Questionnaire Design Effects in Climate Change Surveys: Implications for the Partisan Divide

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Despite strong agreement among scientists, public opinion surveys reveal wide partisan disagreement on climate issues in the United States. We suggest that this divide may be exaggerated by questionnaire design variables. Following a brief literature review, we report on a national survey experiment involving U.S. Democrats and Republicans (n = 2,041) (fielded August 25–September 5, 2012) that examined the effects of question wording and order on the belief that climate change exists, perceptions of scientific consensus, and support for limiting greenhouse gas emissions. Wording a questionnaire in terms of "global warming" (versus "climate change") reduced Republicans' (but not Democrats') existence beliefs and weakened perceptions of the scientific consensus for both groups. Moreover, "global warming" reduced Republicans' support for limiting greenhouse gases when this question immediately followed personal existence beliefs but not when the scientific consensus question intervened. We highlight the importance of attending to questionnaire design in the analysis of partisan differences.

Keywords: climate change; global warming; question wording; scientific consensus; framing effects; partisan differences; survey experiments

As survey researchers are well aware, even seemingly trivial differences in questionnaire design can dramatically shift the responses obtained, posing formidable challenges for the interpretation of data obtained through self-reports. The large literature on question wording

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effects is rich with instructive examples, as when 48 percent of U.S. respondents oppose "allowing" speeches against democracy while only 21 percent support "forbidding" them (Schuman and Presser 1981).

One area in which the challenge of wording effects is particularly apparent is polling on topics for which no standard terminology exists to represent the issue at hand. This is the case for climate change. Various terms—including "global warming," "climate change," "global climate change," and "the greenhouse effect"—are routinely used in climate surveys in a more or less interchangeable manner, yet scholars have only recently begun documenting the different ways that the general public reacts to these terms (e.g., Greenhill et al. 2013; Schuldt, Konrath, and Schwarz 2011; Villar and Krosnick 2011; Whitmarsh 2009). To date, this work has yielded some complementary as well as seemingly inconsistent results.

We first review the emerging literature on effects of climate terminology, situating it within the interdisciplinary literature on framing effects and drawing out implications for surveys that seek to assess public opinion on climate change. In light of the well-established tendency for Democrats and liberals to report higher levels of belief, concern, and support for addressing climate change than do Republicans and conservatives (Hoffman 2011; McCright and Dunlap 2011; Nisbet and Myers 2007), we consider the role that questionnaire design might play in the apparent partisan divide on this issue. We then present new data from a survey experiment with more than 2,000 Democrats and Republicans in the United States that tested the effects of two common wording variants—"global warming" and "climate change"—on three fundamental beliefs that are routinely polled in climate surveys, namely, whether the phenomenon actually exists, whether scientists agree about its existence, and whether climate-mitigation policies (e.g., a mandatory reduction in CO_2 emissions) deserve support.

Motivating this work are the discrepant wordings of climate surveys and the press coverage they receive. For instance, a Pew Research poll conducted in October 2010 asked 2,251 U.S. adults "…is there solid evidence that the average temperature on Earth has been getting warmer over the past few decades, or not?" and found that Democrats were much more likely than Republicans to endorse this belief (79 percent vs. 38 percent, respectively) (Pew Research Center 2010). Although respondents were not asked about "climate change" per se, press headlines nevertheless evoked the term in their coverage of the survey (e.g., "Big Partisan Gap on Climate Change…") (Marshall 2010), raising

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questions about whether the partisan divide would indeed have been as large if the survey question had asked about "climate change" instead.

Previous Work on Climate Terminology

During the first term of the George W. Bush administration, the political strategist Frank Luntz issued what is now a well-known memo that urged fellow Republicans to mind their words when discussing climate issues. In the memo, Luntz suggested that the administration should emphasize "climate change" rather than "global warming" in its communications, under the assumption that the more frightening connotations of the latter might heighten the public's concern and willingness to address the problem's manmade causes (Burkeman 2003). A decade later, we are better able to judge the wisdom of Luntz's advice, as researchers have begun exploring how the different ways of framing this issue affects environmental beliefs, attitudes, and behavior (e.g., Lakoff 2010; Myers et al. 2012; Nisbet 2009), producing a handful of published studies that explicitly examine citizens' reactions to "global warming," "climate change," and other terms that are used more or less interchangeably in public discourse on climate issues, despite their different technical meanings.[1]

Such studies have a theoretical home in the literature on framing effects that spans political science, sociology, psychology, communication, and related disciplines (Entman 1993). Frames are commonly conceived as embedded communication devices that draw the audience's attention to a subset of relevant considerations at the expense of others (e.g., framing gun control as an individual rights vs. public safety issue), thereby privileging certain ways of thinking and ultimately different preferences and opinions (for an overview, see Chong and Druckman 2007). Similarly, because the varying terms used in climate change surveys highlight different dimensions of the broader issue (e.g., "global warming" highlights one specific aspect of "climate change"), they can be viewed as emphasis frames (Druckman 2001) with the potential to shape apparent public opinion on climate issues.

