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Science Denial Across the Political Divide: Liberals and Conservatives Are Similarly Motivated to Deny Attitude-Inconsistent Science

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Abstract

We tested whether conservatives and liberals are similarly or differentially likely to deny scientific claims that conflict with their preferred conclusions. Participants were randomly assigned to read about a study with correct results that were either consistent or inconsistent with their attitude about one of several issues (e.g., carbon emissions). Participants were asked to interpret numerical results and decide what the study concluded. After being informed of the correct interpretation, participants rated how much they agreed with, found knowledgeable, and trusted the researchers' correct interpretation. Both liberals and conservatives engaged in motivated interpretation of study results and denied the correct interpretation of those results when that interpretation conflicted with their attitudes. Our study suggests that the same motivational processes underlie differences in the political priorities of those on the left and the right.

Keywords

attitudes, science denial, political psychology, motivated reasoning

Many journalists, authors, and researchers have made bold claims, suggesting science denial is primarily a problem on the political right (e.g., Mooney, 2014). However, is this really the case? The goal of this project was to examine whether political conservatives and liberals are similarly motivated to deny scientific claims in the defense of their beliefs and attitudes. We first review evidence of ideological asymmetry in acceptance and denial of scientific information. We then review theoretical accounts that predict ideological symmetry in science denial as a special case of attitudes-based motivated reasoning.

Asymmetrical Ideological Motivation

Conservatives are more likely than liberals to support policies inconsistent with the scientific consensus on evolution (Newport, 2012), abortion-related health risks (Charles, Polis, Sridhara, & Blum, 2008), the value of stem cell research (Mooney, 2011; Nisbet, 2005), and the efficacy of sex education in reducing teen pregnancies (Kirby, 2008; United Nations Educational, Scientific, and Cultural Organization, 2009). One well-documented area of science denial is the tendency for conservatives to be more likely to deny scientific evidence of climate change—and/or that humans are the cause—a result that shows up in dozens of polls conducted in the last 15 years (e.g., Dunlap, 2008; Gallup Poll, 2009; McCright & Dunlap, 2011; Pew Research Center, 2012, 2013).

Results like these have led some to speculate that conservatives may be more dispositionally inclined and/or motivated to be skeptical and distrustful of scientific evidence than liberals (e.g., Mooney, 2012). According to this view, science denial is ideologically asymmetrical, something largely due to various other differences that characterize right versus left wing worldviews, such as higher levels of need for epistemic closure, cognitive rigidity, and system-justifying beliefs on the right, and openness to experience, cognitive flexibility, and system-challenging beliefs on the left (e.g., Feygina, Jost, & Goldsmith, 2010; Jost, Glaser, Kruglanski, & Sulloway, 2003; Jost, Nosek, & Gosling, 2008; Kruglanski, Webster, & Klem, 1993; McCrae, 1996; Tetlock, 1983). Given that scientific research encompasses testing new ideas and interpreting results often characterized by uncertainty or ambiguity (e.g., Lakatos, 1978), conservatives' psychological tendencies may make them shy away from trusting scientific results more so than liberals. Additionally, stable individual differences between

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conservatives and liberals in traits like openness to experience, intellectual flexibility, and intellectual curiosity have also been linked to lower pro-environmental attitudes (Feygina et al., 2010; Markowitz, Goldberg, Ashton, & Lee, 2012). These results suggest that conservatives' personality characteristics and ideological motivations may limit their openness to scientific conclusions that are at odds with how they want to see the world. In summary, the asymmetrical ideological motivation account for science denial suggests that conservatives (compared to liberals) have psychologically rooted tendencies that lead them to be more likely to deny the credibility of scientific information.

Symmetrical Ideological Motivation

Another possible explanation for ideological differences in science denial is that liberals and conservatives are differentially motivated to deny or accept specific scientific claims. People on both the left and the right are motivated to assess information in ways that bolster their ideological positions (Kahan, 2013; Kahan, Jenkins-Smith, & Braman, 2011; Kahan, Peters, Dawson, & Slovic, 2013; Peterson, Skov, Serritzlew, & Ramsoy, 2013). A motivated reasoning account for science denial suggests that liberals and conservatives may be similarly inclined to be receptive and open to scientific discoveries, but they will differ in their motivation to deny *specific* scientific claims (e.g., climate change for conservatives).

For example, conservatives may appear to be more anti-science than liberals because the issues that are commonly discussed in the media and studied by researchers are ones that conservatives are motivated to reject (e.g., climate change; Lewandowsky & Oberauer, 2016). When researchers broaden the scope of scientific inquiry to include domains that conflict with liberal values (e.g., safety of genetically modified foods), examples of liberal science denial should be more prevalent. Indeed, researchers who study ideological differences in other psychological domains found similar patterns of results for conservatives and liberals when they included domains where liberals were sufficiently motivated to defend their values or worldview. For example, political partisans on both sides of the ideological divide are motivated via value conflict to discriminate against, be intolerant of, and generally dislike political out-groups (Brandt, Reyna, Chambers, Crawford, & Wetherell, 2014; Chambers, Schlenker, & Collisson, 2013; Crawford & Pilanski, 2014; Wetherell, Brandt, & Reyna, 2013), reactions that were once thought to be mostly a conservative phenomenon (e.g., Sibley & Duckitt, 2008).

