

American Risk Perceptions: Is Climate Change Dangerous?

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Public risk perceptions can fundamentally compel or constrain political, economic, and social action to address particular risks. Public support or opposition to climate policies (e.g., treaties, regulations, taxes, subsidies) will be greatly influenced by public perceptions of the risks and dangers posed by global climate change. This article describes results from a national study (2003) that examined the risk perceptions and connotative meanings of global warming in the American mind and found that Americans perceived climate change as a moderate risk that will predominantly impact geographically and temporally distant people and places. This research also identified several distinct interpretive communities, including naysayers and alarmists, with widely divergent perceptions of climate change risks. Thus, “dangerous” climate change is a concept contested not only among scientists and policymakers, but among the American public as well.

KEY WORDS: Affective imagery; climate change; dangerous; interpretive communities; risk perception

1. INTRODUCTION

The ultimate objective of the 1992 United Nations Framework Convention on Climate Change “is to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system” (United Nations, 1992, Article 2). “Dangerous,” however, is an ambiguous term—dangerous to whom, to what, where, and when? At what geographic scale, severity, and rate of change do climate change impacts become dangerous? How many or which people or species must be adversely affected, and to what degree? What level of atmospheric greenhouse gas concentrations will generate these dangerous impacts, how rapidly, and with what level of scientific certainty? Article 2 goes on to say, “such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.” Climate change, however, will

have heterogeneous geographic impacts; thus some ecosystems, food production systems, and economies are more vulnerable than others. How many or which ecosystems must be pushed beyond their thresholds of adaptability before climate change is considered dangerous? How are these thresholds to be defined?

There are many potential interpretations of this key concept as well as many ways to define, operationalize, and legally codify it. The original Framework Convention on Climate Change relied on voluntary measures to reduce greenhouse gas emissions. By the mid-1990s, however, it had become evident that these voluntary approaches were failing to slow greenhouse gas emissions, spurring a new diplomatic effort to formulate legally enforceable targets and timetables, ultimately resulting in the Kyoto Protocol. Recently adopted into international law, the Kyoto Protocol has instituted legal and economic sanctions for countries that fail to meet their initial commitments. Subsequent international negotiations must now determine how much and how quickly global emissions must be further reduced to “prevent dangerous anthropogenic interference with the

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climate system.” The prospect of further legal and economic penalties for failure to achieve national emissions targets invests both the precise meaning and measurement of “dangerous” climate change, and the process by which it is defined, with a new significance.

In addition, “dangerous” climate change will be defined differently by different stakeholders. For example, two important influences on policymakers (among others) are scientists and the lay public. Expert definitions of danger derive from scientific efforts to identify, describe, and measure thresholds in physical vulnerability to natural ecosystems (e.g., coral reefs) or to critical components of the current climate system (e.g., the Thermohaline Circulation System). Expert definitions of dangerous climate change also derive from scientific efforts to define thresholds in social vulnerability to climate change, including increased rates of infectious disease, destabilization of international order, or severe economic impacts. Finally, expert definitions include efforts to identify particular levels of atmospheric greenhouse gas concentrations or average global temperature as ceilings beneath which dangerous climate change can be avoided (e.g., 450 parts per million volume of carbon dioxide or 2°C (3.6°F) warmer than preindustrial levels) (O’Neill & Oppenheimer, 2002; WBGU, 2003).

Lay public perceptions and interpretations of dangerous climate change, however, are “based on psychological, social, moral, institutional and cultural processes” (Dessai *et al.*, 2004). While experts tend to narrowly define risks using two dimensions (e.g., probabilities and severity of consequences), the general public has been found to utilize a much more multidimensional and complex set of assessments. Public risk perceptions are influenced not only by scientific and technical descriptions of danger, but also by a variety of psychological and social factors, including personal experience, affect and emotion, imagery, trust, values, and worldviews (Slovic, 2000).

Furthermore, public risk perceptions are critical components of the sociopolitical context within which policymakers operate. Public opinion can fundamentally compel or constrain political, economic, and social action to address particular risks. For example, public support or opposition to climate policies (e.g., treaties, regulations, taxes, subsidies) will be greatly influenced by public perceptions of the risks and dangers inherent in climate change. Thus, both expert and lay public interpretations of dangerous climate change are important components of the policy-making process.

