Predictors of trust in the general science and climate science research of US federal agencies

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Abstract
In this article, we focus on a key strategic objective of scientific organizations: maintaining the trust of the public. Using data from a nationally representative survey of American adults (n = 1510), we assess the extent to which demographic factors and political ideology are associated with citizens’ trust in general science and climate science research conducted by US federal agencies. Finally, we test whether priming individuals to first consider agencies’ general science research influences trust in their climate science research, and vice versa. We found that federal agencies’ general science research is more trusted than their climate science research—although a large minority of respondents did not have an opinion—and that political ideology has a strong influence on public trust in federal scientific research. We also found that priming participants to consider general scientific research does not increase trust in climate scientific research. Implications for theory and practice are discussed.

Keywords
climate science, public opinion, trust

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1. Introduction

Scientific organizations are faced with the challenge of communicating what they do and why they do it; their success at these tasks influences the extent to which the public trusts the work they do—and to which policy-makers consider relevant scientific findings in policy-making, citizens incorporate scientific knowledge into their life decisions, and institutions secure long-term funding.

In this article, we focus on this key strategic objective for scientific organizations: earning and maintaining the trust of the public—both in regards to general science research and in an especially contentious area of scientific research: climate change. We review the role of public engagement by scientific organizations, highlighting the importance of public trust, as well as conceptualizing the components of public trust. We assess the relationship between demographic factors and public trust, the extent to which political ideology is associated with trust in both general and climate science research, and how various US federal scientific organizations fare in the public’s eyes. Finally, we test the extent to which priming individuals to consider general science influences their perceptions of trust in climate science, and vice versa—how priming with climate science influences perceptions of trust in general scientific research.

The challenge of education and public outreach for scientific organizations

Actively engaging with the public is an important part of the mission for many scientific organizations. The public role of scientists and scientific organizations has evolved from “efforts … directed almost exclusively at policy-makers” (Ward, 2007: 159) to an expectation that they also engage directly with society as a whole. This expectation was clearly established in the British Royal Society’s 1985 “Bodmer” report entitled “The Public Understanding of Science” (Bodmer, 1985). This was a period when scholarship regarding the intersection of science and the public was beginning to develop, with the journal *Public Understanding of Science* publishing its first issue just a few years later in 1992. The view at the time of the release of the Bodmer Report was that the scientific community could remedy perceived negative public attitudes toward science by promoting the public understanding of science. With the primary goal of improving science literacy, the belief was that as the public came to better understand science, the more it would appreciate new technologies and trust scientists to act with the best interests of society in mind (Thomas and Durant, 1987).

As the study of science controversies continued throughout the 1990s, scholars began to question whether increased knowledge alone would indeed result in more positive attitudes toward science and scientists (Miller, 2001). Studies of the socio-psychological determinants of public acceptance or rejection of technologies also began to explore a more diverse array of potential factors influencing public support for various technologies, including trust (Gupta et al., 2012). This period marked a new appreciation for the idea that individuals are “cognitive misers” (Fiske and Taylor, 1991), meaning that they make strategic decisions about when to use their cognitive and time resources—often preferring to rely on heuristics in assessing complex issues rather than learning about a subject which they may find to be only tangentially related to their daily concerns. Trust is one such heuristic individuals use to evaluate the conclusions of science and scientific organizations (Anderson et al., 2012; Brewer and Ley, 2012; Gauchat, 2011).

Definition and dimensions of trust

Scholars disagree about exactly how trust should be conceptualized. However, according to two reviews of the construct (Earle, 2010; Poortinga and Pidgeon, 2003), many scholars seem to accept
to some degree the basic definition proposed by Rousseau et al. (1998), “Trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another [emphasis ours]” (p. 395). In other words, trust indicates that the trust “giver” expects that the entity trusted (whether an organization or person) will act in a benevolent and competent manner and so, therefore, the trust giver is willing to accept risk and vulnerability.

