

THE ORIGINS AND CONSEQUENCES OF DEMOCRATIC CITIZENS' POLICY AGENDAS: A STUDY OF POPULAR CONCERN ABOUT GLOBAL WARMING

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Abstract. This article proposes and tests a model of the causes and consequences of Americans' judgments of the national seriousness of global warming. The model proposes that seriousness judgments about global warming are a function of beliefs about the existence of global warming, attitudes toward it, the certainty with which these beliefs and attitudes are held, and beliefs about human responsibility for causing global warming and people's ability to remedy it. The model also proposes that beliefs about whether global warming is a problem are a function of relevant personal experiences (with the weather) and messages from informants (in this case, scientists), that attitudes toward global warming are a function of particular perceived consequences of global warming, and that certainty about these attitudes and beliefs is a function of knowledge and prior thought. Data from two representative sample surveys offer support for all of these propositions, document effects of national seriousness judgments on support for ameliorative efforts generally and specific ameliorative policies, and thereby point to psychological mechanisms that may be responsible for institutional and elite impact on the public's assessments of national problem importance and on public policy preferences.

Introduction

At any moment in history, large democratic nations face many complex problems, and no government can make significant headway in addressing all of them simultaneously. Consequently, choices must be made about how to allocate legislative attention. These decisions are shaped by many forces, including statistical indicators of national conditions, dramatic "focusing events" that call attention to those conditions, lobbying efforts by interest groups, the development of innovative technological solutions to long-standing social problems, and more (e.g., Cobb and Elder, 1972; Kingdon, 1995; Walker, 1977).

One of these forces is what Kingdon (1995) called “national mood,” or public opinion. Letters and telephone calls from constituents provide an impetus for representatives to focus legislative efforts on particular issues. And news media opinion polls identifying problems that the public considers most important for the country, call legislators’ attention to them, and deflect attention away from others (Cohen, 1973; Kingdon, 1995; Peters and Hogwood, 1985). Therefore, to fully understand the ups and downs of an issue on the legislative agenda, we must understand the issue’s ups and downs on the public’s agenda.

An especially compelling context for examining these issues is that of global warming in the United States. Whereas the scientific community believes that its accumulated evidence justifies substantial public concern about this phenomenon, the American public does not appear to share that view. In fact, national surveys conducted during the last ten years indicate that Americans rank global warming lower than many other problems facing the country (e.g., Krosnick et al., 2000). In order to understand the possible trajectories of public perceptions of the national seriousness of this issue in the future and to identify the forces that might change these judgments, it might seem useful to consult the accumulated literature exploring the causes of national seriousness judgments more generally.

Despite the political significance of such judgments, scholarly research has, until very recently, provided little insight into the factors that shape these judgments. Most of the effort to date has focused on three potential instigators: (1) agenda-setting by the news media (McCombs, 2004; McCombs and Shaw, 1972), (2) agenda-setting by presidential rhetoric (Canes-Rone, 2001; Cohen, 1997; Hill, 1998), and (3) real change in social conditions (Behr and Iyengar, 1985; Erbring et al., 1980).

Our interest in this paper is to deepen and broaden understanding of public judgments of problem seriousness by exploring the cognitive processes through which they are formed and their effects on policy preferences, with a special focus on global warming. To this end, we propose and test a model of the origins and consequences of these judgments called the ACE model (because the principal variables in it are Attitude, Certainty, and Existence beliefs). We begin below by reviewing the literatures on the media agenda-setting, presidential rhetoric, and real-world cues hypotheses, showing how those literatures leave fundamental questions about these public judgments still to be answered. We then detail the ACE model’s account of the psychological underpinnings of national seriousness assessments, which we test using data from two representative sample surveys.

MEDIA AGENDA-SETTING

The Hypothesis

One view of media agenda-setting begins with the presumption that political affairs hover at the periphery of most people’s thinking throughout the course of their daily

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lives. So when asked to name the nation's most important problem in a survey, people must work hard to generate even a single answer and are inclined toward whatever plausible answer happens to come to mind first. The more attention the news media have paid to a particular problem recently (regardless of the content of the messages conveyed), the more likely it presumably is to come to mind as people search their memories for a problem to cite (Iyengar, 1990; Price and Tewksbury, 1997).

A second version of the agenda-setting hypothesis suggests that the news media communicate messages about what their personnel believe are the most significant issues facing the nation via their decisions about which issues to focus upon and how much attention to pay to each one (McCombs and Shaw, 1972). According to this view, agenda-setting occurs because the public chooses to internalize these suggestions as their own beliefs (Miller and Krosnick, 2000).

Evidence

A number of studies have documented positive cross-sectional relations between the amount of news coverage of particular problems and the national importance people ascribe to them (e.g., Bowers, 1973; McCombs and Shaw, 1972; Palmgreen and Clarke, 1977; Smith, 1987). Other cross-sectional studies have shown that people who are exposed to different media sources ascribe importance to problems in line with the amount of attention devoted to the problems by the source to which they attend most (e.g., Erbring et al., 1980; McLeod, 1965). Time series analyses have shown that increases in media coverage of problems precede increases in the importance the public attaches to them (e.g., Demers et al., 1989; Sharp, 1992; Smith, 1987). And laboratory and field experiments have shown that people exposed to news stories on an issue are more likely to consider it to be nationally important than are people not thusly exposed (Iyengar and Kinder, 1987; Leff et al., 1986; Miller and Krosnick, 2000; Wanta, 1988).

PRESIDENTIAL RHETORIC

A smaller literature suggests that presidential rhetoric influences public judgments of problem seriousness. More attention to an issue in presidential speeches is associated with increased public concern about it (Behr and Iyengar, 1985; Cohen, 1997; Hill, 1998). But this correspondence may simply be a result of media agenda-setting, because presidents set the agenda for the news media to some degree (Behr and Iyengar, 1985; Edwards and Wood, 1999; Gonzenbach, 1996; Wanta and Foote, 1994), and presidential focus on an issue is inspired partly by heightened media attention to it (Edwards and Wood, 1999; Flemming et al., 1999; Gonzenbach, 1996; Wood and Peake, 1998). Previous investigations of the presidential rhetoric hypothesis have not controlled for media attention to the issue, so the apparent effects of presidential rhetoric may be attributable to media attention instead.

REAL-WORLD CUES

A strong challenge has been voiced to all of this evidence: that the observed associations may be attributable to the fact that the news media, presidents, and ordinary Americans alike respond to real changes in objective life circumstances. According to this perspective, when a problem becomes objectively more serious, the media and presidents are the first to recognize it and convey this information to the public. As a result, the public eventually comes to learn of this change in real circumstances, and the more news coverage there is of it, the more quickly the public learns. So the surge in public concern about a problem following increased media coverage of and presidential focus on it may be due to people coming to recognize what the media and the president have already seen: that the problem has in fact become more significant. Thus, it may be the content of the media's and the president's messages that produce the observed effects (not the sheer volume of attention or media personnel's beliefs about problem importance).

Consistent with this argument, a number of studies have demonstrated that the frequency with which people cite a problem as the nation's most important is a function of objective indicators of the seriousness of the problem (e.g., Behr and Iyengar, 1985; Cohen, 1995, 1997; Erbring et al., 1980; Iyengar and Kinder, 1987; MacKuen, 1984; Schuman et al., 1986; Shaw and Slater, 1988). However, there is in fact some conflict among the findings of these studies. Whereas MacKuen (1984) found citations of energy problems to be contingent on the objective seriousness of energy problems in the country, Iyengar and Kinder (1987) did not. Whereas Iyengar and Kinder (1987) found citations of unemployment to be contingent on the unemployment rate, MacKuen (1984) did not. Although Erbring and colleagues (1980) found citations of crime to be contingent on the crime rate, MacKuen (1984) did not. And although Schuman, Ludwig, and Krosnick (1986) found that citations of inflation were positively related to the actual inflation rate, Iyengar and Kinder (1987) found no such relation.

Studies exploring whether media coverage of a problem increases public concern about it when controlling for real-world conditions have also yielded mixed results. Some studies found significant agenda-setting effects (Erbring et al., 1980; Iyengar and Kinder, 1987, for energy and inflation), while others have not (Iyengar and Kinder, 1987, for unemployment; Schuman et al., 1986, for unemployment, inflation, and the threat of nuclear war). Thus, despite widespread acceptance of the notion of media agenda-setting, this evidence suggests that there is more to the process by which people generate national seriousness judgments than referring to the amount of media coverage of an issue. Instead, the inconsistencies in these findings suggest the possibility of undetected moderators regulating the impact of media exposure and real-world cues on national seriousness judgments. Understanding the processes by which citizens' formulate judgments of problem seriousness, therefore, may shed new light on the necessary and sufficient conditions under which the media, presidential rhetoric, and real-world cues have impact.

