



The Politicization of Science and Support for Scientific Innovations

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Abstract

Does the politicization of science influence support for scientific innovations? Can it render appeals to evidence inconsequential? The authors use an experiment embedded within a large survey to study these questions, focusing on how exposure to information that highlights the politicization of science affects support for using nuclear power. They find that politicizing science renders arguments about the environmental benefits of nuclear energy invalid, with or without a reference to consensus scientific evidence, and, in fact, reduces support for using it. The authors' goal is to set an agenda of research that focuses on how the politicization of science shapes public opinion. The findings have implications for the future of scientific innovations in today's politicized scientific climate.

A recent statement in the journal *Nature* argued that “there is a growing anti-science streak... that could have tangible societal and political impacts” (2010, 133). This is one of countless commentaries on the politicization of science, i.e., when political interests shape the presentation of scientific facts to fit distinct models of “reality” (Pielke 2007; Oreskes and Conway 2010). While scholars have explored the determinants of trust in science (e.g., Brewer and Ley 2013) and the impact of question wording on opinions related to climate change (e.g., Schuldt et al. 2011), virtually no empirical research looks at how the politicization of science influences public opinion toward scientific innovations. These attitudes matter as the success of any initiative depends in part on public support. We offer what we believe is the first *empirical* foray into how the politicization of science affects public opinion – in particular, support for the use of an innovative/still emergent technology. We focus on opinions toward nuclear energy, which continues to be considered an “emergent” technology due to continuing developments in its (renewed) usage (Board on Energy and Environmental Systems 2008).¹

Opinions toward Scientific Innovations

A longstanding theory when it comes to studying opinions about emergent technologies is the scientific literacy model, which posits that *consensus* knowledge facilitates more accurate assessments of the risks and benefits on the part of citizens in forming an opinion toward scientific innovations (Nisbet and Goidel 2007; Rodriguez 2007). Nonetheless, this model faces at least two challenges: (1) most citizens lack the motivation to engage in knowledge acquisition and instead rely on cues or basic frames to form opinions (Druckman and Bolsen 2011), and (2) it has become increasingly difficult to reach a *consensus* in political debates that center on

¹ Moreover, in February 2010, the Department of Energy approved loan guarantees to aid in the construction of two nuclear reactors in Georgia, and, if the projects go forward, they would be the first reactors approved in the U.S. since 1973 (Wald 2010).

scientific evidence; instead, what often occurs is *politicization* where politically interested individuals or groups manipulate the presentation of science to favor their own agendas for political or self-interested reasons – that is, they cite evidence selectively to support their perspective (Jasanoff 1987, 195; Pielke 2007). The paradigmatic example of politicization is the debate over the existence of global warming (see Oreskes and Conway 2010; Schuldt et al. 2011). We focus on nuclear energy, in part, due to renewed interest in it as an alternative energy source (Ansolabehere and Konisky 2009; Bolsen and Cook 2008; Gamson and Modigliani 1989; MIT 2009).

Does politicization render supportive statements about the environmental benefits of an emergent technology – i.e., nuclear energy – invalid, even when the argument includes a reference to consensus scientific evidence?

Framework for Studying Politicization

We turn to research on framing effects to provide a framework for studying the politicization of science. We use the term “framing” in a broad sense with a focus on emphasis or issue frames that highlight distinct considerations toward an attitude object, sometimes with distinct information (see Druckman 2011).² As Iyengar (2010, 187) explains, frames often involve “presentations accompanied by numerous content differences.” In the study presented here, frame dimensions involve considerations of politicization versus the benefits of science as well as the pros of the technology with supportive evidence and without such evidence. A large literature shows that frames in a communication can affect the way individuals think about an attitude object.

² We focus on issue/emphasis frames as opposed to valence/equivalency frames (Druckman 2004).

Research suggests that framing effects, particularly in the presence of evidence, only occur when the source of a frame is perceived as credible (Druckman 2001; O’Keefe 2001). If there is a reason to doubt the credibility of a source, then any argument attributed to that source may be muted or backfire (Lupia and McCubbins 1998; O’Keefe 2001). Consequently, we expect that the politicization frame will vitiate the effect of supportive evidence by rendering the information untrustworthy. We anticipate this effect due to uncertainty associated with the credibility of scientific evidence and arguments (Oreskes and Conway 2010).

We additionally expect that exposure to positive frames (e.g., positive environmental consequences), with or without additional factual evidence endorsed by a credible source, will increase support for its use (in line with the framing literature).

Experiment

We implemented a survey experiment in August 2010.³ We used the Internet to draw a representative sample of 1,600 members of the U.S. population.⁴ Participants completed an initial battery of attitudinal and demographic questions. Next, they were exposed to one of the

³ Our study took place prior to the Fukushima Accident in Japan. On March 11, 2011, an earthquake and tsunami in Japan caused significant damage to several nuclear reactors. Media coverage was extensive. Public opinion polls in the U.S. showed a notable decline in support for using nuclear energy. This is problematic for energy policy given the renewed commitment to nuclear energy and is relevant for us given that our data were collected prior to this event. However, we expect the accident only to affect overall support for nuclear energy and not to condition the causal impact of the experimental conditions. We conducted a lab experiment virtually identical to our main study using a sample of undergraduate students to confirm that the *treatment effects remained unchanged after the earthquake*. Results available upon request from the authors show that the causal effects resulting from exposure to the experimental conditions are roughly the same, but, as expected, overall support for using nuclear energy dropped by about 6% across conditions (see Druckman and Kam 2011 on the robustness of student subjects in experiments).

