When Science and Ideology Collide: Explaining Public Doubts about Global Warming and Evolution

Michael Tesler
Brown University

Abstract:

This article examines public skepticism about global warming and evolution. The results indicate that conservatives doubt the existence of global warming in large part because of elite rhetoric, but that evolution beliefs are unrelated to reception of political discourse. News reception is perhaps the strongest predictor of conservatives' climate change skepticism, but has no influence on their aversion to evolution. Moreover, politically attentive conservatives were actually more likely to believe scientists about global warming than liberals were in the 1990s before the media depicted climate change as a partisan issue. The United States is also the only nation where news reception significantly predicts conservatives' skepticism about climate change. Finally, evidence from a nationally representative survey experiment shows that Americans would be less skeptical about manmade global warming if more Republicans in congress believed in it, but a growing congressional consensus about evolution would not diminish doubts about that scientific issue.

"I believe in evolution and trust scientists on global warming. Call me crazy."
- Jon Huntsman, Republican Presidential Candidate, August 2011[1]

"The key to bridging ideological differences," according to John Zaller's groundbreaking account of public opinion (1992, 321) "appears to be the existence of a body of conventional scientific knowledge…This knowledge is apparently sufficiently well developed and routinized that it can lead its users to accept conclusions they are predisposed against." There is certainly evidence to support that contention too. Zaller, for instance, notes that elites of all predispositions generally accepted the social scientific consensus about the lack of biological differences between the races that emerged in the 1930s. Likewise, elite rhetoric about gays and lesbians by politicians of both parties and the news media changed rather dramatically after the American Psychiatric Association altered its earlier stance in 1974 to declare that homosexuality was not rooted in mental illness (Zaller 316-319).

Such scientific consensuses should have a *mainstream effect* on public opinion (Zaller 1992, 98-100). That is, politically sophisticated citizens of all predispositions will be more likely to endorse the position because they are most aware of the prevailing conventional wisdom. In keeping with this contention, Figure 1 shows that education was positively associated with both white Americans' beliefs in biological equality between the races way back in 1944 and in rejecting the notion that homosexuality was an illness in a 1998 public opinion poll.[2] Perhaps more importantly, the display discloses that better educated respondents of all

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[1] For more see: Blake, Aaron, "Jon Huntsman believes in evolution and global warming, so can he win a Republican primary?" *Washington Post*, August 18, 2011.

[2] This 1998 Washington Post/Kaiser/Harvard opinion poll is the only one in the entire ipoll databank that asked if homosexuality is a disease or illness.

predispositions were more likely to embrace the scientific viewpoint than their less educated counterparts.[3]

We might expect mass opinion about global warming and evolution to follow the same mainstream pattern. After all, the scholarly conventional wisdom on these issues is probably just as strong as it was for biological equality between the races in the 1940s and homosexuality in the 1970s. The leading scientists commissioned by the Intergovernmental Panel on Climate Change concluded with over 90 percent certainty in 2007 that global warming is caused by burning fossil fuels; and the American Anthropological Association reached a similar agreement in 2000 about the evolutionary origins of human beings. The scholarly consensuses for evolution and global warming were further on display in a 2009 Pew poll of more than 2,500 scientists. That survey found that 97% and 84% of scientists thought humans have evolved overtime and that global warming is *mostly* caused by human activities respectively (Pew Research Center 2009).

Yet, despite the abundance of evidence in support of evolution and anthropogenic climate change, Figure 2 depicts a much different pattern of public endorsement for these positions than the mainstream effects produced for scientific issues in Figure 1. In fact, the display illustrates Zaller's *polarization effect*, especially for climate change opinions, whereby liberals and conservatives become increasingly divided as they acquire more information (Zaller 1992, 100-102). The four panels in Figure 2 all show that the small differences in global warming and evolution beliefs between liberals and conservatives who did not graduate high school became

[3] Region is used here as a general proxy for more conservative racial predispositions. The same mainstream pattern holds when splitting the sample up between individuals who supported Roosevelt in the 1940 presidential election and those who preferred the Republican, Wilkie.

substantially larger with educational attainment. So much so that the best educated liberals and conservatives are divided by as much as 60 percentage points in their beliefs about both evolution and anthropogenic global warming.

These large ideological differences among the most sophisticated segments of the population are ironic and somewhat perplexing. For if, as Zaller suggests and Figure 1 further confirms, scientific knowledge "can lead its users to accept conclusions they are predisposed against" then why does ideology trump science so decisively for mass conservative opinions about global warming and evolution? The results presented below strongly suggest that conservatives doubt the existence of global warming in large part because of elite rhetoric, but that evolution beliefs are unrelated to reception of political discourse. Instead, skepticism about evolution is largely a function of deeply held religious beliefs that just so happen to be correlated with ideology. Before presenting these findings, though, I first turn my attention to some plausible explanations for why ideology now trumps science for global warming and evolution opinions when other scientific consensuses had previously bridged the ideological divide.

Theoretical Background and Empirical Expectations

There is a rapidly growing literature explaining public opinion about global warming. Psychological inquiries, of course, focus on individual-level explanations for global warming skepticism. Feygina et al. (2010) posit that system justification—the motivational tendency to defend and justify the societal status quo—is a leading cause of global warming denial. Kahan et al (2011), similarly situate global warming opinions within a larger "cultural cognition of risk," whereby individuals form perceptions of risk that are congenial to their values. Risk perception and underlying values have been put forth as causes of climate change skepticism by other scholars as well (Leiserowitz 2006; Weber 2006; Whitmarsh 2011). And several additional

studies convincingly demonstrate the importance of weather fluctuations in public opinion about climate change (Donner and McDaniels 2013; Krosnick et al. 2006; Hamilton and Klein 2009).

While not discounting the importance of any of these factors in shaping global warming attitudes, public opinion about this scientific issue seems to be especially ripe for political elites to influence mass opinion. For starters, liberal and conservative elites have become increasingly divided over global warming in the last decade (McRight and Dunlap 2011). Polls of congressional members by the National Journal in 2006 and 2007, in fact, found that 97% of congressional Democrats believe it is a proven fact that the earth is warming because of human activity compared to just 18% of Republicans.[4] Moreover, the content analysis presented in Figure 3 shows that the media increasingly covered climate change as a partisan issue during the past decade. Far more televised news stories in the 1990s mentioned science than mentioned political parties. Figure 3, however, shows that both the number of global warming stories and the ratio of party to science mentions within them increased dramatically since 2005. The sharp divide between partisan political elites, along with the media's expanding coverage of global warming as a partisan issue, stands in stark contrast to the aforementioned scientific consensuses that politicians of all ideological persuasions and the news media tended to accept.

When partisan elites are so divided over an issue—especially about a relatively new and complex one like climate change—the mass public should follow their lead (Zaller 2013; Tesler 2011). Students of public opinion have long argued that a substantial majority of Americans are uninformed about politics and lack well-developed political belief systems. Instead, responses to survey questions about public policy are largely informed by cues that citizens take from groups and politicians who share their values (Converse 1964; Sniderman, Brody, Tetlock 1991; Zaller

[4] "Congressional Insider Poll Results." http://syndication.nationaljournal.com/images/203Insiderspoll_NJlogo.pdf

1992; Lupia 1994). Public opinion about foreign policy, stem cell research, social security privatization, health care reform, top-bracket tax increases, and extending the children's health insurance program are among the many issues that became more polarized by party and ideology after Democratic and Republican elites took dissimilar positions (Zaller 1992/1994; Berinksy 2007/2009; Levendusky 2009; Lenz 2012; Kriner and Reeves 2012; Tesler 2011).

Consistent with those previous findings, recent studies have documented a growing partisan divide in public opinion about global warming since political elites have moved farther apart on this issue (Guber 2013; McCright and Dunlap 2011; Gallup 2010/2011). Perhaps more importantly, some of these studies also uncovered a significant interaction between ideology/partisanship and education in public opinion about global warming (Hamilton 2011; Malka et al. 2009; McCright and Dunlap 2011). Those results, which are strikingly similar to the findings presented back in Figure 2, certainly suggest that partisan elites are playing an important part in global warming opinions. After all, education is one of the best proxies for attentiveness to elite political discourse (Price and Zaller 1993; Zaller 1996). However, there is simply no way of knowing whether the effects of education were actually caused by reception of partisan discourse or something else. One possibility is that well-educated conservatives are particularly skeptical of global warming, not because they follow elite political discourse, but because they are aware of how a new regulatory regime to curb climate change runs counter to their ideology.