In this vein, Whitmarsh (2009) surveyed 589 residents in the south of England to assess whether "global warming" and "climate change" evoke different connotations using a series of open- and closed-ended items. The findings highlighted some broad differences, with "global warming" conjuring stronger associations of rising temperatures and human causation and "climate change" evoking stronger associations of more holistic climatic changes and natural causation. For instance, when asked *"What do you know about global warming [climate change]?"* 30.1 percent of respondents in the "global warming" condition indicated an association with *temperature increase* compared to only 16.2 percent in the "climate change" condition.[2] Similarly, both *pollution* (16.3 percent vs. 6.9 percent) and *carbon dioxide* (10.6 percent vs. 4.7 percent)—products of human activity—were endorsed by more respondents in the "global warming" condition.

Although such findings suggest that the different terms employed in climate surveys evoke different interpretations among the public, whether they would appreciably sway public opinion—as Luntz's memo implied—remained unclear. In a study assessing perceptions of problem seriousness, Villar and Krosnick (2011) recruited a large nonrepresentative sample of more than 3,000 American adults from various Internet sources and randomly assigned them to one of three terminology conditions: "global warming," "climate change," or "global climate change." Specifically, respondents were asked, *"If nothing is done to reduce [global warming/climate change/global climate change], how serious of a problem do you think it will be? {Extremely serious, Very serious, Moderately serious, Slightly serious, Not at all serious}."* In addition to the wording manipulation, the researchers counterbalanced the order of the response options, such that some respondents received the above order while others received the reverse order (i.e., *Not at all serious* came first). Although no main effect of terminology on perceived seriousness was observed, Democrats perceived climate change as marginally less serious than global warming, whereas Republicans perceived global warming as marginally less serious than climate change. For its part, the response-order manipulation revealed a significant primacy effect, with greater seriousness ratings observed when the *"Extremely serious"* option came first. In a separate study (published together with the study above), Villar and Krosnick (2011) embedded a global warming/climate change manipulation into a survey of more than 30,000 respondents from European nations who were asked the following open-ended question in face-to-face interviews: *"In your opinion, which of the following do you consider to be the most serious problem currently facing the world as a whole?"* Depending on condition, the first response option was either *global warming* or *climate change*, followed by eight additional choice options (e.g., *international terrorism, poverty*). Respondents also rated the perceived seriousness of their answer choice. Although results showed that significantly more respondents endorsed "climate change" than "global warming," the proportions themselves were substantively about equal (63.5 percent vs. 62.3 percent, respectively) and perceived seriousness varied little across terms, regardless of political orientation.

On the whole, results from Villar and Krosnick (2011) call into question the wisdom of Luntz's suggestion. Overall, global warming and climate change were perceived as equally serious in both their American and European samples. However, their finding that climate change was perceived as somewhat more serious than global warming among Republicans, but vice versa for Democrats, hints that the effects of these terms may vary across political partisans in the United States where climate issues have become highly politicized (e.g., Bernauer 2013; Dunlap and McCright 2008). In this vein, a survey experiment by Schuldt, Konrath, and Schwarz (2011) asked a sample of 2,267 U.S. adults to report their personal existence belief on an item adapted from a previous national poll (ABC News, Stanford University, and *TIME* 2006) that was worded in terms of "global warming" or "climate change," depending on condition (formatting original):

> You may have heard about the idea that the world's temperature may have been *going up* [*changing*] over the past 100 years, a phenomenon sometimes called "*global warming*" ["*climate change*"]. What is your personal opinion regarding whether or not this has been happening? {Definitely **has not been** happening; Probably **has not been** happening; Unsure, but leaning toward it **has not been** happening; Not sure either way; Unsure, but leaning toward **it has been** happening; Probably **has been** happening; Definitely **has been** happening}.

Overall, results revealed less belief in "global warming" than "climate change": whereas 74.0 percent of respondents reported a high level of belief (5 or above) when the questionnaire was worded in terms of climate change, this figure dropped to 67.7 percent on the global warming version. What is notable is that this effect varied significantly across political groups, such that a majority of Republicans reported high belief in "climate change" (60.2 percent), while only a minority reported high belief in "global warming" (44.0 percent). In marked contrast, most Democrats reported high belief regardless of question wording (86.9 percent vs. 86.4 percent, respectively). Stated another way, the apparent partisan divide on personal existence belief fell from 42.9 points under global warming wording to just 26.2 points under climate change wording—a reduction of nearly 40 percent. Practically, these results suggest that the public perception of a large partisan divide may be partly attributable to the fact that many climate surveys ask about "global warming" rather than "climate change" (see Nisbet and Myers [2007] for a review).