Political partisans are also more likely to be sensitive to political elite cues about which kinds of science to trust/distrust (e.g., Zaller, 1992). Therefore, ideological patterns of science skepticism may fall in line with party leaders and/or platforms, in which case knowing a person's ideological leaning would provide clues as to what scientific topics a conservative or liberal is willing to accept or reject. In summary, the differential ideological motivation account for science denial suggests that conservatives and liberals are motivated to deny the credibility of scientific information that conflicts with their attitudes or values on salient political topics.

The Current Research

The goal of the current research was to test whether science denial varies as a function of ideological orientation. We test two hypotheses: (1) the *asymmetrical ideological motivation hypothesis*, that is, that conservatives are inclined to deny attitude-inconsistent science more than liberals and (2) the *symmetrical ideological motivation hypothesis*, that is, that both liberals and conservatives are likely to deny scientific evidence that counters their respective policy preferences.

Although policy preferences are often motivated by ideological worldviews, they are also shaped by personal experience and self- and group interests. For example, political scientists acknowledge that ordinary citizens, compared to elites, often lack ideological consistency in their attitudes which are often based on personal preferences or other social influences rather than core ideological principles (e.g., Converse, 1964). Knowing that a person is liberal or conservative, in other words, will always be an imperfect predictor of the person's position on any given issue. Consistent with this idea, correlations between self-reported political orientation and various political attitudes are substantially less than perfect (e.g., Nosek, Banaji, & Jost, 2009). Therefore, we measured motivated reasoning for scientific information at the policy preference level to provide the clearest test of our ideological symmetry and asymmetry hypotheses.

Method

The current study was a 7 (issue: control, immigration, gun control, climate change, health-care reform, nuclear power, same-sex marriage) $\times$ 2 (results: consistent with attitude, inconsistent with attitude) between-subjects design. The social issues listed were selected based on previous research, showing a wide range of support and opposition extremity across the political spectrum on these issues (see Skitka, Morgan, & Wisneski, 2015). By including all six of these social issues, we could take a more thorough look at the influence of context on ideologically motivated reasoning and observe if these effects change depending on the issue under consideration.

Participants

We recruited a total of 1,347 adult participants from the United States from two different subject pools. Four hundred forty-three participants were recruited via a mass e-mail system at the University of Illinois at Chicago. The remaining 904 participants were recruited via Amazon.com's Mechanical Turk (MTurk).[1] We removed 10 participants from the university sample and 14 participants from the MTurk sample for failing two instructional manipulation checks. An additional 61 participants from the university sample and 93 participants from the MTurk sample were removed because they indicated neutral or

uncertain attitudes on the issue to which they were assigned,[2] leaving a final sample size of 1,169 participants (M_{age} = 37.25, SD = 14.55; 53.7% female; 73.6% European American, 6.9% African American, 7.4% Latino/a, 7.2% Asian, 3.8% multiracial, 0.3% Native American, 0.2% Pacific Islander, remainder other or unknown).[3] We over recruited conservatives on MTurk because their workers tend to skew liberal (Berinsky, Huber, & Lenz, 2012) and ended up with 552 participants self-identified as some level of liberal, 145 self-identified as moderate, and 472 participants self-identified as some level of conservative.

Procedure

Participants were informed that they were participating in a study about attitudes toward public policies. Participants were randomly assigned to 1 of 14 experimental conditions where they were given a short excerpt describing a recent scientific study with results presented below it. There were two versions for each of the seven issues presented (six social issues and one control issue). One version presented results that were consistent with the participant's attitude on that issue and one version presented results that were inconsistent with their attitude. Participants were asked to interpret the data and decide which conclusion the study results supported. After providing their interpretation, participants were informed of the correct interpretation of the results and were then asked to rate how much they agreed with, found knowledgeable, and trusted the researchers' correct interpretation. Participants then reported their attitude stance, strength, and level of moral conviction for the six social issues and one control issue (immigration, gun control, climate change, health-care reform, nuclear power, same-sex marriage, and skin rash treatment/control). Finally, participants completed demographic information.

Measures

Political orientation. Political orientation was assessed using 2 items asking participants, "What is your political orientation?" Participants responded by selecting whether they were conservative, liberal, or neither/uncertain. Participants who indicated that they were conservative or liberal branched to a question that assessed their degree of conservatism/liberalism by asking, "To what extent are you conservative (liberal)?" with response options ranging from 1 = *slightly* to 4 = *very much*. Those who responded that they were neither/uncertain branched to an item that asked whether they leaned more toward conservative or liberal or were still neutral/uncertain. Those who indicated leaning toward conservative or liberal were coded as 1 or −1, respectively, and those who again marked neither or uncertain were coded as 0. These items were combined to form a single liberal/conservative bipolar measure ranging from −4 = *very much liberal* to +4 = *very much conservative*.

Attitude stance and strength. Participants' attitudes toward the various issues were assessed using 2 items (e.g., "Do you support or oppose immigration reform making it easier for undocumented immigrants to attain citizenship in the United States?"). Participants responded by selecting whether they supported, opposed, or were uncertain. Degree of support/opposition and leaners were coded similarly to political orientation. The combined single support/opposition bipolar measure ranged from −4 = *very much oppose* to +4 = *very much support*.