This definition encompasses dimensions of both competence and “character”—two components of trust that have been identified across many conceptualizations of trust. Perceived competence includes perceptions of the degree of technical expertise (Renn and Levine, 1991, see also Hellmueller and Trilling, 2012; Kasperson et al., 1992; Poortinga and Pidgeon, 2003) and might also include perceptions of the ability of that institution to carry out its mission (Walls et al., 2004). Perceived character includes belief that the source is acting in “good will” or has the receiver’s interests at heart (McCroskey and Teven, 1999), and has been labeled “faith” (Renn and Levine, 1991), “caring” (Kasperson et al., 1992), and “relational trust”—which can be associated with perceptions that the source shares similar values to the trusting individual (Earle, 2010). Trust in an institution—in this case, federal scientific organizations—is necessarily reliant on observations about the actions of the institution since it is unlikely that individuals directly develop a relationship with the institution. Thus, perceptions about the “character” of the organization may include perceptions about how the organization will perform its functions (in this case scientific research) and whether it will be benevolent in doing so.

Demographic correlates of trust in scientific research

Several studies have identified demographic factors related to trust in both general science (Critchley, 2008; Gauchat, 2011; Haerlin and Parr, 1999) and climate or environmental science (Bickerstaff et al., 2008; Brewer and Ley, 2012; Nisbet and Myers, 2007), but no consistent pattern of relationships has yet emerged. In fact, this lack of consistency may be due to the variety of organizations studied; it may be that the relationship between demographic factors and trust varies by governmental versus non-governmental scientific organizations, by organizations versus individual scientists, or by scientific topic. For instance, educated individuals are more likely than less educated individuals to trust scientists regarding solutions to climate change (Sleeth-Keppler et al., 2015) and vaccines (Hamilton et al., 2015). Additionally, in a study that examined trust in various sources of environmental information, Brewer and Ley (2012) found that females are more likely to trust the US Environmental Protection Agency (EPA) but are no more or less likely to trust scientists or environmental organizations; older Americans and African Americans are less likely to trust scientists, but are no more or less likely to trust the EPA or environmental organizations; and people with higher income have less trust in environmental organizations than people with lower income. Given these mixed findings, we propose the following research question to add to the literature that seeks to assess what demographic factors may be related to trust in governmental scientific organizations’ research:

RQ1. Which demographics are related to trust in the scientific research of federal organizations?

In the United States, political ideology has been identified as a strong correlate of trust in scientists—with conservatives less trusting of scientists than liberals (Brewer and Ley, 2012; Dunlap and McCright, 2008; Gauchat, 2012; Hamilton et al., 2015). Various factors have been proposed as possible contributors to this polarization along ideological lines. Mooney (2005) argues that conservative political philosophy is inherently in tension with scientific endeavors: “The dynamism of
science—its constant onslaught on old orthodoxies, its rapid generation of new technological possibilities—presents an obvious challenge to more static [conservative] worldviews” (p. 5). In the realm of climate science, other mechanisms suggested include a well-organized disinformation campaign to instill uncertainty about climate science (McCright and Dunlap, 2010, 2011), selective attention to partisan news outlets such as Fox News (Feldman et al., 2012), and ineffective framing by advocates for action on climate change (Nisbet, 2009).

Other scholars have suggested that conservatives may not be less trusting of “science” or “scientists” in the abstract, but merely mistrustful of specific scientific topics, scientists, or organizations whose work is seen as threatening to the values of the conservative worldview (Carlisle et al., 2010; Kahan et al., 2011). Climate science research has identified substantial risks associated with continued anthropogenic climate change (e.g. Intergovernmental Panel on Climate Change (IPCC), 2007), which has led many to promote societal efforts to limit carbon emissions. Because emissions reductions have been assumed to require strong limits on industry and free enterprise, and because conservatives tend to oppose these kinds of limits, they are motivated to distrust climate scientists (Kahan et al., 2011). There is evidence that liberals can be similarly mistrustful of areas of science that threaten the values of the liberal worldview, such as nuclear power and fracking (Kahan et al., 2011; Nisbet et al., 2015).

Little research has examined the relationship between political ideology and trust in specific scientific organizations. In one of the few studies of this relationship, Brewer and Ley (2012) surveyed adults in Milwaukee, Wisconsin, about their trust in the EPA as a source of environmental information. Surprisingly, they found that political ideology was unrelated to trust in the EPA. The Pew Research Center (2013) provides another source on trust in government agencies; unfortunately, it is not specific to scientific research. Despite the lack of information on scientific research specifically, there is evidence that conservatives may be less trusting than liberals of governmental scientific agencies because they are generally less trusting of government (Hochschild et al., 2012; Uslaner, 2001).

