Salvation by Science: Confidence in Scientists and Engineers to Solve Global Warming

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A common view among people who care about global warming is that if the public had more trust in science and scientists, the public would accept their findings and take action to minimize climate change (Ehrlich 1996; Cicerone 2010; Gelbspan 2004; Gore 2007; Sykes 2007; Wolfson and Schneider 2002). Building trust in scientists and knowledge of climate change has long been a strategy of environmentalists. Recently this view was challenged by Kellstedt et al. (2008), who found—contrary to expectations—that people with high levels of knowledge about global warming and trust in scientists felt less concerned about and less responsible for global warming than people with low levels of knowledge and trust. We seek to explore this surprising finding.

In this paper, we examine whether people’s confidence in scientists influences their likelihood of taking action to prevent global warming. Our question is not the same as that asked by Kellstedt and his colleagues, but it is similar and it addresses the same strategic question: Should global warming activists seek to build public confidence in climate change scientists?1

The concern underlying our question is that having high confidence in scientists might lead people to conclude that scientists can solve global warming problems in ways that will not require people to reduce their energy consumption or change their lifestyles. In effect, we are asking whether people might reason to themselves, “Scientists can do anything they want to do. They can land on the Moon; they can build amazing computers; surely they can solve global warming without my help.”

To answer our question, we developed a measure of confidence that scientists and engineers will solve the global warming problems we face. We label this attitude optimism about science to distinguish it from the concept of trust. Using data from a national internet survey, we show that contrary to what one might expect from Kellstedt et al., as people’s optimism increases, their willingness to take personal action on climate change also increases.

Trust and Optimism

We are studying a variable, optimism about science, which is obviously related to trust. We begin, therefore, by discussing the relationship of optimism and trust.

Social scientists have been studying trust for decades. Psychologists have identified it as a key variable in persuasion. The leading contemporary theories of persuasion, the elaboration likelihood model or ELM (Petty and Cacioppo 1983, 1986a, 1986b; Petty and Wegener 1999) and the heuristic-systematic model (Chaiken 1980; Chaiken et al. 1989; Chen and Chaiken 1999), identify trust in the communicator as a key variable. The more one trusts the source of a message, the more one is likely to believe the message.

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1 Our survey was designed before Kellstedt et al (2008) published their study. Because our survey was not designed to replicate Kellstedt et al., it does not include any knowledge questions about global warming, nor does it use the same trust questions.
2 This quote paraphrases what an undergraduate once said to one of the authors.
Political scientists have focused on trust in government, by which they mean the responsiveness of government, its ability to do “what is right,” and the competence and honesty of elected officials (Abramson and Finifter 1981; Citrin 1974; Citrin and Luks 2000; Citrin and Green 1986; Weatherford 1992). Some scholars who examine trust in government include a somewhat broader range of perceptions in the definition, including confidence that the government can effectively addresses societal problems (Own and Dennis 2001). Other social scientists have examined the extent to which people have confidence in major institutions in our society (Lipset and Schneider 1983; Kasperson et al. 1999; Metlay 1999). Finally, and most relevant to our work here, scholars have investigated social trust, which refers to the “reliance on the character, ability, strength, or truth” of the people or organizations in question (Cvetkovich and Lofstedt 1999, 4). In particular, researchers have studied the public’s trust in the people and organizations that manage environmental hazards (Earle and Cvetkovich 1995, 1999; Freudenburg 1993; Kasperson et al. 1999; Michaud 2007; Slovic 1999). Freudenburg (1993, 916-17) has coined the term “recreancy” to describe “the behaviors of persons and/or institutions that hold positions of trust, agency, responsibility, fiduciary or other forms of broadly expected obligations to the collectivity, but that behave in a manner that fails to fulfill the obligations or merit the trust.”

Our measure of optimism is closely related to the concepts of social trust and recreancy. Measures of social trust have been used to explain how much confidence people have in the risk managers who, for example, oversee nuclear power plants or nuclear waste dumps (Slovic 1999). If they fail—or if they are recreants, in Freudenburg’s terminology—society suffers.

A closely related concept, which has not been studied, is people’s optimism, or their confidence in scientists and engineers to solve the environmental problems we face. This is more than just a matter of trusting the competence of scientists to find a solution. Being optimistic also includes believing that a solution exists for scientists to find. In this sense, optimism is somewhat broader than the concept of trust in scientists because it includes both an aspect of trust and a belief about the state of nature.