Manipulations and Dependent Measures

The stimulus material described a fabricated experiment and reported the results of that experiment in a 2 × 2 table with the columns representing the positive and negative results and the rows representing the different levels of the experimental treatment (adapted from Kahan et al., 2013). In the control condition, participants were informed that "medical researchers have developed a new cream for treating skin rashes" and that "new treatments often work but sometimes make rashes worse" and "skin rashes sometimes get better and sometimes get worse on their own." The participants were then told that the medical researchers divided the patients with skin rashes into two groups—one that was administered the skin cream and another that was not—and then observed the number of patients that got better and worse in each of the two conditions. Based on the results reflected in the table, participants were asked to indicate whether the people who used the skin cream were likely to get better or worse than those who did not.

Issue manipulation. Participants were randomly assigned to only one of the seven issues. The basic construction and layout of the stimulus remained the same for each issue with details adapted to make the fabricated experiment and results plausible (adapted from Kahan et al., 2013; see Supplemental Materials for full description of studies).

Results manipulation. The supported results of the fabricated experiment were manipulated by switching the labels of the two columns of the results table. Each of the seven fabricated studies had two versions where the first column was either labeled "increase" or "decrease." In all conditions, the actual numbers in each of the cells did not change nor did the labels for each of the rows. Also, in all conditions, the label of the column on the right indicated the correct interpretation of the data. To correctly interpret the results, participants were required to assess not just the *absolute number* of subjects (or cities) who experienced positive outcomes (e.g., "rash got better") and negative ones (e.g., "rash got worse") in each condition (the simple strategy) but instead were required to compare the *ratio* of those who experienced a positive outcome to those who experienced a negative one in each condition (the complex strategy). Using the complex strategy to correctly interpret the results, therefore, required greater cognitive effort than using any simple strategy (Kahan et al., 2013; Stanovich & West, 1998). The numbers used in the cells of the tables were

selected, so that using the simple strategy always resulted in an incorrect interpretation.

Whether either interpretation strategy (simple or complex) was consistent or inconsistent with the participant's attitude depended on that participant's stance on the issue. For example, if a participant was randomly assigned to the gun control condition where the correct interpretation of the data implied that a gun ban decreased crime, and that participant opposed gun control laws, that participant was in the "simple strategy consistent" condition because using the simple (and incorrect) strategy to interpret the data would provide an answer that fit with the participant's attitude. Concurrently, a participant assigned to that same condition who supported gun control laws was in the "complex strategy consistent" condition because using the complex (and correct) strategy to interpret the data would provide an answer that fit with the participant's attitude.

Motivated interpretation of science. Motivated interpretation of scientific information was measured with the dichotomous choice variable that participants used to decide which interpretation the study supported. This variable served as a measure of motivated reasoning because participants were expected to first use the simple strategy to interpret the results (e.g., Stanovich & West, 1998). If the simple strategy provided an attitude-consistent interpretation, participants were expected to stop reasoning and not engage in the effortful process of comparing the ratios of the results to arrive at the correct answer. However, if the simple strategy provided an attitude-inconsistent result, participants were expected to continue to expend cognitive effort and engage in the complex process to try to reach their desired conclusion (see Figure 1 for an example interpretation). Scores on this measure were recoded such that 1 = *correct interpretation of the results* (complex strategy) and 0 = *incorrect interpretation of the results* (simple strategy).

Science denial. Science denial was measured using 4 items assessed after participants were shown how to correctly interpret the results of the study (e.g., "How much do you agree or disagree with [trust/distrust, etc.] the researchers' interpretation?" on a scale ranging from 1 = *completely disagree [distrust]* to 6 = *completely agree [trust]*). The items were combined and recoded, such that higher scores indicated less agreement, less trust, and so on, and this served as our measure of science denial ($\alpha = .94$).

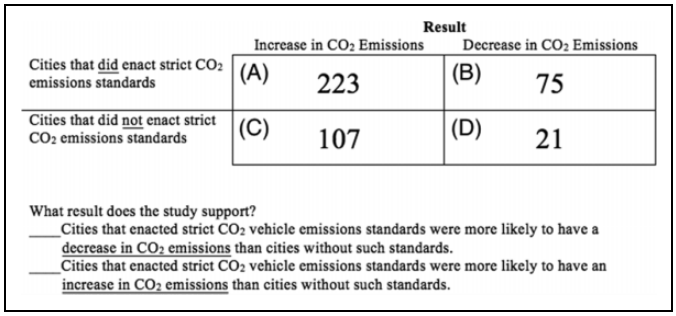

Figure 1. Example of interpretation. Participants could interpret these results in one of two ways. The simple strategy involves either comparing Box A to Box B or comparing Box A to Box C. Comparing Box A to Box B results in an incorrect interpretation because it does not take into account the control group (cities that did not enact strict emissions standards). Comparing Box A to Box C results in an incorrect interpretation because it does not include information that disentangles the effect of the strict emissions standards from other factors leading to increases or decreases in carbon emissions. The complex strategy involves comparing the ratios of either increases or decreases in emissions for each group [A/(A + B) vs. C/(C + D)]. A participant who supports strict emissions standards would be more likely to engage in the complex strategy for interpreting these results because the simple strategies lead to a conclusion that conflicts with the participant's attitude (cities that enacted strict emissions standards experienced a greater increase in emissions compared to cities that did not). Therefore, these results would be a "complex strategy consistent" condition for strict emissions standards supporters. However, a participant who opposes strict emissions standards would find the conclusions derived from the simple strategies agreeable and be more likely to get the interpretation wrong as a result. Therefore, these results would be a "simple strategy consistent" condition for strict emissions standards opposers.

