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Building Public Support for Science Spending: Misinformation, Motivated Reasoning, and the Power of Corrections

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Abstract

While most Americans support scientific research, few favor an increase in federal investment. This opposition is driven in large part by misinformation about the actual level of governmental support for science. Employing an experiment embedded on a nationally representative survey, we find that most Americans significantly overestimate the share of the federal budget allocated to scientific research. Correcting this misperception significantly increases support for additional science spending. We find little evidence that subjects engage in motivated reasoning when confronted with this correction. Information about the low level of existing funding increased support for investment in science across partisan and ideological divides.

Keywords

public opinion, science budget, misinformation, survey experiment, motivated reasoning, federal government

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Introduction

One of the most important debates in contemporary scholarship examining the relationship between the scientific community and the American public concerns whether science is increasingly politicized (Bolsen, Druckman, & Cook, 2014; Mooney, 2006; Oreskes & Conway, 2010; Pielke, 2007; "Science Scorned," 2010).[1] Levels of trust in science have decreased significantly over time, particularly among ideological conservatives (Gauchat, 2012). Consequently, many studies have begun to question a key tenet of the "deficit model" (Gross, 1994; S. Miller, 2001) that public ignorance is primarily responsible for growing skepticism toward science (e.g., Sturgis & Allum, 2004). When presented with new information, many Americans appear to engage in motivated reasoning and resist incorporating scientific evidence into their policy preferences on a host of hot-button issues ranging from global climate change (Hart & Nisbet, 2012) to stem cell research (M. C. Nisbet, 2005) to nanotechnology (Druckman & Bolsen, 2011).

Against this backdrop of changing public attitudes toward science, federal investment in scientific research and development has declined precipitously from the mid-1960s through the early 1980s and remained stagnant ever since (Hourihan & Parkes, 2016). A 2015 MIT Report, *The Future Postponed*, warns of an "innovation deficit" in the United States if this long-term trend of declining investment in basic research is not reversed (MIT Committee to Evaluate the Innovation Deficit, 2015). However, efforts to reverse course and increase federal support for scientific research face a steep uphill battle in the contemporary budgetary climate. The combination of sequestration with the ever-growing share of entitlement spending places an increasingly tight squeeze on domestic discretionary spending. As a result, advocates for the science budget face stiff competition for funds that must be drawn from an increasingly small slice of the fiscal pie.

Efforts to increase federal investment in science are unlikely to succeed absent strong public support. However, existing data suggest that this support will not be forthcoming. The National Science Foundation has long tracked public preferences for spending on scientific research. Contra narratives that lament the polarization of science and erosion of public trust, more than 80% of Americans continue to believe that the federal government should financially support scientific research. However, according to the most recent data from the 2014 General Social Survey just under 40% of Americans believe that the federal government spends too little on scientific research (National Science Board, 2016). This figure is much greater than the 10% who believe that the government spends too much on science; however, the share of Americans calling for increased investment in research and development is modest compared with support for more spending in other policy areas. For example, support for increased spending on scientific research barely surpasses that for increased mass transit spending, and lags behind support for more money for other priorities, including child care, drug rehabilitation, highways and bridges, and law enforcement (National Science Board, 2016).

While a wealth of survey data exists to help us understand public support for scientific research spending, both longitudinally and even in a cross-national context (e.g., European Commission, 2010; Funk & Rainie, 2015b; J. D. Miller, 2004; Sanz-Menéndez, Van Ryzin, & del Pino, 2014), important questions remain. We seek to answer four questions that illuminate what the public knows about current levels of government spending on scientific research, and how providing new information about current spending levels influences Americans' support for increased science spending. First, given the widespread public lack of knowledge concerning both science (J. D. Miller 1998) and politics (Delli Carpini & Keeter, 1997), how many Americans lack basic knowledge about the level of federal support for scientific research? Second, will providing new information about the actual level of federal budgetary support for scientific research raise public support for increased federal spending? Third, to what extent is there a partisan or ideological divide on this crucial policy question? Finally, does partisanship or ideology moderate the influence of information about actual spending levels on support for an increased federal commitment to scientific research?

The answers to these questions are of both theoretical and practical import. Our results have important implications for scholarship investigating the extent to which science is inherently politicized in the contemporary American polity. They also have ramifications for policy makers seeking to build public support for federally sponsored scientific research and development in an era of fiscal austerity.