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THE ACE MODEL OF NATIONAL SERIOUSNESS JUDGMENTS

The ACE model seeks to describe these processes, with roots in the combinatorial expectancy-value theories that have been popular in psychology throughout the last century (e.g., Atkinson, 1958; Feather, 1982; Fishbein and Ajzen, 1975; Tolman, 1958). Stated in general terms, these theories propose that a person's evaluation of an object is a function of his or her beliefs about the features of the object and his or her evaluations of those features. The ACE model expands the scope of and redirects such expectancy-value models in order to describe judgments of problem seriousness. Although the ACE model can be applied to judgments of the national seriousness of many problems, we describe and test it with regard to the issue of global warming.

Proximal Causes of National Seriousness

Shown in Figure 1, the model proposes that a person's perception of the national seriousness of global warming is a multiplicative function of three proximal considerations: his or her belief about the existence of global warming, his or her attitude toward global warming, and the certainty with which this belief and this attitude are held (the interaction between these three variables is shown by path g).¹ For example, Americans differ in their perceptions of whether global warming will occur in the future, some believing it will occur and others believing it will not (e.g., Bostrom et al., 1994; Gallup and Saad, 1997). This belief is the gate-keeper

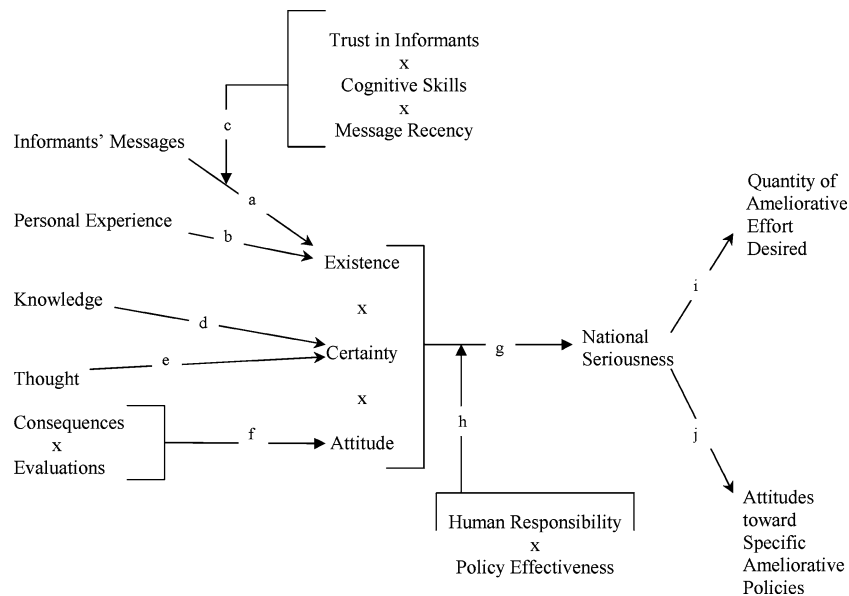


Figure 1. ACE Model of the origins and consequences of national seriousness judgments.

of the entire process, because the latter individuals would certainly not be expected to consider global warming to be a serious national problem.

However, people who believe global warming will occur in the future will not necessarily consider it to be a serious national problem. According to the ACE model, the effect of beliefs about the existence of a potentially problematic condition depends upon whether a person believes the condition will be good or bad. For example, some people believe global warming will be damaging, whereas others believe that it will be beneficial (e.g., Bostrom et al., 1994; O'Connor and Bord, 1998). Only if a person holds a negative attitude toward the phenomenon is he or she likely to consider it a national problem.

An interesting feature of the model arises because attitudes are inherently bipolar, whereas seriousness judgments are inherently unipolar. That is, seriousness judgments can range from an absolute zero point ("not at all a problem") to a very high level ("extremely serious"), whereas attitudes range from very negative through a point of indifference to very positive. People whose attitudes toward global warming are either indifferent or positive should all perceive minimal levels of national seriousness. So, for example, global warming should be considered no problem at all by people who are indifferent to it and by people who believe that warmer global temperatures would be good. Thus, the effect of attitudes on national seriousness judgments should be monotonic but non-linear, with increases in seriousness resulting mostly from increasing extremity on the negative half of the evaluative dimension.

The final proximal determinant is certainty (see Gross, Holtz, and Miller, 1995), which seems likely to operate with a default implication comparable to the legal presumption of innocence until proven guilty. Specifically, people may exhibit an optimistic preference for believing that global warming does not exist or will not lead to negative consequences until proven otherwise. This default approach may reflect a practicality-based belief that the nation faces more significant problems at any one time than it can address, so we should reserve judgments of great seriousness for problems that are certain to be real and are certain to lead to severe consequences. Also, the perception of a problem such as global warming as nationally serious probably brings with it psychological distress at its very existence, so people may defensively prefer to avoid such discomfort by denying a problem's seriousness when they are uncertain about its existence or consequences (Taylor, 1989).

In Figure 1, the effects of existence beliefs, attitudes, and certainty on seriousness judgments interact to influence national seriousness judgments, meaning that the three proximal antecedents are posited to have multiplicative effects. That is, if a person believes global warming does not exist, he or she should judge the issue to be of no national seriousness at all. And if he or she believes global warming does exist, seriousness ratings are posited to increase as a direct function of the negativity of his or her attitude toward global warming. The more damaging one feels global warming would be for the country, the more serious the problem should be judged. In addition, national seriousness judgments can only be maximally high

when existence beliefs and attitudes are held with maximum certainty. That is, only among people who believe global warming exists and hold negative attitudes toward it should increased certainty be associated with increasing judgments of seriousness.

The ACE model proposes that the impact of these three proximal causes is moderated by the combination of beliefs about human responsibility for causing global warming and about the existence of effective solutions for reducing it (represented by path *h* in Figure 1; e.g., Downs, 1972). Labeling a problem as serious may be uncomfortable to people if they feel they cannot solve it or should not solve it. For example, Downs (1972) asserted that public concern about a problem declines when people come to recognize that solving it will be difficult. Likewise, Schuman et al., (1986) found that people said they did not mention the threat of nuclear war as an important problem facing the country simply because nothing could be done about it, not because the risk wasn't real and substantial. And Brickman et al.'s (1982) research suggests that people do not generally ascribe responsibility for solving a problem to people who did not cause it. Although people may sometimes want government to solve problems for which society is not responsible (e.g., finding a cure for cancer), people seem more likely to expect government to help in solving problems that were created by society. Thus, citizens may judge global warming to be especially nationally serious if they perceive that humans can and should act to ameliorate it (because humans caused it and have effective solutions in hand; see Hallman and Wandersman, 1992).

Causes of Existence Beliefs

People learn about the state of the nation by two means: direct, personal experiences (shown by path *b*) and indirect learning from informants (shown by path *a*). Thus, people can come to believe that global warming will occur because they believe they have experienced rising daily temperatures in recent years (e.g., Weber, 1997). Or a person can learn that other people believe the world's temperature will rise in the future.

The model includes three hypothesized interactions regulating the impact of informants (who are most typically scientists in the case of global warming). The first is their perceived credibility: the more credible informants are believed to be, the more an individual will presumably rely upon them when developing their beliefs about the existence of global warming (Lupia and McCubbins, 1998; Petty and Cacioppo, 1986). The second and third interacting factors are cognitive skills and message recency. People with limited cognitive skills often manifest the most attitude change immediately after exposure to a persuasive message, because they are least able to see the flaws in an argument (e.g., Eagly and Warren, 1976; Visser and Krosnick, 1998). But such attitude change is likely to dissipate quickly, because it is based on minimal thinking (Petty et al., 1995). Therefore, people with more limited cognitive skills are only likely to show effects of information they have received from informants very recently (Haugtvedt and Wegener, 1994; Wood and Crockett, 1964).

In contrast, people with greater cognitive skills are best equipped to see flaws in messages they receive from informants, and these individuals are able to retain new information in their memories over longer time periods. Therefore, when highly skilled individuals do change their attitudes in response to acquired information, those attitudes are likely to have a great deal of inertia, remaining in place longer after the acquisition (Haugtvedt and Wegener, 1994; Miller and Krosnick, 1996). Consequently, as time passes after exposure to a set of new information, the attitudes of people high and low in cognitive skills should increasingly diverge from one another, with the former manifesting effects for longer. But even highly skilled individuals presumably update their beliefs regularly in response to acquired information, so the effects of a particular piece of information will most likely decay with time for these people as well. Trust in informants, cognitive skills, and message recency are hypothesized to interact to moderate the effects of informants' messages on existence beliefs.

