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Gordon Gauchat[a]

Abstract

This study explores time trends in public trust in science in the United States from 1974 to 2010. More precisely, I test Mooney's (2005) claim that conservatives in the United States have become increasingly distrustful of science. Using data from the 1974 to 2010 General Social Survey, I examine group differences in trust in science and group-specific change in these attitudes over time. Results show that group differences in trust in science are largely stable over the period, except for respondents identifying as conservative. Conservatives began the period with the highest trust in science, relative to liberals and moderates, and ended the period with the lowest. The patterns for science are also unique when compared to public trust in other secular institutions. Results show enduring differences in trust in science by social class, ethnicity, gender, church attendance, and region. I explore the implications of these findings, specifically, the potential for political divisions to emerge over the cultural authority of science and the social role of experts in the formation of public policy.

Keywords

cultural authority of science, political ideology, public understanding of science, science and technology

In the first months of his presidency, Barack Obama addressed the National Academy of Sciences to speak about U.S. science policy and a renewed commitment to fund scientific research. In this speech he charged: "We have watched as scientific integrity has been undermined and scientific research politicized in an effort to advance predetermined ideological agendas" (White House 2010). The previous administration under George W. Bush was widely seen as unfriendly toward the scientific community. As a consequence, many scientific organizations and advocacy groups became concerned that political and ideological interests were threatening the cultural authority of science. Prior to the 2008 presidential election, the National Academy of Sciences and 150 universities and associations joined together to form ScienceDebate2008 to address the politicization of science and organize a presidential debate on science policy. Although no formal debate occurred, the group produced a set of questions

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and responses from the major party candidates, Barack Obama and John McCain.[1] In summary, scientific organizations, policymakers, and social analysts have voiced increasing concern about the politicization of science, both in government and the public sphere.

The perceived politicization of science during the Bush administration awakens longstanding problems in Science and Technology Studies (STS) concerning the relationship between politics and science.[2] On the one hand, STS has established that science and politics are inseparable (Cozzens and Woodhouse 1995; Frickel and Moore 2005; Jasanoff 2004). STS research has shown that scientific knowledge embodies the interests of various social actors and institutions, including scientists, departments, professional organizations, universities, funding agencies, regulatory agencies, and legislators (Barnes 1977; Bloor 1976; Gieryn 1999; Jasanoff 1990; Knorr Cetina 1983; Latour and Woolgar 1979; Shapin 1994). As a result, the political interests of social actors and powerful funding organizations are assumed to be part and parcel of the production of scientific knowledge. Simply put, *science has always been politicized*. What remains unclear is how political orientations shape public trust in science and how these dynamics might influence the way science is organized.

One key aspect of the cultural authority of science is the link between scientific knowledge and political authority (Frickel and Moore 2005; Gieryn 1999; Jasanoff 1990, 2004). In the political sphere, the credibility of scientific knowledge is tied to cultural perceptions about its political neutrality and objectivity, which are crucial social resources for building consensus in ideologically polarized policy arenas. In its legitimation role, the scientific community leverages its credibility and technical expertise to assess and certify social policy and other institutional practices (e.g., military technology, medical developments, and expert advisory panels). A breakdown of this postwar consensus along sociopolitical lines may signal that the authority of science no longer provides sufficient legitimacy to policymakers and government regulators or, paradoxically, that the authority of science has reached its upper limit (Yearley 1994). Thus, unsettled questions about the "politicization of science" persist, particularly the dynamics of public trust in science across political orientations and ideologies. The relationship between public trust in science and political orientations also poses larger questions about the unevenness of the cultural authority of science and the potential for deep sociocultural divisions in the public sphere.

The current study addresses these issues by examining differences and changes in public trust in science by political ideology and party as well as changes resulting from particular cultural movements and shifts. Drawing on various theoretical perspectives, I explore uniform (i.e., among all groups) versus group-specific change over time. In particular, I examine Mooney's (2005) claim that conservatives have become increasingly distrustful of science.

SCIENCE AND THE MODERN WORLD

Luhmann (1979) suggests that trust in science involves an abstract faith that some third-party has the specialized knowledge to apprehend the complexity of the world (e.g., how car engines work, how to fight disease, or how to manage economic affairs). Luhmann concludes that this form of trust is essential to highly differentiated societies where knowledge is specialized and disparate, because it ameliorates the uncertainty attached to the unknown (see also Shapin 1994). For Barber (1990:144), public trust in science is an extension of science's cultural achievements: "Through all the multifarious benefits it has brought, science has increased public trust certainly in its competence, but more ambivalently, in its fiduciary responsibility for the public welfare." This cultural congruence between scientific knowledge and secular institutions has led to competing ideas about how the public views science-in-society.

The view that public trust in science is related to the growth of modern social

systems has enjoyed longstanding support in social science and the dominant culture. Parsons (1962) proposed that scientific knowledge, particularly its empirical and universal qualities, is essential to secular institutions. Similarly, Barber (1952, 1975, 1990:40) describes a "special congruence" of science with rational-legal authority and modern societies. Yet, even these scholars envisaged limits to public trust in science, because, in their view, organized science would reach a level of societal prestige and power that would engender public anxiety (Barber 1990; Merton 1938; Parsons 1962). STS scholars have been sharply critical of the "special congruence" of science and modernity on numerous fronts (for a concise summary, see Shapin 2008), but most clearly, the underlying assumption that modernity is irrevocably tied to scientific progress and technical innovation. Notwithstanding these criticisms, the modernist argument translates into a clear and testable hypothesis. Predominately, it forecasts science's cultural ascendency: a uniform growth in public trust in science over time that may be slowed by a general distrust in power and authority.

Conversely, commentators from a variety of social backgrounds have expressed concern over a "crisis of trust" in science that is associated with "the very limits of modernity" (Yearley 2000:105). For example, Holton (1993:145) argues that "anti-science" dispositions pose a serious threat, because "it is one symptom of a long-standing struggle over the legitimacy of the authority of conventional science, as well as of the concept of modernity within which science claims to be embedded." Holton (1993:153) contends that "anti-science" challenges come from numerous segments of society that desire to delegitimize science and secular institutions. Beck (1992) offers the most wide-ranging sociological critique of science in modern societies. Beck's main point is that the cultural authority of science is destabilized by the application of scientific rigor to itself, that is, the intensity and ubiquity of scientific skepticism undermines its own credibility and ability to influence public debate (Beck 1992). Beck also maintains that the public holds the scientific community responsible for the negative consequences of industrialization. These "catastrophic risks" are prominent features of the early twenty-first century and include toxic waste, pandemics, food contamination, and climate change (Beck 1992:156; see also Giddens 1991). In opposition to the cultural ascendency thesis, there is potential for a severe cultural backlash and growing public alienation from science. This alienation stems from anxiety over the negative consequences of industrialization, technocratic authority, and the diminished capacity of science to make credible truth-claims in the public sphere.