Information and Support for Increased Science Spending

While survey researchers routinely query the public's support for increased or decreased federal science spending, existing scholarship tells us little about the quantity and accuracy of the information on which most Americans draw when answering standard questions about their science spending preferences. A long literature has examined Americans' lack of scientific literacy (J. D. Miller 1983, 1998, 2004). Similarly, political scientists have demonstrated that most Americans lack a broad range of factual information about politics and governance (e.g., Delli Carpini & Keeter, 1997). More focused research suggests that public understanding of budgetary policy is no exception. For example, most Americans seriously overestimate the percentage of the federal budget spent on foreign aid and a range of other programs (Cable News Network, 2011; Milner & Tingley, 2013). As a result, it is highly likely that many Americans have little idea how much of the federal budget is actually spent on scientific research.

Establishing a precise figure for the share of federal spending devoted to scientific research is somewhat open to interpretation. Figures vary depending on what budget items are considered to be scientific research and what figure is used as the denominator. However, the American Association for the Advancement of Science provides over time data on federal research spending as a percentage of total annual federal spending (Hourihan & Parkes, 2016).[2] After hitting a high of almost 6% of federal spending in the mid-1960s, the share of the federal budget devoted to nondefense research and development declined over the late 1960s and 1970s before stabilizing roughly at or below 2% in the 1980s. In fiscal year 2015, the federal government spent $61.5 billion on nondefense research and development out of a total budget of almost $3.7 trillion. This equates to approximately 1.6% of the federal budget.

Given the frequent overestimation of the degree of federal spending in other areas, it is likely that many Americans also significantly overestimate the share of the budget devoted to scientific research. This misinformation, in turn, may depress public support for increases in science spending. The modal response in most surveys of public preferences for federal spending on scientific research is to maintain current levels (e.g., National Science Board, 2016). We hypothesize that if many Americans learned that the federal government actually spends significantly less on science research than they suppose, support for more research funding could increase sharply. However, the ultimate influence of such information depends on how different Americans process information about science policy.

The Politicization of Science in a Polarized Polity

Scholars continue to dispute the extent to which the public debate over science policy in the contemporary American polity is politicized. On many critically important questions, such as whether human activity is directly contributing to global climate change (Malka, Krosnick, & Langer, 2009; McCright & Dunlap, 2011) or whether the federal government should support stem cell research (M. C. Nisbet & Goidel, 2007), public opinion is intensely polarized along partisan and ideological lines. Ideological conservatives and those affiliated with the Republican Party are systematically less likely to accept the scientific consensus and support scientific research than are other Americans. However, on other questions, such as general trust in the scientific community or support for renewable energy development, the results of previous research are decidedly more mixed with some studies continuing to show evidence of a strong, ideological split (Brewer & Ley, 2013; Cacciatore, Scheufele, & Shaw, 2012; Delshad & Raymond, 2013; Gauchat, 2012; Goldfarb, Buessing, & Kriner, 2016; Mooney, 2006), while others find evidence of a much more limited and contingent ideological gap (Ansolabehere & Konisky, 2009; Gauchat, 2011; Klick & Smith, 2010; McCright, Dentzman, Charters, & Dietz, 2013; Suhay, Druckman, Nisbet, Cooper, & Garrett, 2015).

Past scholarship has proposed several competing dynamics that could produce divergences in science attitudes along partisan and ideological lines. One school of thought argues that there is a fundamental psychological difference between conservatives and liberals, a difference that instills in conservatives an inherent antiscience bias (Mooney, 2006, 2012). Research in this vein argues that conservatives' greater adherence to dogmatism and stronger desire to avoid dissonant messages (e.g., Nam, Jost, & Van Bavel, 2013) leads them to engage in motivated reasoning and dismiss scientific information that is inconsistent with their ideological priors to a greater extent than ideological liberals or moderates.

Others counter that conservatives are not intrinsically more likely to distrust science than are others. Rather, subjects from all partisan and ideological stripes engage in motivated reasoning and resist information that is inconsistent with their preexisting beliefs (Carlisle, Feezell, Michaud, Smith, & Smith, 2010; Kahan, 2013). For example, those tending to reject climate change also adopt laissez-faire economic ideologies (Heath & Gifford, 2006), and conspiracy ideologues have a strong tendency to reject the medically accepted fact that HIV causes AIDs, and smoking lung cancer (Lewandowsky, Oberauer, & Gignac, 2013). The relationship between ideology and attitudes toward science is therefore contextual, and varies according to what are the dominant issues in the policy debate at a given time (Suhay et al., 2015). For example, many conservatives hold particularly strong priors that lead them to be skeptical of climate change. These beliefs were fostered and reinforced in large part by a steady stream of cues transmitted by trusted, copartisan elites (Lupia, 1994; Zaller, 1992) and by the conservative media (Feldman, Maibach, Roser-Renouf, & Leiserowitz, 2012; Hmielowski, Feldman, Myers, Leiserowitz, & Maibach, 2013; Zhao, Rolfe-Redding, & Kotcher, 2014). Research by McCright et al. (2013) found that conservatives are, indeed, less likely to trust scientific research showing the adverse environmental impacts of various economic and other human activities. Likewise, Ho, Brossard, and Scheufele (2008) argue that public attitudes toward stem cell research are shaped by value predispositions and (to a lesser extent) the media; while scientific knowledge was found to shape attitudes toward stem cell research, this effect was moderated by religiosity and ideology, with the impact of scientific knowledge having the weakest effect on conservatives' attitudes.

