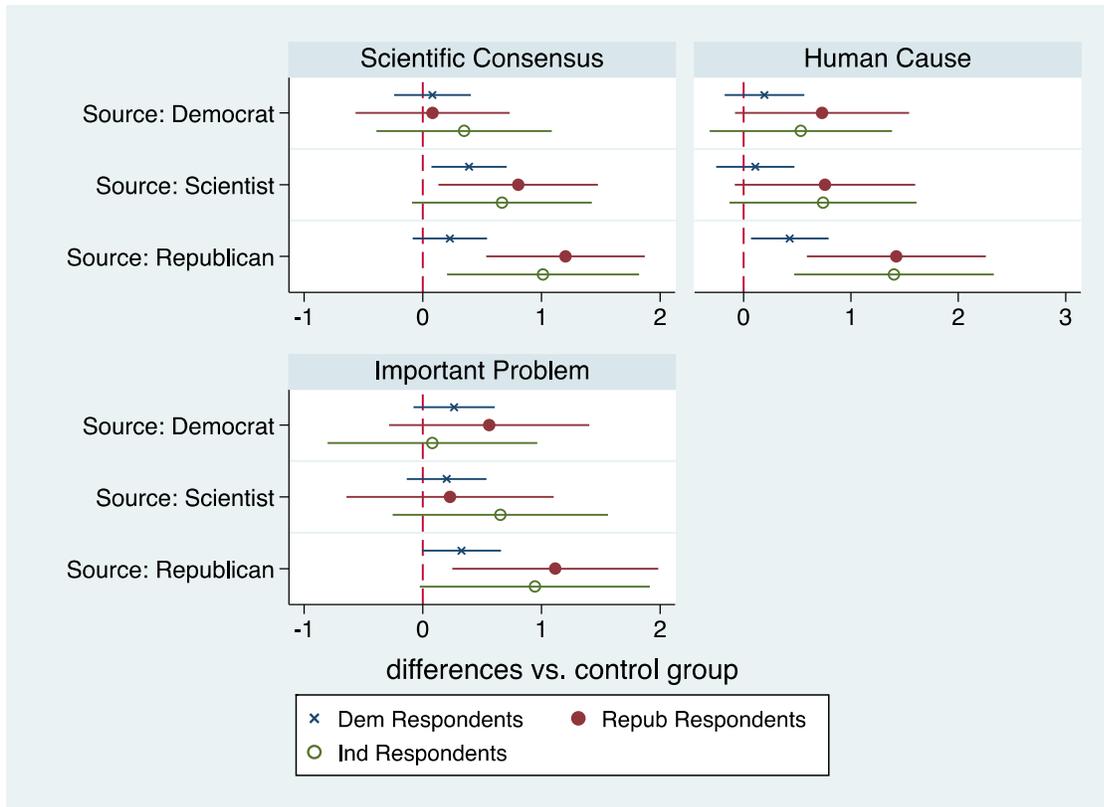
Tables and figures:

Figure 1: Effect of correction source on three climate change opinion question items



Point estimates (x's, •'s, o's) are coefficient plots (Stata 14.2 coefplot) of the inter-group difference-of-mean between a control group (receiving climate change denial statement) and three groups receiving an identical correction statement attributed to one of three different "Sources": (respectively) Congressional Republicans, Congressional Democrats, and climate scientists. Lines are 95% confidence intervals. Intervention statements and item wordings are in the appendix

Figure 2: Effect of corrective source on three climate change items by respondent party affiliation.



Coefficient plots of difference-of means (treatment vs control) among Democrats (x), Republicans (•), and Independents (o), for correction statements attributed to partisan “Sources.” (Responses are from the same experiment as in Figure 1, groups are subdivided by party.)