Table 1. Means, Standard Deviations, and Correlations Between Measures.

Variable	*M*	*SD*	1	2	3
1. Interpretation of results	0.48	0.50	—		
2. Science denial	2.70	1.33	−.41**	—	
3. Political orientation	−0.21	2.47	−.03	.001	—

Note. *$p < .05$. **$p < .01$

Results

Means, standard deviations, and zero-order correlations between all relevant variables are presented in Table 1.

Motivated Interpretation of Science

If the asymmetrical ideological motivation hypothesis is true, we should observe a significant interaction between political orientation and strategy–attitude consistency condition on interpretation of the study results. According to this view, conservatives should be more motivated than liberals to interpret results in a way that supports their preferred conclusions, including engaging in greater cognitive effort to reach their desired outcome if necessary. In contrast, if the symmetrical ideological motivation hypothesis is true, we should observe a main effect of strategy–attitude consistency on interpretation of results, such that all participants are motivated to interpret study results in ways that fit with their preferred conclusions regardless of topic or political orientation.

To test these competing hypotheses, a hierarchical logistic regression was conducted predicting interpretation of the scientific results (dummy coded: 1 = *correct interpretation*, 0 = *incorrect interpretation*) with strategy–attitude consistency

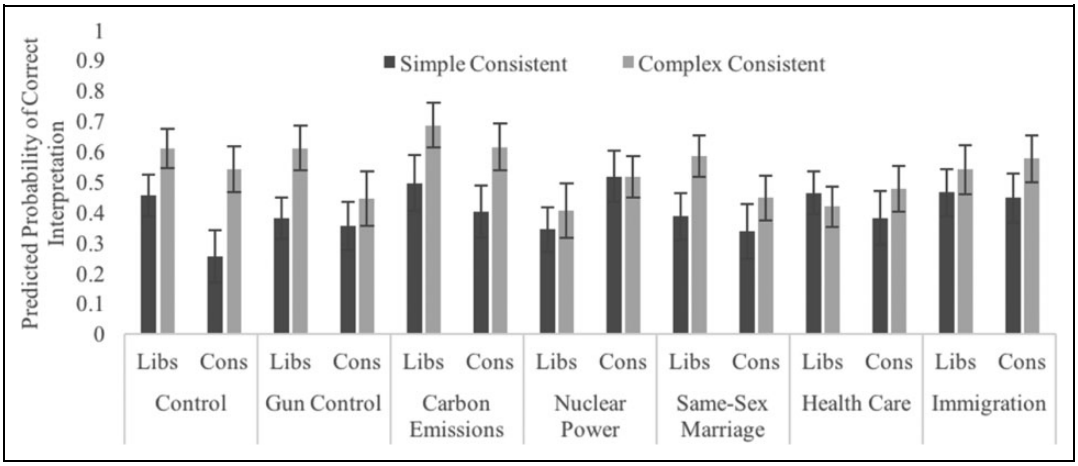

Figure 2. Predicted probability of correct interpretation of study results as a function of strategy–attitude consistency, issue, and political orientation. Libs = liberals (1 *SD* below the midpoint of the scale) and Cons = conservatives (1 *SD* above the midpoint of the scale). Error bars represent standard error of the mean.

condition (0 = *simple consistent*, 1 = *complex consistent*), dummy coded issue (control issue as reference group), and political orientation entered in step 1, all two-way interactions in step 2, and the three-way interaction in step 3.

The results were most consistent with the symmetrical ideological motivation hypothesis. In step 1, participants assigned to the complex consistent conditions were more likely to engage in the complex strategy and correctly interpret the results than those in the simple consistent conditions, $B = .54$, $SE = .12$, Wald $\chi^2(1) = 20.16$, $p < .001$, Exp(B) = 1.71, Exp(B) 95% CI [1.35, 2.16] (see Figure 2). There were no other main effects, and adding the two-way and three-way interactions did not improve model fit nor change the effect of strategy–-attitude consistency. Therefore, the effect of strategy–attitude consistency on interpretation of the scientific data did not depend on the type of issue, political orientation, or any combination of the two. Instead, participants were more likely to engage in a cognitively effortful complex strategy to correctly interpret the results of the study only when the first pass simple interpretation of the results was inconsistent with their attitude.

Science Denial

Like the results of the motivated interpretation variable, if the asymmetrical ideological motivation hypothesis is true, we should observe a significant interaction between political orientation and strategy–attitude consistency condition on science denial. Conservatives should be more motivated than liberals to deny the correct interpretation of the results when the correct interpretation does not fit with their preferred conclusion. In contrast, if the symmetrical ideological motivation hypothesis is true, we should observe a main effect of strategy–attitude consistency on science denial, such that all participants are motivated to deny the correct interpretation of the results when the correct interpretation conflicts with their attitude regardless of topic or political orientation.