Causes of Attitudes

The ACE model posits that attitudes toward global warming are a function of people's evaluations of its perceived consequences (Anderson, 1981; Fishbein and Ajzen, 1975). The most negative attitudes toward global warming are likely to be held by people who believe that it will have a large number of very damaging consequences.

Represented more formally, attitudes toward global warming are thought to be derived from beliefs as follows:

$$A = \sum_{i=1}^q (w_i \times p_i \times A_i) \quad (1)$$

where A is a person's attitude toward global warming; p_i is the probability that consequence i will follow from global warming; A_i is the evaluation, positive or negative, of consequence i ; and w_i is the weight attached to consequence i in this derivation process. In this context, i varies from 1 to the total number of perceived possible consequences of global warming (q). The impact of beliefs about consequences and evaluations of them are represented by path f in Figure 1, which represents the posited interaction. Estimating the weights in this equation would reveal the perceived significance of particular consequences of global warming.

Causes of Certainty

The ACE model identifies two determinants of certainty. Confidence in other types of judgments has been shown to increase as the result of knowledge gains (e.g., Estes and Hosseini, 1988; Gill et al., 1998; Gross et al., 1989; Sidanius, 1988) and thought (Abelson, 1988; Miller et al., 1991). In accordance with these findings, the ACE model posits that people develop a sense of certainty about global warming if they feel they know a lot about it (represented by path d) and if they have thought a great deal about it (represented by path e).

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Consequences of National Seriousness Judgments

Judgements of the national seriousness of global warming may be politically consequential because elected representatives learn about those judgments directly (via public opinion polls). But such national seriousness judgments may also be consequential indirectly, via their influence on the public's policy preferences, of two types. First, believing that a problem is more nationally serious may yield more popular support for government effort in general to ameliorate the problem (represented by path *i*). And second, greater perceived national seriousness may yield more popular support for specific government policies intended to ameliorate the problem (represented by path *j*).

IMPLICATIONS OF THE MODEL

The ACE model suggests a multiplicity of cognitive pathways by which news media stories, presidential rhetoric, and real-world cues might influence national seriousness judgments. For example, news media stories might increase perceived seriousness of global warming by convincing people of its existence, by informing them about its negative consequences, by convincing them that it will have fewer positive consequences than expected, or simply by increasing their confidence in beliefs they already held. Likewise, real-world cues might impact seriousness judgments by affecting existence beliefs or attitudes or certainty. Thus, if the model proves to have empirical validity, it suggests complex underpinnings of shifts in national seriousness judgments.

TESTING THE MODEL

We turn next to empirical evaluations of the model's predictions with regard to global warming. First, we describe the results of a large-scale survey of a nationally representative sample of American adults. This study allowed assessment of the proximal causes of national seriousness assessments of global warming, the causes of attitudes, certainty, and existence beliefs, and the effects of national seriousness judgments on policy preferences. Then, using data from a survey of a representative sample of adults living in Ohio, we explored many of the same issues and one new one.

National Survey

DATA

Sample

Computer-assisted telephone interviews were conducted with a representative sample of 1,413 American adults by the Ohio State University Survey Research Unit

between September 17, 1997, and February 13, 1998. The sample was generated via random digit dialing, and the cooperation rate was 70%. The resident of each household with the most recent birthday was asked to participate (Salmon and Nichols, 1983).

Measures

Respondents were asked about the national seriousness of global warming,² whether the winter and summer temperatures in their local areas had changed in recent years, their beliefs about global warming's existence (i.e., whether global warming would occur in the future if nothing is done to stop it), their attitudes toward global warming, the certainty with which they held those beliefs and attitudes, how much they felt they knew about global warming, how much they had thought about global warming, how much they trusted scientists (the primary informants about global warming in the media), how much they thought the U.S. government should do to deal with global warming, and whether they thought the U.S. government should require air pollution reductions from U.S. businesses and from countries that receive foreign aid from the U.S. We measured cognitive skills via number of years of formal education, which is extremely strongly correlated with direct measures of cognitive skills (Ceci, 1991).

Respondents were also asked about six possible consequences of global warming: on sea level, water shortages, food supplies, the number of types of animals in the world, the number of types of plants in the world, and the frequency of hurricanes and tornadoes.³ For each possible consequence, respondents were asked whether they thought global warming would cause an increase, a decrease, or no change. Respondents who thought global warming would produce a change in a phenomenon were then asked whether the change would be good or bad. All variables were coded to range from 0 to 1, with 1 corresponding to the largest amount (e.g., of seriousness or importance) or the most negative evaluation or the highest likelihood.

RESULTS

Proximal Causes of Nation Seriousness Beliefs

To test whether attitudes, existence beliefs, and certainty interacted as expected to influence national seriousness judgments, we conducted a series of OLS regressions predicting national seriousness judgments, which was measured by asking respondents whether change in the world's climate was no problem at all (coded 0), slightly serious (coded .25), pretty serious (coded .50), very serious (coded .75), or extremely serious (coded 1). In the first, existence beliefs, attitudes, and certainty all had positively-signed and significant effects (see column 1 of Table I), meaning that higher seriousness ratings were associated with belief in global warming's existence ($b = .23, p < .01$), more negative attitudes ($b = .14, p < .01$), and higher

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TABLE I
Predictors of National Seriousness Judgments (National Survey)

Predictor	Unstandardized regression coefficients			
Existence Beliefs	.23**	.09	.16**	.12
	(.02)	(.04)	(.05)	(.14)
Attitudes toward Global Warming	.14**	-.05	.18+	.05
	(.02)	(.06)	(.10)	(.26)
Certainty	.09**	-.19**	-.09	-.26+
	(.03)	(.07)	(.07)	(.13)
Human Responsibility				-.14
				(.22)
Policy Effectiveness				-.10
				(.12)
Existence Beliefs × Attitude		.09+	-.19+	-.32
		(.05)	(.11)	(.34)
Existence Beliefs × Certainty		.22**	.08	.12
		(.08)	(.09)	(.23)
Attitude × Certainty		.22**	-.25	-.21
		(.07)	(.19)	(.43)
Policy Effectiveness × Human Responsibility				.07
				(.27)
Policy Effectiveness × Existence Beliefs				.17
				(.17)
Policy Effectiveness × Attitude				.03
				(.38)
Policy Effectiveness × Certainty				.23
				(.24)
Human Responsibility × Existence Beliefs				-.07
				(.32)
Human Responsibility × Attitude				.29
				(.76)
Human Responsibility × Certainty				.07
				(.37)
Existence Beliefs × Attitude × Certainty			.55**	1.17*
			(.21)	(.59)
Existence Beliefs × Attitude × Certainty				.49
				(.88)
Existence Beliefs × Attitude × Human Responsibility				.28
				(.45)
Existence Beliefs × Attitude × Policy Effectiveness				.68
				(.56)
Existence Beliefs × Certainty × Human Responsibility				-.29
				(.33)
Existence Beliefs × Certainty × Policy Effectiveness				-.03
				(.37)

(Continued on next page)

TABLE I
(Continued)

Predictor	Unstandardized regression coefficients			
Existence Beliefs × Human Responsibility × Policy Effectiveness	.35			
	(1.30)			
Attitude × Certainty × Human Responsibility	.12			
	(.70)			
Attitude × Certainty × Policy Effectiveness	.07			
	(.86)			
Attitude × Policy Effectiveness × Human Responsibility	.24			
	(.51)			
Existence Beliefs × Attitude × Certainty × Human Responsibility	-2.18			
	(1.49)			
Existence Beliefs × Attitude × Certainty × Policy Effectiveness	-.79			
	(.84)			
Existence Beliefs × Certainty × Human Responsibility × Policy Effectiveness	-1.21			
	(1.53)			
Existence Beliefs × Attitude × Human Responsibility × Policy Effectiveness	-.71			
	(.68)			
Attitude × Certainty × Human Responsibility × Policy Effectiveness	-.87			
	(.97)			
Existence Beliefs × Attitude × Certainty × Human Responsibility × Policy Effectiveness	3.03⁺			
	(1.71)			
<i>R</i> ²	.18	.20	.21	.23
<i>N</i>	1309	1309	1309	1270

Note. Standard errors appear below coefficients in parentheses. No demographic control variables were include in these analyses.