Research in the area of Public Understanding of Science (PUS) has not addressed these broad sociological issues directly. Instead, it has emphasized the relationship between public scientific literacy—knowledge of basic scientific facts, methods, and developments—and favorable public attitudes toward science and scientists: a perspective often called the deficit model. Empirical studies do support an association between scientific literacy or education and public trust in science (Allum et al. 2008; Gauchat 2008, 2010). However, the statistical relationships are fairly weak and explain attitudes about science only in the abstract (e.g., Does science change life too fast?). Notably, scientific literacy and levels of education do not predict attitudes related to specific science controversies (e.g., attitudes about climate change) (Allum et al. 2008; Gauchat 2010). Similar to the cultural ascendency thesis discussed earlier, it follows from the deficit model that educated populations will evince greater overall trust in science, which cross-national studies confirm (Allum et al. 2008; Inglehart 1997). Yet, evidence for expanding trust *within* the United States is less straightforward. Some studies show increased favorability toward science over time in the United States (National Science Board 2008, 2010); other studies find mixed trends depending on question wording and content (Miller 2004). Taken together, these results highlight a perplexing issue: cross-nationally, more highly educated societies

trust science more; yet, within advanced societies the expansion of public education over time has not brought about greater public trust. One possible interpretation, supported by a growing number of studies, is that social factors such as race/ethnicity, income, religiosity, social capital, and political identifications are at least as important as knowledge and education in predicting trust in science (Gauchat 2008, 2010; Sturgis and Allum 2004; Yearly 2005).

These recent studies underscore the overall problem with the deficit approach. In short, it contradicts a basic tenant of sociology: the idea that subgroups of society possess distinct cultural perspectives and that these perspectives have consequences for how groups relate to social institutions. Consequently, social scientists have criticized the literacy approach on numerous fronts. The most prominent critique is that it presumes the cultural superiority of scientific knowledge over other types of knowledge that lay people might also possess (Wynne 1995). Hilgartner (1990) adds that this approach abdicates scientists' role in popularizing science; instead, it blames the media and public education when communication fails (e.g., climategate). Overall, research on public trust in science has yet to address sociological issues relating to group change over time and has insufficiently identified how ideological dispositions influence public attitudes irrespective of education.

POLITICS AND SCIENCE IN THE PUBLIC SPHERE

One question that remains largely overlooked is whether change over time in public trust in science is uniform or group-specific. The cultural ascendancy and alienation theses each imply a uniform increase or decrease in public trust in science, respectively. These uniform changes correspond with a general mood in society or large-scale cultural shifts, such as expanded public education or a general alienation from technocratic authority. Another possibility is that public trust in the United States is associated with social factors such as political ideology or religious cleavages, which account for declines or improvements in public dispositions toward science but are group-specific. For example, Mooney (2005) claims that ideological conservatives in the United States have become increasingly disenchanted with the scientific establishment since the 1970s. Accordingly, he anticipates that conservatives in the United States will exhibit group-specific change in trust in science over time.

To summarize, Mooney proposes that in the first two decades after World War II, political parties and ideologies were largely neutral and even deferential toward the scientific community. According to this account, the political neutrality of science began to unravel in the 1970s with the emergence of the new right (NR)—a group skeptical of organized science and the intellectual establishment in colleges and universities (see also Hofstadter 1970).[3] The NR is often closely aligned with the religious right and promotes limited government, strong national defense, and protection of traditional values against what they view as encroachments of a permissive and often chaotic modern society (Blee and Creasap 2010; Frank 2004; Gross, Medvetz, and Russel 2011; Jenkins and Shumate 1985; Krugman 2009; McCarty, Poole, and Rosenthal 2006). Mooney and others have argued that the NR gained considerable political power with the election of President Reagan. In addition to his prediction that conservatives have grown more distrustful of science, Mooney identifies two cultural shifts in public trust in science in the United States. The first occurred with Reagan's presidential election in 1980. The second shift occurred with the election of President George W. Bush in 2000, which Mooney marks as the start of the conservative "war on science."

The NR's ideology conflicts with the scientific community on a number of crucial aspects. First, Mooney (2005:5) identifies an inherent tension between conservatism as a political philosophy that emphasizes traditionalism and the "dynamism of scientific inquiry—its constant onslaught on old orthodoxies, its rapid generation of new technological possibilities."

Mooney also stresses two key constituencies of the NR, the religious right and transnational corporations, that each have vested interests in scientific outcomes. Corporations subject to government regulation often challenge science to undermine federal controls and protect their profit margins (McCright and Dunlap 2000, 2003). Religious groups clash with science over moral, epistemological, and ontological issues, such as Darwinian evolution, stem cell research, and AIDs research (Ansell 1997; Burack 2008; Smith 2001). Studies of the conservative movement in the United States have also focused on its cultural dimensions and, particularly, the NR's media empire. Beginning with radio and book publishing houses and then extending into cable television, think tanks, and Internet social networking sites, the NR has created an intellectual apparatus that promotes the conservative agenda and articulates a conservative cultural identity. This intellectual base represents an alternative to academic locations and the scientific community and is often socially distinguished and reinforced through its criticism of "liberal" bias in these cultural spheres (Blee and Creasap 2010; Gross et al. 2011; Nash 1998). For example, Jacques, Dunlap, and Freeman (2008) have identified an elite-driven movement that is culturally located in conservative think tanks and media outlets and often disputes scientific conclusions to advance ideological or financial goals (see also Oreskes and Conway 2010). Altogether, a wide range of scholarship points to the NR's intellectual boundary work that successfully distinguishes the conservative identity in terms of a competing base of knowledge that opposes the broader society's established cultural institutions (Gross et al. 2011).

STS research has also identified changes to organized science since the early postwar period that may account for distrust among conservatives. Chief among these is the growth of regulatory science, which has been a central theme in STS for the past few decades. In Jasanoff's (1990) research, regulatory science refers to the institutionalization of science's legitimization role through the formation of a science advisory community. Her main examples of regulatory science are the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA), organizations that are considered adversarial to corporate interests. Regulatory science directly connects to policy-management and, therefore, has become entangled in policy debates that are unavoidably ideological. Yearley (1994:252) argues that "there has begun to be a switch from science being seen as a way of increasing production to a view of it as a means of handling risks and of achieving regulation." The shift toward regulatory science that began in the 1970s could account for conservatives' growing distrust in science, given this group's general opposition to government regulation. These considerations further strengthen Mooney's account, because they stress the changes in organized science that have helped mobilize conservative discontent.