⁴ We contracted with a survey research company (Bovitz Inc.) to collect the data. The sample was drawn from a panel of respondents who have opted in to complete online surveys. The panel was originally developed based on a random-digit-dial (RDD) telephone survey, where to enter the panel a respondent needed to have access to the Internet (In this sense, it is a non-probability sample in the same way as those taken by firms such as YouGov are non-probability samples). The panel has continued to grow based on ongoing RDD recruiting and referrals. From the panel, which has approximately 1 million members, a given sample is drawn using a matching algorithm (based on likely response rates) to ensure that those screened to qualify for the survey constitute a sample that demographically represents the United States. Of those contacted to participate in the survey, about 21% opted in which is similar to other experimental approaches using opt-in surveys and in line with AAPOR guidelines and published in *Public Opinion Quarterly* (see, e.g., Bailenson et al. 2008). Moreover, for experimental studies, this sampling approach is acceptable (see Druckman and Kam 2011).

treatments (described below). All participants were informed, “We are now going to ask you about an alternative energy source – nuclear power.” Respondents in the control condition were then presented with our primary dependent measure, which asked, “Given what you know, to what extent do you oppose or support the use of nuclear energy as one of the ways to provide electricity for the U.S.?” on a 1 to 7-point fully labeled scale ranging from 1 = “strongly oppose” to 7 = “strongly support.” All other participants were randomly assigned to one of eight other conditions where we manipulated two types of frames.

Manipulations

The first manipulation varied the presence of a frame highlighting the politicization of science or the benefits that stem from science. We randomly assigned participants to one of three conditions: no frame (i.e., no information), a politicization frame, or a frame highlighting the benefits of science. Immediately following the initial statement, participants randomly assigned to a condition with a politicization frame read, “The development of alternative energies, such as nuclear energy, relies on scientific progress. Yet, it is increasingly difficult for non-experts to evaluate science – politicians and others often color scientific work and advocate selective science to favor their agendas.” We pre-tested this frame on 100 respondents from a different sample and found that it generated significantly lower trust in science and decreased optimism toward science.⁵

The flip side of a politicization frame is a frame highlighting the benefits stemming from science – e.g., a way to obtain “unbiased” information through systematic observation.

⁵ We recognize that one could operationalize a politicization frame in many ways. To avoid confounding politicization of science with partisan polarization (e.g., different sides arguing from which people could impute partisanship), we used a direct politicization frame in this initial study.

Participants randomly assigned to conditions that highlighted the benefits of science were told, “... The development of alternative energies, such as nuclear energy, relies on scientific progress. Indeed, scientific research involves the systematic gathering of observable, measurable, and replicable evidence – as such, it provides a relatively objective and unbiased basis for new innovations.” We pre-tested this frame on 100 respondents from a different sample and found that it generated increased trust in science and led to greater optimism toward science.

The second experimental manipulation varied the presence of a distinct supportive frame, with or without factual evidence, related to the potential environmental benefits of nuclear power. We randomly assigned participants to one of three conditions: no frame, a supportive frame environmental benefits frame, and a condition that included related *consensus* evidence from a credible scientific organization. We chose an environmental frame because of its prominence in debates over nuclear power (e.g., Ansolabehere and Konisky 2009), and we focus here on a positive frame in line with the scientific literacy approach where positive evidence accumulates (Kahan et al. 2012).

Participants assigned to a condition highlighting the environmental benefits of nuclear power read, “...many have pointed to research that suggests alternative energy sources (e.g., nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment.” Respondents assigned to a condition that additionally included supportive evidence read, “...A recent National Academy of Sciences publication states, ‘A general scientific and technical consensus exists that deep geologic disposal can provide predictable and effective long-term isolation of nuclear wastes’” (Board on

Energy and Environmental Systems 2008).⁶ Table 1 displays our expectations for each experimental condition. The complete wording for all treatments is reported in Appendix 1 (all appendices available online).

[Table 1 About Here]

As noted, we expect an increase in support for the use of nuclear power when the positive environmental consequences are emphasized, with or without a reference to evidence supported by a credible scientific organization with a consensus of expert scientists. In contrast, we expect any reference to the politicization of science to decrease support for nuclear power, as it will lead people to lose faith in the credibility of supportive information since they will believe it is being used selectively (Lupia and McCubbins 1998).⁷

Results

We explore how each experimental condition affects support for using nuclear energy to generate electricity in the U.S. relative to our control group baseline (neither type of frame, condition 1, Table 1). Figure 1 displays the percentage shift in support for using nuclear energy for each condition relative to the control group, where the mean support for nuclear power is 4.46 (std. dev. = 1.78; N = 178); across conditions, the mean support for nuclear power is 4.56 (std. dev. = 1.86; N = 1600). The mean for each condition is listed in Table A-1 in Appendix 2.