Table 1: Distribution of respondent partisanship by treatment condition

	Misinformation + No correction (control)	Misinformation + Scientists' correction	Misinformation + Democrat correction	Misinformation + Republican correction
Republican	74 (24.5%)	90 (27.0%)	106 (31.2%)	93 (28.1%)
Democrat	160 (53.0%)	185 (55.6%)	170 (50.0%)	192 (58%)
Independent	68 (22.5%)	58 (17.4%)	64 (18.8%)	46 (13.9%)
Total cases in treatment condition	302	333	340	331

Pearson's $\chi^2 = 8.701$, $p=.191$

Note: partisan classification includes "Independent leaners" as party affiliates

Table 2: Mean item score by partisanship and treatment condition

	Respondent party identification		
	<i>Republican</i>	<i>Democrat</i>	<i>Independent</i>
Scientific consensus that climate change is underway			
No correction (C)	7.16	8.91	7.57
Scientists source (TS)	7.97**	9.30**	8.24
Democrat source (TD)	7.25	8.99	7.92
Republican source (TR)	8.37***	9.14	8.59**
Climate change is mostly man-made			
No correction (C)	5.30	8.39	6.29
Scientists source (TS)	6.06*	8.50	7.03
Democrat source (TD)	6.03*	8.58	6.83
Republican source (TR)	6.72***	8.82**	7.70***
Climate change is an important problem			
No correction (C)	5.27	8.51	6.79
Scientists source (TS)	5.50	8.71	7.45
Democrat source (TD)	5.83	8.78	6.88
Republican source (TR)	6.39***	8.84*	7.74**

* $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$ different from control

Table 3: Regression results for models predicting response to climate attitude survey items

	Scientific consensus that climate is changing		Climate change mainly affected by humans		Climate change an important problem	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Respondent's party ID (baseline: Republican)						
Democrat	1.75*** (.35)	.85* (.37)	3.09*** (.38)	1.66*** (.40)	3.24*** (.39)	1.66*** (.40)
Independent	.41 (.44)	-.20 (.45)	1.00** (.48)	.03 (.49)	1.52** (.47)	.37 (.46)
Source of Correction Statement (baseline: no correction statement)						
Democrat	.08 (.39)	-.02 (.37)	.73 (.48)	.57 (.41)	.56 (.45)	.42 (.41)
Scientist	.80* (.38)	.73* (.37)	.76 (.46)	.68 (.44)	.23 (.47)	.16 (.43)
Republican	1.20*** (.37)	1.15** (.36)	1.42** (.44)	1.39** (.41)	1.12** (.46)	1.12** (.42)
7Partisanship × Source interaction (baseline: Republicans in control condition)						
Dem with Dem source	-.00 (.43)	.11 (.41)	-.54 (.47)	-.38 (.45)	-.30 (.48)	-.16 (.45)
Dem with Sci source	-.41 (.41)	-.41 (.40)	-.65 (.50)	-.62 (.48)	-.03 (.50)	-.04 (.47)
Dem with Rep source	-.98* (.41)	-.97* (.39)	-.99** (.47)	-1.04** (.45)	-.79 (.49)	-.88* (.45)
Ind with Dem source	.27 (.55)	.43 (.54)	-.20 (.60)	-.03 (.59)	-.48 (.63)	-.26 (.60)
Ind with Sci source	-.14 (.57)	.03 (.55)	-.02 (.66)	.18 (.64)	.42 (.65)	.61 (.63)
Ind with Rep source	-.19 (.53)	-.15 (.52)	-.02 (.64)	-.04 (.62)	-.17 (.65)	-.22 (.62)
Age (baseline: 30 or under)						
31-45		.10 (.11)		.00 (.13)		-.06 (.13)
46-65		.09 (.15)		-.14 (.18)		-.13 (.17)
Over 65		.20 (.38)		-.03 (.95)		-.32 (.50)
Ideology (baseline: moderate)						
Very conservative		-1.50*** (.39)		-2.24*** (.45)		-2.30*** (.44)
Conservative		-.62*** (.21)		-.90*** (.25)		-1.33*** (.24)
Liberal		.32* (.14)		.61*** (.16)		.50** (.16)
Very liberal		.70*** (.14)		1.01*** (.18)		1.06*** (.17)
Education (baseline= college degree)						
HS or less		-.41** (.18)		-.28 (.20)		-.38* (.21)
Some coll		.08 (.12)		-.06 (.14)		-.06 (.14)
Post grad		.17 (.24)		-.15 (.18)		-.10 (.17)
Race: white		.10		-.07		.10