Thus, we would suggest that the findings from Villar and Krosnick (2011) and Schuldt, Konrath, and Schwarz (2011) are more compatible than they may at first appear. Both studies cast doubt on Luntz's strategic advice that conservatives should emphasize "climate change" to promote the political Right's pursuit of the status quo in climate policy: in cases where the terms are perceived differently, the data appear to suggest that Republicans are more likely to believe that "climate change" (as opposed to "global warming") exists and to rate it as slightly more serious. We see these patterns as complementary given that, theoretically, judgments about the seriousness of this issue should rest on the belief that it really exists (Krosnick et al. 2006).

In addition to "global warming" and "climate change," Jaskulsky and Besel (2013) examined responses to two additional terms: "climate disruption" and "climate crisis." They randomly assigned 225 undergraduates in the western United States to read a climate change news article that was framed in one of these four ways before soliciting agreement with statements related to the issue's severity (e.g., *"Rising temperatures pose a serious threat to my way of life"*). Results showed that wording influenced a number of beliefs, with "climate disruption" promoting the highest levels of concern and "climate crisis" promoting the lowest ("global warming" and "climate change" typically fell in between). Interestingly, the results revealed little variation across terms on the endorsement of statements related to the scientific consensus (e.g., *"Experts are agreed that there is a problem with rising temperatures"*). However, the researchers note that their small, nonrepresentative sample may limit the generalizability of their findings to the broader American public.

Relating Climate Beliefs to Policy Preferences

As is evident in this review, research into the effects of question wording in climate surveys has explored a number of outcome variables; in each case, there are theoretical and practical reasons for doing so. For instance, models of climate engagement posit that the belief that the problem exists is fundamental to higher-order judgments of problem seriousness, which in turn contribute to the public's willingness to support legislative action to mitigate climate change (e.g., mandatory cuts to greenhouse gas emissions) (Krosnick et al. 2006). In addition, understanding the extent to which public opinion is swayed by different terminology carries practical implications for the design and interpretation of climate polls.

Researchers have recently begun to explore the role that respondents' perceptions of the beliefs held by climate scientists—so-called meta-beliefs—play in the willingness to support broad-scale societal action to mitigate climate change. Analyzing U.S. nationally representative survey data from 2010, Ding et al. (2011) found that respondents who perceived that a majority of scientists agree that global warming is real expressed greater certainty that it is really happening along with more support for climate mitigation policies. In related work, McCright, Dunlap, and Xiao (2013) reported on representative data from 2012 that further demonstrated the relationship between perceiving scientific consensus and support for mitigation policy, a pattern that held for conservatives and liberals alike. In addition to the climate domain, Lewandowsky, Gignac, and Vaughan (2013) found that perceiving scientific consensus on a number of issues (e.g., that smoking causes cancer, that HIV causes AIDS) predicted the acceptance of related scientific propositions and, moreover, that making the scientific consensus salient through a situational manipulation bolstered this tendency.

While these studies compellingly suggest that meta-beliefs about the scientific consensus have important downstream consequences, they simultaneously raise additional questions. First, the questionnaires fielded by both Ding et al. (2011) and McCright, Dunlap, and Xiao (2013) were worded in terms of "global warming," leaving it unclear whether a different pattern would emerge had respondents instead been asked about the consensus on "climate change." Second, given that both personal existence beliefs and perceptions of the scientific consensus have been theorized to mediate support for climate policy, it is possible that the order in which these questions are posed may influence the answers obtained, as suggested by a body of research demonstrating that information rendered cognitively accessible by preceding survey questions can influence subsequent responses (for reviews, see Bless and Schwarz 2010; Schuman and Presser 1981; Tourangeau and Rasinski 1988).

The Study

The study presented here builds on the literature discussed above in a number of ways. First, we tested whether the previously reported effect of "global

warming" versus "climate change" wording on personal existence beliefs (Schuldt, Konrath, and Schwarz 2011) would replicate among a sample of U.S. political partisans surveyed more than three years after the original survey experiment was conducted. Beyond the general value of replication for testing the reliability of the effects, the time period bracketed by the original study and the replication (i.e., 2009 to 2012) was notable because it witnessed fluctuations in public opinion about climate change (e.g., Newport 2010). We also examined whether the "global warming"/"climate change" wording effect would extend beyond personal existence beliefs to influence two additional opinions that are commonly solicited in climate change surveys, namely, perceptions about the scientific consensus and support for legislation to limit greenhouse gas emissions. More formally, we hypothesized:

Hypothesis 1a: Wording survey questions in terms of "global warming" as opposed to "climate change" will shift apparent public opinion, such that beliefs that are more consistent with a skeptical position on climate issues will be observed in response to "global warming" wording.

Hypothesis 1b: The expected effect will be more pronounced among groups that typically report greater climate skepticism, namely, Republicans.

