

GLOBAL WARMING IN THE AMERICAN MIND: THE ROLES OF AFFECT,  
IMAGERY, AND WORLDVIEWS IN RISK PERCEPTION,  
POLICY PREFERENCES AND BEHAVIOR

by

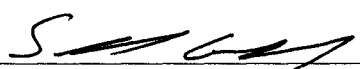
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A DISSERTATION

Presented to the Environmental Studies Program  
and the Graduate School of the University of Oregon  
in partial fulfillment of the requirements  
for the degree of  
Doctor of Philosophy

December 2003


“Global Warming in the American Mind: The Roles of Affect, Imagery, and Worldviews in Risk Perception, Policy Preferences and Behavior,” a dissertation prepared by Anthony Allen Leiserowitz in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Environmental Studies Program. This dissertation has been approved and accepted by:

  
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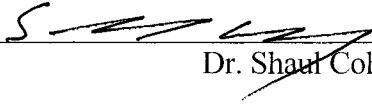
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An Abstract of the Dissertation of  
Anthony Allen Leiserowitz for the degree of Doctor of Philosophy  
in the Environmental Studies Program to be taken December 2003  
Title: GLOBAL WARMING IN THE AMERICAN MIND: THE ROLES OF AFFECT,  
IMAGERY, AND WORLDVIEWS IN RISK PERCEPTION, POLICY  
PREFERENCES AND BEHAVIOR

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Natural scientists warn that global climate change is a risk with potentially devastating consequences for human societies and natural ecosystems around the world. Meeting this challenge will require a concerted national and international effort to dramatically reduce anthropogenic greenhouse gas emissions. It will also, however, require public support for political leaders and government mitigation policies, and committed action by individual citizens and consumers.

This dissertation examined whether the American public perceives global warming as a real threat, supports public mitigation policies, or has taken individual actions to mitigate climate change. It found that measures of affect, imagery and cultural worldviews predict public risk perceptions, policy preferences, and individual behaviors. Finally, it used affective image analysis to identify several distinct “interpretive communities” within the American public.

The data comes from three surveys: a national survey of the American public completed in February, 2003 (n=673); a statewide survey of the Oregon public completed in February, 2001 (n=900); and a survey of student activists at the 2000 World Climate Conference (COP6) in The Hague, Netherlands (n=112).

This research describes an American public with broad concern about global warming, strong bipartisan support for international treaties and national mitigation policies, and strong opposition to higher energy or gasoline prices to reduce greenhouse gas emissions. Relatively few Americans have undertaken individual mitigation behaviors. While global warming does have negative connotations for most Americans, the thoughts and images evoked by this term primarily reflect impacts temporally and spatially distant from most people's lives. Critically, this research also finds that Americans do not currently associate global warming with any impacts on human health. Overall, these results suggest that American public opinion about global warming is at a critical turning point. Americans are aware and concerned about global climate change and predisposed to support political leaders and mitigation policies across party lines. Global warming is not a national priority, however, and Americans have yet to confront the tradeoffs that will ultimately be required.

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## ACKNOWLEDGMENTS

It is said that it takes a village to raise a child. In my case, it has taken several villages to raise an interdisciplinary scholar. Thank you to the Department of Geography, my focal discipline, and especially to Dr. Shaul Cohen for his invaluable advice, perspective and support. Thank you to Drs. Alexander Murphy and Peter Walker for steeping me in the traditions of geography and encouraging me to reach beyond disciplinary boundaries. A profound thank you to Dr. Paul Slovic and Decision Research for guiding me into the worlds of social psychology, risk perception, and empirical research. Thank you to the Environmental Studies Program for creating a new, interdisciplinary doctoral program and your tremendous support over the years. A special thank you to Dr. Patricia Gwartney and the Oregon Survey Research Laboratory, without whom this research literally would not have been possible. Another special thank you to Dr. Mark Johnson, for guiding me into the worlds of cognitive science, conceptual metaphor and philosophy. Many thanks to my family and friends who have provided invaluable support, perspective, and laughter throughout this journey. To my parents, who have always supported my restless wanderings as well as my focused endeavors. To my wife Jennifer - my love and my best friend - and to my son Tobias, who has brought such joy to the everyday. Finally, a deep note of appreciation to the many Americans, Oregonians and activists willing to share their thoughts, feelings, hopes and fears about global warming. This research was supported by a Doctoral Dissertation Research Improvement Grant, SES-0221896, from the National Science Foundation and several grants from the Donald R. Barker Foundation.