		(.13)		(.15)		(.16)
Attention to News (baseline=<15 minutes/day)						
15-30 mins per day		.06		-.19		-.14
		(.12)		(.13)		(.13)
Over 30 mins per day		.05		-.15		-.05
		(.15)		(.43)		(.19)
Male		-.08		-.30**		-.21*
		(.10)		(.12)		(.12)
No religion		-.12		-.27**		-.23*
		(.11)		(.13)		(.13)
Constant	7.16***	7.67***	5.30***	6.72***	5.27***	6.72***
	(.32)	(.38)	(.35)	(.41)	(.36)	(.41)
N	1306	1305	1306	1305	1306	1305

Reference categories are: Republican partisan, No correction, under 30, Moderate ideology, low news attention (<15 minutes/day), and has a four-year college degree.

* p< .10, ** p< .05, *** p< .01 different from control

Robust standard errors in parentheses

References:

- Ahler, D. J. (2014). Self-fulfilling misperceptions of public polarization. *The Journal of Politics*, 76(3), 607-620.
- Achen, C. H., & Bartels, L. M. (2016). *Democracy for realists: Why elections do not produce responsive government*. Princeton University Press.
- Bastardi, A., Uhlmann, E. L., & Ross, L. (2011). Wishful thinking: Belief, desire, and the motivated evaluation of scientific evidence. *Psychological science*, 22(6), 731.
- Berinsky, A. (2017). Rumors and Health Care Reform: Experiments in Political Misinformation. *British Journal of Political Science*. doi:10.1017/S0007123415000186
- Berinsky, A. J., Huber, G. A., & Lenz, G. S. (2012). Evaluating online labor markets for experimental research: Amazon.com's Mechanical Turk. *Political Analysis*, 20(3), 351-368.
- Boussalis, C., & Coan, T. G. (2016). Text-mining the signals of climate change doubt. *Global Environmental Change*, 36, 89-100.
- Boykoff, M. T., & Boykoff, J. M. (2004). Balance as bias: global warming and the US prestige press. *Global Environmental Change*, 14(2), 125-136.
- Burke, R. J. (2014). Institutionalizing delay: foundation funding and the creation of US climate change counter-movement organizations. *Climatic Change*, 122(4), 681-694.
- Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk a new source of inexpensive, yet high-quality, data?. *Perspectives on Psychological Science*, 6(1), 3-5.
- Calvert, R. L. (1985). The value of biased information: A rational choice model of political advice. *The Journal of Politics*, 47(2), 530-555.
- Chong, D., & Druckman, J. N. (2007). Framing theory. *Annu. Rev. Polit. Sci.*, 10, 103-126.
- Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R., Verheggen, B., Maibach, E. W., ... & Nuccitelli, D. (2016). Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*, 11(4), 048002.
- Coppock, A. (2018). Generalizing from Survey Experiments Conducted on Mechanical Turk: A Replication Approach. *Political Science Research and Methods*. Forthcoming.
- Ding, D., Maibach, E. W., Zhao, X., Roser-Renouf, C., & Leiserowitz, A. (2011). Support for climate policy and societal action are linked to perceptions about scientific agreement. *Nature Climate Change*, 1(9), 462-466.
- Ditto, P. H., & Lopez, D. F. (1992). Motivated skepticism: Use of differential decision criteria for preferred and nonpreferred conclusions. *Journal of Personality and Social Psychology*, 63(4), 568.
- Druckman, J. N. (2001). On the limits of framing effects: Who can frame?. *Journal of Politics*, 63(4), 1041-1066.
- Druckman, J. N., & Lupia, A. (2016). Preference change in competitive political environments. *Annual Review of Political Science*, 19.
- Dunlap, R. E., McCright, A. M., & Yarosh, J. H. (2016). The Political Divide on Climate Change: Partisan Polarization Widens in the US. *Environment: Science and Policy for Sustainable Development*, 58(5), 4-23.
- Dunlap, R. E., & Jacques, P. J. (2013). Climate change denial books and conservative think tanks: exploring the connection. *American Behavioral Scientist*, 0002764213477096.
- Egan, P. J., & Mullin, M. (2017). Climate Change: US Public Opinion. *Annual Review of Political Science*, 20(1).