In addition, we explored the role of question order and its possible interaction with question wording on climate beliefs in the national survey context. Numerous studies at the intersection of cognitive psychology and survey methodology demonstrate that preceding questions can sway responses to subsequent questions by affecting the type of information that is brought to mind (e.g., McFarland 1981; for reviews, see Schwarz 1999; Sudman, Bradburn, and Schwarz 1996). In this vein, we explored whether support for curbing greenhouse gas emissions—a policy preference that is frequently polled in climate surveys (e.g., *Washington Post* and ABC News 2010)—might vary depending on whether the preceding question elicited thoughts about one's personal existence beliefs as opposed to those of climate scientists, given that these questions are likely to bring to mind different considerations that impinge upon support for climate mitigation policy (e.g., Republican doubts about the existence of "global warming" in the former case). More formally, we asked:

Research Question 1: Does apparent support for limiting greenhouse gas emissions to reduce "global warming" or "climate change" shift depending on the order in which survey questions are asked?

Method

Participants

Data were collected between August 25 and September 5, 2012, by GfK Knowledge Networks (GfK). Respondents were invited to participate from

TABLE 1
Demographics of Survey Respondents (Unweighted Analytic Sample) (n = 2,041)

Political party identification	
Democrats	47.7 (974)
Republicans	52.3 (1,067)
Political ideology (M [SD])	4.24 (1.52)
Age (M [SD])	50.6 (16.6)
Gender	
Females	51.0 (1,040)
Males	49.0 (1,001)
Highest level of education attained	
Less than high school	7.8 (159)
High school diploma or equivalent	29.3 (599)
Some college	28.3 (577)
Bachelor's degree or higher	34.6 (706)
Race/ethnicity	
White, non-Hispanic	75.6 (1,544)
Black, non-Hispanic	8.5 (173)
Other, non-Hispanic	4.5 (92)
Hispanic	9.2 (187)
2+ races, non-Hispanic	2.2 (45)
Region of residence	
Northeast	18.9 (385)
Midwest	23.3 (476)
South	35.7 (729)
West	22.1 (451)

NOTE: Data are displayed as percentages (ns) except political ideology and age. Political ideology scaled from 1 = *extremely liberal* to 7 = *extremely conservative*.

KnowledgePanel®, GfK's Web-based panel made up of individuals recruited through random-digit dialing and address-based sampling procedures who agree to complete a demographic questionnaire and respond periodically to surveys in exchange for incentive points that are redeemable for cash. Households without Internet access instead receive monthly Internet service and equipment (formerly WebTV, now a laptop) for completing surveys, affording a panel that is representative of the U.S. population.[3] Because our hypotheses and research question focused on political partisans, only panelists who had been previously self-identified as Republican (n = 1,067) or Democrat (n = 974) were invited to participate (see Table 1 for sample demographics).[4] A random sample of 3,070 was invited and 2,401 completed the survey, resulting in a response rate of 78.2 percent (95 percent sampling margin of error = ±2.0 percent).

Procedures

Respondents were randomly assigned to one of four survey versions using a 2 (question wording: "global warming" vs. "climate change") × 2 (question order: personal existence belief, support for climate mitigation policy, perceived scientific consensus vs. personal existence belief, perceived scientific consensus, support for climate mitigation policy) design.[5] The first between-subjects factor examined the effect of question wording on each of the three main outcome variables, whereas the counterbalanced second factor tested whether support for climate mitigation policy varied by question order (i.e., whether this item was asked second and immediately after personal existence belief vs. third and immediately after perceived scientific consensus).

Measures

Personal existence belief. Respondents first indicated their personal existence belief on the item employed by Schuldt, Konrath, and Schwarz (2011) (see above).

Perceived scientific consensus. We solicited perceptions of the scientific consensus with a question adapted from previous national surveys (Newport 2010) and used in recent research highlighting the importance of this meta-belief (Ding et al. 2011; McCright, Dunlap, and Xiao 2013) (alternative wording in brackets; formatting original):

> Just your impression, which one of the following statements do you think is most accurate – most scientists believe that global warming [climate change] is occurring, most scientists believe that global warming [climate change] is NOT occurring, or most scientists are unsure about whether global warming [climate change] is occurring or not?

Support for climate mitigation policy. Participants rated their support for federal legislative action to curb greenhouse gas emissions on the following item adapted from the *Washington Post* and ABC News Poll (2010). Specifically, participants were asked (formatting original):

> Do you think the federal government *should* or *should not* regulate the release of greenhouse gases from sources like power plants, cars and factories in an effort to reduce global warming [climate change]?[6]

Political party identification. GfK's panel measure of political party identification was used to categorize Democrats and Republicans in our sample.[7]

Control variables. Finally, we incorporated a number of demographic variables provided by GfK that have been shown to predict climate beliefs and party identification in previous work, namely, gender, age, educational attainment,

ethnicity, and regional location (Northwest, Midwest, South, and West) (e.g., Hamilton 2010; Krosnick et al. 2006; McCright 2010).