However, along other dimensions the partisan and ideological gap in science attitudes is significantly narrower. For example, liberals are less likely than conservatives to trust chemical, industrial, and agricultural scientists and their production-boosting research (Carlisle et al., 2010; Kloor, 2012). In such areas, for example concerning the safety of genetically modified food, scientific research challenges the predispositions of more liberals than conservatives. Similarly, research by Myers, Maibach, Peters, and Leiserowitz (2015) suggests that even on polarizing issues like global warming, carefully constructed and clear messages can influence public understanding and attitudes, even among ideological conservatives. This competing perspective suggests that the size of the gap between liberals and conservatives in terms of their attitudes toward science and science policy, and even the direction of that gap, varies considerably depending on the nature of the science policy issues in play and how communications are framed.

We should expect a difference in support for increased federal spending on scientific research along partisan and ideological lines for reasons that have little to do with an antiscience bias. Democrats and ideological liberals are more likely to support increased spending than Republicans and ideological conservatives across a range of policy issues (Dunlap, Xiao, & McCright, 2001; Jacoby, 1994). As a result, finding evidence of a partisan or ideological gap in raw support for more science spending would do little to help discriminate between the two hypotheses articulated by previous research. However, the intrinsic and contextual hypotheses do offer sharply competing expectations about whether Americans will differentially process new information about the actual amount of federal spending on scientific research along partisan or ideological lines.

If Republicans and ideological conservatives are inherently biased against science, then new information about the relatively modest levels of existing federal support for scientific reasoning will likely have little influence on their willingness to support increased science funding. Rather, Republicans and ideological conservatives will engage in motivated reasoning; they will counterargue against this new information and find reasons to resist incorporating it into their policy preferences (Bolsen et al., 2014; Druckman & Bolsen, 2011; Kraft, Lodge, & Taber, 2015). For example, in a study of how information about the human consequences of climate change affects popular attitudes, Hart and Nisbet (2012) found that this information either has no effect among Republicans, or can even generate a "boomerang effect," making them even less supportive of policies to address climate change than they were in the absence of this dissonant cue.[3]

By contrast, the contextual thesis suggests that Republicans and conservatives are not inherently antiscience. While some Republican and conservative elites demonstrate a clear antiscience bent ("Science Scorned," 2010), others, such as the 2012 Republican presidential nominee Mitt Romney, warn that federal funding for basic research is important, and even needs to grow (Fisher, 2013; Plummer, 2013). The general question of the proper level of federal funding for scientific research does not involve specific, ideologically charged policy issues that will trigger motivated reasoning among Republicans and conservatives. As a result, the contextual thesis suggests that Republicans and conservatives should respond to new information about the paltry levels of current federal support for science in the same way as other Americans with different partisan allegiances and ideological leanings.

Experimental Design and Estimation Strategy

To determine the extent to which Americans are misinformed about how much money the federal government spends on scientific research and to assess the influence of correct information on public preferences for future levels of science spending, we embedded an experiment on the 2014 Cooperative Congressional Election Study. This internet-based survey administered by YouGov/Polimetrix uses a two-stage sample matching methodology to produce nationally representative results from a large opt-in panel (Ansolabehere & Rivers, 2013). Our experimental module was administered to 1,000 adult Americans between October 1, 2014 and November 3, 2014.[4]

The module consisted of two questions. All subjects were first asked a question adapted from previous polling conducted by the Henry J. Kaiser Family Foundation (2012) on the foreign aid budget to measure how much they think the federal government actually spends on scientific research: "Just your best guess, what percentage of the federal budget is spent on scientific research?" To answer, subjects selected their choice from a drop-down box with answer choices that ranged from 0% to 100%.

After answering this question, subjects were randomly assigned to one of two groups. Those in the control group received no information. Those assigned to the treatment group were given information about the actual level of federal support for scientific research. Subjects in this group were told that "each year, just over 1% of the federal budget is spent on scientific research." The wording of the treatment is based on the American Association for the Advancement of Sciences' data showing that nondefense federal spending on research and development has hovered between 1% and 2% for the last decade. All subjects were then asked the same follow-up question adapted from a CBS News Poll (2010): "Should federal spending on scientific research be increased, decreased, or kept the same?"