The first hypotheses in this study are therefore designed to more precisely test how reception of elite political discourse influences global warming opinions. If, as Zaller (1992) suggests, politically attentive Americans "respond to new issues mainly on the basis of the partisanship and ideology of the elite source of the message," then we should expect liberals' and conservatives' global warming opinions to increasingly diverge with news reception, even after

controlling for education and a number of other relevant factors. Or put more formally, reception of elite political discourse should be positively correlated with global warming skepticism among conservatives and negatively correlated among liberals (H1).

For reasons just mentioned, though, those correlations are not proof positive that partisan elites are playing an important part in public opinion formation. Yet, if H1's contention that reception of elite rhetoric is the main reason why politically attentive liberals and conservatives are so divided in their global warming opinions is correct, then we would expect different results in places and times where/when elites are not so divided over this issue as they currently are in the United States. Our second hypothesis, then, is that conservative ideology will be a significantly stronger predictor of global warming skepticism in the United States than in the rest of the world where political elites are more unified in their climate change positions[5] (H2). Moreover, we would expect news reception to be a stronger predictor of liberals' belief in and conservatives' skepticism of global warming in the USA than in the rest of the world (H3).

Of course, it could still be possible that American conservative elites are suspicious of manmade global warming because their most politically attentive constituents are climate change skeptics rather than vice versa. That seems unlikely since the mass public tends to follow elites rather than lead them, especially on new and complex issues like climate change (Zaller 1992; Lenz 2012; Tesler 2011; Tesler and Zaller 2013; Zaller 2013). Still, it is important to rule out

[5] In 2008, for instance, the European Parliament passed a climate change package to ensure the European Union will achieve its climate targets in 2020 with nearly unanimous support (635 in favor to 25 opposed). Moreover, the United States is one of the only four UN countries who are not parties to the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

this alternative hypothesis by assessing the interactive effects of news reception on global warming opinions before elites became so sharply divided about climate change science in the United States. If, as the prior hypotheses suggest, reception of elite discourse is responsible for the unique polarization pattern in the United States, then we would expect different results in the 1990s when climate change was covered more as a scientific then a partisan issue. More specifically, we should expect the growing overtime ideological divide in global warming opinions to be most pronounced among well-informed liberals and conservatives who are most likely to receive their elites' increasingly disparate messages on this issue (H4). Finally, if elite rhetoric is influencing global warming opinions, then experimentally assigning respondents a mainstream message, in which more Democratic and Republican members of congress agree about the causes of climate change, should reduce Americans' global warming doubts (H5).

There is much less prior research on evolution opinions from which to derive our expectations. It is particularly informative, though, that one of the only empirical explorations of this topic found a markedly different pattern for overtime trends in evolution opinions than the recent changes in public doubts about climate change. Public opinion about climate change, as alluded to earlier, has noticeably shifted since the dawn of the twenty-first century. The last decade witnessed a sharp decline, especially among conservatives, in beliefs about the existence of global warming, its seriousness, and the role of humans in causing it (Gallup 2010/2011). Public opinion about climate change also varies considerably based upon question wording (Schuldt et al. 2011), changes in local temperatures (Donner and McDaniels 2013), and public discourse (Krosnick et al. 2000). In stark contrast to that volatility in climate change opinions, Plutzer and Berkman (2008, 544) find the basic pattern in public responses to a number of different questions about evolution "is remarkably stable over the span of a quarter century."

Also unlike global warming opinions, where mass ideological polarization increased considerably during the Bush and Obama presidencies, liberals and conservatives have remained consistently divided in their beliefs about evolution over the past two decades.[6]

There are several plausible explanations for why evolution attitudes are more stable than global warming opinions. First, evolution has been hotly contested for almost a century. The public's familiarity with this issue should necessarily lead to more stable opinions. Second, Americans oftentimes get their information about global warming and evolution from different sources. A 2006 Pew Poll revealed that 83% of respondents get most of their information about global warming from television, magazines, and newspapers, compared to 52% who get most of their information about the origins of life on this planet from those three sources.[7] The fact that a plurality of those respondents received most of their evolution information from school should also make these opinions more resistant to change. Finally, and perhaps most importantly, the longstanding debate about evolution has primarily been motivated by religious considerations like bible literalism (Ruse 2005; Lienesch 2007). Not surprisingly, then, church attendance and fundamentalist identification are among the most important predictors of evolution beliefs in the few published studies on this topic (Putnam and Campbell 2010; Berkman and Plutzer 2009). Mass policy positions that are strongly rooted in religious predispositions (e.g. abortion) tend to

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[6] The percentage of liberals and conservatives who believed human beings developed from earlier species of animals when this question first appeared in the pooled 1993-1994 General Social Survey was nearly identical to the percentages when this item reappeared in the pooled 2006-2010 GSS (roughly 60 to 35 percent).

[7] Survey by Pew Internet & American Life Project, January 9- February 6, 2006. Percentages accessed from ipoll databank.

be unusually stable at the individual level (Converse and Markus 1979; Sears and Levy 2003), and less influenced by elite discourse than other issues (Lenz 2012; Tesler 2011; Layman and Carsey 2002; Zaller 2013). That individual-level stability also surely contributes to the impressive aggregate stability in evolution beliefs observed over the last two decades.

All of these factors that have made evolution beliefs so stable also make it less likely that reception of elite political discourse is responsible for the ideological divisions in public opinion about human origins. Indeed, stable attitudes should necessarily be less susceptible to elite influence. Or put more formally, news reception should be much less of a factor in conservatives' skepticism of evolution than it is in their suspicion of global warming (H6). Instead, we should expect religious considerations, such as thinking the bible is the actual word of god, to be the dominant predictor of disbelief in evolution (H7). Finally, if evolution opinions are unrelated to elite political discourse reception, then experimentally assigning respondents a mainstream message, in which more Democratic and Republican members of congress agree about human origins, *should not* reduce Americans' skepticism about that scientific issue (H8).

Method

Data

This study utilizes cross-sectional surveys, cross-national data, and an original survey experiment to test these hypotheses. The first test examines the determinants of liberals' and conservatives' beliefs about both global warming and evolution in the 2008-2009 American National Election Study (ANES) Panel Survey. More specifically, I test how reception of elite discourse influences public opinion about these issues. The results from the 2008-2009 ANES are then replicated in two massive surveys—the 2007-2008 Pew Religious Public Landscape Survey (n = 35,957) and the December 2011 Cooperative Campaign Analysis Project's baseline

survey (CCAP, n = 46,000; Jackman et al. 2012)—which ask about evolution and global warming respectively and contain the exact same measure of news reception in both surveys.

Yet, as discussed in the prior section, concluding that elite rhetoric is responsible for any significant relationships between news reception and public doubts about the existence and causes of climate change could still be problematic. Indeed, we have no way of knowing for certain whether those relationships were caused by reception of elite rhetoric or some other factor. The next section of the paper, therefore, leverages three unique sources of variation in elite discourse about global warming to help unpack the role of political elites in public opinion about climate change. The first test employs data from both the 2005-2008 World Values Survey (WVS) and three Pew Global Attitudes Project surveys conducted annually between 2007 and 2009 to determine if, as H2 suggests, ideology is a stronger predictor of global warming opinions in the United States than in countries where elites are more unified about the existence of anthropogenic climate change; the WVS is also employed to test H3's expectation that attentiveness to elite discourse is a stronger predictor of liberals' belief in and conservatives' skepticism of global warming in the United States than other countries. I then use repeated cross-sectional surveys to test H4's expectation that the growing overtime ideological divide in global warming opinions was most pronounced among well-informed liberals and conservatives who are most likely to receive their ideological elites' increasingly different messages about climate change science. Those data are not quite ideal because the late 1990s survey was conducted by Gallup and the pooled late 2000s surveys were conducted by Pew. However, these surveys are the only publically available data that ask the same global warming question in both the late 1990s and more than ten years later.