Analytic strategy

For each of the three main outcome variables, we ran a series of regression models to test for independent effects of question wording ("global warming" vs. "climate change"), political identification (Republican vs. Democrat), and their interactive effects. An additional series of models assessed the independent effects of question order and all possible interactive effects in our analysis of support for climate mitigation policy. While GfK uses the aforementioned control variables plus metropolitan area and Internet access to compute statistical weights that adjust for known deviations from U.S. Census data, we analyze the unweighted data given our primary interest in experimental effects among our partisan-restricted sample.

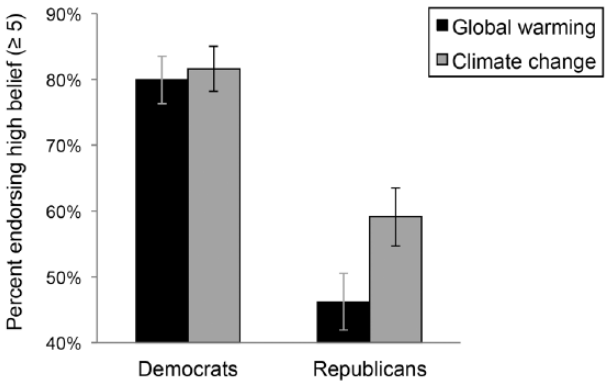
Results

Effect of question wording on personal existence beliefs

To test whether question wording elicited differential levels of personal existence beliefs among this sample of U.S. political partisans, we ran an ordinary least squares (OLS) model regressing this variable (1 to 7 scale, where 7 = *definitely has been happening*) onto question wording condition (0 = "climate change," 1 = "global warming"), controlling for the aforementioned covariates. We then ran a second model testing the overall effect of partisanship (0 = Democrats, 1 = Republicans) on personal existence beliefs regardless of question wording, again controlling for covariates. Finally, we added the question wording by political identification interaction term to the previous model to test whether partisanship moderated the wording effect on personal existence beliefs as expected.

Results from the first model revealed an overall effect of question wording. Compared to the "climate change" questionnaire, the "global warming" version elicited significantly lower personal existence beliefs, $b = -.31$, $t\ (2{,}021) = -4.03$, $p < .001$ ($M_{GW} = 4.92$ vs. $M_{CC} = 5.23$). Whereas 62.0 percent of respondents endorsed a high level of belief (i.e., 5 or above) in "global warming" (i.e., 634 out of 1,023), 69.9 percent endorsed a high level of belief in "climate change" (i.e., 702 out of 1,005). Thus, Hypothesis 1a is supported by the data. The second model revealed that Republicans reported significantly lower personal existence beliefs than did Democrats, $b = -1.24$, $t\ (2{,}021) = -16.18$, $p < .001$ ($M_{\text{Republicans}} = 4.48$ vs. $M_{\text{Democrats}} = 5.72$)—a finding that is consistent with prior work on the partisan nature of climate beliefs.[8] Moreover, the third model revealed a significant interaction between question wording and political identification, $b = -.36$, $t\ (2{,}019) = -2.48$, $p = .01$.[9]

FIGURE 1
Effect of Question Wording ("Global Warming" vs. "Climate Change") on Personal Existence Beliefs, by Political Identification



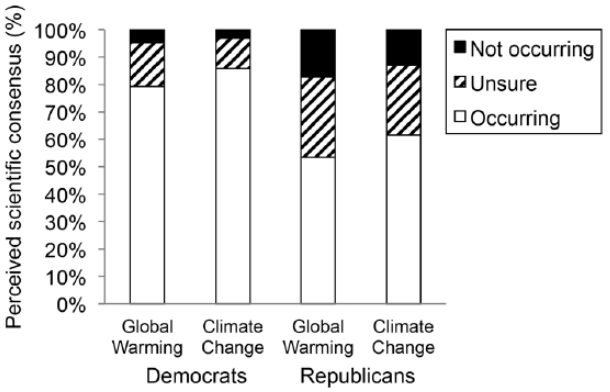
NOTE: Error bars represent 95 percent confidence intervals.

To probe this interaction, we conducted a priori defined planned contrast analyses by using the linear combination of the coefficient ("lincom") command in Stata to compare mean-level existence beliefs in "global warming" versus "climate change" separately for Republicans and Democrats. Results revealed that Republicans expressed significantly lower personal existence beliefs in global warming as compared to climate change (M_{GW} = 4.25, M_{CC} = 4.72), b = –.47, 95 percent confidence interval (CI): –.66 to –.27, t = –4.61, p < .001. In contrast, this wording effect was not observed among Democrats, who showed similarly high mean-level existence beliefs across conditions (M_{GW} = 5.67, M_{CC} = 5.77), b = –.10, 95 percent CI: –.31 to .11, t = –0.97, p = .33. Expressed in percentage terms, whereas a minority of Republicans endorsed high belief in "global warming" (46.2 percent), a majority endorsed high belief in "climate change" (59.1 percent)—an effect that was much smaller and nonsignificant among Democrats (79.9 percent vs. 81.6 percent, respectively) (Figure 1). Thus, Hypothesis 1b is also supported by the data. This interaction pattern replicates our previous wording results (Schuldt, Konrath, and Schwarz 2011) on an independent sample of U.S. partisans collected more than three years later.