- Gauchat, G. (2012). Politicization of science in the public sphere: A study of public trust in the United States, 1974 to 2010. *American sociological review*, 77(2), 167-187.
- Guber, D. L. (2013). A cooling climate for change? Party polarization and the politics of global warming. *American Behavioral Scientist*, 57(1), 93-115.
- Jacques, P. J., Dunlap, R. E., & Freeman, M. (2008). The organisation of denial: Conservative think tanks and environmental scepticism. *Environmental politics*, 17(3), 349-385.
- Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, 14(2), 147-174.
- Kahan, D. M. (2015). Climate-science communication and the measurement problem. *Political Psychology*, 36(S1), 1-43.
- Kahneman, D. and Tversky, A. (1996). On the Reality of Cognitive Illusion. *Psychological Review* 103(3): 582-591.
- Krosnick, J. A., Holbrook, A. L., & Visser, P. S. (2000). The impact of the fall 1997 debate about global warming on American public opinion. *Public Understanding of Science*, 9(3), 239-260.
- Krosnick, J. A., Holbrook, A. L., Lowe, L., & Visser, P. S. (2006). The origins and consequences of democratic citizens' policy agendas: A study of popular concern about global warming. *Climatic change*, 77(1-2), 7-43.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological bulletin*, 108(3), 480.
- Layzer, J. A. (2012). *Open for business: Conservatives' opposition to environmental regulation*. MIT Press.
- Levendusky, M., & Malhotra, N. (2016). Does media coverage of partisan polarization affect political attitudes?. *Political Communication*, 33(2), 283-301.
- Lewandowsky, S., Gignac, G. E., & Vaughan, S. (2013). The pivotal role of perceived scientific consensus in acceptance of science. *Nature Climate Change*, 3(4), 399-404.
- Lodge, M., & Taber, C. S. (2013). *The rationalizing voter*. Cambridge University Press.
- Lupia, A., & McCubbins, M. D. (1998). *The democratic dilemma: Can citizens learn what they need to know?*. Cambridge University Press.
- McCright, A.M., Charters, M., Dentzman, K., & Dietz, T. (2016). Examining the Effectiveness of Climate Change Frames in the Face of a Climate Change Denial Counter-Frame. *Topics in Cognitive Science* 8, 76-97.
- Motta, M. (2017). The Dynamics and Political Implications of Anti-Intellectualism in the United States. *American Politics Research*, 1532673X17719507.
- Mullinix, K. J., Leeper, T. J., Druckman, J. N., & Freese, J. (2015). The generalizability of survey experiments. *Journal of Experimental Political Science*, 2(2), 109-138.
- NASA. (2015). "Scientific Consensus: Earth's Climate is Warming" Accessed via <<http://climate.nasa.gov/scientific-consensus/>>
- Nyhan, B., Reifler, J., & Ubel, P. A. (2013). The hazards of correcting myths about health care reform. *Medical Care*, 51(2), 127-132.
- Nyhan, B., Reifler, J., Porter, E., & Wood, T. (2017) Taking corrections literally but not seriously? The effects of information on factual beliefs and candidate favorability. Working paper at <https://www.dartmouth.edu/~nyhan/trump-corrections.pdf>.
- Oreskes, N., & Conway, E. M. (2011). *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming*. Bloomsbury Publishing USA.
- Paolacci, G., & Chandler, J. (2014). Inside the Turk: Understanding Mechanical Turk as a participant pool. *Current Directions in Psychological Science*, 23(3), 184-188.

- Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in experimental social psychology*, 19, 123-205.
- Pew Research Center (2015) *Global Concern about Climate Change, Broad Support for Limiting Emissions*. November.
- Priester, J. R., & Petty, R. E. (1995). Source attributions and persuasion: Perceived honesty as a determinant of message scrutiny. *Personality and Social Psychology Bulletin*, 21(6), 637-654.
- Shipan, C. R., & Lowry, W. R. (2001). Environmental policy and party divergence in Congress. *Political Research Quarterly*, 54(2), 245-263.
- Skocpol, T., & Hertel-Fernandez, A. (2016). The Koch network and Republican Party extremism. *Perspectives on Politics*, 14(3), 681-699.
- Testa, P. F., Hibbing, M. V., & Ritchie, M. (2014). Orientations toward conflict and the conditional effects of political disagreement. *The Journal of Politics*, 76(3), 770-785.
- Thorson, E. (2016). Belief echoes: The persistent effects of corrected misinformation. *Political Communication*, 33(3), 460-480.
- Uscinski, J. E., & Parent, J. M. (2014). *American conspiracy theories*. Oxford University Press.
- Van der Linden, S. L., Leiserowitz, A.A., Feinberg, G. D., & Maibach, E.W. (2015). The Scientific Consensus on Climate Change as a Gateway Belief: Experimental Evidence. *PLOS One* <https://doi.org/10.1371/journal.pone.0118489>
- Zaller, J. (1992). *The Nature and Origins of Mass Opinion*. Cambridge University Press.

Appendix:

Appendix A: Treatment wording

Shown to all treatment groups:

Senator James Inhofe (R-OK), Chairman of the Senate Environment Committee, stated in an interview last month that environmental regulations aimed at addressing climate change were "alarmist" and that the science over climate change remains unsettled.

"It's important to question whether climate change is even a problem for human existence," Inhofe said. "Thus far no one has seriously demonstrated any scientific proof that increased global temperatures would lead to the catastrophes predicted by alarmists. The claim that global warming is caused by man-made emissions is simply untrue and not based on sound science."

Inhofe has made similar comments in the past, most notably during a Senate speech in 2015 when he argued that the earth is currently in a cooling period. Inhofe has been a strong critic of recent federal bills aiming to cut carbon pollution by regulating power plant emissions and oil drilling. The regulations pose a serious threat to the country's economy, he said.

Treatment 1: Only received misinformation article with no correction.⁸

Treatment 2: Misinformation article with the following (scientist source) conclusion:

However, several scientists have been critical of Inhofe's remarks on climate change. Members of NASA pointed to recent reports from the Intergovernmental Panel on Climate Change (IPCC) that recently declared that human activities have caused most of earth's temperature rise since 1950 and will continue to do so in the future. The IPCC, which is a non-partisan panel of scientists from over 100 countries, estimates that global temperatures may increase by as much as 4.8°C over pre-industrial levels by 2100. Dr. James Hansen, a climatologist who worked at NASA for over 40 years said, "When you have over 90 percent of the world's scientists who have studied this stating that climate change is occurring and that humans play a contributing role, it's time to defer to the experts."

Treatment 3: Misinformation article with the following (Democrat source) conclusion:

However, several Democrats have been critical of Inhofe's remarks on climate change. Senators Brian Schatz (D-HI) and Maria Cantwell (D-WA) pointed to recent reports from the Intergovernmental Panel on Climate Change (IPCC) that recently declared that human activities have caused most of earth's temperature rise since 1950 and will continue to do so in the future. The IPCC, which is a non-partisan panel of scientists from over 100 countries, estimates that global temperatures may increase by as much as 4.8°C over pre-industrial levels by 2100. Democrat Senator Sheldon Whitehouse (D-RI) said, "When you have over 90 percent of the

⁸ This is one possible limitation of the study: the control group received a substantially smaller treatment (~150 words) while respondents in other groups received a substantially longer treatment including the misinformation statement and the correction.

world's scientists who have studied this stating that climate change is occurring and that humans play a contributing role, it's time to defer to the experts."

Treatment 4: Misinformation article with the following (Republican source) conclusion:

However, several Republicans have recently been critical of Inhofe's remarks on climate change. Senators John Thune (R-SD) and Kelly Ayotte (R-NH) pointed to recent reports from the Intergovernmental Panel on Climate Change (IPCC) that recently declared that human activities have caused most of earth's temperature rise since 1950 and will continue to do so in the future. The IPCC, which is a non-partisan panel of scientists from over 100 countries, estimates that global temperatures may increase by as much as 4.8°C over pre-industrial levels by 2100. Republican Congressman Chris Smith (R-NJ) said, "When you have over 90 percent of the world's scientists who have studied this stating that climate change is occurring and that humans play a contributing role, it's time to defer to the experts."