** $p < .01$, * $p < .05$, + $p < .10$

certainty ($b = .09$, $p < .01$). High certainty exacerbated the effects of existence beliefs and attitudes ($b = .22$, $p < .001$, in both cases; see column 2 of Table I), and the posited three-way interaction between existence beliefs, attitudes, and certainty was statistically significant and positive, as expected ($b = .55$, $p < .01$; see column 3 of Table I).

To determine the nature of this three-way interaction, we computer the raw means for respondents with various sets of beliefs about global warming. People who believed that global warming will probably not occur in the future rated it as less serious ($\bar{X} = 0.23$, $N = 303$) than people who believed global warming probably will occur ($\bar{X} = 0.51$, $N = 1038$). Among people who thought global warming probably will occur, those who thought it will be neutral or good rated it as less serious ($\bar{X} = 0.43$, $N = 276$) than those who thought it will be bad ($\bar{X} = 0.54$, $N = 741$). And among people who thought that global warming will occur and that it will be bad, those who were highly certain rated it as more serious ($\bar{X} = 0.56$, $N = 598$) than those who were less certain ($\bar{X} = 0.45$, $N = 143$). Thus, national

seriousness ratings were highest among people who believed in global warming's existence, thought it would be bad, and were highly certain of those views.

To illustrate the three-way interaction in a different way, we explored the effects of attitudes toward global warming among respondents with differing existence beliefs and levels of certainty. Among people who believed that global warming probably will not occur, attitudes were not significant predictors of national seriousness judgments ($b = .06$, n.s., $N = 291$). But among people who believed global warming probably will occur, attitudes were powerful predictors of national seriousness judgments ($b = .25$, $p < .001$, $N = 1017$), and the effect of attitudes on national seriousness judgments among this latter group was significantly greater than among the former group ($z = 2.86$, $p < .01$). Among people who believed global warming will occur, attitudes had more impact on national seriousness judgments among people who were highly certain ($b = .30$, $p < .001$, $N = 768$) than among people who were uncertain ($b = .04$, n.s., $N = 249$; difference between the coefficients in two groups: $z = 3.25$, $p < .01$). Thus, attitudes toward global warming most strongly predicted national seriousness ratings when respondents believed global warming probably will happen in the future and were certain of their global warming beliefs.

To test whether beliefs about human responsibility and policy effectiveness regulated the impact of existence beliefs, attitudes, and certainty on judgments of national seriousness, we regressed judgments of national seriousness on existence beliefs, attitudes, certainty, and beliefs about human responsibility and policy effectiveness, as well as all possible interactions. The expected 5-way interaction was indeed marginally significant ($b = 3.03$, $p < .10$, see the last row in column 4 of Table I). The three-way interaction between existence beliefs, attitudes, and certainty was positive and highly significant among respondents who thought that humans were responsible for causing global warming and that reducing air pollution would reduce future global warming ($b = 1.31$, $p < .001$, $N = 522$), and the pattern of this interaction was such that respondents who believed that global warming would happen, would be bad, and were highly certain reported the highest national seriousness ratings. The attitude \times existence beliefs \times certainty interaction was not significant among respondents who did not believe both that humans were responsible and that reducing air pollution would reduce global warming ($b = 0.37$, n.s., $N = 771$; test of difference between coefficients: $z = 1.75$, $p < .10$). The pattern of the five-way interaction can be seen clearly in Figure 2. The proposed three-way interaction between existence beliefs, attitudes toward global warming and certainty is much more apparent in the bottom portion of the Figure (among respondents who believed that humans are mostly responsible for causing global warming and who believed that reducing pollution will reduce future global warming) than in the top portion of the Figure (among respondents who believed that humans are not mostly responsible for causing global warming or who believed that reducing pollution will not reduce future global warming).⁴

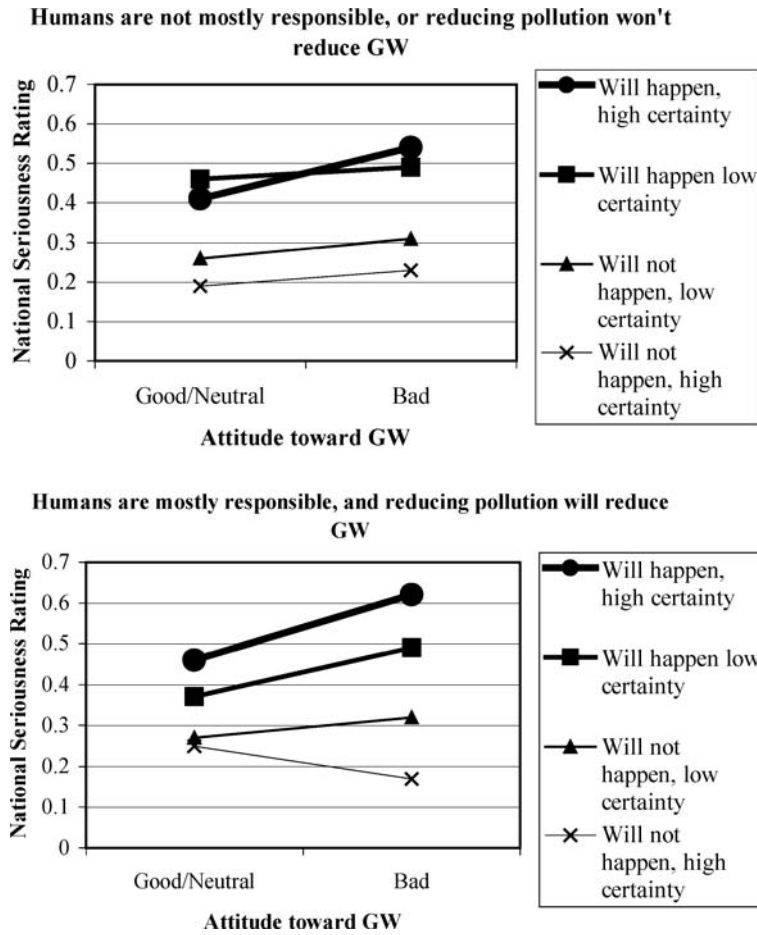


Figure 2. Illustration of the five-way interaction predicting national seriousness ratings.

Causes of Existence Beliefs

News media coverage of global warming prior to the national survey was heterogeneous in terms of messages conveyed about global warming's existence, precluding a reasonably simple and sensible characterization of that coverage for testing its effects on existence beliefs. However, the national survey did permit testing of the ACE model's predictions regarding the impact of personal experience on existence beliefs. When we conducted a probit analysis predicting existence beliefs (coded 1 if people thought global warming would happen in the future and 0 if they did not) with personal experiences with the weather (controlling for demographics), a perceived increase in local temperatures was associated with significantly greater likelihood of believing in global warming's existence (see column 1 of Table II; probit coefficient = 1.70, $p < .001$).

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TABLE II
Impact of media exposure and personal experiences on existence beliefs

Predictor	National survey	Ohio Survey – Subsample A		
		High trust in informants		Low trust in informants
		Low education	High education	
Days of newspaper reading		–5.46** (2.07)	1.34 (1.63)	–0.55 (0.71)
Days of TV watching		–0.28 (1.50)	4.20* (1.98)	–0.58 (0.70)
Local temperature change	1.70** (0.23)	5.58** (2.17)	5.44+ (3.06)	1.49* (0.70)
Age	–1.18** (0.34)	–5.12 (3.50)	2.97 (4.21)	–0.81 (1.26)
Gender	–0.28* (0.14)	–1.89 (1.34)	1.19 (1.22)	–0.72 (0.51)
Education	–0.20 (0.32)	–0.22 (5.58)	1.60 (6.45)	0.26 (1.19)
Political ideology	1.54 (0.25)	3.90 (2.42)	–1.21 (2.37)	0.84 (0.81)
Trust	1.23 (0.35)	6.89 (8.76)	–8.28 (8.06)	1.23 (2.56)
<i>N</i>	1271	66	50	103

Note. Standard errors appear in parentheses below probit coefficients.

** $p < .01$, * $p < .05$, + $p < .10$

Causes of Attitudes

To explore the origins of attitudes toward global warming, we first computed a variable for each possible consequence of global warming according to the formula in Equation (1). For each phenomenon that global warming might alter (e.g., sea level), we calculated the product of two variables: (1) a variable coded 0 if the respondent thought global warming would have no impact on the phenomenon and 1 if he/she thought global warming would alter the phenomenon, and (2) the evaluation of the expected consequence, ranging from –2 (meaning “very bad”) to +2 (meaning “very good”). These products were then recoded to range from 0 to 1, where 0 meant the respondent believed global warming would alter the phenomenon in a very good way, .5 meant the respondent believed global warming would have no effect on the phenomenon or that its effect would be neither good nor bad, and 1 meant the respondent believed global warming would alter the phenomenon in a very bad way.