Finally, I fielded a nationally representative survey experiment on more than 2,000 respondents with the internet polling firm, YouGov, in October 2010 to test H5 and H8's expectations about how providing respondents with a mainstream message about global warming and evolution affected public opinion about these two issues. The mainstream treatment was designed to be subtle, as it merely told respondents that "more Democrats and Republicans in congress than ever before now believe that global warming is mostly caused by human activity, but some people still think global warming is mostly caused by natural changes in the earth's climate." Similarly, the evolution mainstream treatment told the same individuals that "more Democrats and Republicans in congress than ever before now believe that human beings evolved over time, but some people still think humans have existed in their present form since the beginning of time." As a result, many respondents might correctly know that the vast majority of congressional Republicans remained skeptical of manmade climate change. The experiment is, therefore, a conservative test of elite influence.

Reception of Elite Discourse

Following Zaller (1992; 1994; 1996; Price and Zaller 1993), I use political awareness as a proxy for attentiveness to news and elite discourse. Several measures of political awareness have been effectively utilized in prior inquiries into elite influence on mass opinion, including factual political knowledge (Zaller 1992/1996; Berinsky 2007/2009; Jacobson 2007), education (Zaller 1994; Zaller and Hunt 1995), and political interest (Berinksy 2007/2009). These analyses operate under the assumption that the most politically sophisticated segments of the population are especially likely to receive and accept messages from their fellow partisans.

I use interest in politics and public affairs as my focal measure of news attentiveness and reception of elite discourse because of its availability in nearly all of the aforementioned surveys.

The 2008-2009 ANES has a reliable (alpha = .76) 3-item, political interest scale comprised of the following three questions: 1) How interested are you in information about what's going on in government and politics? 2) During a typical week, how many days do you talk about politics with family or friends? 3) How interested are you in politics? The Pew religious landscape, the CCAP, and the WVS all have single-item measures, which asked how much interest their respondents have in news/public affairs (Pew and CCAP) or politics (WVS).

Control Variables

The regression models include several other variables to help isolate the effects of news attentiveness and elite discourse reception from other factors. Perhaps most importantly, I control for educational attainment to parse out whether the interactive effects between education and ideology on global warming and evolution opinions displayed back in Figure 2 resulted from reception of elite discourse or something else correlated with educational attainment. Since a plurality of Americans get most of their information about evolution from school it is especially important to isolate formal education from political attentiveness in our analyses. It is also important to include religious variables since prior research suggests they play a major role in public opinion about both evolution (Putnam and Campblell 2010; Burkman and Pultzer 2009) and environmental issues (Guth et al. 1995). As a result, all of the multiple regression models include measures of either bible literalism or religious service attendance. Finally, several other factors including party identification and standard demographics are included as controls.

Determinants of Mass Ideological Opinion about Global Warming and Evolution

If, as expected, reception of elite discourse influences liberals' and conservatives' climate change opinions, then at a minimum we should see political interest associated with thinking global warming is real and manmade for liberals and thinking that is fake or naturally occurring

among conservatives. Our first test of that hypothesis examines the interactive relationships between ideology, political interest and opinions about global warming in the 2008-2009 ANES Panel. The top two displays in Figure 4 graph out the interactive effects of ideology and political interest on a four-category question asking respondents whether global warming is nonexistent, naturally occurring, mostly manmade (Panel 1) or both natural and manmade (Panel 2). Consistent with expectations, political interest is strongly associated with liberals' belief in, and conservatives' skepticism about, global warming. After controlling for party identification, bible literalism, education, and other demographics, the most politically interested liberals were 60 percentage points more likely to think humans contribute to global warming than their least interested counterparts. Meanwhile, the same change in political interest was associated with a 30 point decrease in thinking human beings are a cause of the earth's rising temperatures among conservatives.

The effect of political interest on conservatives' global warming skepticism was even stronger on a question in the May 2008 ANES wave, which asked how strongly respondents agreed with the statement, "There is not enough scientific evidence to support claims that the Earth is getting warmer." As can be seen in the third panel of Figure 4, moving from lowest to highest in political interest increased warming skepticism by 40 percent of the 10-point agreement scale's range, even after controlling for party identification, bible literalism, education, and other demographics. Moreover, the coefficients in Table 1 suggests that none of those other factors in the model consistently predicted liberals' beliefs in, and conservatives' skepticism of, global warming as powerfully as political interest in these ANES surveys.

The story is much different for public opinion about evolution. The final panel of Figure 4, in fact, shows that there was virtually no interaction between ideology and political interest in

evolution beliefs among the same ANES respondents. Instead, the final columns of Table 1 suggest that bible literalism was the dominant predictor of evolution skepticism among both liberals and conservatives. So much so, in fact, that a change from thinking the bible is a book of fables to thinking it is the word of god increased evolution skepticism by 55 percent of the 10 point scale's range among liberals and 64 percent among conservatives.

All told, then, the results presented in Figure 3 and Table handsomely support H1, H6, and H7. Reception of elite discourse, as measured by political interest, is perhaps the strongest predictor of liberals' belief in, and conservatives' skepticism of, global warming. Evolution beliefs, however, are mostly unrelated to reception of elite discourse. Instead, opinions about the origins of human life are largely informed by religious considerations.

Those conclusions are based on some pretty small split-sample surveys, though. There were only about 200 liberals, for instance, in the May 2008 ANES analyses. It is quite fortunate, then, that we can attempt to replicate those results in two massive surveys, both of which interviewed over 35,000 respondents. Reassuringly, the results from those two supersized surveys, which are graphically displayed in Figure 5, produced almost the exact same patterns as the ones uncovered in the ANES.

The first panel of that display once again shows that political awareness was a powerful predictor of liberals' belief in, and conservatives' skepticism of, anthropogenic climate change in the CCAP. All else being equal, moving from low to high interest in news and public affairs increased liberals' belief in anthropogenic climate change by roughly 30 percentage points raised conservative disbelief by 25 points. Those significant effects were substantially larger when replacing interest in public affairs with factual political knowledge—a measure that is consistently the best proxy for news attentiveness and reception of elite discourse (Zaller 1992;

Price and Zaller 1993; Zaller 1996). Indeed, the least knowledgeable liberals and conservatives had virtually identical global warming opinions whereas the most informed liberals and conservatives were separated by a whopping 80 percentage points after controlling for our base model variables (see Figure A1 in the appendix). Moreover, no other factor predicted liberals' belief in and conservatives' skepticism of anthropogenic climate change nearly as powerfully as our proxies for news attentiveness and reception of elite discourse in the CCAP (see Table A1).

The results, however, are once again much different for mass opinions about evolution. Much like the findings presented in Figure 4, the second panel of Figure 5 shows hardly any interactive effects between political interest and ideology in evolution opinions. Also like our prior ANES results, bible literalism was the by far the dominant predictor of evolution beliefs among both liberal and conservative respondents in Pew's sizable Religious Landscape Survey (see Table A1).

Taken together, then, the results from the ANES, CCAP, and Pew surveys all suggest that reception of elite discourse is the primary reason why liberals and conservatives are so divided in their global warming opinions but that political attentiveness does not significantly contribute to the strong ideological divide in public attitudes about evolution.

Variation in Elite Discourse on Climate Change and its Effect on Mass Opinion

As mentioned earlier, there is still no way of knowing for certain whether the patterns produced in Figures 4 and 5 were caused by reception of elite discourse or another factor. The following sections therefore leverage variation in elite discourse on climate change to help determine if, as expected, changes in the prevalence of partisan cues affect the influence of political awareness on global warming opinions.

Cross-National Variation

The first source of variation in elite discourse exploits the fact that partisan elites in the United States are far more divided over climate change than they are in any other country. If those elite divisions are responsible for the interactive effects of political interest and ideology on global warming shown in Figures 4 and 5, then we would *not* expect those same patterns to produce themselves in other countries (H2 and H3).

Consistent with that expectation, Figure 6 shows that the effect of conservative ideology on global warming skepticism is consistently much stronger in the United States than it is in any other country. That display graphs out the relationship between ideology and climate change opinions for every country in the 2005-2008 WVS asked about global warming's seriousness and in three surveys conducted from 2006 to 2009 by the Pew Global attitudes project. All four of these surveys indicate that the most liberal Americans are about 60 percentage points more likely to say global warming is a very serious problem than their most conservative counterparts. Moreover, this ideology effect in the United States was twice as large as it was in any other country—differences in effects that were highly significant in all four surveys, as indicated by the non-overlapping confidence intervals in Figure 6.