Table 2. Effect of Issue, Strategy–Attitude Consistency, and Political Orientation on Science Denial.

Effect	F (df_n, df_d)	p	ω^2
Issue (I)	3.26 (6, 1141)	.004	.01
Strategy–attitude consistency (SAC)	29.98 (1, 1141)	<.001	.02
Political orientation (PO)	0.04 (1, 1141)	.852	.00
I × SAC	2.72 (6, 1141)	.012	.01
I × PO	1.15 (6, 1141)	.329	.00
SAC × PO	1.31 (1, 1141)	.253	.00
I × SAC × PO	0.68 (6, 1141)	.667	.00

To test these competing hypotheses regarding science denial, we conducted a 7 (issue) × 2 (strategy–attitude consistency) × political orientation between-subjects analysis of covariance on science denial.[4] The results mostly supported the symmetrical ideological motivation hypothesis. Somewhat unexpectedly, there was an effect of topic, $F(6, 1141) = 3.26$, $p = .004$, $\omega^2 = .01$, on science denial such that people engaged in greater science denial for the issue of same-sex marriage compared to all other issues, $F(1, 1141) = 10.70$, $p = .001$, $\omega^2 = .01$. More importantly, people engaged in greater science denial when the simple rather than complex interpretation of the results was consistent with their attitude, $F(1, 1141) = 29.98$, $p < .001$, $\omega^2 = .02$. However, these effects were qualified by an interaction between type of issue and strategy–attitude consistency, $F(6, 1141) = 2.72$, $p = .012$, $\omega^2 = .01$, such that the effect of strategy–attitude consistency on science denial was not present for the control issue, $F(1, 1141) < 1$, nuclear power, $F(1, 1141) = 1.41$, $p = .235$, or health care, $F(1, 1141) < 1$ (see Table 2 and Figure 3).[5] Importantly, there were no significant effects concerning political orientation.

These results mostly support the *nonideological motivation hypothesis* and suggest that people seem to be sufficiently motivated to discredit attitude-inconsistent science, regardless of political leanings.

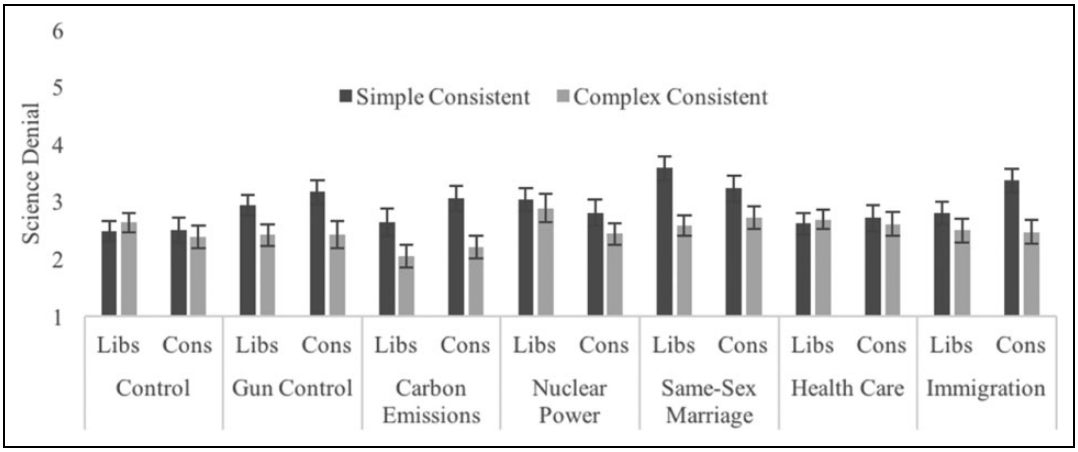

Figure 3. Science denial as a function of strategy–attitude consistency, issue, and political orientation. Libs = liberals (1 *SD* below the midpoint of the scale) and Cons = conservatives (1 SD above the midpoint of the scale). Error bars represent standard error of the mean.

Alternative Analyses for Testing the Ideologically Motivated Science Denial Hypotheses

Another way to test hypotheses about ideologically motivated science denial would be to use self-reported ideology as a predictor, rather than whether policy position consistency. To test the direct effect of political orientation without incorporating policy-level attitudes on science denial, we conducted a mixed-effects regression analysis predicting science denial from results condition (liberal-consistent results vs. conservative-consistent results), political orientation, and their interaction as fixed factors with issue as a random factor. The liberal-consistent results were when the correct interpretation of the results fit more with a liberal preference (e.g., gun bans decreased crime). Likewise, the conservative-consistent results were when the correct interpretation of results fit with a conservative preference (e.g., lenient immigration decreased economic prosperity). This analysis controls for the influence of issue topic, which is treated as a random sample of different possible political topics. Because the skin cream control conditions do not have a liberal or conservative frame, these conditions were dropped from the analysis. Because this analysis did not incorporate attitude consistency, those with uncertain attitudes were included in this analysis, leaving a sample of 1,121 participants.