While we confirmed the success of random assignment, we nonetheless present analyses in Table

⁶ We recognize that many respondents may not realize that the job of the National Academy of Sciences as a non-profit, independent organization entails offering consensus advice on science, technology, and medicine, based on expert panels. Thus, any effect could stem from a full understanding that the National Academy does provide consensus evidence or it could be simply seen as a credible source cue.

⁷ As a manipulation check, we asked participants, “To what extent do you think political considerations affect the nature of information the public receives about different policies?” on a 7-point fully labeled scale ranging from 1 = “not at all” to 7 = “always.” Participants randomly assigned to the politicization conditions reported significantly higher scores on this question.

A-2 in Appendix 3 that show the robustness of all main treatment effects reported below with the inclusion of a host of control variables that may be of interest.⁸

[Figure 1 About Here]

We find that the environmental benefit frame, with or without evidence, significantly increases support for nuclear power (conditions 2 and 3, Figure 1). This finding coheres with our expectations regarding the power of emphasizing positive environmental consequences. Second, emphasizing the benefits of science has no effect on support for using nuclear power (condition 4, Figure 1). However, once one adds a statement regarding the environmental benefits of nuclear power, individuals give more credence to that frame and it significantly increases support by over 6% (condition 5, Figure 1). The addition of evidence that is supported by a consensus of credible scientists to the pro environmental frame increases support for the use of nuclear power by over 10% (condition 6, Figure 1).

Exposure to a frame that highlights the politicization of science significantly decreases support for the use of nuclear power (condition 7, Figure 1). Decreased support continues even when the politicization frame is paired with an environmental benefits frame (condition 8, Figure 1), and with the inclusion of evidence supported by a credible organization of scientists (condition 9, Figure 1).

The findings of the politicization of science frame on public opinion have implications for the present state of political battles over scientific innovations. These battles – which now seem to extend well beyond the issue of climate change to scientific advances of all stripes – can work to undermine the support that scientific evidence can have on public opinion, thereby

⁸ We use one-tailed tests of significance, as is common in the framing literature, given that we have clear theoretical expectations for the impact of our experimental conditions on opinions (Blalock 1979; Miller and Krosnick 2000).

making it unlikely that politicians will advocate emergent technologies and/or that consumers will adopt them. Perhaps some will be surprised that adding scientific evidence to a frame that highlights the environmental benefits of nuclear power does not overpower the politicization frame, but, as explained, we suspect politicization causes people to lose faith in the credibility of science and become risk averse toward innovations, thereby making the scientific literacy model impotent. To summarize, an environmental benefits frame with or without consensually supported scientific evidence only marginally increases support for an emergent technology unless the benefits of science are highlighted. If, in contrast, the politicization of science is highlighted, not only does the frame and evidence have no effect but overall support drops significantly.⁹

Secondary Evidence

We addressed three possible concerns in follow-up studies, the details of which are available in the appendices available online. The first is whether our findings might be related to the politicization frame being presented in conjunction with the *positive* environmental frame and the evidence presented with it. As mentioned, the use of a positive frame coheres with the scientific literacy approach where evidence often accumulates in a positive direction leading to support; yet, we recognize it raises the question of what would happen had we used a negative (anti-nuclear energy) frame instead. We implemented another study where we used a similar design but used a frame emphasizing the *negative* health consequences of nuclear power. Not surprisingly, we found that highlighting the negative health effects associated with radiation exposure, with or without evidence sponsored by a credible organization of scientists,

⁹ We also asked a series of belief importance questions, e.g., in thinking about nuclear energy, how important are the effects of nuclear energy on the environment or human health, and belief content questions that asked whether nuclear energy would have positive or negative effects on these dimensions. Our results largely replicate what is presented in Figure 1 as would be expected given the large literature on framing effects.

significantly decreases support for using nuclear power (even when paired with a scientific benefits frame). Perhaps most interestingly, however, is that the politicization frame did not eliminate the impact of the negative health frame. We find this result intriguing as it suggests that politicization may do less to vitiate negative arguments. Regardless, this is an area in need of much more work as the result could stem from a status quo bias, the salience of health concerns, a negativity bias or some other mechanism (see Appendix 4).

A second issue has to do with the duration of these effects and whether politicization affects attitudes toward a different emergent technology not evaluated in the initial study. Participants in our first study completed a follow-up survey two weeks after the original survey. We asked about support for using carbon nanotubes, another emergent technology with applications in the energy sector (see Druckman and Bolsen 2011), in the follow-up (ranging from 1 = “strongly oppose” to 7 = “strongly support”). We also asked respondents to report trust in policymakers when it comes to introducing new energy technologies (ranging from 1 = “not at all” to 7 = “complete trust”) and trust in scientists’ decisions when it comes to introducing new technologies (ranging from 1 = “not at all” to 7 = “complete trust”). In every case, those randomly assigned to the politicization conditions in the first survey two weeks earlier registered significantly lower scores on each of these measures relative to a control group (by 10%, 14%, and 13%, respectively).