The analysis proceeds in four stages. First, to assess the extent of public misinformation about the share of federal spending allocated to scientific research, we examine the distribution of responses to the first survey question. Second, an ordinary least squares regression analysis examines the factors that predict variation in respondents' beliefs concerning the percentage of the federal budget spent on scientific research. The regression examines the influence of partisanship, ideology, and demographic characteristics, such as race, age, and gender on estimates of federal science spending.

The analysis then uses logistic regression to examine the factors influencing support for increased federal spending on scientific research. The dependent variable is coded 1 for subjects who stated that federal science spending should be increased. It is coded 0 for subjects who replied that federal science spending should be kept at its current levels or decreased.[5] The independent variable of interest is an indicator variable coded 1 for subjects assigned to the information treatment group and 0 for those assigned to the control. Because subjects were randomly assigned to either the treatment or the control group, any difference in support for increased science spending can be attributed to the experimental treatment informing half of the sample about the actual modest level of federal funding for scientific research.[6]

The logistic regression model also controls for a range of factors identified by prior research to shape Americans' assessments of science and scientific research. First, past research has shown that attitudes toward scientists and key elements of science policy vary significantly along partisan and ideological lines (McCright & Dunlap, 2011; Gauchat, 2012; Goldfarb et al., 2016; M. C. Nisbet, 2005). As a result, we include two dummy variables identifying whether or not a subject affiliates with either the Democratic or Republican parties. Following literatures in political science (e.g., Petrocik, 2009), subjects who "leaned" toward one party or the other are coded as partisans.[7] We also include a measure of ideological conservatism, which was measured on a 7-point scale ranging from very liberal to very conservative.[8] Some previous research has found that attitudes toward federal science spending are somewhat unique; in contrast to a range of other programs, support for science spending in the 1980s was not split along partisan or ideological lines (Jacoby, 1994). However, this analysis used data from an earlier, less polarized era. Finally, given their importance in prior analyses of attitudes toward and understanding of science more generally (e.g., Bauer, Allum, & Miller, 2007; Brewer & Ley, 2013) and support for science spending in Europe (Sanz-Menéndez et al., 2014) the logit models also control for a range of

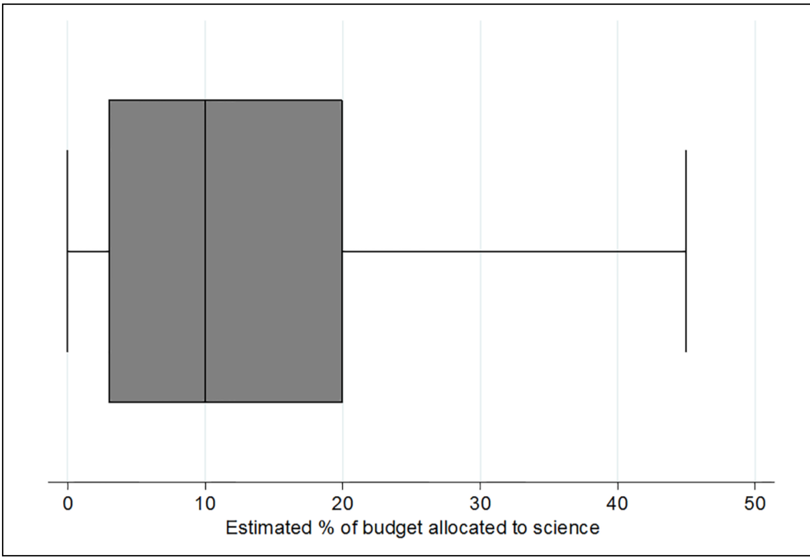

Figure 1. Estimates of share of federal spending allocated to science research.
Note. Excludes outside values that are more extreme than 1.5 times the interquartile range.

demographic variables. The models include a measure of educational attainment, measured on a scale ranging from less than high school to postgraduate degree; each subject's age; and indicator variables for being male and white.

Finally, the analysis concludes by estimating a series of additional model specifications with interaction variables to determine whether the influence of the information treatment on support for increased science spending is conditional on a range of factors—most important, political partisanship and ideology.

Results

Consistent with expectations, our data suggest that many, though not all Americans, significantly overestimate the share of the federal budget allocated to scientific research. Figure 1 presents a box plot to illustrate the distribution of subjects' answers to the first question asking for their guess of what percentage of federal spending supports scientific research. We observed considerable variation in responses. Just under 30% of subjects gave a highly accurate estimate, stating that federal science spending accounted for between 0% and 3% of the federal budget.[9] The median subject, however, significantly

Table 1. Factors Predicting Science Spending Estimates.