We then regressed overall attitudes toward global warming (coded to range from 0 to 1, where 0 indicated that global warming would be very good, and 1 indicated

that global warming would be very bad) on all of these product terms, as well as demographic variables and the dummy variables representing respondents' beliefs about whether or not each phenomenon would be affected (see column 1 of Table III).⁵ The effects of these latter variables represent the impact of any change in the phenomenon, regardless of its nature; these effects could be significantly negative (meaning that any change in the world's status quo is undesirable) or significantly positive (meaning that any change in the world's status quo is desirable). The effects of the product terms reflect the impact that each (belief \times evaluation) product had on attitudes. Thus, the coefficients for the product terms represent the weight given to each potential consequence in Equation (1).

The resulting regression coefficients indicate that respondents placed significant weight on three possible consequences: changes in sea level ($b = .28, p < .01$), food supplies ($b = .15, p < .01$), and the numbers of animal species ($b = .12, p < .01$). All of the relevant coefficients were positive, meaning that the more undesirable the expected consequence of global warming was perceived to be, the more negative was a person's attitude toward global warming.

Causes of Certainty

We regressed certainty, measured by asking respondents whether they were extremely sure (coded 1), very sure (coded .75), somewhat sure (coded .5), slightly sure (coded .25) or not at all sure (coded 0) on knowledge and prior thought about global warming while controlling for demographics and found both knowledge and thought to have the expected strong, positive effects ($b = .45, p < .001$, and $b = .20, p < .001$, respectively; see column 1 of Table IV).

Consequences of National Seriousness Assessments

To assess the impact of national seriousness judgments on support for devoting effort to ameliorate the problem and for specific policies designed with that intent, we first regressed amount of desired U.S. government effort (coding ranged from 0 for "nothing" to 1 for "a great deal") to deal with global warming on national seriousness judgments and found a significant and positive effect, as expected ($b = .20, p < .001$; see column 1 of Table V). As predicted, greater perceived national seriousness also enhanced support for specific policies to reduce air pollution by limiting air pollution from U.S. businesses (coded 1 if a respondent favored the proposed policy and 0 otherwise) and by requiring countries given U.S. aid to reduce pollution (coded 1 if a respondent favored the proposed policy and 0 otherwise; probit coefficients = 1.81 and 1.35, $p < .01$; see columns 2 and 3 of Table V).

Ohio Survey

The national survey's evidence was quite consistent with the ACE model's predictions. However, that survey did not permit testing the ACE model's predictions

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TABLE III
Predictors of attitudes toward global warming

Predictor	Unstandardized regression coefficients		
	National survey	Ohio survey (Subsample B)	Ohio survey (Subsample C)
Change in Sea Level	-.01 (.02)	.06 (.04)	
Change in Food Shortages	.00 (.02)		-.02 (.04)
Change in Number of Animal Species	.01 (.02)		.02 (.04)
Change in Water Shortages	.03 (.02)	-.05 (.04)	
Change in Number of Plant Species	.02 (.02)	-.01 (.04)	
Change in Number of Plants		.06 (.04)	
Change in Number of Local Plants		.01 (.03)	
Change in Natural Scenery		.04 (.04)	
Change in Local Natural Scenery		-.03 (.04)	
Change in Rainfall			.02 (.04)
Change in Number of Animals			-.01 (.04)
Change in Number of Local Animals			.00 (.04)
Change in Animal Migration			.00 (.04)
Change in Number of Hurricanes/Tornadoes	.03 (.02)		
Change in Sea Level × Evaluation	.28** (.04)	.23** (.08)	
Change in Food Shortages × Evaluation	.15** (.03)		.11* (.05)
Change in Number of Animal Species × Evaluation	.12** (.04)		.25** (.10)
Change in Water Shortages × Evaluation	-.04 (.03)	.16** (.06)	
Change in Number of Plant Species × Evaluation	.03 (.03)	.07 (.06)	
Change in Number of Plants × Evaluation		.09 (.07)	

(Continued on next page)

TABLE III
(Continued)

Predictor	Unstandardized regression coefficients		
	National survey	Ohio survey (Subsample B)	Ohio survey (Subsample C)
Change in Number of Local Plants × Evaluation		.11 (.08)	
Change in Natural Scenery × Evaluation		.15* (.08)	
Change in Local Natural Scenery × Evaluation		-.04 (.09)	
Change in Rainfall × Evaluation			.27** (.07)
Change in Number of Animals × Evaluation			.00 (.10)
Change in Number of Local Animals × Evaluation			-.16 (.13)
Change in Animal Migration × Evaluation			.12 (.10)
Change in Number of Hurricanes/Tornadoes × Evaluation	.04 (.04)		
Education	.12** (.03)	.14* (.06)	.08 (.07)
Ideology	.04 (.02)	.04 (.04)	.11* (.05)
Sex	.01 (.01)	.02 (.03)	.03 (.03)
Age	-.06+ (.03)	-.07 (.07)	-.09 (.08)
Race	.03+ (.02)	.07+ (.04)	.11* (.05)
R^2	.28	.40	.29
N	1145	250	229

Note. Standard errors appear below coefficients in parentheses.

** $p < .01$, * $p < .05$, + $p < .10$

regarding the influence of media coverage on existence beliefs. Fortunately, the Ohio survey provided a suitable opportunity to test these predictions, because news media coverage of the issue in the State during the months prior to our data collection in December, 1995, was relatively easy to characterize.

Although some scientists had been expressing concern about the possibility of global warming since the beginning of the 20th century, there was no scientific consensus about its existence until 1995. In September 1995, the United Nations Intergovernmental Panel on Climate Change (IPCC) issued a landmark report stating for the first time that human activities had most likely been causing a gradual

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TABLE IV
Predictors of certainty of opinions about global warming

Predictor	Unstandardized regression coefficients	
	National survey	Ohio survey (all subsamples)
Knowledge	.45** (.03)	.54** (.04)
Thinking	.20** (.03)	.24** (.04)
Age	-.21* (.03)	-.09* (.04)
Gender	.03** (.01)	.02 (.02)
Education	.01 (.03)	-.01 (.04)
Ideology	.00 (.02)	-.03 (.02)
Race	.03* (.02)	.01 (.02)
R^2	.36	.43
N	1332	722

Note. Standard errors appear below coefficients in parentheses.

** $p < .01$, * $p < .05$

increase in global temperature during the last century (Stevens, 1995). This unified message from a large, respected international body of climate experts represented a dramatic change in the opinion informants conveyed to the public on this issue and kicked off a surge of media coverage of the issue that lasted three months.

Between September 1 and December 9, 1995, 46 news stories about global warming appeared in national and Ohio newspapers, and ten stories appeared on national network television news programs.⁶ The television news stories appeared primarily in September and October and consistently focused only on the assertion that global warming existed; the newspaper stories' content varied over time. Initial newspaper stories in September and October primarily asserted the existence of global warming, whereas later stories focused on skepticism and uncertainty about its existence.

This variation in information flow provides an unusual opportunity to study the impact of the mass media on public opinion. Usually, the messages conveyed to the public about political issues are very similar across this country's major news media (e.g., Baumgardner and Jones, 1993; Gozenbach, 1996; Mazur 1981a,b; Mazur and Lee, 1993; McCombs and Shaw, 1972; Patterson and Caldeira, 1990; Rogers et al., 1991). But in 1995, television viewing brought Ohioans one message about global warming, while newspaper reading brought people additional, contradictory

TABLE V
Effects of national seriousness judgments on support for government effort and specific remedies
(national survey)

	Dependent variable		
	Desired amount of government require effort	Support for ameliorative policies	
		U.S. businesse to reduce air pollution	Require countries that Receive foreign aid to reduce air pollution
National seriousness	.20** (.03)	1.81** (.38)	1.35** (.24)
Age	-.11** (.04)	-1.79* (.48)	-.08 (.33)
Gender	.02 (.02)	-.07 (.21)	.13 (.14)
Education	.00 (.03)	.31 (.47)	-.68* (.30)
Ideology	.09** (.02)	1.38** (.37)	.19 (.22)
Race	-.04+ (.02)	.52+ (.28)	.12 (.18)
R^2	.09		
N	1089	1312	1295

Note. Unstandardized OLS regression coefficients appear in the first column, and probit coefficients appear in the remaining columns. Standard errors appear below coefficients in parentheses.