**Data and Measures**

To test our hypotheses, we use data from an internet survey of 610 American adults, which was conducted June 18-23, 2008. Internet samples, of course, are generally not representative of their target populations (Berrens et al 2003; Malhotra and Krosnick 2007), and our sample is no exception. We can, however, say is that it is roughly representative. Our sample over-represents whites and under-represents blacks and Hispanics. In addition, it over-represents college graduates. However, the distributions

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3 The U.C. Santa Barbara Survey Research Center conducted the survey using a sample purchased from Survey Sampling International.
4 Our sample is 88% white, 4% black, and 6% Hispanic; the Census reports 81% white, 12% black, and 16% Hispanic. In our sample, 96% graduated from high school and 32% graduated from college. The Census reports that only 86% graduated from high school and only 28% graduated from college.
of age and gender in our sample match the U.S. Census data quite well. Despite the fact that our sample is only roughly representative, we believe that it provides a solid basis for testing our central hypotheses.

[Figure 1 here]

To measure scientific optimism, we combined the following three questions into a simple additive index with optimistic answers scored high. Figure 1 shows the distributions of the items.

- Do you think that scientists and engineers will be able to develop solutions to prevent global warming from happening? [Answers: Yes; No]
- Do you think that scientists and engineers will be able to develop solutions so that if global warming happens, Americans can adapt to it without much difficulty? [Yes; No]
- How much confidence do you have in scientists and engineers to address environmental threats associated with global warming? [A great deal of confidence; Some confidence; Not much confidence; No confidence at all]

The three items work nicely as a scale. Table 1 presents the results of a principal components analysis. The analysis yielded a single factor with loadings ranging from 0.81 to 0.86. The Cronbach’s alpha for the scale is 0.77, which indicates a high level of reliability.

[Table 1 here]

Our measure of activism consists of seven questions, each of which has four possible answers—very likely, somewhat likely, somewhat unlikely, and very unlikely. These items were also combined into a simple, additive scale with likely to act scored high. The principal components analysis of the items in table 2 shows a single scale with loadings ranging from 0.62 to 0.83. The Cronbach’s alpha for the scale is 0.82. The activism items are:

- Taking into consideration the cost and inconvenience for each action, how likely is that you personally would do each of these? … Choose a car that gets good gas mileage.
- Use less air conditioning in the summer and less heat in the winter.
- Carpool and drive less by using trains and buses more often.
- Spend money to buy appliances that use less energy to accomplish the same tasks.
- Pay higher taxes to support efforts to minimize global warming.
• Donate money to an environmental organization

• Volunteer to work for an environmental organization

[Table 2 here]

In our regression analysis, we also use a set of questions about belief in climate change science:

• Do you believe the theory that increased carbon dioxide and other greenhouse gases released into the atmosphere will, if unchecked, lead to global warming and an increase average temperatures on Earth? [Believe the theory of global warming; Do not believe]

• Which of the following statements reflects your view of when the effects of global warming will begin to happen? Global warming has (a) already begun, (b) will begin within a few years; (c) will begin within your lifetime; (d) will not within your lifetime, but will affect future generations; (e) will never happen.

• How serious of a threat is global warming to the economy and quality of life for California’s future? [Very serious; Somewhat serious; Not too serious; Not at all serious]

• Do you believe that we have a responsibility to take care of the environment for future generations, even if the actions we take will be expensive? [Yes; No]

Finally, we use four other variables that are known to influence opinions on environmental topics—party identification, liberal-conservative ideology, and two measures of religiosity—frequency of prayer and frequency of church attendance.

Data Analysis

Our central question is whether holding the optimistic belief that scientists and engineers will solve the problems of global warming will cause people to feel that they do not need to take personal actions to help solve our energy problems. A first, simple way to test the hypothesis is to look at the correlation between the optimism and activism scales. The Pearson’s R between the scales is 0.31 (p<.0001). The more confidence people have in scientists, the more willing they are to act.

A second, more thorough way to test the hypothesis is to estimate a regression model to discover if optimism about scientists’ ability to solve our problems increases the likelihood of taking action to minimize global warming when controlling for other, possibly confounding factors. In particular, we need to find out whether optimism affects activism among those who believe that global warming is real and that it poses a serious threat. The two models in table 3 give us this information.