1.1. The Importance of Public Risk Perceptions in the United States

In this context, American public risk perceptions of climate change are critical for at least two reasons. First, the United States, with only 5% of the world’s population (U.S. Census Bureau, 2005), is currently the world’s largest emitter of carbon dioxide, the primary heat-trapping gas, alone accounting for nearly 25% of global emissions. Per capita, Americans emit 5.40 metric tons of carbon each year. By comparison, the average Japanese emits 2.55 tons per year, while the average Chinese emits only 0.60 and the average Indian only 0.29 tons per year (Marland *et al.*, 2003). Second, successive U.S. presidents and congressional leaders have been at odds with much of the world community regarding the reality, seriousness, and need for vigorous action on climate change. For example, in 1997, just prior to the Kyoto climate change conference, the U.S. Senate passed a nonbinding resolution (95–0) co-sponsored by Robert Byrd (D) of West Virginia and Chuck Hagel (R) of Nebraska, which urged the Clinton administration to reject any agreement that did not include emission limits for developing as well as industrialized countries, arguing that to do so would put the United States at a competitive economic disadvantage (Senate Resolution 98, 1997). Furthermore, in 2001 President George W. Bush renounced a campaign pledge to regulate carbon dioxide as a pollutant, withdrew the United States from the Kyoto Protocol negotiations, and proposed national energy legislation to increase drilling for oil and natural gas, increase mining for coal, and build more than a thousand new fossil-fuel-burning power plants (Pianin & Goldstein, 2001; Revkin, 2001; United States, 2001). Clearly, the American public will play a critical role, both in terms of their direct consumption of fossil fuels, and resulting greenhouse gas emissions, and through their support for political leaders and government policies, in the effort to mitigate or adapt to global climate change.

This article summarizes current public opinion on climate change and reports results from a recent study of American risk perceptions, policy preferences, and individual behaviors.

2. BACKGROUND

2.1. Public Opinion Polls

Despite scientific warnings in prior decades (e.g., Revelle & Suess, 1957; *Nature*, 1979), global climate change did not become a significant public concern

in the United States until the summer of 1988—at that time the hottest year since the middle of the 19th century. On June 23, the second day of summer, Senator Timothy Wirth of Colorado convened a U.S. Senate Energy and Natural Resources Committee hearing on climate change. The date of the hearing happened to fall during a heat wave sweeping over much of the nation and on a day that temperatures reached a record 101°F (38°C) in a sweltering Washington, DC. At the hearing, Dr. James Hansen, director of the NASA Goddard Institute of Space Studies and a leading climate modeler, testified that “the greenhouse effect has been detected and it is changing our climate now” (Christianson, 1999, p. 196). Hansen’s testimony became front-page news across the country. As the summer of 1988 continued, severe drought gripped the Midwest and Southeast. “Two thousand daily temperature records were set that year in the United States. Widespread heat and drought caused some crop yields in the U.S. Midwest to fall between 30 and 40 percent” (Johansen, 2002, p. 43). Nationwide, an estimated 10,000 deaths were linked to heat stress. In Los Angeles, 400 electrical transformers blew up on a day in which temperatures reached 110°F (43°C) in September (Christianson, 1999, p. 197). After the events of 1988 and subsequent years, numerous public opinion polls found that Americans were increasingly aware of and concerned about global climate change and supportive of a wide range of mitigation and adaptation policies. By 2001, a *Los Angeles Times* national poll found, in response to the question “Have you heard or read anything about the issue of global warming?” that 82% of Americans answered “yes,” 14% said “no,” and 4% said “don’t know” (PIPA, 2003).

Throughout the 1990s, the fossil fuel industry, represented by lobby groups like the Global Climate Coalition, spearheaded a public relations effort to cast doubt on the science and reality of anthropogenic climate change (see Gelbspan, 1997; Leggett, 2001). This campaign, while achieving several short-term victories, appears to have lost the larger war for public opinion. In 1994, at the height of industry efforts, a national poll by Cambridge Reports found that only 28% of respondents said that “there is a consensus among the great majority of scientists that global warming exists and could do significant damage,” while 58% said that scientists are divided on the existence of global warming and its impact. By 1997, a CNN/USA Today poll, however, found that 48% thought “most scientists believe that global warming is occurring, while 39% thought “most scientists

are unsure about whether global warming is occurring or not.” Most recently, a 2001 Gallup poll found that 61% of respondents said “most scientists believe that global warming is occurring,” while only 30% said most scientists are unsure (PIPA, 2003). Thus, a majority of Americans now believe that there is scientific consensus on the reality of global climate change. Furthermore, virtually all polls taken since 1997 have found that a large majority of Americans believe global warming is real. Most recently, a Harris Interactive poll conducted in September 2002 found that 74% said they “believe the theory that increased carbon dioxide and other gases released into the atmosphere will, if unchecked, lead to global warming and an increase in average temperatures” (PIPA, 2003).