If, as expected, the larger effects of ideology in the United States were produced by reception of elite discourse, then we should also expect a stronger interactive effect between ideology and political interest among Americans than among individuals in any other country. Consistent with that expectation, Figure 7 shows that the United States is the only country in the WVS where political interest was positively associated with *both* liberal belief in, and conservative skepticism, of global warming. Politically interested liberals, for instance, were about 20 percentage points more likely to say global warming is a very serious problem than

their less interested fellow partisans, while politically attentive conservatives were roughly 20 percentage points less likely to think global warming is a very serious problem than their least interested ideological counterparts.

The ideological underpinnings of global warming opinion are, therefore, quite different in the USA than they are in the rest of the world—a difference likely caused by the fact that American ideological elites are more divided over this issue than they are in other countries.

Over-Time Variation in the United States

It is still possible, however, that liberal and conservative elites in the United States are more divided over climate change because their most informed constituents are so polarized. That is, well-informed mass opinion may be leading rather than following ideological elites' position taking. That alternative hypothesis, as stated earlier, seems unlikely since the mass electorate tends to follow rather than lead on matters of public policy, especially on complicated issues like climate change. Nevertheless, it is important to rule out this rival explanation. One way to determine whether masses are leading or following elites is to assess how reception of elite discourse influences public opinion before and after partisan/ideological elites take increasing similar or divergent issue stances—a method effectively employed by Berinsky 2007/2009 and Zaller 1992/1994 to gauge elite influence on public opinion about World War II, Vietnam, and the Gulf War. Much the way that those prior studies exploited changes in elite partisan discourse about war and peace, we can leverage the increasingly partisan nature of the global warming debate (e.g. Figure 3) to determine if well-informed liberals and conservatives polarized in response to that shift in elite discourse (H4).

Figure 8 tests that expectation. Unfortunately, the 1997 Gallup and 2007-2009 pooled Pew surveys did not include political interest, so education is used here instead as a proxy for

attentiveness to elite discourse. The patterns in the display are unmistakable, nonetheless. Back in 1997—a year in which Figure 3 showed the ratio of science to party mentions in televised news stories about climate change was especially high—there was actually a modest mainstream pattern, whereby *both* liberals and conservatives were increasingly likely to say scientists agreed that global warming is manmade as they acquired more information. In fact, well-educated conservatives were even more likely than liberals to believe climate change science. After more than a decade of ideological debates over global warming science, though, the second panel of the display reveals a sharp polarization pattern in public opinion. As can be seen, college-educated liberals and conservatives were now divided by more than 50 percentage points in their beliefs about climate change science, with the best informed conservatives being most skeptical.

These results, therefore, support H4's contention that the growing overtime ideological divided in global warming opinions should be most pronounced among news attentive liberals and conservatives who are most likely to receive their elites' increasingly disparate messages about the veracity of global warming science.

Experimental Variation

Our final source of variation in elite discourse examines whether treating respondents with mainstream messages about global warming and evolution affected their opinions about these scientific issues, particularly among conservatives. As described above, that experiment randomly informed half of the sample that more Democrats and Republicans in congress than ever before now believe in both anthropogenic climate change and evolution. The experiment, therefore, tests the expectations put forth in H5 and H8 that treating respondents with a mainstream message should reduce public doubts about global warming, but not evolution.

The results in Table 2 are mostly consistent with those expectations. There was a modest, but statistically significant (p =.02), decrease in global warming skepticism among those who received the treatment. Respondents in the treatment group were about 5 points less skeptical of manmade climate change after controlling for the variables in Table 3. There was a larger, but more marginally significant, treatment effect of 8 points among conservatives (p=.08); yet, this larger treatment effect for conservatives was not significantly stronger than it was for non-conservatives. Consistent with H8's expectations, the treatment had no discernible effects on public opinion about evolution for either the full sample or conservatives. While those results certainly support this paper's main expectations that elite political discourse is a main reason for public doubts about climate change but not evolution, it is important to once again note that the global warming treatment effect was not significantly stronger than the evolution treatment.

The coefficients on interest and church attendance in the third and fourth column of Table 2 also support the paper's main hypothesis that elite discourse is a powerful determinant of opinions about global warming, but not evolution. We again see that news interest is the dominant predictor of global warming skepticism among conservatives, but has no influence whatsoever on their suspicion of evolution; meanwhile, religious service attendance is easily the strongest predictor of evolution skepticism among conservatives but has no influence on their suspicions about global warming.

Conclusion

As the epigraph that introduced this article indicates, evolution and global warming skepticism are often lumped together. In reality, though, public doubts about these two scientific issues have very different foundations, with distinct political implications. Conservatives are particularly skeptical of evolution in large part because they disproportionately believe that the

bible is the actual word of god and should be taken literally.[8] Political factors such as party identification and attentiveness to elite discourse have virtually no influence of their aversion to evolution. It appears, then, that ideology trumps science for conservatives on this issue because the scientific consensus about evolution challenges deeply held religious teachings. As a result, these views should remain difficult for political debates to change.

Global warming beliefs are entirely different, though. Unlike evolution, reception of elite discourse is the dominant reason for the ideological divided in climate change opinions. In fact, conservatives' views about global warming unequivocally fit Zaller's (1992, 313-314) definition of elite domination—"elites inducing the public to hold attitudes it would not hold if fully informed." Despite the fact that elite influence on public opinion is so pervasive, Zaller (1992, 314) concluded that elite domination is exceedingly rare because even if citizens "devoted their whole lives to investigating the given policy problem, they would not reach conclusions." Most conservatives, however, would surely reach a different conclusion about anthropogenic climate change if they devoted their whole lives to studying it; after all, scientists who spend such time studying climate change are highly confident about its existence. It appears, then, that ideology can trump science when ideological elites refuse to accept scientific consensuses.

That conclusion paints a much more ominous picture of elite influence than prior accounts. In the past, ideological elites were constrained by scientific facts, as Zaller noted back in 1992. Now, however, Zaller (2013) astutely observes, "science-minded elites are not the principal initiators of new partisan policies; interest groups, political intellectuals, and perhaps

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[8] Conservatives were three times more likely than liberals to say the bible is the actual word of god (37% to 12%) in the 2008-2009 ANES, and four times less likely than liberals to say the bible is a book of fables (10% to 42%).

even ambitious politicians are more important actors (Layman et al. 2010; Bawn et al., 2012; Noel, 2013; Karol, 2009). The dynamics of public opinion formation may still be top-down, but science-minded elites are not the top." That passage perfectly summarizes public opinion about global warming. For as this study showed, mass opinion about climate change is largely top-down, but ideological interests rather than science minded elites are the top.

Those results suggest that ideological elites—both conservative and liberal—can effectively dominate public opinion if and when scientific facts prove to be inconvenient to their interests. They also suggest that it will be impossible to mobilize public opinion in an effort to curb the earth's rising temperatures, so long as ideological elites continue to cast doubts about climate change science.

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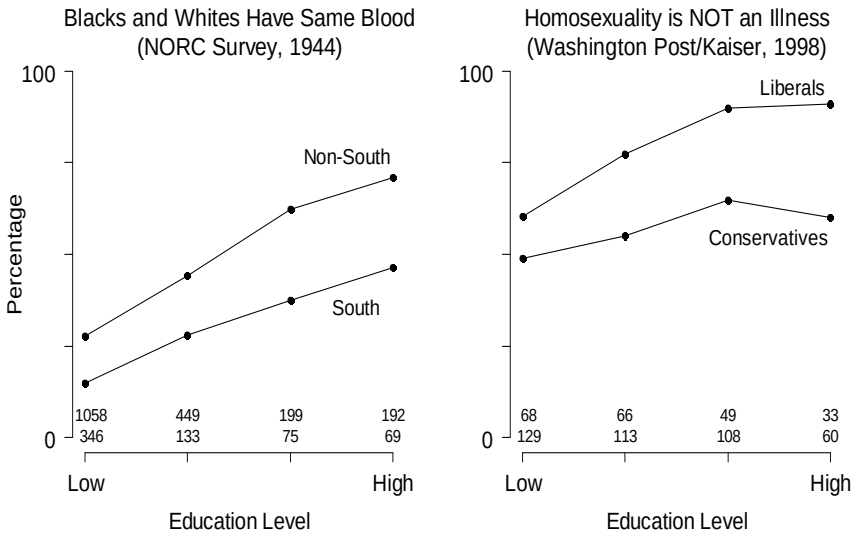


Figure 1: Belief in Biological Equality between the Races and that Homosexuality is Not an Illness by Ideology and Education. Numbers at the bottom of the display represent the amount of respondents in each cell, with liberals/non-southerners on top and conservatives/southerners on the bottom. *Source*: NORC, May 1944; Washington Post/Kaiser/Harvard, August 1998. Data accessed from Roper Archives.