A final issue concerns trust in science in general as a moderator of science-based communications. One may expect that those who express greater trust in science to be affected to a greater extent by the pro science frame (with or without consensus evidence), and, indeed, this is what we find. However, we also find that when individuals are exposed to arguments that politicize science, even those who are generally trusting of science are skeptical of subsequent

information. While politicization does not directly decrease support, it does render the environmental frame with or without evidence moot. This is because politicization decreases trust in science (i.e., even if one trusts scientists, can they trust a particular piece of evidence invoked in an argument?). On the flip side, those initially reporting lower levels of trust in science only increase support for nuclear power when provided with a science benefits frame, an environmental benefits frame, and related evidence sponsored by credible group of scientists, and decreased support universally when exposed to the politicization frame. All of these results are presented in Appendix 5.

Conclusion

Commentators have long thought that the politicization of science could have negative effects on public opinion (Nature 2010, 133). We now have some of the first empirical evidence that it does – at least in regard to support for nuclear energy. The take-away point is that the politicization of science negatively affects public support for the implementation of novel technologies, even among those who trust science. We see our study as an initial one and think that much more research is needed to examine politicization. While we did not offer a full-fledged theory in this note, our results challenge the scientific literacy model insofar as even when supportive credible evidence is presented, a politicization frame negates the impact of that evidence, suggesting that simply accumulating and passing along positive information is insufficient for generating support for scientific innovations.

Overall, the growing politicization of science seems to have the potential to have widespread and troubling societal and political implications. Yet this does not mean that scholars should give up. For example, Lupia (2012) offers a variety of intriguing prescriptions for how science can be better communicated in a politicized environment, and we see this avenue of

research as a critical way forward. Policy-making is inherently a political process that is studied by political scientists, sociologists, and scholars of mass communication among others; however, the politicization of science has received virtually no attention empirically. Despite anecdotes of its history and power in shaping public opinion, little theory and research exist. We hope that our results demonstrate the importance of a research agenda exploring this topic.

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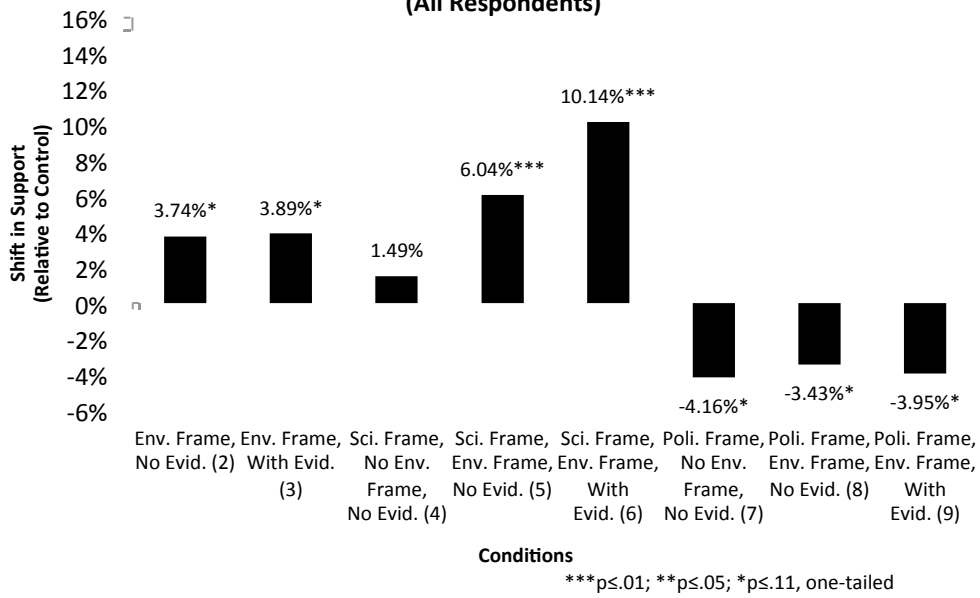
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Table 1: Experimental Conditions and Predictions

	No Politicization or Science Benefits Frame	Science benefits Frame	Politicization Frame
No Environmental Frame	Condition 1 Baseline	Condition 4 No Clear Prediction	Condition 7 Decrease Support
Environmental Frame without evidence	Condition 2 Increase Support	Condition 5 Increase Support	Condition 8 No effect or small decrease
Environmental Frame with evidence	Condition 3 Increase in Support	Condition 6 Largest Increase in Support	Condition 9 No effect or small decrease

Figure 1
Support for Using Nuclear Energy
(All Respondents)



Appendix 1 Experimental Wording

Condition 1 No Environmental Frame / No Politicization or Science Benefits Frame

We are now going to ask you about an alternative energy source – nuclear power.

Condition 2 Environmental Frame without evidence / No Politicization or Science Benefits Frame

We are now going to ask you about an alternative energy source – nuclear power. Many have pointed to research that suggests alternative energy sources (e.g., nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment.