MAIN HYPOTHESES

This study examines three specific hypotheses related to the uniform and group-specific changes described earlier. Although these hypotheses do not necessarily correspond with full-blown theories, they represent important empirical possibilities that are informed by previous research and scholarship. The *cultural ascendency thesis* predicts a uniform increase in public trust in science across all social groups. In other words, the special congruence of science and modern institutions increases the need for scientific knowledge and public education, which, in turn, encourages public trust in science (Barber 1990; Parsons 1962; Whitehead 1946). By contrast, scholars have predicted a uniform decline in public trust across all social groups, or the *alienation thesis*. This decline in public trust is associated with a cultural backlash against technocratic authority and science's inability to defend itself against its own standards in public discourse (Beck 1992; Holton 1993). Finally, the *politicization thesis* predicts that ideological conservatives will experience group-specific declines in trust in science over time. Conservatives' distrust is attributable to

the political philosophy and intellectual culture accompanying the NR and the increased connection between scientific knowledge and regulatory regimes in the United States, the latter of which conservatives generally oppose.

The politicization thesis also translates into two supplementary hypotheses. First, public distrust in science is associated with two cultural shifts: the first occurred during the post-Reagan era (after 1980) when the NR emerged politically, and the second during the NR's intensification in the G. W. Bush era (2001 to 2008). Second, declines in public trust in science will be unique to ideological conservatives, suggesting that other key sociopolitical groups will experience no significant change over time.

DATA AND MEASUREMENT

Data for this analysis come from the General Social Survey (GSS), 1972 to 2010 (Smith et al. 2011). The GSS was administered annually between 1972 and 1994 (except 1979 and 1992) and biannually since 1994. This analysis uses a repeated cross-sectional sample for 26 years between 1974 and 2010 (some questions used in the analysis were not asked in 1972 and 1973). The GSS uses a split-ballot design with ballots typically given to a random two-thirds of the sample. Even with these limitations, the final sample includes 30,802 cases. The repeated cross-section series provided by the GSS is an ideal data source for examining changes in attitudes (see Loftus 2001). The advantage of the GSS is that it contains repeated measures of demographic characteristics, political ideology, and party identifications, as well as questions relating to public confidence in the scientific community starting in the early 1970s.

Measurement of Trust in Science

"Confidence in Institutions" questions have appeared in the GSS since 1974. Many studies have used similar confidence items to measure public trust in various political and nonpolitical institutions (see, e.g., Paxton 1999; Pharr, Putnam, and Dalton 2000; Zmerli and Newton 2008). Luhmann (1979:4) defines trust simply as "confidence in one's expectations" that mitigates the complexity and uncertainty of the social world so that action can occur. Luhmann (1979:72) proposes that a lack of trust results in "often drastic simplification" because individuals narrow down the information they are confident they can rely on and are thus more dependent on less information. This study adopts this conceptualization of trust and distrust.

The GSS asked respondents the following question: "I am going to name some institutions in this country. As far as the people running these institutions are concerned, would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them [the Scientific Community]?" Respondents were then given the choice to respond "a great deal," "only some," or "hardly any" (they could also choose "don't know" or "refuse"). Over the 36 years of the GSS, 40.8 percent expressed a "great deal" of confidence in the scientific community, 46.2 percent responded "only some," and 6.6 percent expressed "hardly any." In addition, 6.5 percent of respondents chose "don't know" or "refuse." To simplify the analysis, I recoded this variable into a binary outcome comparing respondents with "a great deal" of confidence to those with "only some" and "hardly any" combined. I ran a supplementary analysis with "don't know" responses coded as zero, but this had no influence on the results.

Although the confidence variable has its limitations (Peterson 1981; Smith 1981), it is the most frequently asked question relating to science in the GSS and the only repeated science item going back to 1974. I examined the 2006 to 2010 GSS in supplementary analyses because it contains a wide variety of items that probe different aspects of public trust in the scientific community. These analyses suggest that the confidence measure used in this study is a reasonable approximation of a favorable disposition toward science.

Measurement of Independent Variables

To identify group-specific changes in confidence in science, I examine a number of political identifications. Political ideologies are categorized as "conservative," "liberal," and "moderate." Among respondents, 4.8 percent did not identify with a political ideology and were excluded from the multivariate analysis. I also examined models that included these cases; results were nearly identical to those presented below. Measures for political parties are categorized as "Republican," "Democrat," and "Independent." Of the respondents, 1.5 percent identified with "other party"; I excluded this category from the analysis. The main focus of this study is the effect of political ideology on trust in science. Political parties in the United States largely reflect ideological distinctions between conservative and liberal, but this correspondence is not perfect. For the purposes of this study, political party is a secondary orientation that likely tempers pure ideological divisions.[4] Consistent with the politicization thesis, I consider two cultural break effects. I use a *post-Reagan era* (1981 to 2010) variable measured 1 for every year after the election of President Reagan and 0 otherwise. Additionally, I created a cultural break variable for the Bush era; this is coded 1 for every year of the Bush administration (2001 to 2008) and 0 otherwise.

A number of options are available for specifying time. Preliminary analyses included a dummy variable for each survey year; however, when all covariates were added, these survey year variables were not statistically significant. Alternative models with a single continuous trend variable did not substantially change the results, so the final analysis reported here includes only a linear time trend variable, *time (yrs)*. After experimenting with various transformations of time, there was no evidence for a nonlinear relationship between time and confidence in science.

The analysis also includes numerous demographic controls. Gender is represented by a dummy variable for female. Ethnicity is represented by a dummy variable for nonwhites. I measure education in two ways because of its potentially strong interrelation with the political variables and confidence in science. First, education is represented by a count variable for years of schooling. Second, I use three dummy variables for highest degree: high school degree, four-year college degree, and graduate degree. Family income is measured in real dollars. However, 10.2 percent of cases for this measure were missing. I imputed missing values for this measure using the Gaussian normal regression imputation method. I include a dummy variable for South to control for regional differences. I measure strength of religious faith by how often respondents attend religious services. Age is represented in years and, after experimenting with various transformations, I added a squared polynomial to represent nonlinear age effects.

Analytic Strategy

This analysis evaluates constant period effects as well as changes across survey years in public trust in science. Constant period effects refer to associations that do not change over time and could represent either a broad cultural climate or reactions to specific events or social movements. One can also conceptualize constant period effects as the average effect of a group or characteristic over the entire study period. The cultural ascendency and alienation hypotheses, discussed earlier, generally correspond to a "spirit of the times" model in public opinion research (House and Mason 1975; Weakliem and Borch 2006), which suggests that change over time would apply equally to all political and sociodemographic groups. Group-specific changes are of particular interest in this study. That is, the politicization thesis suggests that declines in public trust in science are largely attributable to changes unique to ideological conservatives. In linear regression models, I examine group-specific change by including interaction effects with time (e.g., conservative × time). Analysis of group-specific change over

time is complicated by the use of a binary outcome.