[Table 3]
The first model in table 3 uses our optimism index and our four questions about global warming to predict global warming activism. Several variables were statistically significant. When we controlled for the other questions about belief in climate change science and optimism in scientists and engineers, we found that those who believe in the theory of global warming are more likely to take action to minimize the effects of global warming. This was significant at the p<.01 level. Furthermore, those who believed that global warming is a serious threat to the economy and quality of life were significantly more likely to report that they would take action to “do their part” to minimize global warming. This was significant at the p<.001 level. In total, these first two findings are rather intuitive; those who believe in the theory of global warming and those who believe that global warming poses a serious threat report that they are more likely to take actions in their own lives to curb the effects of global warming.

Our key finding is that after we controlled for the belief in climate change science variables, we found that those individuals who held optimistic beliefs that scientists and engineers will solve the problems of global warming are significantly more likely to feel that they need to take personal actions to help solve our environmental troubles (p<.001). This finding runs counter to Kellstadt et al.’s (2008) claim.

In model 2, we included several additional variables that are known to influence opinions on environmental issues to find out what effect, if any, these variables have on environmental activism. Frequency of prayer and frequency of church attendance were positive and statistically significant at the p<.05 level. That is, those who pray more often and attend church more frequently are significantly more likely to claim that they would take environmental action to help solve our energy problems. This result is contrary to prior findings about the interplay between religiosity and environmental opinions, which suggest that people who are strongly religious, especially fundamentalists, lean against environmentalism (Eckberg and Blocker 1996; Guth et al. 1995; Kempton 1995).

In addition, our ideological variable was positive and statistically significant at the p<.001 level. That is, the more liberal people are, the more likely they are to report that they would take environmental action. This, too, is consistent with previous literature on ideology as a well known cause of environmental views (Guber 2003; Jones and Dunlap 1992; Kanagy et al. 1994; Michaud 2007; Smith 2002; Van Liere and Dunlap 1980; Whitaker et al. 2005). More specifically, previous findings suggest that liberals are far more likely to hold strong environmentalist opinions than conservatives. Thus, it is not surprising that liberals hold strong environmentalist opinions which easily translate into strong self-reported environmental activism.

With the new control variables added—party identification, ideological predisposition, and frequency of prayer and frequency of church attendance—our findings from the first regression model remain unchanged. Belief in the theory of global warming and belief that global warming poses a serious threat was positive and statistically significant at the

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5 In addition to the variables shown in table 3, model 2, we tested several other variables to see if they had effects on activism, including age, level of education, gender, race, and ethnicity. None of these variables had statistically significant impacts or even had t-values over 1.0, so we omitted them.
p<.05 level and p<.001 level, respectively. Again, individuals those who accept global the global warming theory as true and those who believe that it poses a serious threat to our collective well-being report that they are more likely to take actions in their own lives to donate and/or volunteer to environmental organizations and reduce their own “carbon footprints.”

Finally, even in our more rigorous second regression model, optimism in scientist and engineers remains positive and statistically significant at the p<.001 level. The more optimistic an individual is that scientist and engineers will solve the problems of global warming, the more likely that individual is to report that he or she would behave in an environmental friendly way.

Discussion and Concluding Comments

With regards to background variables, we found that only three variables had a significant impact on activism. Individuals who are more liberal, those who pray and attend church more frequently are significantly more likely to report that they would take personal action to curb the effects of global warming. In addition, both of our equations show that individuals who accept the science behind global warming and fear that global warming poses a serious threat to the environment are significantly more likely to take action to minimize climate change. Thus, it seems that information about the theory and potential effects (however detrimental) of global warming cause people to take environmental action.

Finally, the findings in both of our models called into question the surprising finding of Kellstadt et al. (2008) that “Ironically, steps taken to persuade the public that scientists understand climate change, that the science is real, and that their warnings should be taken seriously have the effect of persuading people to have confidence that scientists will find solutions to the problem” (p. 122). These previous results were disturbing: an individual’s optimism in scientist and engineers encourages and justifies complacency. Thus according to Kellstadt et al., the more information a person has about global warming and the more optimistic they are that something can be done by others to solve the problem, the less responsible he or she feel for it.

Our findings, however, suggest the exact opposite conclusion. We find that optimism in science and engineers does not inherently translate into social loafing. In fact, our data suggest that individuals who hold optimistic beliefs that scientist and engineers will help solve the problems of global warming will not sit idly by and wait for the problem to be solved. These people are significantly more likely to report that they will take actions in their own lives to reduce our environmental woes. Thus, these individuals feel more not less responsible to take environmental action.