Public opinion polls also demonstrate significant levels of public worry about global warming. In May 1989, a Gallup survey of American public asked: “How much do you personally worry about the greenhouse effect or global warming?” Gallup found that 35% worried “a great deal,” 28% worried “a fair amount,” 18% worried “only a little,” and 12% worried “not at all.” Thus, 63% of Americans were fairly to greatly worried about global warming in 1989. Gallup found that this level of worry oscillated over the subsequent 14 years, with a dip to 50% in 1997, an increase to 72% in 2000, and a decrease to 58% in 2002 (Brewer, 2002). The general decline in levels of worry may partly be the result of changing media coverage. During the unusually hot summer of 1988, global warming was a front-page story across the country. A media analysis by the Center for Media and Public Affairs found, however, that since 1990, television network coverage of global warming declined by 50%, while national newspaper coverage dropped by 25% (FrameWorks Institute, 2001).

Other polling organizations have measured public levels of concern by using various permutations of the question: How serious of a problem/threat is global warming? In a 1998 Mellman Group national poll, 70% of voters said global warming was a “very serious” or “somewhat serious” threat. By 2001, Time/CNN found that 76% thought global warming a “very serious” or “somewhat serious” problem. Despite the variability indicated by different polling methods, it is clear that public levels of concern about global warming have remained consistently high since 1989.

Overall, Americans currently demonstrate a high awareness of global climate change, a strong belief that it is real, and high levels of concern about the

issue. At the same time, however, public opinion polls and academic studies consistently show that Americans regard both the environment and climate change as relatively low national priorities (Dunlap & Scarce, 1991; Bord *et al.*, 1998, p. 77). For example, in a 2000 Gallup poll, the environment ranked 16th on Americans' list of most important problems facing the country today. Furthermore, global warming ranked 12th out of 13 environmental issues, just below urban sprawl (Dunlap & Saad, 2001). Thus, Americans paradoxically seem to be highly concerned about global warming as an individual issue, yet view it as less important than nearly all other national or environmental issues.

While useful, public opinion polls have limited utility for explaining public risk perceptions of global climate change. Most polls use only relatively simple, holistic measures of concern (e.g., "How serious of a threat is global warming?"), which provide little insight into the determinants and components of public risk perception. Why do some see climate change as an urgent, immediate danger, while others view it as a gradual, incremental problem, or not a problem at all? How severe and how likely do they think the impacts will be? And importantly, what is their affective response to global warming?

The remainder of this article reports results from a recent national study of American risk perceptions, policy preferences, and individual behaviors, which provide further insight into how the American public currently perceives and interprets the dangers of global climate change.

3. METHODS

3.1. Procedure and Respondents

A national study of American climate change risk perceptions, policy preferences, and behaviors was conducted from November 2002 to February 2003. The study was implemented with a 16-page mail-out, mail-back survey of a representative sample of the American public, using the Dillman (2000) tailored design method. A total of 673 completed surveys were returned for an overall CASRO response rate of 55.4% and a refusal rate of 11.2%. Compared with the population distributions from the 2000 U.S. Census, the sample overrepresented males (65%) and persons 55 and older (47%). The results were weighted by sex and age to bring them in line with actual population proportions.

3.2. Measures

3.2.1. Risk Perception

Several measures of public risk perception were implemented, including holistic concern; assessments of the severity of current and future impacts of global climate change on human health (mortality and morbidity); likelihood measures of local and global impacts of climate change on standards of living, water shortages, and rates of serious disease; the seriousness of the threat to nonhuman nature; and the seriousness of the current impacts of climate change around the world, and scale of concern (see Fig. 1 and Table I).