The analysis below uses logistic regression to examine the association between political ideology and public trust in science over time. To evaluate group-specific change, I added over time interactions between groups and time to the models; however, interpretation of these interaction effects is not analogous to linear models. Traditional tests of equality of coefficients across groups cannot be used because the estimated logit coefficients confound the magnitude of the effect of a predictor with the degree of unobserved heterogeneity in the model (Allison 1999; Long 2009). Because predicted probabilities are unaffected by residual variation, tests of equality of predicted probabilities across groups can be used to evaluate group differences. I used the delta method to examine the statistical significance of group comparisons. I computed predicted probabilities and delta significance tests using Stata 11's MARGINS command. All predicted probabilities reported below represent average probabilities of an outcome at different values of the covariates (e.g., conservative = 0, conservative = 1). Reported values represent the average of the probability among actual persons in the data.

Because this study examines group-specific versus uniform change, time varying covariates are the focus of this analysis. There is some difficulty with age-period-cohort analyses using repeated cross-section sample surveys. The methodological challenge arises because of the exact linear dependence between age, period (time), and cohort (Period = Age + Cohort). To alleviate the APC problem, the analysis treats cohort as a random effect and age and period as fixed effects in a mixed-level model (Yang and Land 2006, 2008). This approach can assess the amount of variance in the dependent variable that is associated with cohorts while controlling for time and age. Cohort is measured using respondents' year of birth. Comparing point estimates and standard errors before and after the inclusion of random cohort effects indicates relatively small changes. However, due to the many advantages of random effects, there are likely some limitations in the current specification due to the fixed period effects. Alternative specifications that add random period effects did not change the conclusions of the analysis (see Table S1 in the online supplement [http://asr.sagepub.com/supplemental]). However, future research should explore alternative and more robust estimation methods.

ANALYSIS

Aggregate Change

Table 1 shows descriptive statistics for the combined GSS data. Approximately 34 percent of respondents identify as conservative, 39 percent identify as moderate, and 27 percent identify as liberal over this period. Figure 1 shows changes over time in unadjusted means for public trust in science by political ideology, which corresponds to the relative frequencies for each group reporting a "great deal" of confidence in science in a survey year. Conservatives' trust in science clearly declined over the period: they begin the period with the highest levels of trust and end with the lowest. Patterns for liberals and moderates are less definitive. Liberals ended the period with the highest levels of trust among ideological groups, due to consistently low levels of trust among moderates and a decline among conservatives. In summary, moderates show the lowest levels of trust among ideological groups for most of the period, conservatives close the gap with moderates around the millennium, and a large gap opens up between conservatives and liberals after the 1980s. Overall, Figure 1 offers superficial evidence for the politicization thesis. However, further analysis is needed to corroborate these patterns before more definitive interpretations can be advanced.

Constant Period Effects and Group Specific Change

Table 2 shows parameter estimates from mixed-level logistic regression models predicting trust in science.[5] Results in Model 1 represent the "spirit of the times" model (House and

Table 1. Descriptive Statistics, General Social Survey 1974 to 2010 (N = 30,802)

Variables	Mean	SD	Min	Max
Confidence in Science	.436		0	1
Female	.545		0	1
Non-white	.168		0	1
Education (yrs)	12.915	3.035	0	20
High School	.580		0	1
Bachelor	.149		0	1
Graduate	.069		0	1
South	.249		0	1
Church Attendance	3.845	2.677	0	8
Family Income	.029	.996	–1.840	4.980
Age	4.468	1.707	1.8	8.9
Independent	.131		0	1
Republican	.352		0	1
Moderate	.383		0	1
Conservative	.342		0	1
Post-Reagan (1981 to 2010)	.750		0	1
Bush (2001 to 2008)	.152		0	1
Cohort	1945.631	19.580	1885	1992

Note: Family income is measured in constant dollars (year = 1986) and *z*-scores are standardized. The original age variable was divided by 10. Respondents born between 1900 and 1939 represent 34.21 percent of the cumulative GSS sample.

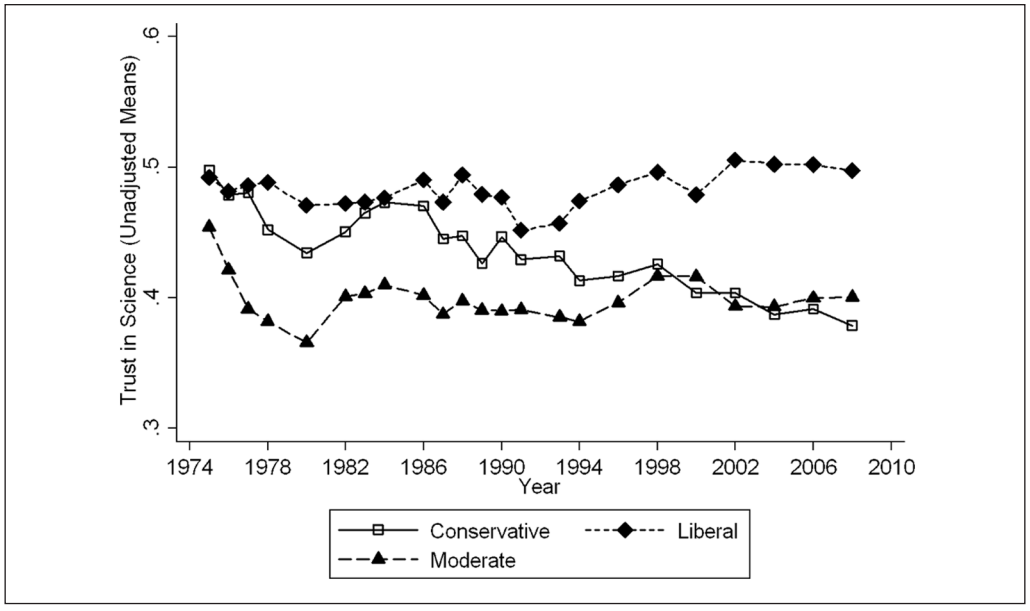

Figure 1. Unadjusted Means of Public Trust in Science for Each Survey Year by Political Ideology
Note: Figure shows three-year moving averages for each group, which smooth the patterns overtime.