Clearly, more research needs to be done on the influence of knowledge about global warming and trust in scientists. The paper by Kellstedt et al. pointed in one direction; our paper points in the other direction. Our paper alone cannot overturn the findings of Kellstedt et al.; it can only call them into question. We can only be confident about the right answer if additional studies consistently point in one direction.
A final point we should make is that further work needs to be done to investigate the nature of optimism about science. As we noted above, we conceptualize optimism as both a matter of trusting the competence of scientists to find a solution and believing that a solution exists for scientists to find. However, we do not know if these are the ideas that people consider when they answer the questions. It may be that our questions tap into the old concept of trust in the honesty and competence of scientists. To develop a better understanding of optimism, more research needs to be done. In particular, questions about trust in scientists and optimism about science need to be asked in the same survey so that we can find out whether they are clearly different concepts in the minds of the people who answer the questions.

References


**Coding Appendix**

Frequency of prayer: “How do often do you pray by yourself?” (5) More than once a day, (4) Once a day, (3) More than once a week, (2) Once a week, (1) Every so often, (0) Never.

Frequency of church attendance: “About how often would you say that you attend religious services?” (5) More often than once a week; (4) Every week; (3) Almost every week; (2) Once or twice a month; (1) A few times a year; (0) Never.

Ideology: “Generally speaking, in politics do you consider yourself to be politically: (5) Very liberal; (4) Somewhat liberal; (3) Middle-of-the-Road; (2) Somewhat conservative; (1) Very conservative. Missing data: Don't Think of Myself in these Terms.

Party identification: “Generally speaking, how do you usually think of yourself in relation to political parties?” (1) Strong Republican; (2) Weak Republican; (3) Independent leaning toward the Republican Party; (4) Pure Independent; (5) Independent, leaving toward the Democratic Party; (6) Weak Democrat; (7) Strong Democrat. Missing data: Other Party.
Figure 1. Confidence in Scientists and Engineers

<table>
<thead>
<tr>
<th>Great deal of confidence</th>
<th>Some confidence</th>
<th>Not much confidence</th>
<th>No confidence</th>
<th>Adapt to global warming</th>
<th>Cannot adapt</th>
<th>Prevent global warming</th>
<th>Cannot prevent</th>
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<td>22</td>
<td>9</td>
<td>59</td>
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Table 1. Principal Components Analysis of Optimism Measures

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<th>Factor</th>
<th>Communality</th>
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<tr>
<td>1</td>
<td>0.81</td>
</tr>
<tr>
<td>2</td>
<td>0.81</td>
</tr>
<tr>
<td>3</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Scientists will develop solutions to prevent global warming
Scientists will develop solutions to adapt to global warming
Confidence in scientists to address global warming threats
Percent variance explained
Sample n

Table 2. Principal Components Analysis of Environmental Activism Measures

<table>
<thead>
<tr>
<th>Factor</th>
<th>Communality</th>
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<tbody>
<tr>
<td>1</td>
<td>0.62</td>
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<tr>
<td>2</td>
<td>0.68</td>
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<tr>
<td>3</td>
<td>0.67</td>
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<td>4</td>
<td>0.76</td>
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<td>5</td>
<td>0.83</td>
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<tr>
<td>6</td>
<td>0.81</td>
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</table>

Use less air conditioning in summer & heat in winter
Carpool and drive less by using trains and buses
Spend money to buy energy efficient appliances
Pay higher taxes to minimize global warming
Donate money to environmental organization
Volunteer to work for environmental organization
Percent variance explained
Sample n
Table 3. Regression of Activism on Optimism about Science & Other Predictors

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
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<tr>
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<td>s.e.</td>
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<tr>
<td>Intercept</td>
<td>3.99</td>
<td>0.57</td>
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<tr>
<td>Optimism about Scientists/Engineers &amp; Global Warming Index</td>
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<td>0.11</td>
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<tr>
<td>Believe theory of global warming</td>
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<td>0.71</td>
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<tr>
<td>When will global warming occur</td>
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<td>0.21</td>
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<td>How serious a threat is global warming</td>
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<td>0.29</td>
</tr>
<tr>
<td>Responsibility to preserve environment for future generations</td>
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<td>0.58</td>
</tr>
<tr>
<td>Ideology (liberal high)</td>
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<td></td>
</tr>
<tr>
<td>Party identification (Democrat high)</td>
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<td></td>
</tr>
<tr>
<td>Frequency of prayer</td>
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<td></td>
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<tr>
<td>Frequency of church attendance</td>
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<td>Adjusted R-square</td>
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<td>0.37</td>
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<tr>
<td>Sample n</td>
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<td>398</td>
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</table>

*** p < .001; ** p < .01; * p < .05