	(1)
Republican	−3.65** (1.62)
Democrat	−0.95 (1.45)
Ideological conservatism	0.80** (0.40)
Education	−3.02*** (0.37)
White	−8.95*** (1.26)
Male	−6.10*** (1.08)
Age	−0.13*** (0.03)
Constant	40.01*** (2.93)
Observations	973
R^2	0.19

Note. Results of ordinary least squares regression. Standard errors in parentheses. All significance tests are two-tailed.
*$p < .10$. **$p < .05$. ***$p < .01$.

overestimated the share of the budget allocated to science spending, and guessed that 10% of the budget was allocated toward federal spending. Another quarter of subjects estimated between 11% and 20%, with the final quarter of our sample guessing that more than 20% of the budget went to support scientific research.

Factors Influencing Spending Estimate

To explore the factors that systematically influence this considerable variation in Americans' beliefs about the share of federal spending allocated to science, we constructed an ordinary least squares regression. The regression models each subject's spending share estimate as a function of the subject's partisan affiliation, ideology, educational attainment, race, gender, and age. Table 1 presents the results.

The strongest predictor of a subject's science spending estimate was education. As shown previously in Figure 1, most Americans significantly overestimated the share of the budget devoted to science research. However, the regression in Table 1 shows that highly educated Americans gave systematically lower, and hence more accurate, estimates than did less educated Americans, all else being equal. Indeed, a two–standard deviation increase in educational attainment (from having completed some college to having earned a postgraduate degree) reduced the median subject's estimate of the budget share of science spending by 9%. White Americans also gave systematically lower estimates than non-whites, and men gave substantially lower estimates than women, all else being equal.

Finally, the model in Table 1 offers only modest evidence that partisanship and ideology influenced Americans' assessments. All else being equal, Republicans gave slightly lower, and hence more accurate, estimates than Democrats and independents; however, increasing ideological conservatism is positively correlated with the size of a subject's science spending estimate. Thus, the net influence of partisanship and ideology on Americans' estimates of science spending were substantively modest.

The Influence of Correct Information on Support for Increased Science Spending

The foregoing results demonstrate that when asked by pollsters whether they support increased federal spending on scientific research, most Americans draw on incorrect information. A majority of subjects in our sample significantly overestimated the percentage of the federal budget devoted to scientific research and development. Does this overestimation depress support for increased federal science funding?

To answer this question, the first column of Table 2 presents the results of a logistic regression modeling support for increased science spending. The main theoretical variable of interest is an indicator identifying subjects assigned to the experimental treatment, which informed subjects of the very small percentage of the federal budget that is actually spent on scientific research. Strongly consistent with our hypothesis, the coefficient on this variable is positive and highly statistically significant.[10] Correcting the widespread public misperception concerning the actual level of federal funding for science significantly increased support for additional funds.

Figure 2 uses a series of simulations to illustrate the effect of the information treatment, as well as increases in other variables of interest, on support for increased spending. Informing subjects of the actual level of federal support for scientific research substantially increased support for additional spending; for the median subject, it raised the predicted probability of supporting more science spending by .20, from .40 to .60, all else being equal.

The logistic regression model also found evidence of significant partisan and ideological divides in support for scientific spending. Democrats were significantly more likely to support increased science spending than were Republicans or independents; similarly, increasing levels of ideological conservatism significantly dampened enthusiasm for more science funding. Finally, educational attainment was also a highly significant predictor of

Table 2. Factors Influencing Support for Increased Science Spending.

	(1)	(2)	(3)	(4)
Estimate corrected	0.83*** (0.14)	0.87*** (0.29)	0.98** (0.41)	0.48** (0.19)
Correction * Republican		−0.27 (0.38)		
Correction * Democrat		0.11 (0.37)		
Correction * Conservatism			−0.04 (0.09)	
Correction * Spending estimate				0.02** (0.01)
Republican	−0.24 (0.21)	−0.10 (0.28)	−0.23 (0.21)	−0.29 (0.21)
Democrat	0.48** (0.19)	0.44* (0.26)	0.49*** (0.19)	0.48** (0.19)
Ideological conservatism	−0.27*** (0.05)	−0.27*** (0.05)	−0.26*** (0.07)	−0.27*** (0.06)
Education	0.20*** (0.05)	0.21*** (0.05)	0.21*** (0.05)	0.15*** (0.05)
White	0.41** (0.17)	0.41** (0.17)	0.41** (0.17)	0.24 (0.18)
Male	0.23 (0.14)	0.23 (0.14)	0.23 (0.14)	0.10 (0.15)
Age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)
Science spending guess				−0.03*** (0.01)
Constant	−0.35 (0.39)	−0.39 (0.41)	−0.43 (0.43)	0.66 (0.44)
Observations	990	990	990	969

Note. Results of logistic regressions. Standard errors in parentheses. All significance tests are two-tailed.
*$p < .10$. **$p < .05$. ***$p < .01$.

support for increased federal science spending. For the median respondent, a two–standard deviation increase in education raised the probability of supporting more science spending by over .15.