Condition 3 Environmental Frame with evidence / No Politicization or Science Benefits Frame

We are now going to ask you about an alternative energy source – nuclear power. Many have pointed to research that suggests alternative energy sources (e.g., nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment. A recent National Academy of Sciences publication states, “A general scientific and technical consensus exists that deep geologic disposal can provide predictable and effective long-term isolation of nuclear wastes.”

Condition 4 No Environmental Frame / Science benefits Frame

We are now going to ask you about an alternative energy source – nuclear power. The development of alternative energies, such as nuclear energy, relies on scientific progress. Indeed, scientific research involves the systematic gathering of observable, measurable, and replicable evidence – as such, it provides a relatively objective and unbiased basis for new innovations.

Condition 5 Environmental Frame without evidence / Science benefits Frame

We are now going to ask you about an alternative energy source – nuclear power. The development of alternative energies, such as nuclear energy, relies on scientific progress. Indeed, scientific research involves the systematic gathering of observable, measurable, and replicable evidence – as such, it provides a relatively objective and unbiased basis for new innovations. Along these lines, many have pointed to research that suggests alternative energy sources (e.g., nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment.

Condition 6 Environmental Frame with evidence / Science benefits Frame

We are now going to ask you about an alternative energy source – nuclear power. The development of alternative energies, such as nuclear energy, relies on scientific progress. Indeed, scientific research involves the systematic gathering of observable, measurable, and replicable evidence – as such, it provides a relatively objective and unbiased basis for new innovations. Along these lines, many have pointed to research that suggests alternative energy sources (e.g.,

nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment. A recent National Academy of Sciences publication states, “A general scientific and technical consensus exists that deep geologic disposal can provide predictable and effective long-term isolation of nuclear wastes.”

Condition 7 No Environmental Frame / Politicization Frame

We are now going to ask you about an alternative energy source – nuclear power. The development of alternative energies, such as nuclear energy, relies on scientific progress. Yet, it is increasingly difficult for non-experts to evaluate science – politicians and others often color scientific work and advocate selective science to favor their agendas.

Condition 8 Environmental Frame without evidence / Politicization Frame We are now going to ask you about an alternative energy source – nuclear power. The development of alternative energies, such as nuclear energy, relies on scientific progress. Yet, it is increasingly difficult for non-experts to evaluate science – politicians and others often color scientific work and advocate selective science to favor their agendas. Even so, many have pointed to research that suggests alternative energy sources (e.g., nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment.

Condition 9 Environmental Frame with evidence / Politicization Frame

We are now going to ask you about an alternative energy source – nuclear power. The development of alternative energies, such as nuclear energy, relies on scientific progress. Yet, it is increasingly difficult for non-experts to evaluate science – politicians and others often color scientific work and advocate selective science to favor their agendas. Even so, many have pointed to research that suggests alternative energy sources (e.g., nuclear energy) can dramatically improve the environment, relative to fossil fuels like coal and oil that release greenhouse gases and cause pollution. For example, unlike fossil fuels, wastes from nuclear energy are not released into the environment. A recent National Academy of Sciences publication states, “A general scientific and technical consensus exists that deep geologic disposal can provide predictable and effective long-term isolation of nuclear wastes.”

Appendix 2

Table A-1: Experimental Means (Standard Deviations, Ns) By Condition

	No Politicization or Science Benefits Frame	Science benefits Frame	Politicization Frame
No Environmental Frame	Condition 1 4.46 (1.78, 178)	Condition 4 4.56 (1.80, 177)	Condition 7 4.16 (1.90, 177)
Environmental Frame without evidence	Condition 2 4.72 (1.90, 180)	Condition 5 4.88 (1.81, 180)	Condition 8 4.22 (1.87, 177)
Environmental Frame with evidence	Condition 3 4.73 (2.03, 176)	Condition 6 5.17 (1.45, 176)	Condition 9 4.18 (1.98, 179)

Appendix 3 Regressions with Controls

We assessed the robustness of our main treatment effects by adding a host of variables correlated with support for using nuclear energy including: *gender* (male = 0; female = 1); *minority status* (minority = 0; non-minority/white = 1); *age* (average of 44.76); *education* (5-point scale from less than high school to advanced degree); *income* (five-point scale from less than \$30k to over \$200k); *partisanship* (7-point scale from strong Democrat to strong Republican); *trust in government* (4-point scale from never to just about always); *home ownership* (1 = yes; 2 = no); and, *pay utilities* (1 = yes; 1 = no) (e.g., Ansolabehere and Konisky 2009). We also measured *ideology* on a 7-point scale from strong liberal to strong conservative, and values, building on Kahan's (2012) *hierarchism* (from low to high on a 7-point scale) and *individualism* (from low to high on a 7-point scale), as well as a general value on a 7-point scale in favor of prioritizing the *economy over the environment* (higher scores indicate greater support for prioritizing the economy over the environment). Finally, we include measures for *media exposure* (standardized 0 to 1 score of newspaper, television news, online news exposure), *political knowledge* (standardized 0 to 1 number of correct answers to four standard political knowledge questions), *scientific knowledge* (standardized 0 to 1 score of number of correct answers to two standard science questions), and *energy knowledge* (standardized 0 to 1 score of number of correct answers to three factual energy questions) Finally, we include a measure for general *trust in science* since those who are more trusting should be more supportive of pro science frames and evidence (standardized on a 0-1 scale with higher scores indicating greater trust).