3.2.2. Affective Imagery

Recent research has demonstrated the crucial role of affect and emotion in risk perception and behavior (e.g., Finucane *et al.*, 2000; Slovic *et al.*, 2002), and the utility of *affective image analysis* as a means to study the relationship between affect, cognitive imagery, and perceived risk (e.g., Slovic *et al.*, 1991; Leiserowitz, 2003; Satterfield, 2001).

Affect refers to the specific quality of "goodness" or "badness" experienced as a feeling state (with or without conscious awareness) or the positive or negative quality of a stimulus. Affect is here distinguished from *emotion*, which generally refers to specific, transitory states such as anger and fear. Affect is also distinct from *mood*, which generally refers to transitory, low-intensity feelings that are undirected and lack specific cognitive content. By contrast, *affect* refers to a person's relatively stable positive or negative evaluation of specific cognitive contents or images. It is also "an orienting mechanism that directs fundamental psychological processes such as attention, memory, and information processing" (Slovic, 1997, p. 292).

Imagery refers to all forms of mental representation or cognitive content. Images include both perceptual representations (pictures, sounds, smells) and symbolic representations (words, numbers, symbols) (Damasio, 1999, pp. 317–321). In this sense, "image" refers to more than just visually-based mental representations. *Affective images* are thus "broadly construed to include sights, sounds, smells, ideas, and words, to which positive and negative affect or feeling states have become attached through learning and experience" (Slovic *et al.*, 1998, p. 3). Affective images are evaluative feelings of good/positive or bad/negative associated with particular concepts or stimuli.

Affective images are gathered using the method of discrete or continued word associations (Szalay & Deese, 1978; Slovic *et al.*, 1991; Peters & Slovic, 1996). Free associations minimize the researcher bias typically imposed in closed questionnaires; they are unfiltered, relatively context-free, and spontaneous, thus providing a unique means to access and assess subjective meaning. This national survey asked: “What is the first thought or image that comes to your mind when you think of global warming?” Each self-reported image was then rated by the respondent on a Likert affect scale ranging from -5 (very negative) to +5 (very positive). A rich data set of more than 700 respondent associations was generated by this technique (a few respondents provided more than one image). Images often took the form of either single-word responses (e.g., “disaster”) or short narrative statements. An inductive content analysis was then performed with two independent coders to reduce the data into 24 categories.

3.2.3. Sociodemographics

Finally, sociodemographic measures included sex, age, income, educational attainment, race or ethnicity, main source of news, political identification, political ideology, and voter registration. Worldviews derived from cultural theory (egalitarianism, fatalism, hierarchism, and individualism) were operationalized using a set of 25 questions selected in part from scales used by Dake (1991, 1992), Peters and Slovic (1996), and Rippl (2002). Detailed descriptions of all variables are available upon request.

4. RESULTS

4.1. American Risk Perceptions

Americans as a whole perceived global climate change as a moderate risk (see Fig. 1). On average, Americans were somewhat concerned about global warming, believed that impacts on worldwide standards of living, water shortages, and rates of serious disease are somewhat likely, and that the impacts will be more pronounced on nonhuman nature. Importantly, however, they were less concerned about local impacts, rating these as somewhat unlikely. The moderate level of public concern about climate change thus appears to be driven primarily by the perception of danger to geographically and temporally distant people, places, and nonhuman nature.

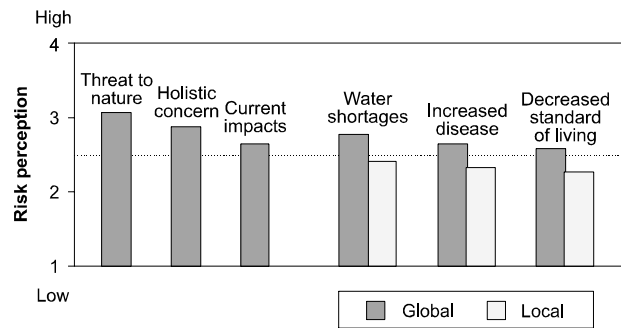


Fig. 1. Mean American risk perceptions of global warming. Scales range from 1 (low) to 4 (high), with the midpoint indicated by a dotted line. Response categories include seriousness of threat to nature and current impacts around the world (*not at all to very serious*), level of concern about global warming (*not at all to very serious*), and the likelihood of specific impacts locally and worldwide (*very unlikely to very likely*). *n* = 590.