Effect of question wording on perceived scientific consensus

Next, to test whether question wording elicited different perceptions of the scientific consensus (three-categorical nominal scale: scientists believe global warming/climate change *is occurring, is NOT occurring*, or *are unsure*), we ran a series of multinomial logistic regression models to estimate the relative likelihood (using relative risk ratio, *RRR*) that respondents would endorse a given nominal response category over another. Results from the first model again revealed an overall effect of question wording such that compared to the "climate change"

FIGURE 2
Effect of Question Wording ("Global Warming" vs. "Climate Change") on Perceived Scientific Consensus, by Political Identification



questionnaire, the "global warming" version elicited a more skeptical response pattern—thus providing further support for Hypothesis 1a. Specifically, the relative likelihood of respondents endorsing the *"is NOT occurring"* option over the *"is occurring"* option was greater in the "global warming" condition (11.5 percent and 65.1 percent, respectively) than in the "climate change" condition (8.1 percent and 73.2 percent, respectively) ($RRR = 1.57$, $p < .01$) (Figure 2). Moreover, the relative likelihood of respondents endorsing the *"unsure"* option over the *"is occurring"* option was greater in the "global warming" condition (23.3 percent and 65.1 percent, respectively) than in the "climate change " condition (18.7 percent vs. 73.2 percent, respectively) ($RRR = 1.40$, $p < .01$).[10] Again consistent with prior work, Republicans were less likely than Democrats to endorse that most scientists believe the phenomenon is real. Specifically, Republicans were relatively more likely to endorse the *"is NOT occurring"* option over the *"is occurring"* option (15.2 percent vs. 57.4 percent, respectively) than were Democrats (3.9 percent vs. 82.6 percent, respectively) ($RRR = 5.61$, $p < .001$). Moreover, Republicans were relatively more likely to endorse the *"unsure"* option over the *"is occurring"* option (27.4 percent vs. 57.4 percent, respectively) than were Democrats (13.5 percent vs. 82.6 percent, respectively) ($RRR = 2.92$, $p < .001$).

Recall that we expected that this wording effect on perceived scientific consensus would be larger among Republicans than among Democrats. Contrary to Hypothesis 1b and in contrast to the pattern observed for personal existence beliefs reported above, the wording effect reported here was not moderated by political identification ($|z|s < .65$).

Effect of question wording and order on climate mitigation support

Our final analysis took the form of multiple logistic regression models in which support for limiting greenhouse gas emissions (two-category nominal scale:

should vs. *should not* regulate) was regressed separately onto question wording condition, question order condition (policy support first vs. scientific consensus first; dummy-coded with policy support first as the referent), and political identification to test for their overall independent effects. Given the exploratory nature of our question order analysis (see Research Question 1), we ran an additional series of logistic regression models to explore the independent effect of each possible interaction term (i.e., all two-way interactions: wording × order, wording × politics, order × politics; and the three-way interaction: wording × order × politics).

Of our three independent variables of interest (question wording, question order, and political identification), only political identification emerged as a significant predictor of support for climate mitigation policy in its logistic regression model. Consistent with the partisan differences noted above, Republicans were less likely to endorse limiting greenhouse gas emissions than were Democrats (OR = 0.20, z = –13.84, p < .001), with 55.4 percent of Republicans but 86.4 percent of Democrats selecting the *"should regulate"* response. Neither question wording nor question order emerged as a significant predictor of policy support overall. Specifically, 69.1 percent of respondents in the "global warming" condition versus 71.9 percent in the "climate change" condition endorsed the *"should regulate"* response (OR = 0.88, z = –1.34, p = .18). Turning to question order, 70.4 percent of respondents endorsed the *"should regulate"* response when the scientific consensus question came first compared to 70.6 percent when the policy support question came first (OR = 0.99, z = –0.09, p = .93). Moreover, none of the two-way interactions emerged as significant (ORs < 1.31, zs < 1.40, ps > .16). Thus, Hypotheses 1a and 1b were not supported.