** $p < .01$, * $p < .05$, + $p < .10$

messages. This allowed us to explore whether these various messages had impact on the respondents most exposed to them.

The ACE model suggests that people minimally trusting of scientists (the primary informants about global warming) should not have been persuaded by information provided by those stories and may instead have derived their opinions about existence simply from their personal experiences with weather changes. Among people more trusting of these informants, exposure to the consistent television messages should presumably have increased belief in the existence of global warming. Because most such television stories appeared during September and October, this effect might have been strongest among highly cognitively skilled people, who were most likely to remember the messages presented during this time. This effect might be weaker or nonexistent among less cognitively skilled people, who were more likely to have forgotten these messages by December.

If highly skilled respondents were indeed able to remember a large set of messages over a relatively long time period, these individuals could presumably have recalled both the initial newspaper claims in support of global warming's existence and the later, more skeptical messages when we interviewed them in December.

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Consequently, any impact of the initial messages may have been neutralized by the later, skeptical messages, yielding no apparent overall impact of newspaper exposure on the beliefs of these individuals. However, less skilled respondents were presumably best able to remember only the most recent skeptical messages they might have received from newspaper articles. Therefore, newspaper exposure might have been associated with greater skepticism about global warming's existence among these individuals. This latter prediction is consistent with Haugtvedt and Wegener's (1994) evidence that people who do not think carefully about messages they receive (which is presumably more common among less skilled individuals) are most influenced by the ones they encountered most recently.

Data

SAMPLE

For the Ohio survey, the Ohio State University Polimetrics Laboratory conducted 40-min computer-assisted telephone interviews with 758 adults. A representative sample of private households with telephones in Ohio was generated by random digit dialing, and the adult member of each contacted household who had the next birthday was selected to be interviewed (Salmon and Nichols, 1983). Interviewing began on December 10, 1995, and ended on January 10, 1996, with 84% of the interviews conducted in 1995 and 16% conducted in 1996. The cooperation rate for the survey was 75%.

MEASURES

Many of the questions used in the Ohio survey were identical to those used in the National survey. In order to permit asking a wider array of questions, each respondent was randomly assigned to receive one of three partially different forms of the questionnaire (all responses were coded as in the national survey). All three forms asked respondents about global warming's existence, their attitudes toward global warming, the certainty with which they held those beliefs and attitudes, how much they felt they knew about global warming, and how much they had thought about global warming. We measured cognitive skills via number of years of formal education.

One-third of respondents (selected randomly, called Subsample A) were asked about the national seriousness of global warming, whether the winter and summer temperatures in their local areas had changed in recent years, media exposure (how many days in the past week they had read a newspaper and/or had seen a news program on television), and their trust in scientists and their beliefs about the accuracy of scientists. Another one-third of respondents (again selected randomly,

called Subsample B) were asked instead about seven potential consequences of global warming (on sea level, water shortages, the number of plant species in the world, the total number of plants in the world, the number of plants in the respondent's local area, the beauty of natural scenery in the world, and the beauty of natural scenery in the respondent's local area). And the final one-third of respondents (called Subsample C) were asked instead about six other potential consequences (on rainfall, the number of animal species in the world, the total number of animals in the world, the number of animals in the respondent's local area, animal migration, and food supplies). For each possible consequence, respondents were asked whether they thought global warming would cause an increase, a decrease, or no change. Respondents who thought global warming would produce a change in a phenomenon were then asked whether the change would be good or bad.

Given the questionnaire structure, some of our hypotheses could be tested using data from the full sample, and other hypotheses could be tested using data from only one of the three sub-samples. Other hypotheses (e.g., the proximal predictors of national seriousness judgments, the consequences of national seriousness judgments, and the role of beliefs about human responsibility and policy effectiveness) could not be tested at all in the Ohio data, because the required measurements were not all administered to the same respondents, or the sample was too small.

Results

CAUSES OF EXISTENCE BELIEFS

To test the ACE model's assertions about the causes of existence beliefs, we conducted a probit analysis predicting existence beliefs with media exposure and personal experiences with the weather, controlling for demographics, separately among respondents high in trust of informants and low in education, respondents high in trust and education, and respondents low in trust. The results obtained were consistent with the ACE model's assertions.

Greater television exposure was indeed associated with an increase in belief in the existence of global warming, but only among people who trusted scientists and who were highly educated (and would therefore have retained the television message over time; third column, row 2 of Table II; probit coefficient = 4.20, $p < .05$). And as predicted, newspaper exposure was not associated with existence beliefs among these respondents, who would have been able to retain both the initial newspaper assertions that global warming existed and the later skepticism (third column, row 1 of Table II; probit coefficient = 1.34, n.s.).

Also as expected, greater newspaper exposure was associated with less belief in global warming's existence among people who were highly trusting and low in education (and would therefore presumably have retained only the most recent, skeptical newspaper messages; see second column, row 1 of Table II; probit

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coefficient = -5.46 , $p < .01$). And television exposure was not associated with existence beliefs among these people, who would have been less able to retain the television story content from September and October (see second column, row 2 of Table II; probit coefficient = -0.28 , n.s.).

Perceived changes in the weather also had the anticipated effects (see Table II): people who thought their local temperatures had increased recently were significantly more likely to believe in warming's existence, regardless of media trust or education (probit coefficient = 5.58 , $p < .01$; probit coefficient = 5.44 , $p < .10$; probit coefficient = 1.49 , $p < .05$).

CAUSES OF ATTITUDES

To explore the impact of beliefs about the consequences of global warming on attitudes toward it, we conducted an OLS regression using the same procedure as was used with the National data (see columns 2 and 3 of Table III). OLS regressions were conducted separately for the two subgroups of respondents who received different sets of questions about global warming's consequences. Of the thirteen regression coefficients testing the belief-attitude interactions, six were statistically significant. These coefficients suggest that respondents placed the greatest weight on the three changes involving water: changes in sea level ($b = 0.23$, $p < .01$), water shortages ($b = 0.16$, $p < .01$), and rainfall ($b = 0.27$, $p < .01$). People placed somewhat less weight on changes in the number of food shortages ($b = 0.11$, $p < .05$), the number of animal species ($b = 0.25$, $p < .05$) and changes in the beauty of natural scenery ($b = 0.15$, $p < .05$). All of these regression coefficients were positive, indicating that the more undesirable the expected consequence of global warming was perceived to be, the more negative was one's attitude toward global warming.

The effects of sea level, food shortages, and number of animal species match the national survey's findings, but the significant effect of water shortages here did not appear in the national data, which could be due to the different equation specification here or to different standards of judgment among Americans as a whole. The latter is certainly possible if Ohio's importantly farm-based economy made its residents more sensitive to water supplies than residents of other parts of the country.

Causes of Certainty

When we regressed certainty on knowledge, thought, and the demographics, both knowledge and thought had strong, positive effects, as expected ($b = 0.54$, $p < .001$, and $b = 0.24$, $p < .001$, respectively; see column 2 of Table IV). And as in the national survey, the effect of knowledge was twice the size of the effect of thought.

Discussion

SUMMARY

Across two studies involving two representative samples, we have seen many results consistent with the ACE model:

- (1) National seriousness judgments regarding global warming are an interactive function of existence beliefs, attitudes, certainty, and beliefs about human responsibility and policy effectiveness. The greatest national seriousness is ascribed by people who believe global warming will happen in the future if unchecked, who believe its consequences will be bad, who are highly certain of these beliefs, who believe humans caused this imminent rise in temperatures, and that humans can take steps to mitigate the problem.
- (2) Existence beliefs were an interactive function of news media message content, time delay, cognitive skills, and trust in the source, as well as personal experiences with real-world conditions. People who believed they had witnessed rising temperatures in recent years were more likely to believe in the existence of global warming. People who did not trust scientists were not influenced by their claims. Among people who did trust scientists, acceptance of their claims was most likely among people who were highly cognitively skilled and who were not exposed to claims of disagreement among scientists by the news media. People who were exposed to news about scientific controversy and who were low in cognitive skills were the most skeptical about the existence of global warming.
- (3) Attitudes were a function of beliefs about consequences and evaluations of those consequences. When evaluating global warming, people placed the most significance on sea level rise, food shortages, animal species extinction, water shortages, rainfall reduction, and natural scenery compromise, and people placed no significance on other effects on animals, effects on plants, and effects on storms.
- (4) Certainty was a function of prior thought and knowledge. The more people thought and knew about the issue, the more certain they were of their views.
- (5) Respondents' beliefs about the national seriousness of global warming predicted support for general anehorative effort and for specific policies to reduce global warming. Those who believed global warming is likely to be a more serious problem were more likely to support government efforts and policies to reduce global warming.