We thus can expect conservatives to be less trusting of federal science agencies’ general and climate scientific research, either because conservatives are less trusting of science generally, because they are less trustful of specific areas of science that threaten their worldview, or because they are less trusting of government and federal agencies.1 However, we have little evidence regarding whether any specific federal agencies will be more or less trusted. For these reasons, we propose the following hypothesis and research question:

\[ H1. \] Political conservatives will exhibit less trust in general scientific and climate science research than political liberals.

\[ RQ2. \] Does political ideology influence trust in some organizations more than others?

**Relationship between general and climate science trust**

While scientists in general have expressed growing concern about the decline in public trust in recent years (Haerlin and Parr, 1999; Millstone and Van Zwanenberg, 2000), climate science has particularly struggled to maintain public trust. Researchers have found that trust in specific topics, such as climate change, is lower than trust in general science (Besley, 2014; Castell et al., 2014), perhaps due to the public’s beliefs about specific scientific topics influencing their trust in that scientific research in comparison to their generally positive ideas about science. Some organizations (e.g. National Aeronautics and Space Administration (NASA)) have built long-lasting relationships with the public, and as a result have high levels of trust in their general work (Leiserowitz
et al., 2011). We wondered whether it was possible to transfer this general public goodwill toward these organizations’ other scientific work to their climate science research. That is, will trust in these organizations as a whole “rub off” on trust in their climate science research?

To test this proposition, we employ the framework of priming. “Priming” activates an idea in an individual’s mind, which influences subsequent thinking, decision making, and behavior (see Bargh, 2006 for a review of priming in psychology research; Roskos-Ewoldsen et al., 2007 and Roskos-Ewoldsen et al., 2008 for a review in communication research). In this study, we test whether individuals who have been primed to consider an organization’s general scientific research subsequently exhibit more trust in the organization’s climate science research than individuals who have not received this prime. We also test whether priming individuals to consider an organization’s climate science research influences their subsequent perceptions of the trustworthiness of the organization’s general scientific research. Thus, we test the following:

**RQ3.** Will priming participants with general scientific research result in higher levels of trust in climate science research in comparison to those who receive no prime?

**RQ4.** Will priming participants with climate science research result in lower levels of trust in general scientific research in comparison to those who receive no prime?

Furthermore, considering the role of political ideology in trust in science, we test the following:

**RQ5.** Will priming effects be dependent on political ideology?

### 2. Method

In April and May 2012, we surveyed a nationally representative cohort sample of adult Americans who had participated in a prior survey assessing their attitudes and beliefs about global warming. Participants were members of a nationally representative, online panel maintained by Knowledge Networks. Knowledge Networks recruits its 50,000-member panel using random digit dialing and address-based sampling. The use of this dual sampling strategy covers both listed and unlisted phone numbers, telephone, non-telephone, and cell-phone-only households. Panelists complete an average of two 5- to 20-minute surveys per month for which they receive small incentives, in the range of US$4 to US$6. Those without a home computer receive a free netbook and Internet service to ensure that segments of the population without computers are represented in the panel. Respondents had been previously surveyed in the summer of 2010 or the winter of 2011 (multi-wave data were used for other analyses). The survey was fielded from 24 April to 25 May 2012; 1510 adults, aged 18 and older, responded, for a completion rate of 68%.

### Demographics

Participants ranged in age from 18 to 90, with a mean age of 46.7, with education levels ranging from “less than high school” to “Bachelor’s degree or higher”—the average education level was between “high school” and “some college.” Average income level was between US$40,000 and US$50,000. A total of 47% of participants were female and 79% were White. Participants attended church on average “a few times a year,” a proxy measure for a participants’ religiosity (which has been found to be correlated with public attitudes about science and the environment, Sherkat and Ellison, 2007).
Political ideology

Political ideology was measured with the item, “In general, do you think of yourself as,” with response options ranging from (1) very liberal to (5) very conservative. On average, participants were “moderate, middle of the road” politically.

Priming with general or climate science

An order experiment was embedded within the survey. About half (52%) of respondents were asked about their views on general scientific research first, and about climate change research next. The other half (48%) of respondents were asked about their views on climate change research first, and about their views on scientific research next.