However, the three-way interaction between question wording, question order, and political identification was significant (OR = 2.41, z = 1.96, p = .05), and we again probed this interaction using the "lincom" command in Stata. Results revealed that when the policy support question came first (i.e., immediately after personal existence belief and before perceived scientific consensus), Republicans were significantly less likely to support reducing greenhouse gas emissions to reduce "global warming" as compared to "climate change" (M_{GW} = 50.8 percent, M_{CC} = 60.6 percent), 95 percent CI: –.18 to –.02, z = –2.31, p < .05. In contrast, this pattern did not emerge among Democrats, who were equally likely to support this policy regardless of question wording (M_{GW} = 85.4 percent, M_{CC} = 86.5 percent), 95 percent CI: –.07 to .10, z = 1.28, p = .20. By comparison, when the scientific consensus question came first, no differences were observed across the question wording conditions, either among Republicans (M_{GW} = 58.9 percent, M_{CC} = 54.2 percent) or Democrats (M_{GW} = 83.5 percent, M_{CC} = 87.3 percent) ($|z|$s < 1.29, ps > .05).[11]

Discussion

It is widely acknowledged that addressing the threats posed by climate change will require a deeper understanding of human psychological processes (e.g.,

Reser and Swim 2011; Stern 1992). National-level surveys are an important tool for illuminating these processes, and past surveys have unveiled numerous factors that predict self-reported climate beliefs, including gender; educational attainment; and, notably, political orientation, which frequently emerges as a robust moderator of climate beliefs and concerns (McCright and Dunlap 2011). Although it is well-established that survey data are prone to shift with questionnaire design variables—including question wording, question order, and response option format—only a handful of published studies speaks directly to these effects in the context of climate change surveys. In addition to reviewing existing studies, our goal here was to describe results from a survey of U.S. political partisans who were randomly assigned to different question wording and order treatments to examine the effect of these questionnaire design variables on routinely polled opinions and beliefs about climate issues (see Druckman and Lupia [2012] for a discussion of survey experiments).

Beyond replicating the familiar partisan pattern wherein climate change existence beliefs and support for policies that address it are more common among Democrats than Republicans, our results reveal that survey responses also depend on whether the questionnaire is worded in terms of "global warming" or "climate change." Specifically, whereas approximately 70 percent of our respondents reported a high level of personal existence belief when asked about "climate change," this figure fell to 62 percent for "global warming." Importantly, an analysis of political identification revealed that Republicans, in particular, were significantly more likely to report higher personal existence beliefs under "climate change" as compared to "global warming" wording (approximately 59 percent vs. 46 percent, respectively). The personal existence beliefs of Democrats, by comparison, were unaffected by this wording treatment (82 percent vs. 80 percent, respectively). These results replicate previously published data (Schuldt, Konrath, and Schwarz 2011) and suggest that the size of the often-discussed political divide on climate issues may be partly due to the way the issue is worded. We see this as an important observation given the lack of a "gold standard" for question wording in climate surveys (Greenhill et al. 2013) and the tendency for some surveys that purport to measure climate change opinions to field questions that are worded in terms of global warming.

Our results also suggest that the global warming/climate change framing effect extends beyond personal existence beliefs to color perceptions of the scientific consensus. Despite the overwhelming agreement among climate scientists that the climate issue presents a real and formidable challenge to human and natural systems worldwide, substantial portions of the public incorrectly believe that the "jury is still out"—a misperception fueled by interest groups that lobby heavily against environmental regulations and by the disproportionate share of media attention allocated to the (minority) opinions of climate deniers (Boykoff and Boykoff 2004; Feldman et al. 2011; Oreskes and Conway 2010; Schlichting 2013). At the same time, recent survey research suggests that these meta-beliefs play an important role in the public's support for climate mitigation policies (Ding et al. 2011; McCright, Dunlap, and Xiao 2013). As our experimental results indicate, these meta-beliefs themselves appear to shift with question wording, such that

survey respondents are more likely to perceive scientific agreement when the issue is referred to as "climate change" rather than "global warming."

Although we observed no overall effect of question wording on support for limiting greenhouse gases, question order moderated the effect of question wording across political partisans. Namely, when support for climate mitigation policy was asked directly after personal existence beliefs, Republicans were less likely to support limiting greenhouse gas emissions to reduce "global warming" as compared to "climate change." In contrast, when the scientific consensus question intervened, this effect was not observed. Although a more definitive explanation awaits, this observation may rest on the ability of preceding questions to activate stored knowledge structures that respondents are consequently more likely to use in forming related judgments. Numerous models of human judgment posit that people rely on heuristics to conserve cognitive effort (e.g., the "cognitive miser" perspective; Fiske and Taylor 1991). In the survey context, an efficient way to conserve cognitive effort is to draw on information rendered accessible in working memory by a preceding question (Strack 1992). Thus, Republicans' greater doubts about the existence of "global warming" (vs. "climate change") may encourage them to report less support for a climate mitigation policy when the questions are asked back-to-back but not when a question about the scientific consensus comes in between. Although it is unclear whether the effect's elimination was caused by the specific nature of the scientific consensus question as opposed to the simple presence of any intervening question, prior research suggests that the public's adherence to the opinions of scientists on politically controversial issues varies across groups (e.g., Brossard and Nisbet 2007) and that perceiving a scientific consensus predicts support for climate mitigation even among those traditionally more skeptical of climate science, such as Republicans (Rolfe-Redding et al. 2011).