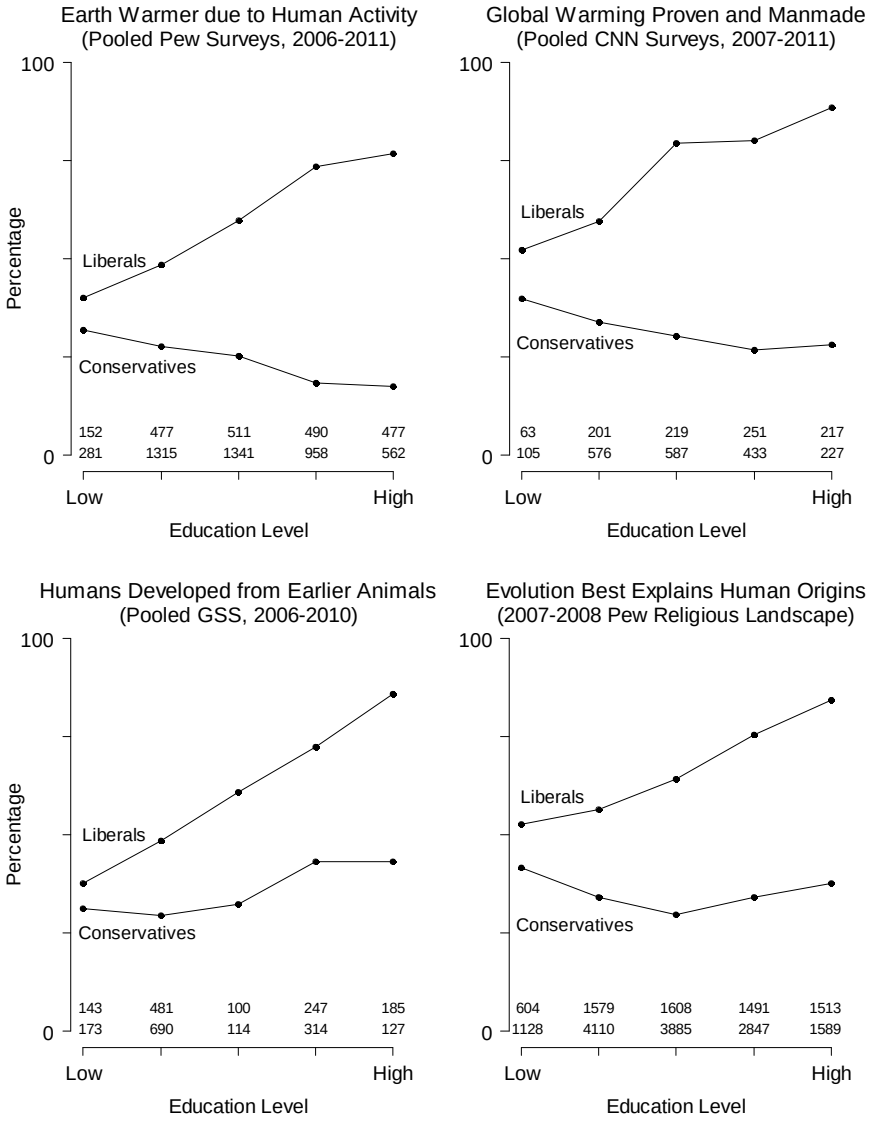


Figure 2: Global Warming and Evolution Opinions by Ideology and Education. Numbers at the bottom of the display represent the amount of respondents in each cell, with liberals on top and conservatives on the bottom. Source: Pooled Pew Surveys: June 2006, July 2006, January 2007, April 2008, April-May 2009, September-October 2009, October 2010, February/March 2011 (accessed from Roper Archives). Pooled CNN Surveys: January 2007, May 2007, October 2007, June 2008, December 2009, September 2011 (accessed from Roper Archives). Pew Religious Landscape Survey 2007-2008. GSS 2006, 2008, 2010.

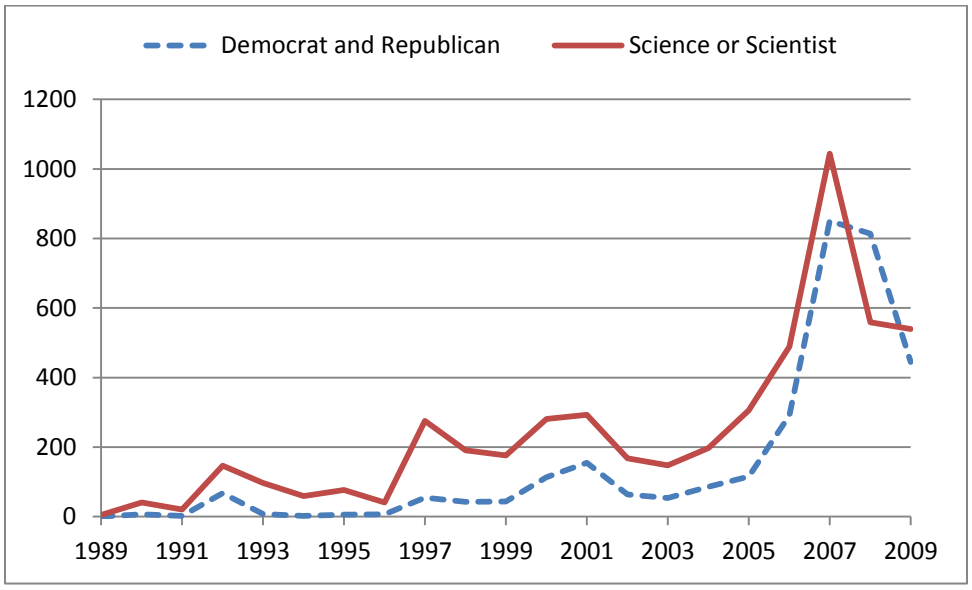


Figure 3: Televised Global Warming Stories that Contain the Words "Democrat and Republican," and/or "Science/Scientist" (1989-2009). Source: Lexis Nexus Transcripts from ABC, CBS, NBC and CNN