IMPLICATIONS REGARDING GLOBAL WARMING

Increasing Public Perceptions of Seriousness

Some observers of the global warming controversy believe that the scientific consensus that has formed about the existence and threat of the phenomenon is being

met with remarkably little real ameliorative action by governments around the world. And some such observers believe that this lack of action is at least partly a result of the public's lack of endorsement of the problem as especially nationally serious. This point of view was asserted recently by Christine Todd Whitman (former Governor of New Jersey and Administrator of the U.S. Environmental Protection Agency), who said on October 28, 2005, that "the public doesn't know where to be" on this issue (Anderson, 2005).

The data analyzed here confirm that the public did not ascribe great national seriousness to global warming in 1997 and 1998 – 10.4% of the national survey sample said global warming was likely to be an extremely serious problem, 19.4% said it would be very serious, 21.3% said it would be pretty serious, 33.1% said it would be slightly serious, and 14.9% said it would be no problem at all. Furthermore, our data identify some of the sources of this lack of perceived seriousness: 21.6% of our respondents said they thought global warming probably will not occur in the future. Of the respondents who did think global warming probably will occur if unchecked, 9.2% of them thought it would be good for people in general, and 17.4% thought it would be neither good nor bad. Of the people who believed that global warming probably would occur if unchecked and would be bad for people, only 8.9% were extremely sure of their views, 29.2% were very sure, 42.6% were somewhat sure, 14.2% were slightly sure, and 5.1% were not at all sure. And among people who believed that global warming probably will occur if unchecked and would be bad for people and were very or extremely certain of their views, 21.5% failed to believe that global warming was caused by humans or could be ameliorated by reducing air pollution. Thus, there is plenty of room for the prevalence of belief in global warming existence, damage, human origins, and ameliorative strategies, and of high certainty to increase toward 100%. Our findings suggest that future public efforts to instigate such increases would translate into greater expressed national seriousness of the problem and greater pressure on government to take action.

Concern about Particular Effects of Global Warming

Attempts to convince Americans that global warming will have undesirable consequences for people must presumably be made by highlighting ways in which global warming is likely to alter the state of life on this planet. And our results suggest that some effects were more motivating than others in 1998 and earlier. Specifically, our evidence suggests that sea level rise, food shortages, and water shortages (and rainfall reduction) were especially motivating for people. Concern about such matters address basic materialistic needs for survival: shelter and sustenance.

In addition, people were motivated by impact on animal species extinction and natural scenery compromise. Concern about animal species diversity is more symbolic and post-materialistic. The impact of this latter consideration is therefore evidence of "biospheric" or "egocentric" thinking (see Dunlap, 1978; Stern et al., 1993; Thompson and Barton, 1994). This may be the result of the relatively developed state of the American economy, which permits people to ascribe weight to con-

siderations beyond mere subsistence (Dunlap and Mertig, 1997; Inglehart, 1995, 1997; Maslow, 1970). Significant effects of both materialistic and post-materialistic concerns suggests that the latter do not supplant the former, but rather supplement them as determinants of attitudes.⁷

People apparently placed no significance on impacts of global warming on the number of animals or on animal migration, when controlling for impact on food supplies. Thus, threatened reductions in the numbers of non-edible animals or threatened disruptions in animal habitats seem not to be troubling for people. Similarly, people placed no significance on effects of global warming on plant species extinction or the number of plants around the country, when controlling for impact on food supplies. Thus, threats to the numbers of plants or plant species seem not to be especially motivating.

The lack of weight placed on global warming's impact on the numbers of storms people experience may have been a temporary condition that has changed in response to recent events. Specifically, back in 1998 and before, Americans probably recognized that the country endures a regular flow of hurricanes and tornadoes, so a few more of them might be no big deal. But recent experiences with flooding in New Orleans, repeated severe hurricanes and tropical storms in that area and along the eastern seaboard, coupled with dramatic events like the 2005 Tsunami, may have helped Americans to see how devastating such natural disasters can be. So perhaps the weight people attach to those consequences has changed.

It is interesting to note that perceived impact of global warming on the number of local plants or animals near the respondent or impact on natural scenery in the respondent's local area had no impact on their overall evaluations of global warming. These findings are consistent with the general claim that when people make nationally-focused judgments (e.g., of the national seriousness of a problem), they do not consult the impact of the issue on them personally (see, e.g., Sears and Funk, 1991).

Taken together, these findings point to persuasion strategies that may be effective and some that may not be. Specifically, it appears that convincing people they personally will be affected is not a promising avenue for arousing public concern. Instead, it seems especially promising to convince people of likely global warming impact on the abilities of humans to assure food and shelter for themselves, as well as irreversible extinction of animal species. And convincing people of impact on plants in ways that do not affect the food supplies seems unlikely to produce changes in concern. We look forward to future research seeing whether global warming impact on storm frequency and severity has taken on significance for people that they lacked in 1998 and before.

The Consequences of "Balance as Bias"

A great deal of concern has been expressed in recent years that news media coverage of the scientific community's views on global warming is often distorted in an

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important way. Whereas the IPCC reports have repeatedly documented a widespread consensus among scientists about the existence, effects, and seriousness of global warming, recent news media coverage has routinely attempted to provide “balanced” portrayals of the issue by mentioning the views of lone dissenters and skeptics who generally do not have conventional credentials to document expertise in the area (Boykoff and Boykoff, 2004). Our findings suggest that such “balance” may be consequential, because the more people with limited cognitive skills were exposed to the views of these skeptics, the more skeptical they themselves were about the existence of global warming. Perhaps a change in the news media’s approach in this regard would yield increases in public concern about this issue.

IMPLICATIONS REGARDING PROBLEM SERIOUSNESS JUDGMENTS GENERALLY

Our findings also have a variety of implications for developing a broad theory of the origins of national seriousness judgments.

Documenting Effects of News Media Content

Documenting the impact of real world news media content on people’s beliefs and attitudes is typically difficult to do with a great deal of refinement, because it is practically impossible to assess precisely what media content a particular person has been exposed to, necessitating relatively crude analyses. Matters are made a bit simpler in this regard because media content is usually quite homogeneous across various television, newspaper, and radio sources (e.g., Gonzenbach, 1996; Mazur and Lee, 1993; McCombs and Shaw, 1972; Patterson and Caldeira, 1990). But such homogeneity also makes it more difficult to be sure that exposure to a particular media source did indeed cause belief or attitude change. In the Ohio study, notable differences in content between television and newspaper coverage offered a better empirical handle than is usually available in such investigations.

Psychological research on persuasion anticipates different media effects depending upon trust in information sources, cognitive skills, and time delay. These are no doubt only three of many factors that regulate media impact (see, e.g., Petty and Cacioppo, 1986). In this light, it is remarkable that our relatively simple approach yielded findings close to the model’s predictions in the Ohio data. This seems likely to have been so because our survey followed an important shift in expert opinion about the issue that was conveyed to the public via a relatively limited set of news stories, making it relatively easy to characterize the messages received.

Media Effects and Trust

Our finding that trust regulates media effects on beliefs about the existence of global warming complements evidence that trust plays an important role in communicating information about risks to the public (e.g., Johnson, 1999; Kasperson et al., 1992; Portinga and Pidgeon, 2003; Siegrist et al., 2000). Furthermore, our evidence comes at a time of increasing interest in trust in other domains of public opinion research,

including social capital (Putnam, 2000), the effectiveness of persuasive messages (Lupia and McCubbins, 1998), and vote choice (Hetherington, 1999). Trust has also been extensively examined in psychological research on attitude change (e.g., Petty and Cacioppo, 1986). Our work adds to this growing literature by documenting the role of trust in regulating persuasion and priming in the domain of politics. And our work provides a dramatic illustration of the potential dangers of ignoring the impact of trust when examining media effects: we would not have observed any media effects on existence beliefs if we had not taken trust into account, because the media effects were in opposite directions in different subgroups of our samples.