Table 2. Mixed-Level Logit Models Predicting Public Confidence in Science (N = 30,802)

	Model 1	Model 2	Model 3
Fixed Effects			
Time (yrs)	−.006**	.001	−.006**
	(.002)	(.003)	(.002)
Female	−.270***	−.271***	−.271***
	(.024)	(.024)	(.024)
Non-white	−.455***	−.456***	−.456***
	(.035)	(.035)	(.035)
Education (yrs)	.059***	.058***	.058***
	(.008)	(.008)	(.008)
High School	.086	.084	.085
	(.044)	(.044)	(.044)
Bachelor	.395***	.394***	.397***
	(.073)	(.073)	(.073)
Graduate	.348***	.344***	.347***
	(.093)	(.093)	(.093)
South	−.109***	−.107***	−.107***
	(.028)	(.028)	(.028)
Church Attendance	−.043***	−.042***	−.042***
	(.005)	(.005)	(.005)
Family Income	.107***	.107***	.107***
	(.013)	(.013)	(.013)
Age	−.324***	−.336***	−.335***
	(.042)	(.042)	(.042)
Age^2	.029***	.031***	.030***
	(.004)	(.004)	(.004)
Independent	−.210***	−.208***	−.209***
	(.038)	(.038)	(.038)
Republican	.035	.051	.046
	(.028)	(.028)	(.028)
Moderate	−.221***	−.155**	−.152**
	(.030)	(.058)	(.058)
Conservative	−.185***	.098	−.002
	(.033)	(.060)	(.061)
Post-Reagan (1981 to 2010)	−.057	−.061	.046
	(.043)	(.043)	(.062)
Bush (2001 to 2008)	−.019	−.015	.063
	(.044)	(.044)	(.071)
Moderate × Time		−.004	
		(.003)	
Conservative × Time		−.016***	
		(.003)	
Post-Reagan × Moderate			−.099
			(.069)
Bush × Moderate			.017
			(.086)
Post-Reagan × Conservative			−.200**
			(.072)
Bush × Conservative			−.246**
			(.088)
Random Effects			
Cohort (v)	.006**	.005*	.005*
ρ	.002	.001	.002
Log likelihood	−20234	−20217	1780
BIC	40675	40661	40691
AIC	40509	40478	40491

Note: Numbers in parentheses are standard errors. Birth year 1939 and under is the reference category for born. Democrat is the reference category for political party. Liberal is the reference category for ideology. Age^2 is a squared term.

*p < .05; **p < .01; ***p < .001 (two-tailed tests).

Mason 1975; Weakliem and Borch 2006), in which effects of the independent variables are constant over the period. A variable representing time is also included. Model 2 adds time/ideology interaction effects, and Model 3 adds cultural break/ideology interaction effects. For political ideology, the reference category is liberal, and for party, the reference category is Democrat. Parameter estimates represent the logged odds of reporting a "great deal" of confidence in science.

Findings for demographic characteristics, reported in Model 1, are largely consistent with previous research. Education is associated with greater trust in science, and church attendance predicts lower levels of trust (Bak 2001; Gauchat 2008, 2011; Hayes and Tariq 2000; Sturgis and Allum 2004). Age has a nonlinear effect, with trust in science declining and then increasing. Underprivileged groups show lower levels of confidence in science: women, non-whites, and individuals with lower family incomes all report lower levels of trust. I also find regional differences: Southerners report lower levels of trust in science compared to other Americans. The effect for cohort (ν) in Model 1 is statistically significant and suggests there is systematic variance between cohorts that remains unaccounted for after controlling for age and period effects. However, the estimated residual interclass correlation of the latent variable indicates that cohort accounts for less than 1 percent of the systematic variance in trust in science. In short, the age and period fixed effects reported here are not confounded with cohort effects. Moreover, cohort does not appreciably influence public trust in science, and this finding remains consistent for all models reported in this analysis.

Moving to political factors, Model 1 shows political ideology is associated with public trust in science. Conservatives and moderates each report less confidence in science than do liberals. The predicted probability of reporting a "great deal" of confidence in science is .47 for liberals, compared to .42 for moderates and .43 for conservatives. Differences between liberals and conservatives, and liberals and moderates, are statistically significant at $p < .001$, but the difference between conservatives and moderates is not significant. Consistent with the unadjusted means reported in Figure 1, moderates are not equidistant between liberals and conservatives but actually have the lowest predicted trust in science across the three ideological groups for the entire period. Effects for political party are less straightforward. The effect for Republican is positive but not statistically significant, and the effect for independent is negative and significant. This suggests that Democrats and Republicans do not differ in their trust in science. Results for political party remain regardless of whether ideology is included in the model (models without ideology not shown here).

Altogether, results in Model 1 show that public trust in science varies by political orientation as well as by demographic factors such as gender, ethnicity, and social class. To evaluate the effect for time, I examined the average change in predicated probabilities. The effect of time is negative and statistically significant ($p < .01$), suggesting a general downward trend in public trust in science among all groups. Cultural break effects, measured by the post-Reagan and Bush eras, are not statistically significant. Results in Model 1 directly contradict the cultural ascendency thesis, because they indicate a uniform decline in public trust in science over time. To compare the cultural ascendance thesis to predictions of the politicization thesis, Models 2 and 3 provide an analysis of group-specific change over time.[6]

Models 2 and 3 show results when political ideology is interacted with time and the cultural break variables, respectively. The moderate × time effect is negative, but predicted probabilities of reporting a "great deal" of trust do not change over time ($p = .344$).[7] The conservative × time effect is also negative, but larger than the moderate/time interaction. Looking at changes in predicted probabilities for conservatives over time indicate a fairly steep decline in their trust in science ($p < .001$). Finally, changes in predicted probabilities for liberals are also negative but are not significant ($p = .554$). These findings are largely consistent with Figure 1 as well as the central claim of the politicization thesis,