Table A-2 (below) reports the results from an ordered probit model estimating support for our main dependent variable with a dummy variable for each condition, and where the excluded condition is the control group (no frame of any sort, condition 1). There are several control variables that are significant, and not surprisingly so given the existing correlational evidence, such as decreased support for developing nuclear power among females and minorities, and increased support among older and more educated individuals. On the other hand there are several other control variables in which the results are more intriguing. For instance, Republicans tend to be more supportive of nuclear power, which presumably reflects values associated with the potential economic gains associated with the technology's development. When it comes to values, individualists (anti-communitarians) are more supportive of nuclear power, which coheres with Kahan's theory. We also find that participants who prioritize the economy over the environment are more supportive of nuclear power. Political knowledge and scientific knowledge increase support too. Finally, trust in science increases support for the development of nuclear power. In the end, our experimental conditions remain significant as shown in Figure 1. Thus, it is safe to say that adding controls does not significantly alter our substantive findings.

Table A-2. Determinants of Support for Action

	Exp. Conditions Only	Exp. Conditions With Controls
Environmental Frame Without Evidence (<i>Condition 2</i>)	0.16* (0.11)	0.18* (0.11)
Environmental Frame With Evidence (<i>Condition 3</i>)	0.17* (0.11)	0.20** (0.11)
Science Frame (<i>Condition 4</i>)	0.06 (0.11)	0.10 (0.11)
Science Frame and Environmental Frame Without Evidence (<i>Condition 5</i>)	0.24** (0.11)	0.30*** (0.11)
Science Frame and Environmental Frame With Evidence (<i>Condition 6</i>)	0.40*** (0.11)	0.48*** (0.11)
Politicization Frame (<i>Condition 7</i>)	-0.14* (0.11)	-0.09 (0.11)
Politicization Frame and Environmental Frame Without Evidence (<i>Condition 8</i>)	-0.14* (0.11)	-0.16* (0.11)
Politicization Frame and Environmental Frame With Evidence (<i>Condition 9</i>)	-0.15* (0.11)	-0.18* (0.11)
Female		-0.28*** (0.06)
Minority		-0.12** (0.06)
Age		0.003* (0.001)
Education		0.07** (0.03)
Income		0.01 (0.03)
Republican		0.03* (0.02)
Trust in Government		0.04 (0.04)
Live in House		-0.02 (0.06)
Pay Utility		-0.01 (0.09)
Ideology		0.01 (0.02)
Hierchalism		0.01 (0.02)
Individualism		0.04**

		(0.02)
Economy Valued Over Environment		0.11*** (0.02)
Media Exposure		0.22** (0.11)
Political Knowledge		0.32*** (0.10)
Energy Knowledge		-0.01 (0.11)
Scientific Knowledge		0.31*** (0.09)
Trust in Science		1.78*** (0.18)
Cut-Points:	See Below	See Below
Log-likelihood	-2991.2547	-2816.9012
Number of observations	1600	1600

^aEntries are ordered probit coefficients with standard errors in parentheses.

*** $p \leq .01$; ** $p \leq .05$; * $p \leq .10$ (one-tailed tests). The coefficients and standard errors for cut points 1 through 6 for Model 1 are: -1.29 (0.09), -0.94 (0.08), -0.56 (0.08), -0.002 (0.08), 0.42 (0.08), 0.96 (0.08). The coefficients and standard errors for cut points 1 through 6 for Model 2 are: 1.24 (0.29), 1.61 (0.28), 2.02 (0.28), 2.64 (0.29), 3.13 (0.29), 3.75 (0.29).