Assessment of trust in the research of US federal agencies

All respondents were asked to assess NASA (the agency that funded this research). For comparison purposes, 10 other agencies that conduct climate science and other science research were also assessed (National Oceanic & Atmospheric Administration (NOAA, which includes the National Weather Service), National Park Service (NPS), Centers for Disease Control and Prevention (CDC), National Institutes of Health (NIH), National Science Foundation (NSF), Department of Defense (DOD), Department of Agriculture (USDA), EPA, Department of Energy (DOE), and the Smithsonian Institution). Each respondent was asked to assess 4 agencies—NASA and three other randomly assigned agencies.

General scientific research trust. Trust in the general science research of these agencies was assessed utilizing three questions: “On average, how competent are the research scientists at the [Agency]?”; “How much do you trust the scientific research conducted at [Agency]?”; and “To what degree do you believe the [Agency] will use the findings from its scientific research in ways that benefit the United States?.” Scores ranged from 1 to 4, with “4” representing the highest level of trust. Additionally, participants could respond “I have no opinion about this.” A score of general scientific research trust for each agency was calculated by averaging the scores to the three questions. If a participant answered “I have no opinion about this,” or declined to answer any of the three questions, the agency score was calculated by averaging the agency items for which the participant did give a score. If the participant answered “I have no opinion about this” for all three trust questions, then the participant was treated as missing for that agencies’ trust score (analysis in the “Results” section describes the distribution and characteristics of participants who indicated they had no opinion on any item). The average score across agencies was 3.23. Reliability was calculated for each agency and ranged from α = .563 (Smithsonian) to α = .838 (DOE), with an average reliability of .720.

Climate science research trust. Trust in the climate science research of these agencies was assessed utilizing three questions: “On average, how competent are the climate change research scientists at the [Agency]?”; “How much do you trust the climate change scientific research conducted at the [Agency]?”; and “To what degree do you believe the [Agency] will use the findings from its climate change scientific research in ways that benefit the United States?.” Utilizing the same process as described in the general science research trust measure, the average score for each agency was calculated. The average score across agencies was 3.04. Reliability was calculated for each agency and ranged from α = .669 (NSF) to α = .830 (NIH), with an average reliability of .766.
Handling of missing data

As is typical in survey research, some participants did not respond to one or more questions used in the analysis. To reduce the amount of missing data on items (excluding the dependent variables of trust), we used a “hotdeck” imputation procedure (Myers, 2011). Any respondent missing on a given variable was assigned the value of a randomly selected respondent with the same sex and education level nearest to him or her. This method is utilized by many large survey organizations (including the US Census), and has been shown to be over 80 times more effective in estimating true t-values than listwise deletion (Hawthorne and Elliott, 2005).

Analytical approach

To appropriately model the repeated measures (participants were asked to rate their trust of multiple agencies) and to allow for missing data (participants were asked about only 4 of the 10 agencies and many had no opinion for the trust measures), we conducted analyses with multilevel modeling using Mplus (Version 7). Modeling repeated measures data in Mplus allows for inclusion of individuals who did not complete each repeated measure (e.g. if individuals answered trust questions for only 2 of the 4 agencies for which they were asked, they are still retained for analysis and modeled for those 2 agencies; as all agencies were included simultaneously in the overall model, this allowed for the inclusion of these individuals; a total of 173 participants declined to answer any of the trust items for the agencies for which they were asked and were excluded from the analysis, thus retaining 1337 individuals for analysis). Individuals were treated as the level two nesting units, with demographics, political ideology, and order of questions (climate first or general first) as level two (“between person”) variables. Trust was the outcome measure, agencies were dummy coded (with NASA as the referent category), and type of science (climate or general), all which were included as level one (“with-in person”) variables.

3. Results

The first observation about responses to this survey is the large number of individuals who indicated no opinion to questions inquiring about participants’ perceptions of trust of these scientific organizations (see Table 1). Many Americans simply did not know how to answer questions regarding the trustworthiness of federal organizations’ scientific research. This finding was most pronounced for the NSF—with approximately 45% of respondents indicating that they had no opinion about NSF’s scientific research trustworthiness. Furthermore, across all agencies assessed, higher percentages of Americans did not have an opinion about the trustworthiness of these agencies’ climate science research in comparison to the agencies’ general scientific research; this discrepancy was largest for the CDC, as 41% of participants indicated that they had no opinion about how much they trusted the CDC’s climate science research, in comparison to 19% for their general scientific research.