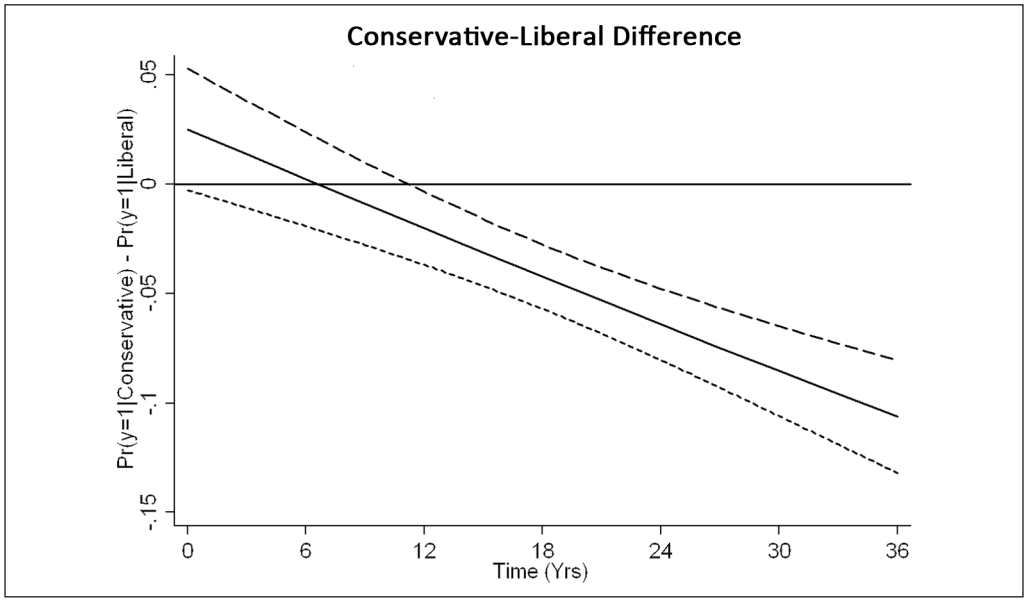

Figure 2. Predicted Probabilities Comparing Liberals and Conservatives
Note: Computed from logit models comparing the difference in predicted probabilities for liberals and conservatives over time along with the 95 percent confidence interval.

which predicts that conservatives' trust in science has declined substantially since the 1970s, while other groups have exhibited little or no change. Figure 2 presents differences in conservatives' and liberals' predicted probabilities over time.[8] Larger negative numbers indicate that the difference between conservatives and liberals is growing with time. Dashed lines in Figure 2 represent the 95 percent confidence interval of the differences. This figure illustrates that conservatives began the period with similar trust in science relative to liberals and ended the period with lower trust; moreover, these differences became significant in the early 1980s.

Model 3 reports interactions with the post-Reagan era and Bush era. Rather than modeling the decline in trust among conservatives as a gradual and continuous process, the interaction effects with the cultural break variables suggest an abrupt shift. As discussed earlier, Mooney posits that science has become more politicized since Reagan's election (1981 to 2010), but that the most abrupt change occurred during George W. Bush's presidency (2001 to 2008). Both the conservative × post-Reagan and conservative × Bush effects are negative, offering preliminary support for Mooney's claims. The predicted probability of reporting a "great deal" of trust in science for conservatives prior to 1980 is .45, and after the election of Reagan it is .42 ($p < .05$). Evidence also suggests a stronger cultural break among conservatives during the George H. W. Bush years ($p < .01$). The Bayesian Information Criterion (BIC), a model fit statistic that penalizes over-parameterized models, can be used to compare which model of change over time provides a better summary of the data. Raftery's (1995) guidelines suggest that the difference of 30 between Models 2 and 3 provides very strong support for the continuous or long-term change model relative to the cultural break model.

To summarize the findings, changes in confidence in science are not uniform across all groups. Moreover, conservatives clearly experienced group-specific declines in trust in science over the period. These declines appear to be long-term rather than abrupt. These results provide strong evidence for a key claim of the politicization thesis. I also examined interactions with time and demographic factors (supplementary analyses not

shown here). Comparing predicted probabilities, only the church attendance × time interaction was statistically significant, and the direction of change was negative. These results are worth mentioning, because they indicate that only conservatives and those who attended church frequently experienced group-specific change over time. Given Mooney's account, it is difficult to distill these two findings, because the growing force of the religious right in the conservative movement is a chief factor contributing to conservatives' distrust in science. Findings in Table 2 thus also support the politicization thesis's stronger claim that *the growing distrust in science in the United States has been driven by a group-specific decline among conservatives.*

As mentioned, one interpretation of these findings is that conservatism in the United States has become a cultural domain that generates its own knowledge base that is often in conflict with the cultural authority of science. For example, on fundamental ontological questions about who we are and how we got here, conservatives are far more likely to doubt scientific theories of origins, including theories of natural selection and the Big Bang (Newport 2007, 2009). A growing number of conservatives also doubt climate change: in 2010, only a third of conservatives believed that global warming is occurring, compared to almost half in 2008 (Jones 2010). These particular opinions, coupled with the general trends examined in Table 2, suggest a growing chasm between conservatives' ideas about "what is the case" and liberals' willingness to trust science on these matters.

Given the theoretical relationship between education and confidence in science, an additional explanation relates to whether conservatives' educational composition changed over the period. Simply, if conservatives as a group are less educated than they once were, this might account for the decline in trust in the scientific community. First, according to the combined GSS data, the proportion of conservatives who received at least a high school degree is greater than the proportion for liberals. Second, the percentage of conservatives and liberals who received bachelor's degrees is nearly identical, approximately 17 percent. Liberals, however, were more likely to receive graduate degrees compared to conservatives, and the gap between ideological groups grows over the period. Importantly, this growing gap is due to an increase in the percentage of liberals receiving graduate degrees and not a decline among conservatives. Altogether, the data provide little evidence that group-specific differences in public trust in science are attributable to changes in conservatives' educational composition.

Table 3 explores an alternative hypothesis, one that suggests that educated conservatives are becoming less confident in science over time. Martin and Desmond (2010) distinguish between ideology, which they argue shapes public opinion by providing knowledge of what is the case, and political sophistication, which they describe as the capacity to incorporate new information or political arguments into an existing ideological rubric.[9] This implies that educated or high-information conservatives will hold hyper-opinions about science, because they have a more sophisticated grasp about what types of knowledge will conform with or contradict their ideological positions, and they will prefer to believe what supports their ideology (see Vaisey 2009). Thus, contrary to conventional wisdom and predictions of the deficit model, Martin and Desmond predict that educated conservatives will show higher levels of distrust than noneducated conservatives.

Table 3 contains three-way conservative/education/time interactions to examine whether educated conservatives have become more or less trusting in science over time. The three-way interactions show that educated conservatives are becoming less confident in science over time. Using predicted probabilities derived from this model, we see that conservatives with high school degrees, bachelor's degrees, and graduate degrees all experienced greater distrust in science over time and these declines are statistically significant ($p < .001$). In addition, a comparison of predicted probabilities indicates that conservatives with college degrees decline more quickly than those with only a high school

Table 3. Mixed-Level Logit Model with Education Interactions (N = 30,802)

	β	SE
Main Effects		
Time (yrs)	–.002	(.004)
High School	.073	(.074)
Bachelor	.318**	(.119)
Graduate	.087	(.154)
Conservative	–.142	(.105)
Interaction Effects		
High School × Conservative	.208	(.122)
Bachelor × Conservative	.343*	(.172)
Graduate × Conservative	.524*	(.234)
Conservative × Time	–.003	(.006)
High School × Time	–.000	(.004)
Bachelor × Time	.004	(.005)
Graduate × Time	.012	(.006)
Conservative × High School × Time	–.010	(.006)
Conservative × Bachelor × Time	–.019*	(.008)
Conservative × Graduate × Time	–.025*	(.010)
Random Effects		
Cohort (v)	.005*	
ρ	.002	
Log likelihood	–20211	
BIC	40733	
AIC	40482	

Note: Models include female, non-white, education (yrs), high school, bachelor, graduate, South, church attendance, family income, age, age^2, independent, Republican, moderate, post-Reagan (1981 to 2010), and Bush (2001 to 2008).
*p < .05; **p < .01; ***p < .001 (two-tailed tests).

degree (p < .05). These results are quite profound, because they imply that conservative discontent with science was not attributable to the uneducated but to rising distrust among educated conservatives. Put another way, educated conservatives appear to be more culturally engaged with the ideology and, in Martin and Desmond's (2010) terms, more politically sophisticated.