This conclusion is confirmed by the results of a separate question that asked respondents to indicate which scale of climate change impacts was of greatest concern to them (see Table I). The question asked: “Which of the following are you *most* concerned about? The impacts of global warming on . . . (1) you and your family; (2) your local community; (3) the U.S. as a whole; (4) people all over the world; (5) nonhuman nature; or (6) not at all concerned.”

A clear majority of respondents (68%) were most concerned about the impacts on people around the world and nonhuman nature. Only 13% were most concerned about the impacts on themselves, their family, or their local community. This may help explain why global climate change remains a relatively low priority in issue-ranking surveys (e.g., Dunlap & Saad, 2001). Higher ranking national issues (e.g., the economy, education, health care) and environmental issues (clean air, clean water, urban sprawl) are all issues that are more easily understood as having direct local relevance. Global climate change,

Table I. Most Concerned about Impacts on?

| | Percent | Cum. Percent |
|------------------------------|---------|--------------|
| You and your family | 12 | 12 |
| Your local community | 1 | 13 |
| The United States as a whole | 9 | 22 |
| People all over the world | 50 | 72 |
| Nonhuman nature | 18 | 90 |
| Not at all concerned | 10 | 100 |
| Total | 100 | |

n = 551

however, is not yet perceived as a significant local concern among the American public. Former Speaker of the U.S. House of Representatives Tip O'Neill famously stated that "all politics is local." To the extent that this is true, climate change is unlikely to become a high-priority national issue until Americans consider themselves personally at risk.

4.2. Affective Images of Global Warming

This study identified a total of 24 distinct categories of affective images associated with global warming (Leiserowitz, 2003). The top eight categories, however, represented 97% of all respondents (see Fig. 2). Associations to melting glaciers and polar ice were the single largest category of responses, indicating that this current and projected impact of climate change is currently the most salient image among the American public (e.g., "melting polar ice caps," "Antarctica melting"). This was followed by generic associations to heat and rising temperatures (e.g., "temperatures increasing"), impacts on nonhuman nature (e.g., "upset ecological balance"), ozone depletion (e.g., "a hole in the ozone layer"), alarmist images of disaster (e.g., "world devastation," "the end of the world as we know it"), sea level rise and the flooding of rivers and coastal areas (e.g., "rising ocean levels," "flooding of Manhattan"), references to climate change ("a change in climate"), and finally naysayer associations, indicating skepticism or cynicism about the reality of climate change. Mean affect scores demonstrate that the term "global warming" evoked negative connotations for almost all respondents. Alarmist images of disaster produced the strongest negative affect, while naysayers displayed very low levels of negative affect.

Thus, two of the four most dominant images (melting ice and nonhuman nature), held by 34% of all respondents, referred to impacts on places or natural ecosystems distant from the everyday experience of most Americans. Most of the references to "heat" were relatively generic in nature, and likely indicated associations with the word "warming" in "global warming." Finally, 11% of Americans provided associations to the separate environmental issue of stratospheric ozone depletion, indicating that a substantial proportion of Americans continue to confuse and conflate these two issues. Thus, 61% of Americans provided associations to impacts geographically and psychologically distant, generic increases in temperature, or to a different environmental problem.

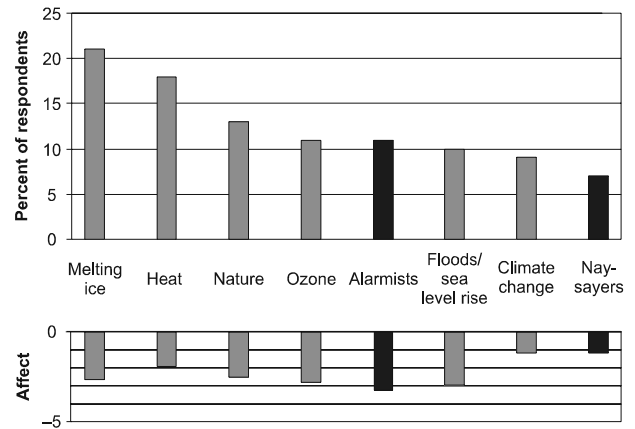


Fig. 2. American images of global warming. Affect was rated on a 10-point scale where +5 = very positive and -5 = very negative.