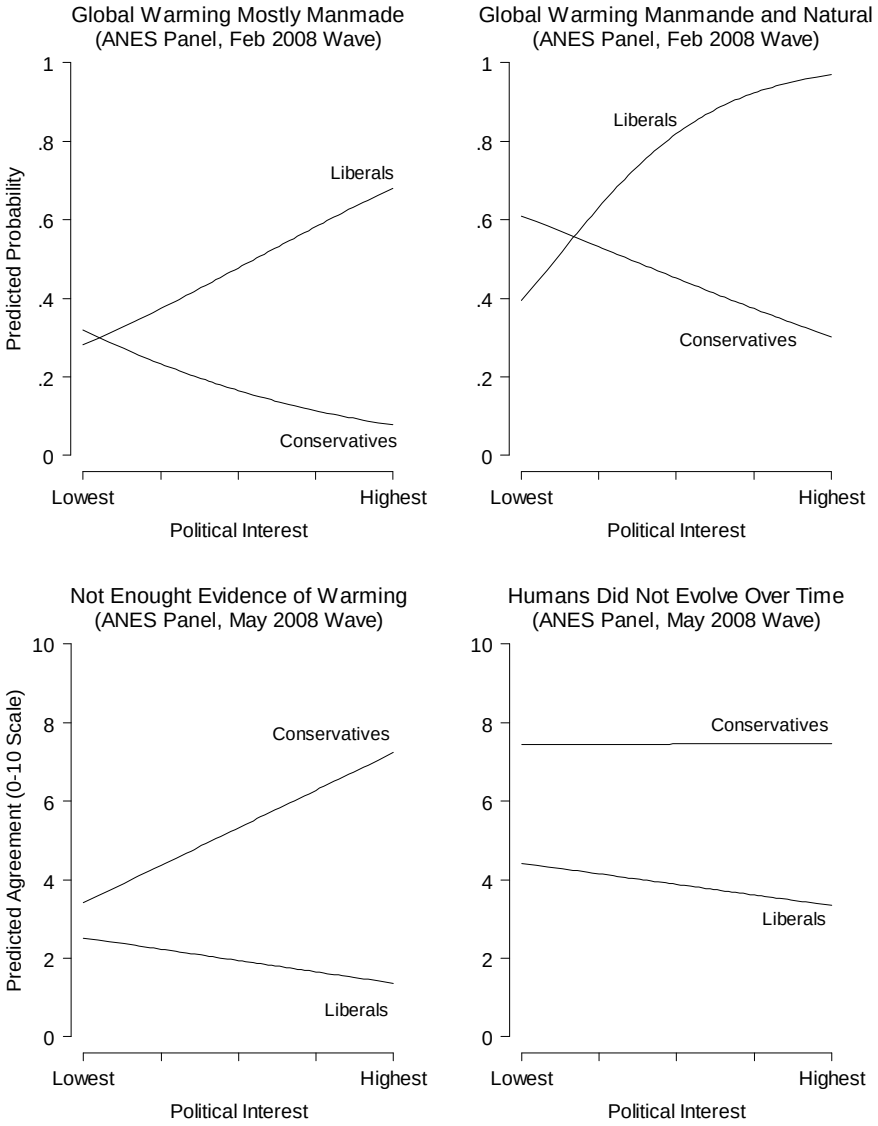


Figure 4: Global Warming and Evolution Opinions as a Function of Ideology and Political Interest. Predicted values based on coefficients in Table 1; predicted values were calculated by setting to education, Republican, Democrat, religious service attendance, bible literalism, black, Latino, age, gender, and marital status to the mean conservative and liberal in the respective analyses. *Source:* 2008-2009 ANES Panel.

Table 1 (Logit,Panels 1&2; OLS, Panels 3&4): Predictors of Global Warming and Evolution Opinions.

	Fig 4: Panel 1		**Fig 4: Panel 2**		**Fig 4: Panel 3**		**Fig 4: Panel 4**	
	Lib	Con	Lib	Con	Lib	Con	Lib	Con
Political Interest	1.70	-1.72	3.88	-1.28	-1.15	3.83	-1.07	.018
	(.616)	(.628)	(.885)	(.473)	(.973)	(.877)	(1.03)	(.765)
Bible Literalism	-.575	-1.20	-.663	-.793	.291	1.06	5.48	6.38
	(.428)	(.420)	(.530)	(.322)	(.657)	(.568)	(.700)	(.510)
Education	.983	-.290	1.38	.039	-1.94	.257	-5.08	-1.27
	(.503)	(.492)	(.655)	(.383)	(.803)	(.727)	(.859)	(.629)
Democrat	.375	.697	-.299	.514	-.527	-1.23	.553	.086
	(.302)	(.310)	(.413)	(.345)	(.454)	(.646)	(.488)	(.595)
Republican	-2.11	-.700	-1.50	-.869	1.22	.898	.024	.292
	(.804)	(.310)	(.644)	(.241)	(1.12)	(.438)	(1.06)	(.395)
Age	-.008	.010	.007	.008	.016	.020	-.012	.005
	(.009)	(.009)	(.012)	(.007)	(.014)	(.014)	(.015)	(.012)
Male	.250	-.412	-.259	-.607	-.040	.487	-1.17	-.650
	(.280)	(.262)	(.368)	(.204)	(.404)	(.362)	(.440)	(.327)
Black	-.709	-.928	-.898	-.829	1.01	.646	2.73	-.268
	(.458)	(.725)	(.521)	(.554)	(.928)	(1.13)	(.836)	(.893)
Latino	-.274	.063	-.214	.911	1.11	-.622	1.19	.747
	(.500)	(.564)	(.631)	(.461)	(.657)	(.856)	(.836)	(.754)
Married	-.421	-.594	-.432	-.256	.377	.883	.667	-.093
	(.272)	(.270)	(.358)	(.226)	(.402)	(.431)	(.438)	(.381)
Observations	297	502	297	502	187	319	202	372

Note: Dependent Variable in Panel 1 is coded as a dummy, taking on a value of 1 (warming is mostly manmade) or 0 (all other answers); dependent variable in Panel 2 is coded as a dummy, taking on a value of 1 (warming is either mostly manmade or manmade and natural) or 0 (all other answers); dependent variable in Panel 3 is coded from 0 (completely disagree that there is not enough evidence for global warming to 10 (completely agree); dependent variable in Panel 4 is coded from 0 (completely disagree that humans did not evolve over time to 10 (completely agree). All explanatory variables (except actual age) are coded from 0-1, with 1 being the highest value. *Source:* 2008-2009 ANES Panel

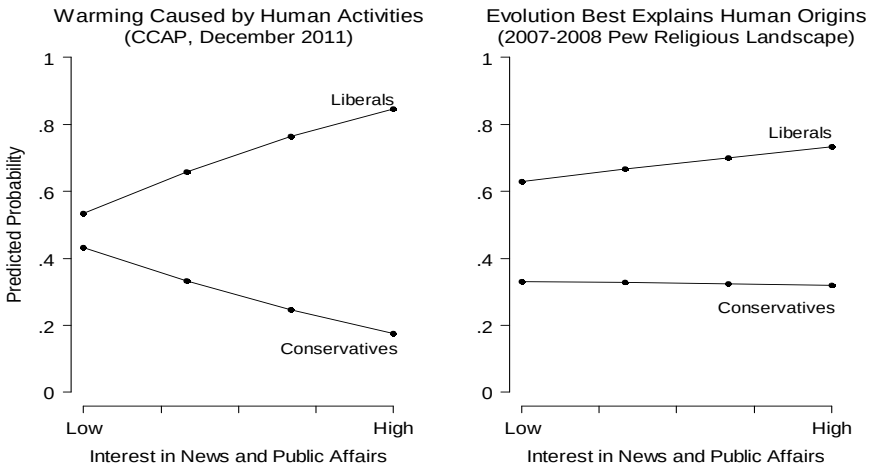
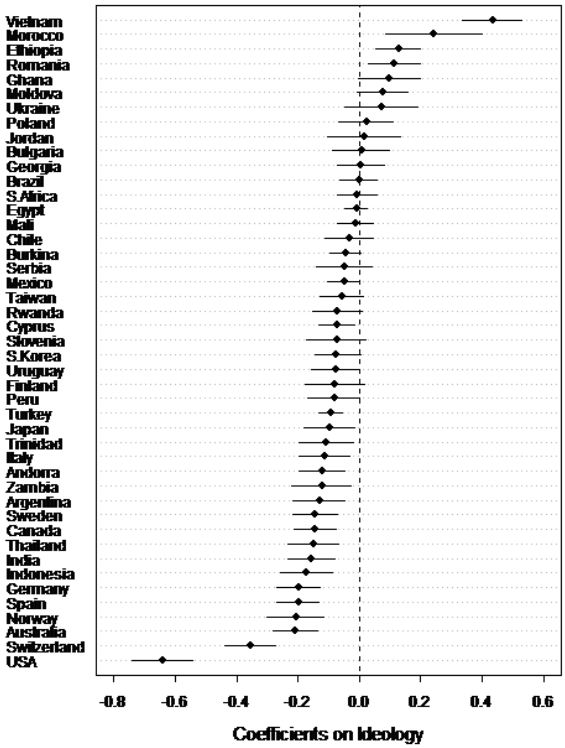


Figure 5: Global Warming and Evolution Opinions as a Function of Ideology and Interest in News and Public Affairs. Predicted probabilities based on logistic regression coefficients in Table A1. Probabilities were by setting education, Republican, Democrat, religious service attendance (panel 1), bible literalism (panel 2), black, Latino, age, gender, and marital status to the mean conservative and liberal in the respective analyses.