One final question relates to the idea that the patterns observed for science are consistent with public trust in other secular institutions. The analysis singles out science as a special case. One might thus ask: are political institutions politicized in the same way as science? Research on trust in institutions shows a general weakening in confidence over time, and recent studies emphasize declines in political institutions (Inglehart 1997; Pharr et al. 2000). Yet, Paxton (1999) found no statistically significant decline in trust in institutions using pooled cross-sections of the General Social Survey (1975 to 1994). No empirical analysis, however, has compared patterns for trust in science to those for other institutions. Affirmative evidence for this hypothesis would suggest that patterns for science presented here are reducible to general trends in confidence in institutions in the United States. Table 4 presents results of mixed-level regression models that examine public trust in political institutions.[10] The specification of this model is identical to those presented earlier, with cohort added as a random effect at level 2.

Table 4. Mixed-Level Linear Models Predicting Trust in Political Institutions (N = 32,675)

	Model 1	Model 2
Fixed Effects		
Time (yrs)	–.011***	–.011***
	(.001)	(.001)
Female	.003	.004
	(.009)	(.009)
Non-white	.006	.005
	(.012)	(.012)
Education (yrs)	.000	.001
	(.003)	(.003)
High School	–.024	–.023
	(.015)	(.015)
Bachelor	.095***	.096***
	(.026)	(.026)
Graduate	.125***	.129***
	(.033)	(.033)
South	–.002	–.003
	(.010)	(.010)
Church Attendance	.018***	.017***
	(.002)	(.002)
Family Income	.009	.009
	(.005)	(.005)
Age	–.164***	–.159***
	(.015)	(.016)
Age^2	.014***	.013***
	(.002)	(.002)
Independent	–.032**	–.075***
	(.012)	(.012)
Republican	.003	–.019
	(.011)	(.012)
Moderate	.061***	.055***
	(.010)	(.010)
Conservative	–.128***	–.128***
	(.013)	(.013)
Post-Reagan (1981 to 2010)	.133***	.136***
	(.015)	(.015)
Bush (2001 to 2008)	.106***	–.063*
	(.016)	(.025)
Moderate × Bush		.300***
		(.031)
Conservative × Bush		.162***
		(.030)
Constant	.450***	.466***
	(.047)	(.047)
Random Effects		
Cohort (ν)	.002***	.003***
	(.001)	(.001)
ρ	.002	.005
Log likelihood	–37600	–37551
BIC	75418	75343
AIC	75241	75150

Note: Numbers in parentheses are standard errors.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests).

Model 1 presents period constant effects and Model 2 adds the interaction between moderate × Bush and conservative × Bush. I examined numerous other models of change, but the model fit statistics provide strong evidence for Model 2. It is important to note there is a general negative trend in public trust in political institutions; yet, the patterns of distrust appear to be distinct from those observed for science. Model 1 shows that moderates are not more alienated from political institutions when compared with liberals, whereas conservatives are distrustful over the whole period. Results for the cultural breaks also differ from those in the science analysis; both the post-Reagan and Bush era variables have positive effects on public trust in political institutions. Notably, both moderates and conservatives experienced group-specific increases in their trust in political institutions during the Bush presidency, and these shifts represented abrupt breaks rather than gradual changes. One explanation for these findings can be found in conservatives' electoral successes during this period, which increased the NR's political influence in the federal government and made political institutions more palatable to conservatives. These results indicate that the politicization patterns observed for science are unique and do not reflect a parallel decline across institutions.

CONCLUSIONS

President Obama's 2011 State of the Union speech suggested that the United States was experiencing a "sputnik moment." He was referring to the Soviet Union's launch of the first satellite in October 1957, which propelled the space race and culminated in the national triumph of the moon landing in 1969. This study's findings call into question whether the cultural authority of science can provide the political consensus it once did in the 1960s. Moreover, strong political headwinds may be pushing for a reorganization of science, particularly its relationship to public policy. Yet, this reorganization, or possibly retrenchment of regulatory science, may have remarkable social implications. Most notably, the political discontent that has manifested in the right-wing in the United States has likely already affected the relationship between organized science, private economic interests, and government.

To summarize the main empirical findings, this study shows that public trust in science has not declined since the 1970s except among conservatives and those who frequently attend church. Accordingly, the analysis provides negligible evidence for the cultural ascendency thesis, which suggests that trust in science will increase over time. Nor do results support the alienation thesis that predicts a uniform decline in public trust in science. In general, results are consistent with claims of the politicization thesis and show that conservatives experienced long-term group-specific declines rather than an abrupt cultural break. Additionally, one of the key findings here involves the relationship between education and trust in science. In essence, this study greatly complicates claims of the deficit model, which predicts that individuals with higher levels of education will possess greater trust in science, by showing that educated conservatives uniquely experienced the decline in trust. This interesting result may indicate that educated conservatives have been most affected by the NR's identity work. Moreover, it suggests that scientific literacy and education are unlikely to have uniform effects on various publics, especially when ideology and identity intervene to create social ontologies in opposition to established cultures of knowledge (e.g., the scientific community, intelligentsia, and mainstream media).

Nevertheless, this study has numerous limitations. First, *confidence in the scientific community* is a single outcome used to assess public trust in science over time. In particular, one issue is how the public interprets the "scientific community" and the "people running these institutions." Based on previous research, it is unlikely the public has uniform ideas about "what science is" (Bauer, Petkova, and Boyadjieva 2000; Gauchat 2011). Yet, the NSF has added a comprehensive science module to the 2006 to 2010 GSS, which includes numerous measures of public trust in science and the perceived meaning of science.

In supplementary analyses not presented here, I compared results for the confidence in science measure to other attitudes toward science. A wide variety of outcomes measuring public attitudes toward science were predicted using model specifications identical to those shown in this study. These analyses consistently show unfavorable attitudes among conservatives, which corroborate the findings presented here (analysis available upon request from author).