To assess what participant characteristics were related to responding versus answering no opinion or not responding, logistic regressions were run predicting whether or not a participant declined to answer any question about general science or climate science research versus whether they provided all answers (providing all answers was coded as (1)) from the demographics of age, education, gender, income, ethnicity (White or not), church attendance, and political ideology. Males and those with higher levels of education were more likely to indicate responses to both general science and climate science research trust questions ($\beta_{\text{Males, General Science}} = .200, p < .10; \beta_{\text{Males, Climate Science}} = .307, p < .01; \beta_{\text{Education, General Science}} = .217, p < .001; \beta_{\text{Education, Climate Science}} = .182, p < .01$).
Furthermore, ethnic minorities were more likely to respond to questions about trust in climate science ($\beta_{\text{White.Climate Science}} = -0.302, p < .05$). No other variables significantly predicted responding.

Next, for those who provided an assessment of trust in these organizations, we modeled trust as a function of personal characteristics, agency, question order, climate versus general science, and to test the priming effect, the interaction between question order and climate or general science (see Table 2). As is typical in multilevel modeling, an intercept only model was fit first and showed that the average level of trust was 3.14 (scale was 1–4), not accounting for differences between climate or general science research, or for any other individual differences. Approximately equal amounts of variance were found due to “between” individual factors (52% was attributable to differences between participants) and “within” individual factors (48% was attributable to differences between agencies). The intraclass correlation coefficient (ICC) was .52 (see Table 2, Model 1).

Next, we modeled the interaction between type of research and order of questions (see Table 2, Model 4) and found that the effect of question order depended on type of research, $b_{\text{Order} \times \text{Type}} = .082, p < .001$. For trust in general scientific research, priming participants with...
Table 2. Results of multilevel models predicting trust.

<table>
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<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
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<td>3.42***</td>
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CDC: Centers for Disease Control and Prevention; DOD: Department of Defense; DOE: Department of Energy; EPA: Environmental Protection Agency; NIH: National Institutes of Health; NOAA: National Oceanic and Atmospheric Administration; NPS: National Park Service; NSF: National Science Foundation; USDA: Department of Agriculture.

Bolded independent variables are level two predictors; italicized independent variables indicate cross-level interactions. All level two predictors are grand mean centered; all level one predictors are uncentered. A total of 1337 participants are included in each model.

\[^a\]Conservative was coded high.

\[^b\]In Model 5, the coefficient for political ideology is conditional; the coefficient reported is the effect of political ideology on trust in NASA climate science when general science was asked first.

\[^c\]In Models 2 through 5, the effect of science type was allowed to randomly vary. Furthermore, in Model 4, the coefficient for science type is conditional; the coefficient reported is the difference between general and climate science when general science was asked first and when political ideology was coded zero (out of the range of political ideology in this analysis).

\[^d\]In Model 4, the coefficient for order is conditional; the coefficient reported is the difference in trust in general science when general science was asked first versus when climate science was asked first and when political ideology was coded zero (out of the range of political ideology in this analysis).

\(p < .10; \ ^*p < .05; \ ^**p < .01; \ ^***p < .001.\)
climate science first resulted in lower reported levels of trust in general scientific research in comparison to those who received no prime prior to being asked about their trust in general scientific research, $b_{\text{Order (for general scientific research)}} = -0.094, p < .001$ (RQ4). However, order of presentation was unrelated to trust in climate science research; levels of trust in climate science were similar whether or not they received the prime of considering general scientific research first, $b_{\text{Order (for climate scientific research)}} = -0.012, p = .709$ (RQ3).

Interpreting these same results with a different focus, this pattern of results also demonstrates that the difference between climate and general science depended on order of presentation of the questions. When general science was assessed first, climate science was rated significantly lower than general science, $b_{\text{Science Type (for general first condition)}} = -0.217, p < .001$. When climate science was assessed first, climate science was still rated lower than general science, but by a smaller margin than when general science was asked first, $b_{\text{Science Type (for climate first condition)}} = -0.135, p < .001$. This pattern of results demonstrates that priming respondents to consider climate science first lowers their perceptions of the trustworthiness of general scientific research. The converse was not true: priming participants to consider general scientific research does not result in a trust increase for climate science research.