There was no main effect of political orientation, $B = .01$, $SE = .02$, $p = .36$, 95% CI [−0.02, 0.05], or results condition, $B = -.06$, $SE = .08$, $p = .43$, 95% CI [−0.21, 0.09], on science denial. However, there was an interaction between the two, $B = -.15$, $SE = .03$, $p < .001$, 95% CI [−0.21, −0.09]. Conservatives engaged in greater science denial in the liberal-consistent than conservative-consistent results condition, $B = -.42$, $SE = .11$, $p < .001$, 95% CI [−0.64, −0.20]. However, liberals engaged in greater science denial in the conservative-consistent than liberal-consistent results condition, $B = .30$, $SE = .11$, $p = .005$, 95% CI [0.09, 0.51]. Additionally, the issue topic random factor accounted for less than 1% of the variance, suggesting that the ideologically motivated reasoning effect is consistent across different political topics. In sum, liberals and conservatives were similarly motivated to deny scientific evidence that did not fit with their preferred conclusions for politically relevant topics.

Discussion

The goal of the current study was to test whether science denial is similarly or differentially likely for liberals and conservatives. The results from the current study provide support for the symmetrical ideological motivation hypothesis. We found that both liberals and conservatives were motivated to interpret scientific information in ways consistent with their attitude stances. Additionally, liberals and conservatives were also more likely to deny the scientific credibility of the results when the correct interpretation of the data conflicted with their attitudes (for most issues). These results point to some interesting and important conclusions about the role of political ideology in motivated rejection of science and suggest some fruitful avenues for further exploration, subjects we turn to next.

The Role of Ideology in Motivated Interpretation of Science

As the current research and other recent research (e.g., Kahan et al., 2013; Lewandowsky, Oberauer, & Gignac, 2013; Nyhan & Reifler, 2010) suggest, motivated rejection of scientific information is a strategy employed by people on both sides of the political spectrum, rather than being a dominant tendency of those on the political right.

The current results also shed light on how science acceptance and denial is and possibly should be portrayed in the popular media. Science denial is often construed as an ideological issue that is typically a problem for those on the political right (e.g., conservatives are anticlimate change science). Our data suggest that this conceptualization needs to be clarified. When scientific conclusions conflict with people's ideological stances and attitudes, people on the left and right are motivated

Table 3. Bivariate Correlations Between Political Orientation and Attitude Stance for Each Issue.

Attitude Item	*n*	*r*	*p*
To what extent do you support or oppose . . .			
. . . medical researchers developing new treatments for skin rashes?	186	.051	.487
. . . additional gun control laws?	176	−.572	<.001
. . . laws designed to place restrictions on carbon emissions?	149	−.451	<.001
. . . government investment in nuclear energy?	159	.254	.001
. . . federal regulation allowing same-sex marriage?	160	−.711	<.001
. . . health-care reform mandating that every U.S. citizen have health insurance?	183	−.633	<.001
. . . immigration reform making it easier for undocumented immigrants to attain citizenship in the United States?	156	−.632	<.001

Note. Higher scores on political orientation indicate greater conservatism. Higher scores on each of the attitude items indicate greater support for the issue.

both to perceive the evidence in a way that supports their preferred conclusions or to deny the validity of the findings when provided an interpretation that is inconsistent with their preferred conclusions. Explanations for ideologically motivated reasoning, however, often go beyond simple attitude preferences and instead posit inherent psychological differences (e.g., need for cognition and cognitive closure) between conservatives and liberals as explanations for why there might be ideological differences in science reasoning. Inconsistent with these claims, we did not find moderating effects of political ideology on our motivated reasoning effect. Instead, liberals and conservatives appear to be similarly motivated to deny scientific claims that are inconsistent with their attitudes.

Strengths, Limitations, and Future Directions

A strength of the current research is that we replicated the motivated reasoning findings of Kahan, Peters, Dawson, and Slovic (2013) across several more political issues and extended prior research by exhibiting that people are not only motivated to interpret scientific data as consistent with their prior beliefs, they are also motivated to deny the scientific rigor of research when informed that the data are in fact at odds with their preferred conclusions. Another strength of the current article is that we examined how both policy-level attitudes and political orientation more generally motivated science denial. Although one could argue that the observed correlations between attitude stance and political orientation are substantial enough to warrant only using political orientation to predict science denial (see Table 3 for correlations between political orientation and attitude stance for each issue), attitude–behavior correspondence is stronger when the attitude target and behavior are similarly specified (Ajzen & Fishbein, 1977). Therefore, one's specific policy-level attitude (e.g., opposing carbon taxes) should correspond more with a specific behavior (e.g., climate change science denial) than an attitude-general measure like political orientation.

Moreover, the current research suggests that science denial may not be ideological in nature. Once attitudinal consistency with the proposed scientific evidence is accounted for, predicting whether someone will preferentially interpret science based on their political orientation becomes less reliable. Additionally, relying on one's political orientation as a marker of whether someone will accept scientific information might ignore other, perhaps more basic, motivations like attitude consistency that could be driving these motivated reasoning effects. Future research should try to disentangle the potential separate influences of politically motivated reasoning from attitudes-based motivated reasoning on science denial.