Examining the Moderating Influence of Partisanship and Ideology

The first model in Table 2 suggests that, on average, informing subjects of the actual, modest level of federal funding for scientific research significantly increased support for more federal investment. However, it is possible that the information treatment's effects were not uniform across the population. Most importantly, prior research asserting an inherent antiscience bias among Republicans and ideological conservatives suggests that such individuals should engage in motivated reasoning; as a result, these subjects should reject incorporating into their policy preferences new information that suggests the need for more federal investment in scientific research. To test this hypothesis,

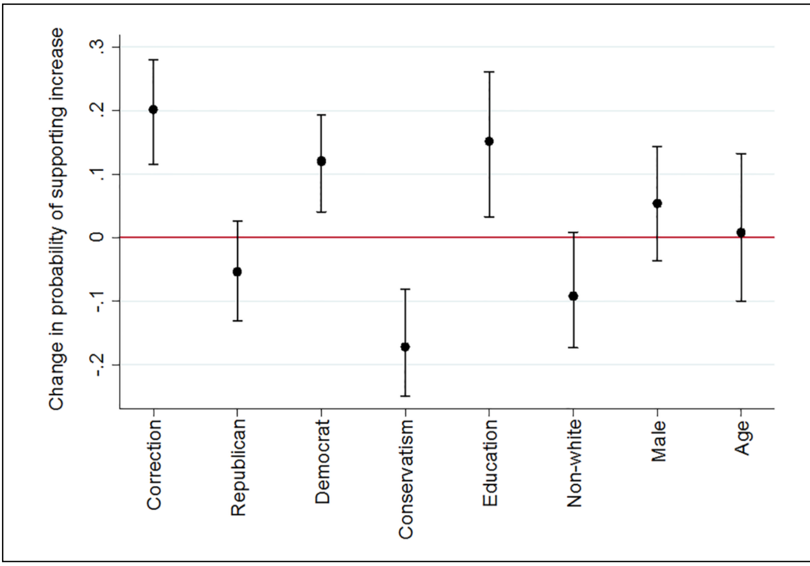

Figure 2. Effect of information on support for increased science spending.
Note. Each dot illustrates the effect of an increase in the chosen variable (from 0 to 1 for indicator variables; or a two–standard deviation increase for ordinal variables) on the predicted probability of supporting increased science spending, while holding all other variables at their median value (for ordinal variables) or zero (for indicator variables). I-bars represent 95% confidence intervals around each point estimate.

the second and third columns of Table 2 reestimate the base logistic regression with a set of new interaction variables. Model 2 examines the interaction of the treatment with the Democratic and Republican partisan indicator variables. Model 3 examines the interaction of the treatment with the 7-point ideological conservatism variable.

In both models, the coefficients on the interaction variables are small and statistically insignificant. Republicans and ideological conservatives responded to new information about the paltry share of the federal budget allocated to science in the same way as Democrats and liberals—by becoming more likely to support additional federal funding for scientific research. These results suggest that claims of an inherent antiscience bias among Republicans and conservatives are overstated. On a number of hot-button issues, such as global climate change and stem cell research, where trusted, copartisan elites have taken clear positions opposed to the scientific consensus, Republicans and conservatives in the mass public have largely rejected scientific evidence and clung to divergent policy preferences (Hart &

Nisbet, 2012). However, conservatives do not appear to be intrinsically opposed to all scientific research (Suhay et al., 2015). Rather, on the less polarizing question of the proper level of federal support for scientific research writ large, conservatives responded in the same way as liberals to new information highlighting limited existing funding levels.

The Conditional Influence of Misinformation

Finally, we began by speculating that an important reason for the comparatively low levels of popular support for increased science spending may be a product of misinformation. Consistent with this argument, we found that a majority of Americans significantly overestimate the share of the federal budget allocated to scientific research. Moreover, correcting this misperception and informing subjects of the modest level of federal support significantly increased support for additional federal science funds. To complete the analysis, we examine the relationship between an individual's estimate of the share of the federal budget devoted to science research and his or her support for increased science spending. Specifically, we test whether subjects who seriously overestimated the actual level of spending were significantly less likely, all else equal, to support increased science spending than were subjects who correctly believed that a low percentage of the budget is devoted to scientific research. Second, we examine whether providing accurate information on the limited share of the budget spent on science diminishes this effect.

Accordingly, Model 4 of Table 2 reestimates the base logistic regression model with two additional variables: each subject's initial estimate of the level of federal science funding and the interaction of this measure with the information treatment indicator. Consistent with our hypothesis, the coefficient on the science spending estimate variable is negative and statistically significant. In the control group, the more a subject overestimated how much the government already spends on scientific research, the less likely she was to support an increase in science spending. However, this relationship all but disappeared among subjects in the treatment group who were informed of the true level of federal science funding. The coefficient on the relevant interaction variable is positive and statistically significant.