This pattern of results, however, was dependent on an individual’s political ideology, as was shown when we tested the interaction of political ideology with the scientific order by type interaction ($b_{\text{Ideology\times Type\times Order}} = .071, p < .001$; RQ5; see Table 2, Model 5 and Figure 1). Climate science research was significantly less trusted than general science research in all conditions, except among those who were very liberal and were asked about general science first (in which case there was no difference between trust in general and climate science research). The magnitude of the difference between trust in general science research and trust in climate science research was most strongly influenced by ideology when general science was asked first. There were no significant differences in trust in climate science when it was asked first versus second, regardless of political ideology (difference in trust of climate science research by order among those who are very liberal, $b = -0.017, p = \text{ns}$; among those who are moderate, $b = -0.015, p = \text{ns}$;

**Figure 1. Differences between trust in general science and trust in climate science, by order of questions and by political ideology.**

This figure depicts the difference in general and climate science trust among those of different political ideologies; the entries are model-based for the “average” agency and control for age, education, gender, income, race, and church attendance. Two stars indicate a significant difference at the $p < .01$ level; three stars indicate significance at the $p < .001$ level.
among those who are very conservative, $b = -0.261$, $p < .001$). This demonstrates that priming respondents to consider climate science prior to assessing trust in general science decreased trust in general science among moderates and conservatives, but not among liberals.

The effect of ideology on trust differed by organization, type of science, and by order of questions (see Tables 3 and 4 for a summary; RQ2). Political ideology was most strongly related to trust in the scientific research of the EPA, NIH, and Smithsonian. Across agencies, the influence of political ideology on trust in general science was less when asking about general science first than when it was asked about after climate science research, $b_{\text{Order} \times \text{Ideology}\text{.General Science}} = -0.09$, $p < .01$. The effect of ideology on climate science research trust was not dependent on order, $b_{\text{Order} \times \text{Ideology}\text{.Climate Science}} = -0.02$, $p = .65$; in both order conditions and across all agencies (with the exception of the DOD), political ideology was negatively related to trust in climate science. In summary, participants’ ratings of trust in climate science research were significantly related to political ideology, regardless of order (although the magnitude varied by agency); however, ideology influenced trust in general science research more when participants had first been asked about climate science in comparison to when they were asked about general science first.

### 4. Discussion

The purpose of this study was to provide a broad survey of trust in federal agencies, to examine the role political ideology plays in trust surrounding a politically contentious issue—climate
Table 4. Average trust ratings by agency and political ideology.

<table>
<thead>
<tr>
<th></th>
<th>Very liberal (A)</th>
<th>Moderate (B)</th>
<th>Very conservative (C)</th>
<th>Very conservative trust–Very liberal trust (C–A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rank</td>
<td>General science trust</td>
<td>Climate science trust</td>
<td>Rank</td>
</tr>
<tr>
<td>NASA</td>
<td>3rd</td>
<td>3.54</td>
<td>3.58</td>
<td>1st</td>
</tr>
<tr>
<td>NOAA</td>
<td>1st</td>
<td>3.57</td>
<td>3.61</td>
<td>2nd</td>
</tr>
<tr>
<td>Smithsonian</td>
<td>2nd</td>
<td>3.57</td>
<td>3.61</td>
<td>3rd</td>
</tr>
<tr>
<td>CDC</td>
<td>7th</td>
<td>3.41</td>
<td>3.45</td>
<td>4th</td>
</tr>
<tr>
<td>NSF</td>
<td>6th</td>
<td>3.44</td>
<td>3.47</td>
<td>5th</td>
</tr>
<tr>
<td>NPS</td>
<td>9th</td>
<td>3.28</td>
<td>3.31</td>
<td>6th</td>
</tr>
<tr>
<td>NIH</td>
<td>4th</td>
<td>3.46</td>
<td>3.50</td>
<td>7th</td>
</tr>
<tr>
<td>USDA</td>
<td>8th</td>
<td>3.28</td>
<td>3.32</td>
<td>8th</td>
</tr>
<tr>
<td>DOD</td>
<td>11th</td>
<td>2.98</td>
<td>3.01</td>
<td>9th</td>
</tr>
<tr>
<td>EPA</td>
<td>5th</td>
<td>3.45</td>
<td>3.49</td>
<td>10th</td>
</tr>
<tr>
<td>DOE</td>
<td>10th</td>
<td>3.22</td>
<td>3.25</td>
<td>11th</td>
</tr>
<tr>
<td>Average</td>
<td>3.38</td>
<td>3.42</td>
<td>3.17</td>
<td>2.99</td>
</tr>
</tbody>
</table>