World Values Survey (2005-2008)



Pew Global Attitudes Project (2007-2009)

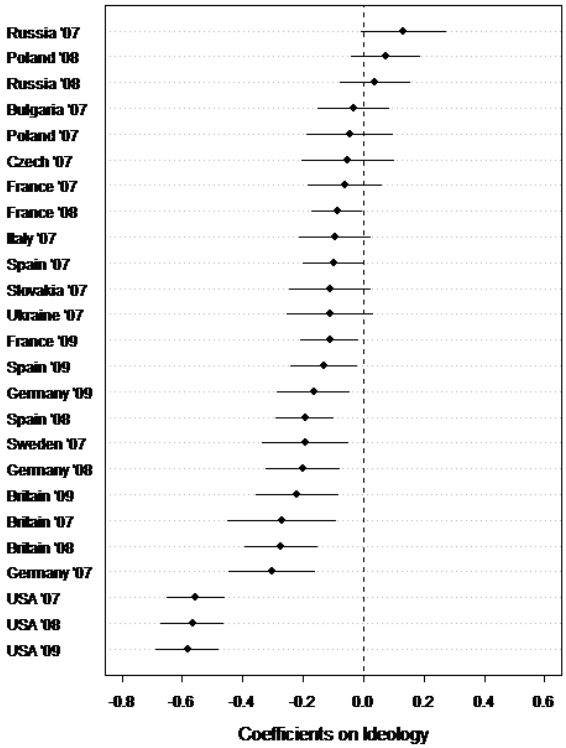


Figure 6: Impact of Ideology on Perceptions of how Serious a Problem is Global Warming (1 = Very Serious; .5 = Somewhat Serious; 0 = Not too/Not at all Serious). Points plot the unstandardized OLS coefficients on ideology with 95 percent confidence bands. Ideology in the World Values Survey is a 10 category variable recoded from 0 (far left) to 1 (far right). In the Pew Global Attitudes surveys, ideology is a 6 category variable recoded from 0 (far left) to 1 (far right) for the European countries, and a 5 category variable recoded from 0 (very liberal) to 1 (very conservative) for US respondents; respondents who cannot place themselves ideologically are recoded as .5 in all surveys.

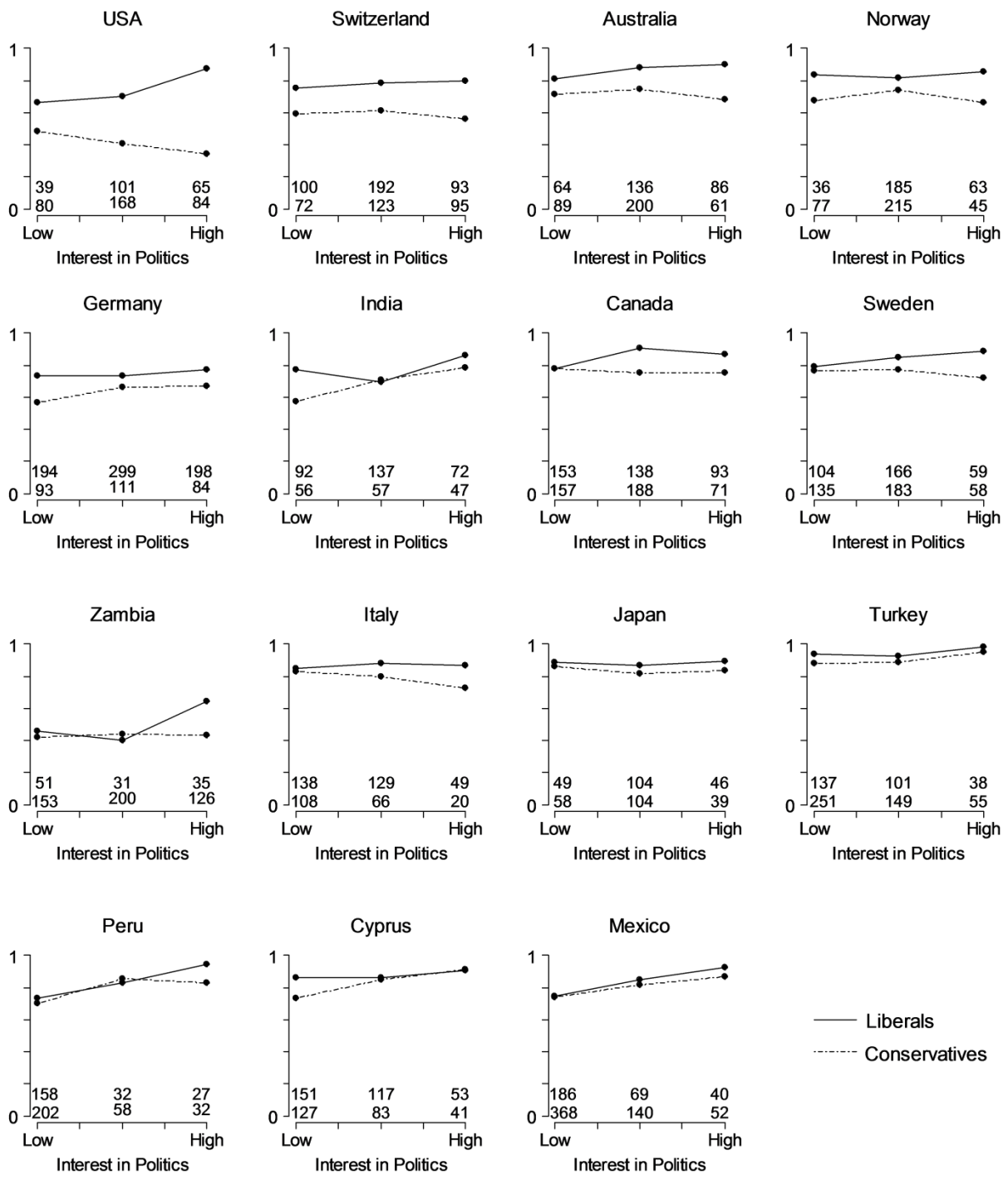


Figure7: Mean Perceptions of How Serious a Problem is Global Warming by Country, Ideological Self-Placement and Interest in Politics. The numbers at the bottom of the panel represent the respondents in each cell, with the upper numbers for liberals and the lower numbers for conservatives. Countries are ordered by the magnitude of their negative ideology coefficients in Figure 6 for countries with at least 30 respondents in each cell. *Source*: World Values 2005-2008.

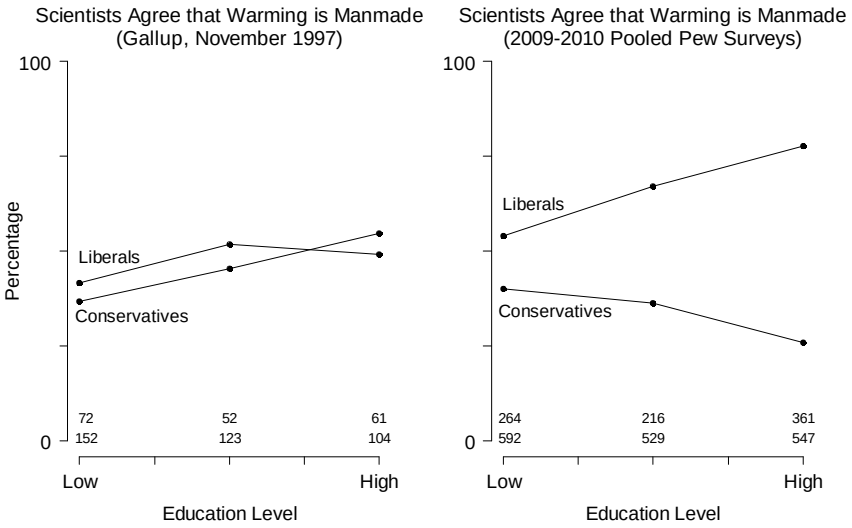


Figure 8: Global Warming Opinions by Ideology and Education. Numbers at the bottom of the display represent the amount of respondents in each cell, with liberals on top and conservatives on the bottom. *Source*: Gallup Poll, November 1997; Pooled Pew Surveys, April-May 2009, October 2010. Data Accessed from Roper Center Archives.

Table 2 (Logistic Regression): Predictors of Global Warming and Evolution Skepticism

	Full Sample		Conservatives	
	Warming Skepticism	Evolution Skepticism	Warming Skepticism	Evolution Skepticism
Treatment	-.251	-.054	-.349	-.094
	(.110)	(.110)	(.196)	(.169)
Liberal	-1.28	-.704		
	(.200)	(.191)		
Conservative	1.46	.747		
	(.133)	(.141)		
Democrat	-.858	-.266	-.949	-.262
	(.142)	(.149)	(.343)	(.339)
Republican	.514	.189	.171	-.037
	(.145)	(.147)	(.221)	(.191)
Male	.160	-.349	.309	-.244
	(.114)	(.115)	(.198)	(.173)
Education	-.329	-2.01	.728	-2.24
	(.226)	(.239)	(.413)	(.367)
Birth Year	-.009	-.001	-.015	.007
	(.004)	(.004)	(.007)	(.006)
Church Attendance	.194	2.30	-.137	2.59
	(.173)	(.174)	(.289)	(.272)
Political Interest	.747	-.189	2.01	-.005
	(.216)	(.216)	(.397)	(.387)
Observations	2048	2048	700	700

Note: Global Warming Skepticism is coded as a dummy, taking on a value of 1 (do not think warming is manmade) or 0 (all other responses); Evolution skepticism is also coded as a dummy, taking on a value of 1 (do not think human beings evolved over time or 0 (all other responses). All explanatory variables are coded from 0 to 1, with 1 taking on the highest value. *Source:* YouGov Survey, October 2010.