Figure 3 illustrates the substantive size of the effects. In the control group, as the median subject's estimated share of federal spending devoted to science increases, her support for increased science spending drops precipitously. For example, a one–standard deviation increase (18%) in the median subject's spending estimate decreases the predicted probability of supporting an increase in science spending by almost .15 in the control group. By contrast, for the median subject in the treatment group, the corresponding

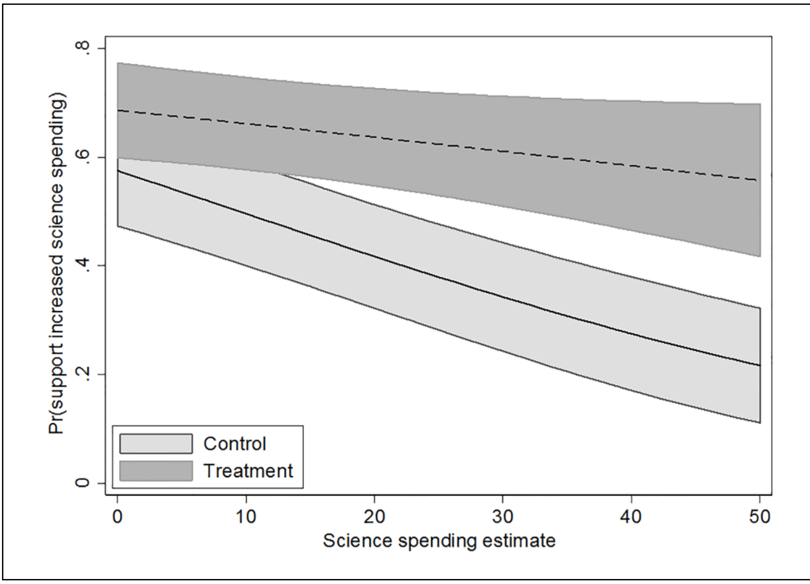

Figure 3. Effect of spending estimate, treatment versus control.
Note. Dashed line illustrates change in predicted probability of supporting increased spending on science in the treatment group; solid line indicates control. Shaded bands indicate 95% confidence intervals. The information treatment significantly dampens the negative effect of overestimating the share of the budget allocated to scientific research.

effect of such an increase is substantively small and not statistically significant.

Discussion

Despite considerable evidence that key elements of science policy are becoming more controversial and politicized in the contemporary polity, scientific research and the scientific community continue to enjoy widespread support among the American public. Super-majorities of Americans believe that the benefits of scientific research outweigh its potential harm. The scientific community remains a highly trusted institution in America, outpacing religious institutions, all three branches of government, and the media (Gauchat, 2012; Norman, 2016). Finally, more than 80% of Americans support continued federal funding for basic research (National Science Board, 2016), with more than 60% of Americans saying that government investment is essential for scientific progress (Funk & Rainie, 2015a). However, against this generally favorable backdrop, fewer than 40% of Americans support an increase in federal support for science (National Science Board, 2016).

Our results suggest an important reason for this somewhat puzzling disjunction. Many Americans significantly overestimate the existing level of governmental investment in scientific research. The median subject in our survey estimated that 10% of the federal budget is allocated to science. In reality, this figure has hovered between 1% and 2% for decades. Subjects who significantly overestimate the size of the science budget are also less likely to support an increase in science spending than others, all else being equal. For example, in our control group the median subject who opposed an increase in science spending estimated that the federal government allocates 15% of the federal budget to science. By contrast, the median subject who supported an increase in science spending estimated that the government spent only 5% of the budget on research and development.

However, the results of our experiment suggest a potential way to increase support for more federal investment in scientific research: by correcting this misperception. Informing half of our subjects of the small share of the federal budget actually devoted to science spending increased support for additional federal investment in research by 20%, all else being equal. Equally important, we found no evidence of resistance to corrections in this context (Nyhan & Reifler, 2010). Americans of all partisan and ideological stripes responded, on average, in the same way to factual information about the small percentage of the federal budget actually devoted to science—by supporting an increase in science spending.

The absence of evidence for partisan motivated reasoning in this context is consistent with the deficit model of public support for science. In this context, misinformation about the actual level of federal support for scientific research was widespread. Providing correct information produced a significant increase in public support. Our results also add to existing scholarship challenging assertions of an inherent antiscience among ideological conservatives (Mooney, 2006). Rather, Americans' reactions to science and scientific evidence are more contextual and contingent than sometimes argued (Suhay et al., 2015). Partisan motivated reasoning may be limited in this context because our experiment only gauged public support for scientific research in general. Future studies that assess the influence of corrective information on public support for increased federal support for specific forms of science spending that are more polarized and controversial, such as to support stem cell or climate change research, may find much stronger evidence of partisan motivated reasoning.