Two interesting patterns from these supplementary analyses are worth mentioning. First, the public defines "what science is" in three distinct ways: (1) as an abstract method (e.g., replication, empirical, or unbiased); (2) as a cultural location (e.g., takes place in a university or is practiced by highly credentialed individuals); and (3) as one form of knowledge among other types such as commonsense and religious tradition (see Gauchat 2011). Interestingly, conservatives were far more likely to define science as knowledge that should conform to common sense and religious tradition. Relating to the second pattern, when examining a series of public attitudes toward science, conservatives' unfavorable attitudes are most acute in relation to government funding of science and the use of scientific knowledge to influence social policy (see Gauchat 2010). Conservatives thus appear especially averse to regulatory science, defined here as the mutual dependence of organized science and government policy.

Given the earlier discussion and the findings of this study, the alienation thesis and the corollary claim that science's legitimacy crisis represents a fundamental challenge to modernity appear overblown. Paradoxically, it is possible that science's cultural authority engendered politicization, particularly its role in policy formation and regulation of private interests. This assumes that science's cultural authority has grown—especially among legal, political, and economic institutions (see Jasanoff 2004)—to the point that the scientific community inevitably becomes entangled in polarized conflicts (e.g., economic growth versus environmental sustainability). As a result, science is "increasingly seen as being politicized and not disinterested" (Yearley 2005:121). Although public distrust in science may not portend systemic crisis, social scientists, policymakers, and scientific organizations should remain concerned about public perceptions.

Contemporary sociological theory has placed science at the power-center of modern social systems, along with governments and transnational corporations. Political realignment and social conflict in the United States related to science is thus worthy of theorizing and further empirical analysis. Not only could growing conservative distrust of science threaten funding, it may also fundamentally transform how science is organized. Lave, Mirowski, and Randalls (2010:665) write:

> The rise of neoliberal science management regimes since 1980, particularly the insistence on the commercialization and privatization of knowledge, has created substantive shifts in the organization and practice of science. Perhaps the most obvious shift is the rollback of government funding for, and organization of, public research universities.

Notably, the emergence of "neoliberal science" as an alternative to regulatory regimes has coincided with increasing distrust of science among conservatives. Changes in the organization of science include (1) increased government outlays to private corporations rather than universities; (2) intellectual property rights restricting public access to scientific knowledge; and (3) reversal of the postwar trend of viewing teaching and research as mutually reinforcing activities (Lave et al. 2010). Transformations in the organization of science could change how the scientific community relates to large transnational corporations and private venture capital. These concerns are particularly relevant when we consider global climate change—and growing public skepticism toward the problem (see Zehr 2000)—or the development of genomics and its implications for private interests.

Overall, this study points to a growing political polarization of science, even though the source of this polarization remains empirically underdetermined. Future research should examine the politicization of public beliefs about science in more detail. The addition of the NSF's *Science Indicators* module to the GSS should spur greater sociological interest in public understanding of science as well as provide a wealth of instruments to probe these issues. Future research may be able to identify which aspects of science pose concerns for conservatives. Qualitative studies in which small groups of people discuss science, science policy, and science controversies would be particularly illuminating (see Gamson 1992).

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Notes

1. ScienceDebate remains active, engaging in initiatives to educate policymakers, members of the media, and the public about science-related issues. A similar organization, the Coalition on the Public Understanding of Science, formed "in response to growing concerns about increased antievolution activities, apparent public confusion about stem cell research and climate change, and reports from the National Science Board that 'most Americans do not understand the scientific process'" (Coalition on the Public Understanding of Science 2010).
2. Following Moore (2008:215), "science" is not easily reduced to a single idea or thing but represents "simultaneously a body of knowledge, a group of people, and the means by which knowledge is acquired and disseminated." For purposes of clarity and consistency, this study uses science to refer to a group of people, the organizations they belong to, and the professional boundary that central institutions in society agree is a source of credible expertise (Gieryn 1999). Terms like scientific establishment or organized science might be more appropriate, but these ideas are often simply referred to as "science."
3. Mooney's argument resonates with the predictions of Hofstadter (1970), who argued in the 1960s that conservative ideology was becoming combative toward the academic and scientific community. Like Mooney, Hofstadter argued that the growing influence of fundamentalist Christians and the market fundamentalism of the wealthy business class produced conflicts between the intellectual/scientific community and conservatives.
4. A separate analysis examined all nine ideology-party combinations (e.g., conservative-republican and conservative-independent). These more complex comparisons did not fundamentally change the conclusions.
5. I estimated mixed-level models using Stata's XTMELOGIT and XTLOGIT commands, which produced nearly identical results. I estimated the final models using XTLOGIT. Cohort was added as a random effect at level 2. Substantively, the mixed-level models produced the same results as the logistic models. This is evident in the estimated residual interclass correlations of the latent response (ρ) reported in each table, which show very little dependence among cohorts. However, because the key finding rests on the period effects that have to be free of the confounding cohort and age effects, mixed-level models are appropriate here. Note that random effects do not influence the predicted probabilities presented in the text, because estimating predicted probabilities requires the assumption that the "random effect" is equal to zero; the models presented here suggest this is a realistic assumption.
6. Interestingly, for the whole period the political middle (i.e., moderates and independents) are more alienated from science relative to those on the right and left. One interpretation of this finding is that the political middle, particularly independents, represents low-information individuals, and thus are the most estranged group due to their inability to mitigate social complexity (Luhmann 1979). The demographic composition of moderates and independents supports this and shows that, on average, they report less family income and lower levels of education compared to other ideological and party groups.
7. The *p*-values reported here represent average change in predicted probabilities over the time period. Results of comparisons between a base year 1974 and subsequent years produce the same conclusion but would involve reporting a series of *p*-values rather than summarizing them with a single value.
8. The difference in predicted probabilities can be represented by the following equation: Pr (y = 1 |Time, Conservative = 1, Moderate = 0) – Pr (y = 1 | Time, conservative = 0, moderate = 0). The predicted probabilities represent the sample average based on actual persons in the data.
9. Martin and Desmond (2010:9) write, "The heights of political knowledge do not necessarily increase one's ideological passion; rather, they allow one a greater field of vision."
10. The trust in political institutions measure is a *z*-score standardized index of three confidence items: CONLEGIS, CONJUDGE, and CONFED. These represent public trust in the legislative branch, judicial branch, and executive branch of the U.S. federal government, respectively. The question and responses to these

items are identical to those described for the original CONSCI variable discussed earlier. Cronbach's alpha for this item is .67. Polychoric correlations, appropriate for ordinal variables, indicate strong relationships between these three variables ($r > .40$). The mean for this variable is 0, the standard deviation is .777, and the range is from 1.783 to 1.861.

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