Agencies ordered by rank for respondents with moderate political ideologies; table entries are model-based means controlling for age, education, gender, income, race, and church attendance. Furthermore, entries are the average of trust scores between the two different orders of questions.
change—and to identify the effects of priming with general or climate science on the trust of the other. Results from our study demonstrate that many US citizens are uncertain about how much they trust these scientific organizations—many individuals were not confident enough in their opinions to offer an assessment of their trust in these organizations’ research. Additionally, our results show the strong influence that political ideology has on trust in general science and climate science research in the United States, among those Americans who offered an assessment. Finally, we show that priming these individuals by asking them to consider climate science led them to interpret their trust in general scientific research through a political lens; however, priming these individuals with general science did not negate the effect of political ideology on trust in climate science research.

Our study has several limitations. First, although this is an issue of broad relevance to the worldwide scientific community, our scope is limited to a sample of the American public and to US federal scientific organizations. Further research that examines correlates of trust in scientific research in other countries—especially testing whether political ideology is as strong of a predictor in other scientific and cultural contexts—will be helpful in further elucidating the correlates of trust. Furthermore, although our study has implications for the outreach efforts of these scientific organizations, we have not assessed their current outreach efforts. Finally, we specifically tested people’s trust in the *research* of these organizations. It may be that this specificity was challenging for participants to assess and that the measures of trust obtained in this study may represent more superficial attitudes than trust built from actual familiarity with an agency’s research (Krosnick, 1999). Research that compares trust in *research* by an organization versus trust in the organization as a whole may be informative.

In general, trust was reasonably high across all participants, suggesting that most people’s impressions of federal science agencies are of competent, trustworthy agencies likely to use their research for the good of the United States. Although trust in scientists has declined in recent years among conservatives (Gauchat, 2012), the majority of Americans still seem willing to express a relatively high level of trust in the research conducted by federal agencies. Additionally, individuals with higher levels of income and education seem to have more trust in federal agencies’ research.

The findings from this study corroborate previous work that has shown that political ideology is an important predictor of trust in science generally—and climate science in particular (Brewer and Ley, 2012; Dunlap and McCright, 2008; Gauchat, 2012). Conservatives were generally less trusting than liberals. However, conservatives still tended to express trust in agencies’ research more often than distrust. Even the most conservative respondents reported levels of trust that were, on average, above the midpoint of the scale. This suggests that conservatives, while less trusting of federal research than liberals, should not be characterized as generally distrustful of science.

Furthermore, our results demonstrate that political ideology matters more for some organizations than for others. We speculate that this finding is due to some agencies being seen as much more aligned with the values of one end of the political spectrum than the other. For example, in contrast to the findings of Brewer and Ley (2012), we found that political ideology had the largest effect on ratings of trust in research done by the EPA. This finding is likely because conservatives are opposed to the EPA’s restrictions on industrial and commercial activity (Carlisle et al., 2010; Nisbet and Myers, 2007). Liberals view the EPA in a much more positive light as they tend to show much greater support for environmental protection and restrictions on industry (Kahan et al., 2011). Less polarizing agencies, such as the NPS, are likely seen as conducting activities that are more equally valued by both liberals and conservatives.

Interestingly, the DOD was the only agency whose general science research was more highly trusted by conservatives than by liberals. The DOD may be seen as a more trustworthy source for political conservatives because conservatives value defense and national security more
strongly than liberals (Malka and Lelkes, 2010). This link between conservative political ideology and national security has led some to suggest that highlighting the national security threats that climate change poses may be an effective way of engaging this audience (Boykoff, 2011). However, other work (Myers et al., 2012) has shown that utilizing this national security frame may backfire among those members of the public who are skeptical of climate science (although those findings may have been the result of participants questioning the attribution of the information to members of the US military; Myers et al., 2012). The results from the current study lend credence to the possibility that in a more externally valid setting, political conservatives may respond favorably to climate science messages from the DOD. However, while conservatives may sometimes be more likely than liberals to trust DOD general science research, conservatives still show higher absolute levels of trust in general and climate research performed by agencies like NASA and NOAA.