We note some limitations of this work. First, we expect the pattern of results reported here, as well as those reported in previous research reviewed above, to be highly context-sensitive and dependent on other seemingly relevant information that comes to mind when respondents are answering survey questions. As with other cognitive frames that guide mental construal, "global warming" and "climate change" likely render different knowledge accessible, which may in turn constrain the extent to which other activated information influences judgments and decision-making (e.g., as when reminders about unseasonable temperatures influence beliefs about "global warming" but not "climate change"; Schuldt and Roh 2014). Therefore, presenting respondents with both frames in close succession (as in within-subjects designs) or asking numerous questions related to climate and environmental issues may produce a different pattern of results than was observed here. Second, our exploratory analysis of the role of question order in support for climate mitigation policy involved multiple statistical tests, and because of the accompanying risk of false positives, we interpret this finding cautiously until it is replicated with independent data. Third, we reiterate that the wording variants examined here—global warming and climate change—are not synonymous but, rather, appear to be used interchangeably in political discourse and survey research despite (or perhaps because of) this fact. Indeed, research

reviewed and presented here suggests that some respondents respond quite differently to these terms, suggesting that survey researchers and those who interpret survey data are wise to bear in mind that this wording matters.

Overall, this work underscores the influence of seemingly mundane questionnaire design considerations in shaping apparent American public opinion on climate change. We end by noting practical implications for those drawing inferences from climate survey data. Many national surveys purporting to measure partisans' beliefs about climate change employ questions that are worded in terms of global warming—a less trivial detail than it may at first appear. Similarly, our results suggest that the well-known political divide that those surveys demonstrate may partly derive from question wording, given our finding that the pronounced partisan gap on "global warming" gives way to a broader consensus when the questionnaire instead asks about "climate change."

Notes

1. "Global warming" and "climate change" refer to technically different but related phenomena, with the former referring to increases in average global surface temperatures and the latter encompassing a host of climate-related changes to ecosystems worldwide (see Environmental Protection Agency 2014). Much of the work reviewed here examines possible wording effects not from the standpoint of equivalent meaning but rather equivalent usage.

2. For nonexperimental data revealing a similar pattern, see an earlier study comparing "global warming" image associations in the U.S. to "climate change" image associations in the UK (Lorenzoni et al. 2006).

3. See http://www.knowledgenetworks.com for more information.

4. GfK's standard measure of political party identification ("XPARTY7") was used for identifying Republicans and Democrats, where 1 = *Strong Republican*, 2 = *Not Strong Republican*, 3 = *Leans Republican*, 4 = *Undecided/Independent/Other*, 5 = *Leans Democrat*, 6 = *Not Strong Democrat*, and 7 = *Strong Democrat*. Panelists choosing option 4 were not invited to participate to maximize the number of political partisans in the sample. Our analysis collapses across categories 1–3 ("Republicans") and 5–7 ("Democrats").

5. Personal existence belief was always asked first to provide maximum statistical power for the replication test of the Schuldt, Konrath, and Schwarz (2011) findings. We also explored the possible role of self-affirmation in self-reported climate beliefs by having participants first rank-order a list of values by their importance to the self (affirmation treatment) or someone else (control) (Sherman, Nelson, and Steele 2000). No effect emerged, and we collapse this variable in our analysis.

6. A follow-up question assessed attitude strength for this item ("Do you think that way *very strongly* or *somewhat strongly*?"). We analyze only the *should/should not* response as a binary measure of policy support.

7. See note 2.

8. Political ideology (1 = *extremely liberal* to 7 = *extremely conservative*, analyzed as a three-category nominal variable: liberal, moderate, conservative) generally revealed a similar effect pattern as party identification. Compared to liberals, conservatives reported lower personal existence beliefs, were less likely to perceive that scientists agree the phenomenon is occurring, and were less likely to support limiting greenhouse gas emissions ($ps < .001$). The interaction between question wording and political ideology was also significant, with conservatives, in particular, reporting less belief in "global warming" as compared to "climate change" ($b = -.48$, $t = -2.64$, $p < .01$).

9. Educational attainment and race also emerged as significant predictors of personal existence beliefs, with greater belief among those with at least some college education (combined referent group: less than high school or completed high school) and white respondents (combined referent group: nonwhites) ($ts > 3.00$, $ps < .01$).

10. Some covariates also emerged as significant predictors in these models. Respondents with at least some college education were relatively less likely to endorse the *"is NOT occurring"* or *"unsure"* option over the *"is occurring"* response; the same pattern was observed for white (as compared to nonwhite) respondents. Age was also significant, such that younger respondents were relatively less likely to endorse the *"unsure"* option over either of the other options (*RRR*s ≥ 0.52, $|z|$s ≥ 2.10, ps $< .05$).

11. Race/ethnicity also emerged as a significant predictor of support for regulating greenhouse gas emissions in the full model, with greater support among white as compared to nonwhite respondents (*OR* $= 1.34$, $z = 2.17$, $p < .05$).

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