Conclusion

Our results cast new light on previous claims that conservatives are more skeptical of science than liberals (e.g., Mooney, 2012). Ideologically, asymmetrical patterns of science denial do not hold up across different topics of scientific inquiry and do not hold up across politicized and apoliticized contexts. We therefore conclude that psychological differences between conservatives and liberals as explanations for science skepticism have most likely been overstated (see also Skitka & Washburn, 2016). To make strong inferences about the role of political ideology in science reasoning, future research should examine attitude consistency as a separate motivation apart from ideology and examine scientific topics beyond those commonly discussed in the media (e.g., climate change) before making claims about fundamental differences between people who ascribe to different political belief systems.

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Supplemental Material

The supplemental material is available in the online version of the article.

Notes

1. We did not observe any differences in our effects based on sampling source.

2. Because one of our main variables of interest was attitude consistency, we needed participants who indicated some level of support or opposition for the issue. We therefore decided a priori to exclude participants who remained neutral on the issue to which they were assigned.
3. The key question of interest is the impact of participant political orientation on the consistency of the results with participants' preferences for each issue (a three-way interaction). Using Kahan et al.'s (2013) motivated numeracy findings, the most appropriate comparison for power estimation is their logistic regression three-way interaction between participant political orientation, numeracy, and results condition, $B = .54$, $z = 2.17$, $p < .05$, $\text{Exp}(B) = 1.72$. We converted the log odds ratio to η^2 following the procedure outlined in Borenstein, Hedges, Higgins, and Rothstein (2009), which resulted in a comparable effect size of $\eta^2 = .022$. We then used the G*Power program under *F*-test family, ANOVA: fixed effects, special, main effects, and interactions to determine sample size. Based on Kahan et al.'s (2013) results but conservatively rounding down to an effect size of $\eta^2 = .02$, the sample size needed to achieve power of at least .95 is 1,036.
4. Rather than create six dummy codes for our issue variable in multiple regression, we opted to conduct our science denial analysis using an ANCOVA model to analyze our issue variable as a single factor. We were unable to do this for our first analysis because we needed to use logistic regression to account for the dichotomous nature of our motivated interpretation of science-dependent variable.
5. Upon closer examination, the moderating effect of topic on the relationship between strategy–attitude consistency and science denial seems reasonable. Participants should not have had any motivation to defend their attitude regarding the effectiveness of skin creams on treating rashes. Additionally, nuclear power attitudes were the lowest in attitude strength compared to all other issues, $F(1, 1162) = 41.11$, $p < .001$, and participants in the health-care conditions were the least confident of their interpretations compared to the other issue conditions, $F(1, 1162) = 5.37$, $p = .02$. Therefore, the motivation to "fight back" against the correct interpretation for these topics was most likely attenuated compared to the other issues.

References

Ajzen, I., & Fishbein, M. (1977). Attitude–behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin*, *84*, 888–918.

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*, 351–368.

Borenstein, M., Hedges, L. V., Higgins, J. P. T. & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester, UK: John Wiley & Sons.

Brandt, M. J., Reyna, C., Chambers, J. R., Crawford, J. T., & Wetherell, G. (2014). The ideological-conflict hypothesis: Intolerance among both liberals and conservatives. *Current Directions in Psychological Science*, *23*, 27–34.

Chambers, J. R., Schlenker, B. R., & Collisson, B. (2013). Ideology and prejudice: The role of value conflicts. *Psychological Science*, *24*, 140–149.

Charles, V. E., Polis, C. B., Sridhara, S. K., & Blum, R. W. (2008). Abortion and long-term mental health outcomes: A systematic review of the evidence. *Contraception*, *78*, 436–450.

Converse, P. E. (1964). The nature of belief systems in mass publics. In D. Apter (Ed.), *Ideology and discontent* (pp. 206–261). New York, NY: Free Press.

Crawford, J. T., & Pilanski, J. M. (2014). Political intolerance, right and left. *Political Psychology*, *35*, 841–851.

Dunlap, R. (2008). Partisan gap on global warming grows. *Gallup Poll*. Retrieved August 5, 2008, from http://www.gallup.com/poll/107593/Partisan-Gap-Global-Warming-Grows.aspx

Feygina, I., Jost, J. T., & Goldsmith, R. E. (2010). System justification, the denial of global warming, and the possibility of "system-sanctioned change." *Personality and Social Psychology Bulletin*, *36*, 326–338.

Gallup, Poll. (2009, October 30). *Environment*. Retrieved from http://www.gallup.com/poll/107593/partisan-gap-global- warming-grows.aspx

Jost, J. T., Glaser, J., Kruglanski, A. W., & Sulloway, F. (2003). Political conservatism as motivated social cognition. *Psychological Bulletin*, *129*, 339–375.

Jost, J. T., Nosek, B. A., & Gosling, S. D. (2008). Ideology: Its resurgence in social, personality, and political psychology. *Perspectives on Psychological Science*, *3*, 126–136.

Kahan, D. M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*, *8*, 407–424.

Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, *14*, 147–174.

Kahan, D. M., Peters, E., Dawson, E. C., & Slovic, P. (2013). Motivated numeracy and enlightened self-government. *Yale Law School Public Law & Legal Theory, Public Working Paper*, *116*. Retrieved from http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2319992_code45442.pdf?abstractid=2319992&mirid=1

Kirby, D. B. (2008). The impact of abstinence and comprehensive sex and STD/HIV education programs on adolescent sexual behavior. *Sexuality Research & Social Policy*, *5*, 18–27.