These results help explain the paradox in public risk perceptions, in which Americans appear concerned about climate change, but do not consider it a high priority relative to other national or environmental issues. This study found that, in aggregate, Americans perceive climate change as a moderate risk, but think the impacts will mostly affect people and places that are geographically and temporally distant. Critically, this study found that most Americans lack vivid, concrete, and personally relevant affective images of climate change.

Furthermore, one of the most important findings was what was missing in these results. There were no associations to the impacts of climate change on human health. There were no associations to temperature-related morbidity and mortality (e.g., heat stroke), health effects of extreme weather events (tornadoes, hurricanes, or precipitation extremes), air-pollution health effects (e.g., asthma and allergies), water- and food-borne disease (e.g., cholera, *Escherichia coli* infections, giardia), or vector- and rodent-borne disease (e.g., malaria, West Nile Virus, Hantavirus Pulmonary Syndrome), all of which are potential health consequences of global climate change (McMichael & Githeko, 2001; National Assessment Synthesis Team, 2001; Patz *et al.*, 2000). Yet, human health impacts are likely to be among the greatest dangers of climate change for human societies, especially for the poor and children in developing countries that lack access to adequate nutrition, clean water, or medical care (IPCC, 2001, p. 12; Watson & McMichael, 2001).

This finding (or the lack thereof) that Americans do not currently associate global warming with

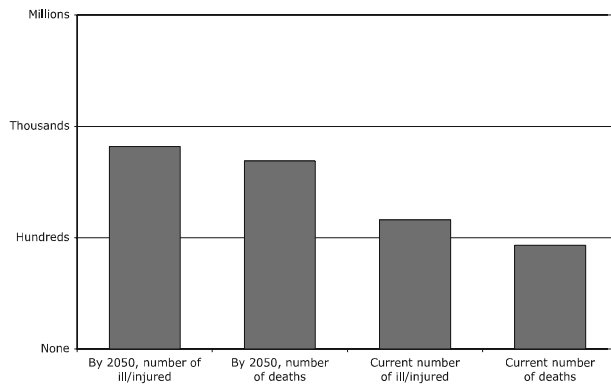


Fig. 3. American estimates of the numbers of deaths, illnesses, and injuries each year because of global warming ($n = 307\text{--}330$).

impacts on human health is supported by the results of four questions that asked respondents to estimate the current and future human health effects of global warming (Fig. 3). On average, Americans said that current deaths and injuries due to global warming number in the hundreds, and in 50 years will number in the thousands. Perhaps more important, 38–41% of respondents selected “don’t know” as their answer to these four questions—by far the dominant response. This is another strong indication that Americans do not currently perceive global warming as a grave danger to human health either now or in the future. Furthermore, this research also found that very few Americans associate global warming with extreme weather events, like heat waves, hurricanes, and droughts—all of which may increase in severity because of global warming.

4.3. Interpretive Communities

The above aggregate results, however, gloss over substantial variation in risk perceptions within the American public. In particular, this study identified several distinct “interpretive communities.” An interpretive community is defined here as a group of individuals that share common risk perceptions, affective imagery, cultural worldviews, and sociodemographic characteristics. Risk perceptions are socially constructed, with different interpretive communities predisposed to attend to, fear, and socially amplify some risks, while ignoring, discounting, or attenuating others. For example, this study found one interpretive community that perceived climate change as a very low or nonexistent danger—climate change “naysayers.” This group, identified by their affective images, was subsequently found to be predom-

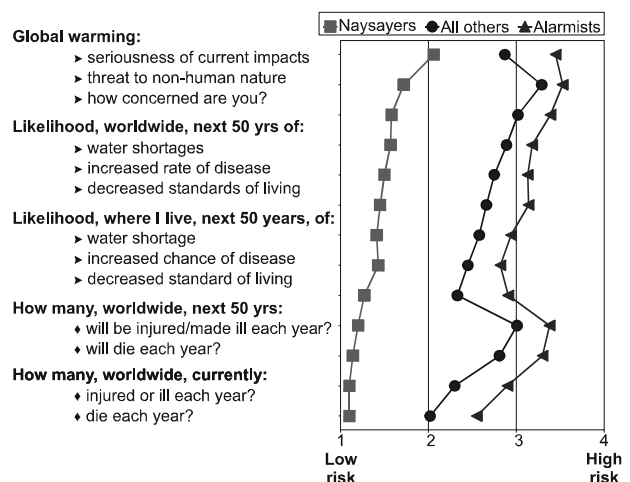


Fig. 4. Risk perception and interpretive communities. For the first nine items, marked with \blacktriangleright , mean n s are naysayers 35, all others 450, and alarmists 55. For the last four items, marked with \blacklozenge , mean n s are naysayers 27, all others 274, and alarmists 27, “don’t know” responses are excluded.