Supplementary Appendix

Explanatory Variables

Age: Actual age.

Bible Literalism (ANES): A three-category variable recoded from 0 (Bible is book of fables) to 1 (Bible is word of God).

Bible Literalism (Pew): A two-category variable recoded from 0 (Bible is book of fables) to 1 (Bible is word of God).

Black: An indicator variable taking on a value of 1 (African-American) or 0 (non-black).

Church Attendance: A six category variable, recoded from 0 (never) to 1 (more than once a week).

Conservative: An indicator variable taking on a value of 1 (identify as conservative or somewhat conservative) or 0 (all other responses).

Democrat: An indicator variable taking on a value of 1 (identify as a Democrat) or 0 (all other responses).

Education (three category): A three-category variable recoded from 0 (high school grad or less) to 1 (college grad or higher).

Education (five category): A five-category variable recoded from 0 (high school dropout) to 1 (post-graduate studies).

Liberal: An indicator variable taking on a value of 1 (identify as liberal or somewhat liberal) or 0 (all other responses).

Latino: An indicator variable taking on a value of 1 (non-white Latino) or 0 (non-Latino)

Male: An indicator variable taking on a value of 1 (male) or 0 (female).

Married: An indicator variable taking on a value of 1 (married) or 0 (not married).

News/Public Affairs Interest: A four category variable, from 0 (hardly at all) to 1 (most of the time).

Political Interest (ANES): An additive index recoded from 0 (low) to 1 (high). The scale was constructed from the following three items: 1) How interested are you in information about what's going on in government and politics? 2) During a typical week, how many days do you talk about politics with family or friends? 3) How interested are you in politics?

Political Interest (WVS): A three-category variable, recoded from 0 (not at all/not very interested) to 1(very interested).

Political Knowledge: An additive index recoded from 0 (low) to high (1). The scale was constructed from 9 correct/incorrect factual questions.

Republican: An indicator variable taking on a value of 1 (identify as a Republican) or 0 (all other responses).

Dependent Variables (in order of appearance)

Biological Equality between the Races: An indicator variable taking on a value of 1 (blacks and whites have same blood) or 0 (all other responses).

Homosexuality is Not a Disease: An indicator variable taking on a value of 1 (homosexuality is not a physical or mental illness) or 0 (all other responses).

Evolution (Pew): An indicator variable taking on a value of 1 (completely/somewhat agree that evolution best explains human origins) or 0 (all other responses).

Evolution (GSS): An indicator variable taking on a value of 1 (true that humans developed from earlier species) or 0 (all other responses).

Evolution (ANES): A ten category variable coded from 0 (completely disagree that humans did not evolve over time) to 10 (completely agree).

Evolution (YouGov): An indicator variable taking on a value of 1 (humans did not evolve over time) or 0 (all other responses).

Global Warming (Pew): An indicator variable taking on a value of 1 (warming caused by human activity) or 0 (all other responses).

Global Warming (CNN): An indicator variable taking on a value of 1 (global warming proven and manmade) or 0 (all other responses).

Global Warming (ANES [1]): An indicator variable taking on a value of 1 (global warming mostly manmade) or 0 (all other responses).

Global Warming (ANES [2]): An indicator variable taking on a value of 1 (global warming mostly manmade or manmade and natural) or 0 (all other responses).

Global Warming (ANES [3]): A ten category variable coded from 0 (completely disagree that there is not enough evidence for global warming) to 10 (completely agree).

Global Warming (CCAP): An indicator variable taking on a value of 1 (warming caused by human activities) or 0 (all other responses).

Global Warming (WVS/Pew Global Attitudes): A three category variable recoded from 0 (global warming is not too/not at all serious) to 1 (very serious).

Global Warming (Gallup/Pew): An indicator variable taking on a value of 1 (scientists agree that warming is manmade) or 0 (all other responses).

Global Warming (YouGov): An indicator variable taking on a value of 1 (global warming is manmade) or 0 (all other responses).

Table A1 (Logistic Regression): Predictors of Global Warming and Evolution Opinions in Massive-N Surveys.

	CCAP Warming [1]		CCAP Warming [2]		Pew Evolution	
	Lib	Con	Lib	Con	Lib	Con
News/Public Affairs Interest	1.28	-1.15			.475	-.054
	(.093)	(.078)			(.103)	(.078)
Political Knowledge			1.73	-2.29		
			(.098)	(.083)		
Bible Literalism					-1.78	-2.04
					(.084)	(.059)
Church Attendance	-.642	-.152	-.500	-.167		
	(.083)	(.061)	(.084)	(.062)		
Education	1.52	-.249	1.24	.157	.848	-.082
	(.105)	(.088)	(.108)	(.091)	(.106)	(.074)
Democrat	.519	.847	.525	.671	.056	.377
	(.058)	(.068)	(.058)	(.069)	(.063)	(.058)
Republican	-.288	-.265	-.223	-.220	-.046	-.354
	(.146)	(.047)	(.145)	(.048)	(.123)	(.046)
Age	-.005	-.004	-.005	-.004	-.003	-.004
	(.002)	(.001)	(.002)	(.001)	(.002)	(.001)
Male	.295	-.472	.184	-.239	.284	.304
	(.055)	(.042)	(.056)	(.044)	(.060)	(.040)
Black	-.417	.161	-.374	.144	-.662	.287
	(.070)	(.084)	(.071)	(.085)	(.090)	(.078)
Latino	-.166	.444	-.248	.350	.383	.705
	(.082)	(.072)	(.082)	(.074)	(.096)	(.075)
Married	-.019	-.369	-.010	-.315	.003	-.222
	(.052)	(.043)	(.053)	(.044)	(.060)	(.042)
Observations	10,301	14,904	10,302	14,909	6,632	13,253

Note: Dependent Variable in the CCAP is coded as a dummy, taking on a value of 1 (global warming is caused by human activities) or 0 (all other answers); dependent variable in the Pew Religious Landscape Survey is coded as a dummy, taking on a value of 1 (completely/somewhat agree evolution best explains human origins) or 0 (all other answers). All explanatory variables (except actual age) are coded from 0-1, with 1 being the highest value. *Source:* Cooperative Campaign Analysis Project, December 2011 Baseline; Pew Religious Landscape Survey 2007-2008.

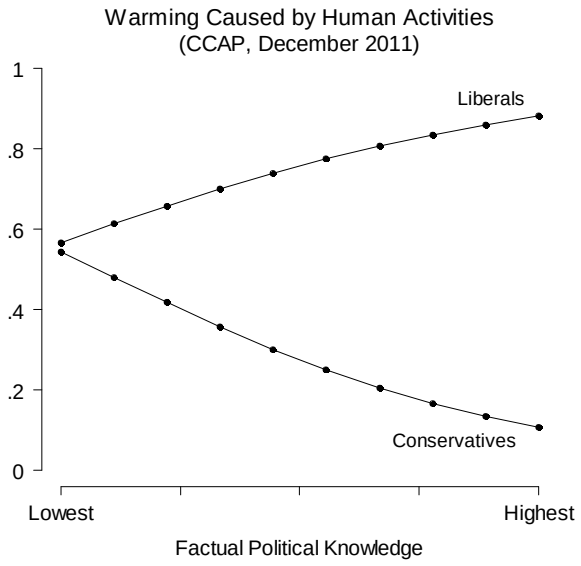


Figure A1: Global Warming Opinions as a Function of Ideology and Factual Political Knowledge. Predicted probabilities based on logistic regression coefficients in Table A1. Probabilities were calculated by setting education, Republican, Democrat, religious service attendance, black, Latino, age, gender, and marital status to the mean conservative and liberal in the respective analyses.