Our results could also have significant policy implications. An extensive literature in political science has explored the responsiveness of policy makers to public opinion (e.g., Geer, 1996; Monroe, 1998; Page & Shapiro, 1983; Stimson, MacKuen, & Erikson, 1995; see Burstein, 2003, for a review). Within the context of budgetary policy, scholars have found strong evidence that spending levels track changes in public opinion in specific areas, such as defense (Bartels, 1991; Hartley & Russett, 1992; Wlezien, 1996). More broadly, research by Wlezien (2004) found evidence of budgetary responsiveness to public opinion across a wide range of policy domains; however, this responsiveness was strongest in highly salient areas. This suggests that public opinion has the potential to be a powerful ally in the efforts of proponents of scientific research to secure greater federal support. If advocates of greater federal investment can correct widespread misperceptions about the actual level of federal support for scientific research, they can significantly increase the percentage of Americans who support increased spending. If they can also increase the salience of science policy in the public mind, this greater support may translate into tangible political pressure on elected officials to respond to popular preferences.

There are several limitations of the current study that merit discussion as fruitful grounds for future research. In this experiment all subjects were first asked to estimate the percentage of the federal budget devoted to scientific research. As a result, we cannot assess whether the effects of providing the correct spending level would be different if we had not first asked subjects to estimate (often incorrectly) the actual level of spending. It is at least possible that for many this initial overestimation shaped how they then responded to the correct information.[11]

Another limitation of the current study is that it did not force subjects to make difficult choices and consider trade-offs in budgetary policy making. Past research has debated important questions about how best to measure public support for governmental funding of scientific research. For example, Besley (2013) notes that most existing surveys ask subjects whether they support spending more money on scientific research without forcing them to make difficult trade-offs, such as cutting spending on other priorities or raising taxes (though, see Bonica, 2015). To support increases in science spending, are Americans willing to make corresponding spending cuts in other priorities or to increase taxes? Future research should examine the extent to which simply informing subjects about the relatively meager current level of federal science funding will encourage Americans to make these more difficult trade-offs. Furthermore, future research could explore how popular trust in the messenger may moderate the influence of corrective information about actual spending levels on public support for increased science spending.

Nevertheless, our results do suggest the importance of another, oft-overlooked element of scientific literacy. While previous research in this vein has meticulously examined the public's factual scientific knowledge and understanding of the scientific method (Bauer et al., 2007; J. D. Miller, 1998), equally important may be the public's understanding of the political realities concerning governmental support for research and development. Correcting widespread misperceptions about the level of federal science spending may help close the gap between the overwhelming majorities of Americans who support scientific research in the abstract, and the more meager numbers who back increased federal investment in research and development.

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Notes

1. Replication materials are available at https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/HOPG6E
2. Additional data are available at http://www.aaas.org/page/historical-trends-federal-rd
3. However, in other aspects of science policy, research has found less evidence of partisan motivated reasoning (e.g., Clarke et al., 2015).
4. Sample demographics and comparisons to census data are presented in the Supporting Information, available at: https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/HOPG6E
5. We focus on support for increased spending as the most politically salient quantity. However, multinomial logit regressions examining the factors influencing the probability of observing all three response categories yield substantively similar results. See online Supporting Information.
6. As a randomization check, we regressed assignment to the treatment group on a host of demographic control variables, including partisan affiliation, ideology, educational attainment, age, gender, and race. We found no evidence of statistically significant imbalances in the demographic characteristics of the sample across the treatment and control groups.
7. "True" independents and those who affiliated with another or no political party make up the omitted baseline category. Treating leaners as independents yields substantively similar results.
8. Just under 7% of our sample replied that they were unsure of where to place themselves on the ideological scale (4% also refused to answer the question). We recoded those who said they were not sure as moderates (almost 60% of these subjects identified as true independents, or replied that they were unsure of their

partisan affiliation). Replicating our logistic regression analyses dropping subjects who were unsure of their ideological leanings yields substantively similar results.
9. Just under a quarter of our sample answered either 1% or 2%.
10. A simple difference in means also reveals a statistically significant difference in support for increased spending across the control (47%) and treatment (63%), $p < .001$. See online Supporting Information for additional tests. Finally, a simple comparison of support for the three response options reveals an identical pattern. In the control group, which received no additional information, 47% supported increases; 39% supported maintaining current levels; and 14% favored decreases in spending. In the treatment group, which received information about the actual low level of federal science spending, 63% favored increases; 31% supported maintaining current levels; and 6% favored decreases in spending.
11. We thank an anonymous reviewer for suggesting this possibility.

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