inantly white, male, Republican, politically conservative, holding pro-individualism, pro-hierarchy, and anti-egalitarian worldviews, anti-environmental attitudes, distrustful of most institutions, highly religious, and to rely on radio as their main source of news (Leiserowitz, 2003). An independent means t -test found that naysayers were significantly different than all other respondents on 13 different risk perception variables ($p < 0.001$) (see Fig. 4). Furthermore, a more detailed content analysis of naysayers’ affective images revealed five distinct reasons why they doubted the reality of global climate change:

1. Belief that global warming is natural (“Normal earth cycles,” “It is just the natural course of events,” “A natural phenomenon that has been going on for years”).
2. Hype (“It is not as bad as the media portrays,” “The ‘problem’ is overblown,” “Environmental hysteria”).
3. Doubting the science (“There is no proof it exists,” “Around 10 years or so ago it was global cooling,” “Junk science”).
4. Flat denials of the problem (“A false theory,” “There is no global warming”).
5. Conspiracy theories (“Hoax,” “Environmental propagandist,” “Scientists making up some statistics for their job security”).

The diversity of these responses demonstrates that climate change naysayers had different

rationales for their disbelief, ranging from acceptance of the reality of climate change (although naturally caused or overblown) to flat denials and outright conspiracy theories. This interpretive community is thus strongly predisposed to discount or flatly reject scientific assessments and definitions of “dangerous” climate change. While only approximately 7% of the U.S. adult population (or 12 million people) according to this survey, naysayers are politically active, are significantly more likely to vote, have strong representation in national government, and have powerful allies in the private sector.¹

This study also identified a contrasting interpretive community with high-risk perceptions of climate change—alarmists. Some members of this group provided extreme images of catastrophic climate change, such as: “Bad . . . bad . . . bad . . . like after nuclear war . . . no vegetation,” “Heat waves, it’s gonna kill the world,” “Death of the planet.” Alarmists held pro-egalitarian and anti-individualist and hierarchist worldviews, were politically liberal, strongly supported government policies to mitigate climate change (including raising taxes), and were significantly more likely to have taken personal action to reduce greenhouse gas emissions. An independent means *t*-test found that this interpretive community was significantly different from all other respondents on every risk perception variable (8 variables: $p < 0.01$; 5 variables: $p < 0.001$) (see Fig. 2). Alarmists represent approximately 11% of the American public. It is also important to note, however, that all other respondents had climate change risk perception levels much closer to alarmists than naysayers (Fig. 4). This demonstrates that most Americans are predisposed to view climate change as a significant danger, albeit not as extreme as the alarmists, while climate change naysayers have substantially lower risk perceptions than the rest of American society.

Finally, this study identified another interpretive community whose members confuse or conflate global climate change with the separate problem of stratospheric ozone depletion—a critical misconception also identified by mental models researchers (e.g.,

Kempton *et al.*, 1995; Bostrom *et al.*, 1994; Read *et al.*, 1994). Demographically, members of this community only tended to be young. Nonetheless, they represent a significant proportion of the American public (11%). Ozone-hole-related images had the third highest level of negative affect, which strongly suggests that these individuals already view climate change as dangerous, albeit for the wrong reasons (e.g., fear of contracting skin cancer).

5. DISCUSSION

Overall, most Americans demonstrate a high awareness of global climate change, a strong belief that it is real, and significant concern about the issue. On the other hand, the results reported here demonstrate that the majority of the American public does not currently consider climate change an imminent or high-priority danger. Instead, most Americans currently believe that the impacts of climate change will have moderate severity and will most likely impact geographically and temporally distant people and places or nonhuman nature. Yet, within the American public, several distinct interpretive communities were found, ranging from alarmists with extreme risk perceptions to naysayers, some of whom view climate change as a hoax perpetrated by scientists and environmentalists. Clearly, each of these interpretive communities will define “dangerous anthropogenic interference with the climate system” in radically different ways. Many alarmists are convinced that any degree of further human interference will have catastrophic consequences, while many naysayers are convinced that human activities have little to no influence, or even a positive influence on the climate system. In between these two extremes are other Americans who either view climate change as moderate risk or confuse it with the dangers of stratospheric ozone depletion.