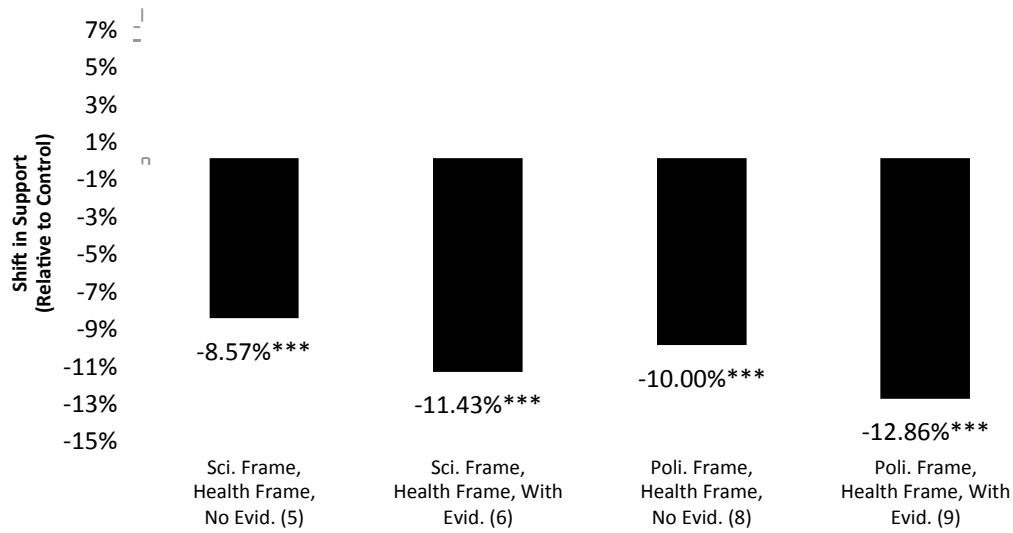
Appendix 4: Con Health Frame Experiment

We implemented an experiment with a design analogous to our main study with the difference being the use of a negative frame emphasizing the potential health hazards from using nuclear energy, and evidence of such health hazards from another National Academy of Sciences (2008) report. The negative health frame stated that “research suggests that alternative energy sources can sometimes raise health concerns, to an even greater extent than those that result from the polluting gases released by fossil fuels like coal and oil. For example, nuclear power plants sometimes release small amounts of low level radioactive materials that are potentially harmful.” Meanwhile, the scientific evidence treatment added, “A recent National Academy of Sciences report explains that the risk of cancer proceeds in a linear fashion and the smallest dose [of radiation] has the potential to cause a small increase in risk to humans” (Board on Radiation Effects Research 2006, 7).

The study was part of an exit poll on Election Day 2010 where a team of 25 pollsters handed out anonymous self-administered surveys to voters departing the polling stations at random voting locations throughout Illinois’ 9th Congressional District. Pollsters offered respondents a \$5 gift card as compensation for filling out a survey on political opinions for an academic research project. Participants were randomly assigned to one of the five conditions just mentioned. Each survey was randomized across polling sites to ensure that the conditions were not correlated with the polling locations. In total, 707 individuals completed the survey at a response rate of 70%. Given the results of our main study, we limited this study to five conditions, including the baseline (N = 165), science benefits frame with the negative health frame (N = 118), science benefit frame with the negative health frame and evidence (N = 109), politicization with the health frame (N = 192), and politicization with the health frame and evidence (N = 123). We did this to ensure a sufficient sample size and because the point was to see if politicization and the science benefits frames have analogous effects even when the frame/evidence is negative.

The results displayed in the below figure (Figure A-1) show that politicization does *not* appear to counteract a negative frame with or without evidence that highlights concern about the risks from using nuclear power. As mentioned in the text, this is an intriguing result insofar as it suggests that politicization may have its most direct effect on public opinion when invoked to undermine positive arguments about the benefits of a scientific innovation. Much more work is needed as we do not know if this reflects a bias toward the status quo, a negativity bias, or if it is specific to credible health-related frames. We did conduct a follow-up on this study and found that trust in science remained significantly lower among individuals randomly assigned to the politicization frame two weeks later by 11%, and thus there seemed to be some consequence.

Appendix Figure A-1
Support for Using Nuclear Energy
(All Respondents)