Appendix B: Question wording

Survey questions

Outcome variables:

Please state your level of agreement with the following statements on a scale of 1-10, 10 indicating the strongest level of agreement.

Acknowledgement of scientific consensus on climate change

There is a general consensus among scientists that the average temperature on earth has been getting warmer over the past few decades.

1. Strongly disagree... 10. Strongly agree

Human activity affects climate change

The problem of climate change is *mainly* due to human activity such as burning fossil fuels.

1. Strongly disagree... 10. Strongly agree

Seriousness of climate change

How important a problem do you think climate change is at this moment, on a scale of 1-10?

1: Not important at all ... 10: Very important

Attention check

Which of the following statements best summarizes the article that you just read?

- a. Senator James Inhofe believes that climate change is an urgent problem
- b. Senator James Inhofe is skeptical about climate change [correct answer]
- c. Senator James Inhofe is optimistic about the 2016 election
- d. Senator James Inhofe wants bipartisan policy on climate change

Respondents who did not answer (b) to the above question were considered to have not adequately read the assigned treatment and were removed from the sample.

Appendix C: Demographics

<i>Variable</i>		<i>Mechanical Turk sample</i>
Sex	Male	51 %
	Female	49 %
Race	White	81 %
	Asian	7 %
	Hispanic	5 %
	Black	6 %
Education	Up to high school	12 %
	Some college studies, no degree	36 %
	Four year college degree	37 %
	Postgraduate degree	15 %
Partisanship	Republican	20 %
	Democrat	40 %
	Independent	31 %
N		1338

Demographics across treatments

<i>Variable</i>	<i>Null (denial)</i>	<i>Treatment type</i>		
		<i>Expert</i>	<i>Democrat</i>	<i>Republican</i>
Male	53 %	52 %	52 %	47 %
White	83 %	81 %	76 %	83 %
College or higher	50 %	57 %	48 %	52 %
Republican	17 %	18 %	22 %	20 %
Democrat	38 %	39 %	36 %	47 %

Sample Ideology breakdown (percentage by party identification)

	<i>Republican</i>	<i>Democrat</i>	<i>Independent</i>	<i>Total</i>
Very conservative	16.8	0.3	1.3	66
Conservative	54.3	2.7	6.0	230
Moderate	25.3	19.8	71.1	399
Liberal	3.0	52.9	16.6	424
Very liberal	0.6	24.3	5.1	186
	100	100	100	1305

Appendix D: Summary of pilot study

A preliminary/pilot study was conducted on Amazon Mechanical Turk in April 2015. Participants in this study were randomly assigned one of the following treatments, with a post-treatment survey. While the results from the two experiments are largely consistent in terms of the significance of effects, this design failed to control for a) the content of the correction message, and b) inadequate isolation of personal affect or credibility for the correction sources due to national name recognition.

Shown to all treatment groups:

In an interview with the Cincinnati Enquirer, Senate Majority Leader Mitch McConnell told the editorial board that he does not believe in climate change, and that the science over climate change remains unsettled. McConnell has raised doubts about climate change in the past, but never as directly.

"I don't buy that climate is changing. In 1970s, we were all concerned about the ice age coming," said the Republican senator, who comes from Kentucky, and was unanimously elected to be Senate Majority Leader last month.

McConnell said that the science remains unsettled on the problem of climate change. "Pick your period and data will support your bias," said McConnell, indicating that the earth has gone through cooling and warming periods in the past. "Each side has their scientists, and they can all go in and argue," he responded, when asked whether he believed if human activity contributes to global warming. McConnell also criticized newly proposed Environmental Protection Agency rules that would cut carbon pollution from coal power plants. The regulations pose a serious threat to Kentucky's coal industry, he said.

Treatment 1: Only received denial article with no correction.

Treatment 2: Denial article with the following conclusion:

McConnell's statements contradict findings from the most recent report published by the Intergovernmental Panel on Climate Change (IPCC.) The panel, which consists of thousands of scientists and reviewers from more than 100 countries, confirmed with 95% certainty that human activities have caused most of earth's temperature rise since 1950, and will continue to do so in the future. The IPCC's most recent report, released on 2 November 2014 in Copenhagen, estimates that global temperatures may increase by as much as 4.8°C over pre-industrial levels by 2100.