The meaning of “dangerous” climate change will continue to be contested by these interpretive communities, as well as by climate change scientists, special interest groups, and political elites, all operating at different spatial scales. The precise meaning of “dangerous” will also certainly be contested in future international negotiations to reduce global greenhouse gas emissions beyond the initial steps of the Kyoto Protocol. In this more or less democratic process, expert definitions of the term “dangerous” and identification of dangerous thresholds in physical and social systems are vitally important inputs into the decision-making process. But so are lay public definitions of “dangerous,” which are sensitive to “technical, social

¹ Naysayers do not appear to have been either over- or underrepresented in this survey. Compared with the population distributions from the 2000 U.S. Census, the sample did overrepresent males (65%) and persons 55 and older (47%). Therefore, the data were weighted by sex and age to bring them in line with national population proportions. Furthermore, the proportions of conservatives (32%) and Republicans (27%) in the sample (two common characteristics of naysayers) were not significantly different than national proportions.

and psychological qualities of hazards that are not well-modeled in technical risk assessments” (Slovic, 2000, p. 392).

In large part, whoever controls the definition of “dangerous” climate change controls the rational solution to the problem. If danger is defined one way, then one set of solutions will emerge as the most cost-effective or the safest. As just one example, some scientists argue that the potential collapse of the West Antarctic Ice Sheet would represent “dangerous” climate change, as such an event could increase sea levels by up to 2 meters over 100–300 years, inundating coastlines and cities around the world and “causing the forced migration of tens to hundred of millions of people” (Hansen, 2005, p. 274). If danger is defined in reference to this and/or the potential disintegration of the Greenland Ice Sheet, then the world can perhaps “safely” warm an additional 1°C (1.8°F) (Hansen, 2005) to 2–4°C (3.6–7.2°F) (Oppenheimer & Alley, 2005). A sea level rise of 2 meters might well be universally viewed as “dangerous,” yet there remain great scientific uncertainties about how the ice sheets will respond to increased global warming. From a policy standpoint, Oppenheimer poses a critical question: “Given the uncertainties, is current understanding of the vulnerability of either ice sheet potentially useful in defining ‘dangerous anthropogenic interference’ in the context of Article 2?” (Oppenheimer & Alley, 2005, p. 263).

If danger is defined another way, however, a much lower threshold and a different set of solutions, significantly more stringent, may be required. For example, climate change is already having severe impacts on the Arctic, including the U.S. State of Alaska (Arctic Monitoring and Assessment Program, 2005). Alaska’s climate has warmed about 4°F (2°C) since the 1950s and 7°F (4°C) in the interior during winter. The state experienced a 30% average increase in precipitation between 1968 and 1990. Sea ice has retreated by 14% since 1978 and thinned by 60% since the 1960s with widespread effects on marine ecosystems, coastal climate, and human settlements. Permafrost melting has caused erosion and landslides and damaged infrastructure in central and southern Alaska. Recent warming has been accompanied by “unprecedented increases in forest disturbances, including insect attacks. A sustained infestation of spruce bark beetles, which in the past have been limited by cold, has caused widespread tree deaths over 2.3 million acres on the Kenai Peninsula since 1992, the largest loss to insects ever recorded in North America” (National Assessment Synthesis Team, 2001). Robert Corell, lead

scientist of the recent international Arctic Climate Impact Assessment, recently stated: “If you want to see what will be happening in the rest of the world 25 years from now, just look at what’s happening in the Arctic” (Borenstein, 2003). Thus, some might argue that the dramatic impacts of climate change on Arctic ecosystems, cultures, food production systems, and economies already qualifies as a “dangerous” level of climate change, requiring greater and faster reductions in global greenhouse gas emissions.

Defining dangerous climate change in international negotiations may ultimately be an exercise in power. Those with the power to define the terms of the debate strongly determine the outcomes (Slovic, 2000, p. 411). It is thus critical that the negotiation of “dangerous” levels of climate change be opened to multiple voices and multiple perspectives, including the broader global public, as the dangers depend literally and figuratively on where one stands, while the solutions will require the coordinated action of us all.

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