Kruglanski, A. W., Webster, D. M., & Klem, A. (1993). Motivated resistance and openness to persuasion in the presence or absence of prior information. *Journal of Personality and Social Psychology*, *65*, 861–876.

Lakatos, I. (1978). *The methodology of scientific research programmes: Philosophical papers* (Vol. *1*). Cambridge, England: Cambridge University Press.

Lewandowsky, S., & Oberauer, K. (2016). Motivated rejection of science. *Current Directions in Psychological Science*, *25*, 217–222.

Lewandowsky, S., Oberauer, K., & Gignac, G. E. (2013). NASA faked the moon landing—Therefore, (climate) science is a hoax: An anatomy of the motivated rejection of science. *Psychological Science*, *24*, 622–633.

Markowitz, E. M., Goldberg, L. R., Ashton, M. C., & Lee, K. (2012). Profiling the "pro-environmental individual": A personality perspective. *Journal of Personality*, *80*, 81–111.

McCrae, R. R. (1996). Social consequences of experiential openness. *Psychological Bulletin*, *120*, 323–337.

McCright, A. M., & Dunlap, R. E. (2011). The politicization of climate change and polarization in the American public's views of

global warming, 2001–2010. *The Sociological Quarterly*, *52*, 155–194.

Mooney, C. (2011, September 30). *Newt Gingrich deceives on stem cell research, mocks evolution*. Retrieved on March 15, 2015, from http://thinkprogress.org/health/2011/09/30/332730/gingrich-deceives-stem-cell-research

Mooney, C. (2012). *The Republican brain: The science of why they deny science—And reality*. Hoboken, NJ: John Wiley & Sons.

Mooney, C. (2014, September 11). Stop pretending that liberals are just as anti-science as conservatives. *Mother Jones*. Retrieved from http://www.motherjones.com/environment/2014/09/left-science-gmo-vaccines

Newport, F. (2012, June 1). *In U.S., 46% hold creationist view of human origins: High religious Americans most likely to believe in creationism*. Retrieved May 12, 2014, from http://www.gallup.com/poll/155003/hold-creationist-view-human-origins.aspx

Nisbet, M. C. (2005). The competition for worldviews: Values, information, and public support for stem cell research. *International Journal of Public Opinion Research*, *17*, 90–112.

Nosek, B. A., Banaji, M. R., & Jost, J. T. (2009). The politics of intergroup attitudes. In J. T. Jost, A. C. Kay, & H. Thorisdottir (Eds.), *The social and psychological bases of ideology and system justification* (pp. 480–506). New York, NY: Oxford University Press.

Nyhan, B., & Reifler, J. (2010). When corrections fail: The persistence of political misperceptions. *Political Behavior*, *32*, 303–330.

Peterson, M. B., Skov, M., Serritzlew, S., & Ramsoy, T. (2013). Motivated reasoning and political parties: Evidence for increased processing in the face of party cues. *Political Behavior*, *35*, 831–854.

Pew Research Center (2012, October 15). *More say there is solid evidence of global warming*. Retrieved from http://www.people-press.org/files/legacy-pdf/10-15-12%20Global%20Warming%20Release.pdf

Pew Research Center (2013, January 24). *Deficit reduction rises on public's agenda for Obama's second term: Public policy priorities, 1994–2013*. Retrieved from http://www.people-press.org/2013/01/24/deficit-reduction-rises-on-publics-agenda-for-obamas-second-term/

Sibley, C. G., & Duckitt, J. (2008). Personality and prejudice: A meta-analysis and theoretical review. *Personality and Social Psychology Review*, *12*, 248–279.

Skitka, L. J., Morgan, G. S., & Wisneski, D. C. (2015). Political orientation and moral conviction: A conservative advantage or an equal opportunity motivator of political engagement? In J. Forgas, K. Fiedler, & W. D. Crano (Eds.), *Social psychology and politics (the 17th Sydney Symposium of Social Psychology)*. New York, NY: Routledge.

Skitka, L. J., & Washburn, A. N. (2016). Are conservatives from Mars and liberals from Venus? Maybe not so much. In P. Valdesolo & J. Graham (Eds.), *Social psychology of political polarization* (pp. 78–101). New York, NY: Routledge.

Stanovich, K. E., & West, R. F. (1998). Who uses base rates and *P*(D|H)? An analysis of individual differences. *Memory & Cognition*, *26*, 161–179.

Tetlock, P. E. (1983). Cognitive style and political ideology. *Journal of Personality and Social Psychology*, *45*, 118–126.

United Nations Educational, Scientific, and Cultural Organization. (2009). *United Nations Decade of Education for Sustainable Development (DESD, 2005-2014). Review of Contexts and Structures for Education for Sustainable Development Learning for a sustainable world*. Paris, France: Author.

Wetherell, G. A., Brandt, M. J., & Reyna, C. (2013). Discrimination across the ideological divide: The role of value violations and abstract values in discrimination by liberals and conservatives. *Social Psychological and Personality Science*, *4*, 658–667.

Zaller, J. (1992). *The nature and origins of mass opinion*. New York, NY: Cambridge University Press.

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