One type of priming was found to have a significant effect on trust. Priming participants by initially asking them about climate science research resulted in significantly lower levels of trust in general science research than when general science research was asked about first. The opposite effect, of priming with general science affecting levels of trust in climate science research, was not found to be significant. This suggests that while drawing attention to agencies’ climate science research may decrease levels of public trust in their other research, drawing attention to their general science research may not increase trust in climate science research, even for more highly trusted agencies like NASA. Generalized trust in an agency’s research may not serve to protect against lower levels of trust in research on polarizing topics such as climate change, but involvement with polarizing research may result in less trust in other areas of research.

While the prospect of politically controversial research affecting public perceptions of all research should be of concern to federal agencies, this effect appears not to occur for all citizens equally. Those who have no ideologically based objections to the conclusions of particular avenues of research may show no decline in generalized trust when primed to think about controversial research. In this study, liberal respondents showed no decline in trust in general science when primed with questions about climate science. The reverse pattern might be observed for areas of science where conservatives are more likely to trust the results, such as nuclear power (Kahan et al., 2011).

Furthermore, while these results may tempt some to view communicating climate science as a lose–lose situation for these federal agencies, we argue that in the long run open communication about climate science is a better strategy than keeping quiet about the research that is conducted. First, because these organizations are publicly funded, there is an expectation of openness about their activities (Arata, 2007); thus, greater openness is likely associated with increased trust in comparison to lack of openness. Second, as external events (such as extreme weather events) accumulate and correspond to the predictions made by climate science research, we may see a swing toward trusting those actors who chose to engage the public with their research when it was politically charged. Finally, it is possible that part of the reason we have witnessed polarization on the issue of climate change is because the discourse over climate change has been dominated by overtly political elites such as the fossil fuel industry, environmental non-governmental organizations (NGOs), and elected officials. Given that our results demonstrate that federal science organizations have fairly high levels of trust across ideological boundaries, increased visibility of the research from these organizations could cut through some of the cacophony among political elites and eventually reduce polarization on the issue.

To this end, federal agencies should consider developing new programs for their research staff and university scientists funded through their grant programs modeled off of NSF’s Becoming the Messenger (http://nsfmessengers.wordpress.com) or the National Academies’
Science & Engineering Ambassador Program (http://www.scienceambassadors.org/) which involves a collaboration between social scientists and other communication experts to provide communications training to scientists and engineers. Following professional development in communication skills, a nationwide network of these public-facing scientists could be tapped to be the spokespersons that contextualize and explain the local relevance and value of new agency research to their community through interviews in local television and print news media, and events at their local schools, science centers, and/or museums.

Trust in climate scientists is important to consider as it has been linked to belief certainty and concern about climate change (Malka et al., 2009)—which has been identified as a key belief associated with support for climate-friendly policies (Ding et al., 2011). Our results show that the average level of trust in both the climate and general scientific research of these federal organizations was above the midpoint of the scale, even among those with a very conservative political ideology. Thus, strong efforts by these organizations to inform the public about the findings of their climate science research may be well received (and much needed, given that in March 2015, almost a fifth of Americans were not fully convinced that global warming is happening and about half did not attribute its cause mostly to human activities; Leiserowitz et al., 2015).

Federal agencies should concern themselves with being trusted and trustworthy; if they are not widely perceived as being trustworthy, their effectiveness and impact is likely to be undermined. The connection between federal agencies and members of the public is relational, with trust being an integral part of meaningful communication between the two. Understanding what cultivates this trust among members of the public should improve agencies’ outreach efforts. Familiarizing the public with agencies’ research is likely an important first step toward meaningful public communication. Only after both parties develop trust in each other can outreach efforts effectively inform scientific research and public policy.

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**Notes**

1. While there is debate about whether it is better to model political orientation by political party or by political ideology (e.g. Kim and Fording, 1998), we stick with recent research in this area, which primarily focuses on political ideology (see Brewer and Ley, 2012; Gauchat, 2012; Hamilton et al., 2015). For verification purposes, we also modeled all results utilizing political party identification rather than political ideology; however, there are no substantive changes to the main conclusions in the article when modeling with party identification rather than political ideology (results available upon request).
2. Very few participants did not respond (<0.8% per item); therefore, we combined modeling those who responded “no opinion” with those who did not respond.

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