Certainty

Evidence here of certainty's role in shaping national seriousness judgments also dovetails with a surge of recent work introducing certainty to the literature on candidate perception and political opinions (Alvarez, 1997; Alvarez and Brehm, 1997; Alvarez and Franklin, 1994). This research provides evidence that certainty is negatively related to individual variability in attitudes (Alvarez and Brehm, 1997), that beliefs and attitudes of which people are certain are more extreme than beliefs and attitudes of which people are uncertain (Alvarez and Franklin, 1994), and that opinions of which people are uncertain are more difficult to predict than those of which people are certain (Alvarez and Franklin, 1994). We have highlighted another effect of certainty, that people are more likely to use attitudes and beliefs of which they are certain in forming judgments of national seriousness and policy preferences. Our evidence that knowledge and thought lead to greater certainty also complements evidence found in previous explorations of the causes of certainty (e.g., Estes and Hosseini, 1988; Gross 1989).

Attributions of Human Responsibility and Beliefs about Remedy Effectiveness

Our evidence that perceptions of human responsibility and remedy effectiveness regulated the impact of existence beliefs, attitudes, and certainty is consistent with Downs's (1972) hypothesis that people stop paying attention to a problem when they realize that there are no easy solutions for it and suggests that people may judge as nationally serious only those problems about which they think action should and can be taken.

FUTURE RESEARCH

Explained Variance

Although the regressions at each step of our model explained substantial amounts of variance in the dependent variables by contemporary social science standards, they certainly did not explain all of the variance. But because we had only single measures of each construct, we were unable to eliminate the attenuating impact of

random and systematic measurement error. In examinations of many large scale surveys, Cote and Buckley (1987) found that only 42% of the variance in a typical survey item is true variance, and Andrews (1984) found this figure to be 66%. Taking an average, perhaps half of the variance in a single survey item is true variance. If this were generally true of our measures, the effect sizes we observed would generally appear to be twice as large as they appear to be here. Future research with multiple measures can assess whether this is indeed a reasonable estimate.

But it also seems likely that explained variance is not maximal here because additional explanatory variables belong in the model as well, and future research should seek to identify them. One potentially useful variable is beliefs about human abilities to adapt to a problem (e.g., Loewenstein and Frederick, 1997). People are remarkably capable of coping effectively with devastating events (e.g., Taylor, 1989), and knowledge of this ability may color people's thinking about national politics. For example, people who believe that global warming will have very bad consequences but that society can readily adapt to them may consider the problem less serious as a result. Beliefs about adaptation may also influence weights attached to some of global warming's consequences in determining attitudes; consequences to which people can readily adapt may be considered less important than those to which people cannot adapt.

Disaggregating Certainty

Another interesting issue to pursue in future studies is the possibility of disaggregating certainty. Respondents in the surveys described here were asked single questions gauging the confidence with which they held their views on global warming generally. Future studies could refine this measurement approach, gauging certainty for attitudes, for existence beliefs, for assessments of consequences, for recollections of personal experiences with the weather, and so on. If these various judgments are made with different levels of certainty, more refined measurement would most likely yield greater explained variance. And measuring certainty of national seriousness judgments may be worthwhile as well – the more confident a person is in those judgments, the more likely he or she may be to use them in forming policy preferences.

Exploring New Policy Domains

The ACE model seems likely to be applicable in many other policy domains besides global warming, and in light of these results, future research investigating such applications seems worthwhile. Most obviously, the model in Figure 1 is directly applicable to other problems where the public can rely both on their own personal experiences of a phenomenon (such as employment rates among their friends and acquaintances) as well as the opinions of experts (such as economists' analyses of unemployment rates) to infer problem existence and consequences.

Documenting Causality

Needless to say, the ACE model posits causal impacts of variables on other variables. Although our results are all consistent with the hypothesized causal effects, cross-sectional survey data do not permit inferences about causality. In some cases, causal relations opposite to that posited by the model may also be plausible (e.g., beliefs about global warming may influence perceptions of the weather). Therefore, the findings reported here should be viewed as suggesting the value of future studies employing experimental procedures (Kinder and Palfrey, 1993) or longitudinal survey designs (Kessler and Greenberg, 1981) to document the causal processes proposed here.

Conclusion

We are now in a position to go beyond the assertion that volume of news media coverage, presidential rhetoric, and real-world cues are the sources of national seriousness judgments. Our research demonstrates how exploration of the cognitive mechanisms involved in such judgments can significantly enrich our understanding of their origins and dynamics and how and when factors such as news media content, presidential behavior, and real-world events will be consequential in this domain. For example, if the methods used here are applied in future studies to help understand why and when these factors affect the public's issue agenda, we may well find that media coverage sometimes increases national seriousness assessments by altering existence beliefs, sometimes by conferring knowledge and thereby increasing certainty, or sometimes by altering people's perceptions of a phenomenon's consequences.

The value of such insights is nicely illustrated by an example from the literature on global warming and support for public policies. O'Connor et al. (1998; Bord *et al.* 1997) documented that people who knew more factual information about global warming were more supportive of ameliorative policies. Yet these investigators did not document why and how this influence occurred. Our findings suggest a possible mechanism: knowledge may have increased certainty (path f in Figure 1), which in turn increased assessments of national seriousness (path m), which in turn increased policy support (path r). Without such mechanistic explanations for observed effects, it is difficult to know what to make of simple correlations or to know how to build inferences about their implications.

Our results suggest that knowledge about an issue *per se* will not necessarily increase support for a relevant policy. It will do so only if existence beliefs, attitudes, and beliefs about human responsibility are in place to permit the necessary reasoning steps to unfold. This finding is consistent with past research that has studied public understanding of other complex scientific issues and challenged knowledge deficit models of communication, which posit that greater knowledge about science leads directly to more positive attitudes toward it (e.g., Bonfadelli et al., 2002; Gaskell

et al., 2003). Thus, we would concur that “[i]t is too simplistic to attribute opposition to science to a lack of knowledge and to suggest that a dose of scientific information will cure people’s skepticism (Gaskell et al., 2003, p. 26)”.

Coda

If indeed democratic publics’ issue agendas are driven by considerations along the lines outlined by the ACE model, the formation process would seem more normatively reassuring than alternative portrayals of the process might. Of course, if people’s ingredient beliefs about a problem’s existence and consequences are largely inaccurate, then the ultimate judgments people make may well misdirect government, thereby leading to other, quite serious problems. But the fault here would lie not in the process by which judgments are made, but rather in the information channels through which citizens become informed and their interpretations of the information thus gained.

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Notes

¹A great deal of research has explored the causes on the left side of Figure 1, but we do not discuss that work here, instead focusing on the model’s predictions.

²During the last six decades, national surveys have often measured perceived national problem seriousness by asking respondents to identify the most important problem(s) facing the country using open-ended questions (typically acquiring one, two, or at most three problems per respondent). Thus, these questions spotlighted only the issues at the very top of respondents’ problem hierarchies. Just below these most serious problems may be many other issues that respondents believed were also extremely serious for the country, but they went unidentified. Furthermore, open-ended questions like

these allow researchers to identify top-ranked issues without any assessment of the absolute level of importance attached to each of those issues. Because our model seeks to explain the causes of absolute levels of the perceived national seriousness of global warming, we used a closed-ended question to measure this construct directly.

³To identify all the effects people might think global warming will have, we content-analyzed news media stories, conducted focus groups around the country, examined the findings of relevant previous studies of public beliefs (e.g., Bostrom et al., 1994; Read et al., 1994), and did a pilot survey of Ohio adults. We then selected the most frequently mentioned effects to ask about explicitly in our surveys.

⁴We also tested other possible interpretations of the 5-way interaction and found no evidence consistent with these interpretations. Most notably, we compared respondents who believed either that humans were mostly responsible for causing global warming or that reducing air pollution would reduce future global warming to respondents who held neither belief. The three-way interaction between existence beliefs, attitudes, and certainty did not differ between these two groups of respondents as it did for those shown in Figure 2.

⁵A respondent was only asked about his or her attitude toward a potential consequence if he or she thought global warming would cause a change in a phenomenon. Therefore, these attitudes could not be included as predictors, because respondents who said no change would occur did not (and in fact could not) have valid attitude values.

⁶To assess media coverage of this issue, we focused on three national newspapers that have extensive circulation in Ohio (the New York Times, USA Today, and the Wall Street Journal), the three major regional papers in the State (the Columbus Dispatch, the Cincinnati Enquirer and the Cleveland Plain Dealer), and four national television networks' news programs (NBC, CBS, ABC, and CNN). No transcripts of local Ohio television news programs were available.

⁷Some past research on environmental attitudes suggests that people whose lives are materially insecure focus mostly on survival issues (e.g., food, water, and shelter), whereas people with more economic security have the luxury of being concerned about more symbolic aspects of the environment (e.g., animal species extinction). To test this idea, we examined whether the parameter estimates in Table III differed between respondents low and high in income, but no systematic and reliable differences appeared.

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