Treatment 3: Denial article with the following conclusion:

McConnell's statements were refuted by several members of the Democrat Party, including Senators Elizabeth Warren, Brian Schatz, and Minority Leader Harry Reid. In an earlier statement, Schatz (D-Hawaii) had called climate change "the most pressing issue of our time,"

declaring that there was overwhelming evidence that "it is real, it is caused by humans, it is happening now, and it is solvable."

Treatment 4: Denial article with the following conclusion:

Although many other Republican senators have been skeptical of climate change, a growing number have become more accepting of the issue and its risks in the past year. Marco Rubio (R-FL) and John Thune (R-SD) have in recent months publicly acknowledged that global temperatures are increasing, while Chris Christie (R-NJ) said two years ago that "When you have over 90 percent of the world's scientists who have studied this stating that climate change is occurring and that humans play a contributing role, it's time to defer to the experts."

Respondents were asked similarly worded questions about whether climate change is occurring and whether it is affected by human activity. A similar attention check was included to ensure respondents had read the treatment. A total of 969 respondents completed this survey. Results showed that a Republican correction was effective in persuading other Republicans to update their reported attitudes on climate change closer to the scientific consensus, and had moderate effects on Independents and Democrats. In an effort to rely on actual quotes from real politicians, the details of corrective messages differed in this pilot study. This sacrificed some degree of internal validity for external validity, as the intensity and phrasing of messages differed by group. We then developed similar corrective treatments for the main study discussed in the manuscript, but with a greater focus on maintaining internal validity.

Mean opinions by treatment group and partisanship from pilot

<i>Partisanship</i>	<i>Corrective treatments:</i>			
	<i>None (denial)</i>	<i>Expert (IPCC)</i>	<i>Democrat</i>	<i>Republican</i>
Belief in evidence that climate change exists				
Republican	6.392	7.195	6.510	7.609
(std. deviation)	(2.293)	(2.595)	(2.550)	(2.157)
(N)	56	46	49	64
Democrat	8.705	8.877	8.644	8.895
	(1.711)	(1.588)	(1.681)	(1.646)
	129	155	135	124
Independent	7.615	8.588	7.560	8.170
	(1.914)	(1.760)	(2.083)	(2.301)
	39	34	25	41
Combined	7.970	8.480	8.000	8.360
	(2.098)	(1.975)	(2.187)	(1.979)
	241	254	223	250
Belief that human activity affects climate change				
Republican	5.446	5.586	5.489	6.234
(std. deviation)	(2.507)	(2.963)	(2.534)	(2.758)
(N)	56	46	49	64
Democrat	8.364	8.380	7.925	7.967
	(1.672)	(1.762)	(1.835)	(1.929)
	129	155	135	124
Independent	5.846	6.941	6.360	7.073
	(2.508)	(2.282)	(2.885)	(2.327)
	39	34	25	41
Combined	7.149	7.610	7.179	7.308
	(2.451)	(2.422)	(2.411)	(2.339)
	241	254	223	250

Two-tailed t-tests from this study:

<i>Partisanship</i>	<i>Corrective treatments (compared to the null/denial group)</i>		
	<i>Expert (IPCC)</i>	<i>Democrat</i>	<i>Republican</i>
Belief in evidence that climate change exists			
Republican Δ mean	.802* (1.657)	.117 (0.248)	1.216*** (2.992)
Democrat Δ mean	.171 (.877)	-.060 (0.292)	.189 (0.226)
Independent Δ mean	.972*** (2.248)	-.055 (1.070)	.555 (0.389)
Belief that human activity affects climate change			
Republican Δ mean	.140 (0.259)	.0433 (0.088)	.787** (1.628)
Democrat Δ mean	.016 (0.079)	-.438** (2.026)	-.396* (1.749)
Independent Δ mean	1.095** (1.939)	.513 (0.753)	1.227** (2.269)

T-statistics in parentheses, * $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$