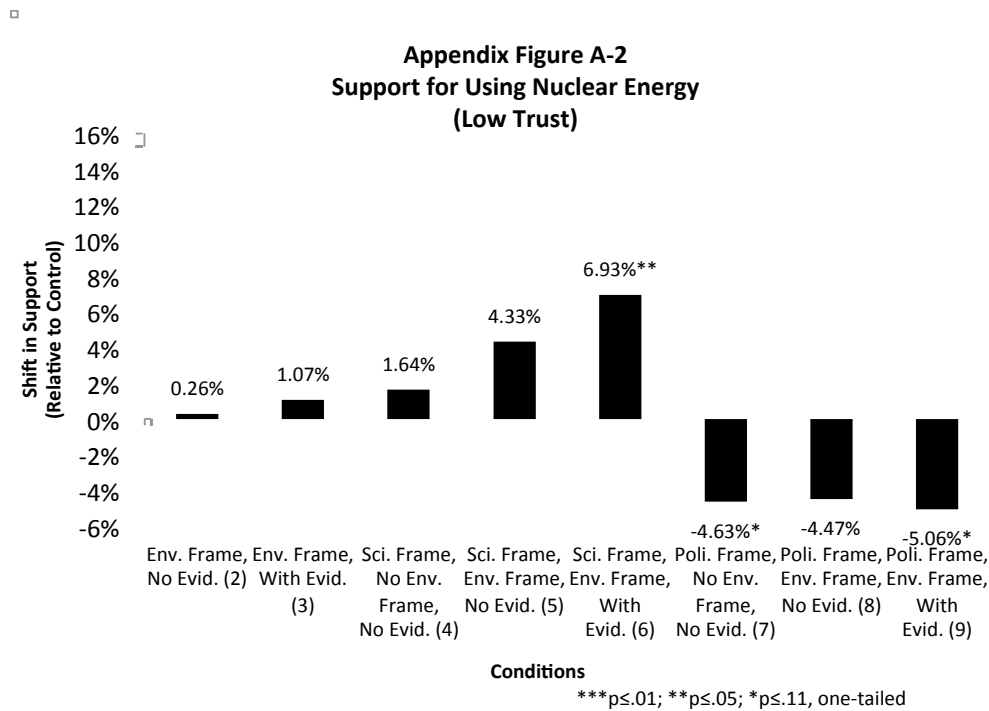


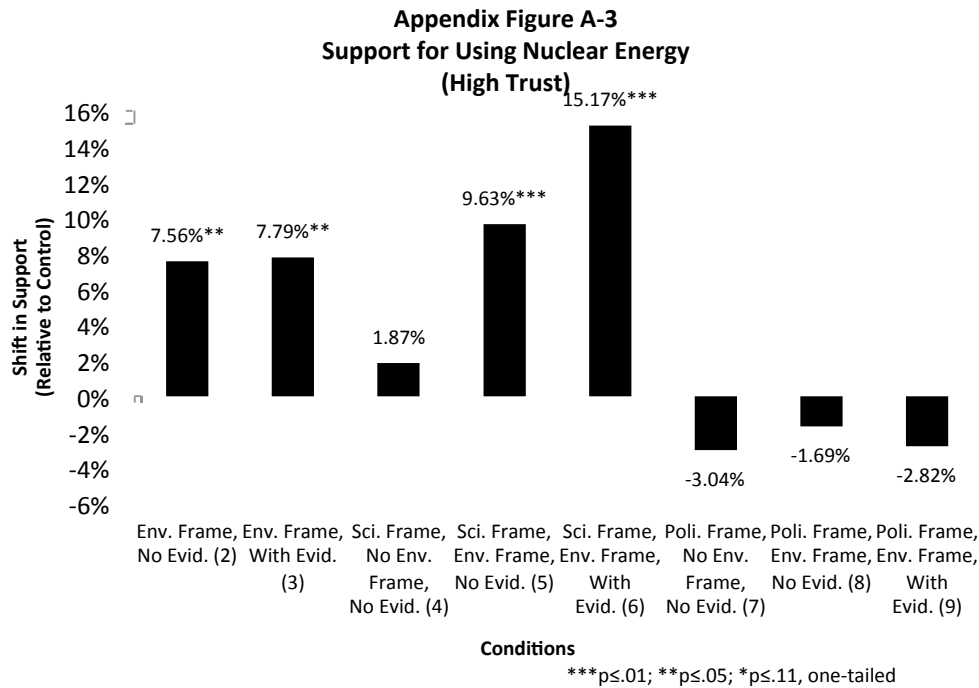
Conditions

***p<.01; **p<.05; *p<.11, one-tailed

Appendix 5: Trust results

Table A-2 in Appendix 3 shows that trust in science is predictive of support for nuclear energy. We also anticipate that trust in science may moderate the impact of the frames, since they invoke science-based arguments. Those more predisposed to trust science may be more accepting of the frame highlighting the benefits of science. In contrast, the politicization frame reminds people of the selective use of science and even those who trust science may be suspicious of its particular usage in rhetoric. Politicization is not about science evidence being positive or negative *per se* but about its *application in making arguments*. Those trusting of science may not think of politicization when they hear science invoked in an argument, but when stimulated to think about politicization, they may not know what to believe. Figure A-2 and A-3 (below) present two illustrations of the experimental treatment effects, one for the low trust group and one for the high trust group, separately. We used a median split to divide the groups as is often done (e.g., Miller and Krosnick 2000). (The median split is .51 on a 0 to 1 scale.)





The results show that the environmental benefits frame and the frame with scientific evidence has no effect among individuals with lower levels of trust in science (conditions 2 and 3, Figure A-2); however, there is a substantial treatment effect among individuals with higher levels of trust in science (conditions 2 and 3, Figure A-3). Thus, as we expected, it is not necessary to remind individuals with a high level of trust in science that “science is worthwhile.” In contrast, individuals with lower levels of trust in science need a frame reminding them of the benefits of science to have any faith in frames highlighting the environmental benefits with or without supportive evidence. In fact, the only way to generate significant support among individuals lacking trust in science is by adding the science benefit frame, the environmental benefits frame, and the statement with evidence regarding a scientific consensus. Otherwise, the lack of faith in science presumably stunts any movement by the frames in isolation. In contrast, individuals with relatively high levels of trust in science show substantial movement when given the science benefits frame and the environmental benefits frame with or without evidence sponsored by a credible group of scientists. Note that although the science benefits frame by itself does nothing, the science benefit frame has the added effect among trusting individuals of making the frame with or without evidence more impactful (see conditions 5 and 6, Figure A-3).

As we expected, politicization can vitiate support for an innovation because it causes people – even those who trust science – to be confused about who they can and cannot believe in any specific instance. Note that the differences between groups are significant when we estimate the treatment effects with an ordered probit that includes interactions between each experimental condition and our trust measure. Further, we confirmed that all the main treatment effects are robust with multivariate analyses using the same control variables as listed in Appendix 3.