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## CHAPTER I

### INTRODUCTION

*The release of carbon dioxide to the atmosphere by the burning of fossil fuels is, conceivably, the most important environmental issue in the world today” (Nature 1979).*

Natural scientists have described global warming as perhaps the preeminent environmental risk confronting the world in the 21<sup>st</sup> century. Meanwhile, social scientists have found that people respond to hazards based on their perception of the risks. What the public perceives as a risk, why they perceive it that way and how they will subsequently behave are thus vital questions for policy makers attempting to address global climate change, in which the effects are delayed, have inequitable distributions of costs and benefits, and are beyond the control of any one group. In this situation, public support or rejection of proposed climate policies will be greatly influenced by the perceived risks of global warming. Further, “scientists need to know how the public is likely to respond to climate impacts or initiatives, because those responses can attenuate or amplify the impacts” (Bord, et al. 1998:75). This dissertation uses survey methods to investigate global warming risk perceptions, policy preferences and individual behaviors among three populations: the American public, the Oregon public, and student climate change activists attending the 2000 World Climate Conference (COP6) at The Hague, Netherlands.

## Global Warming

Global warming, or global climate change, refers to the enhanced greenhouse effect resulting from anthropogenic, or human-caused, emissions of greenhouse gases to the atmosphere.<sup>1</sup> The greenhouse effect is a natural process that traps heat at the Earth's surface. Short-wave radiation from the sun is absorbed by the Earth's surface and converted into long-wave, infrared radiation (heat). The Earth in turn radiates this long-wave energy back towards space. Some of this energy escapes, but some is trapped by greenhouse gases in the atmosphere (e.g., carbon dioxide, water vapor, methane, nitrous oxide, etc.), which act like a thermal blanket to keep the Earth warmer than it would otherwise be.

Carbon dioxide (CO<sub>2</sub>) is the primary greenhouse gas of concern, despite comprising less than .03% of the atmosphere. For several thousand years prior to the industrial revolution, carbon dioxide in the atmosphere averaged around 280 parts per million by volume (ppmv) (Houghton 1994:24). Since the industrial revolution concentrations of carbon dioxide have increased approximately 33% to nearly 373 ppmv in 2002 (Keeling and Whorf 2003). Carbon dioxide is part of the natural carbon cycle, but humans have recently and dramatically increased the amount of CO<sub>2</sub> in the atmosphere, primarily through the burning of fossil fuels. Over millions of years,

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<sup>1</sup> The terms "global climate change" and "global warming" are used interchangeably throughout this dissertation. Global climate change is the term most often used by the scientific community, while global warming is the term most often used by the media and the lay public.



growing vegetation absorbed atmospheric carbon dioxide and converted it to organic material through the process of photosynthesis. Some of this organic material became buried deep underground and fossilized into vast accumulations of coal, oil and natural gas through geologic processes, effectively sequestering this carbon from the atmosphere. With the advent of the industrial revolution, human beings began burning fossil fuels at an exponential rate, and the carbon sequestered by these ancient plants was suddenly released back into the atmosphere, thereby leading to an “enhanced” greenhouse effect.

The present atmospheric carbon dioxide concentration is the highest in at least the past 420,000 years (Falkowski 2000; Petit, et al. 1999) and probably the past 20 million years (Pagani, et al. 1999). The Intergovernmental Panel on Climate Change (IPCC)<sup>2</sup> projects that by the year 2100, CO<sub>2</sub> concentrations may increase by as much as 350% and the average global temperature may rise by as much as 11° F under business-as-usual scenarios (2001:12-13). By comparison, in the last ice age about 20,000 years ago, average global temperatures were only about 9° F cooler than present. At that time, ice over 2 miles thick covered present-day Canada, stretching south over the upper Midwest and New England. Human greenhouse gas emissions may increase average global temperatures by an equal order of magnitude.

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<sup>2</sup> The IPCC is comprised of over 2,500 of the world’s leading climate scientists, economists and policy experts who summarize the state of knowledge on climate change every five years. Their work is recognized by all the countries of the world as the scientific basis for international negotiations.

Higher global temperatures are projected to have a wide range of impacts with potentially severe consequences for human societies and natural ecosystems, including rising sea levels, increased rates of infectious disease, heat waves, droughts, more frequent and severe wildfires, floods, extreme weather events, melting polar and glacier ice, species extinctions, shifts in species distributions, changing seasonal patterns, etc. Many of these anticipated changes are already occurring. The 1990s were the warmest decade on record (IPCC 2001:2). The five warmest years since 1860, in decreasing order were: 1998, 2002, 2001, 1995, and 1997 (WMO 2003:4). Currently, this year (2003) is on track to become the third warmest year ever recorded (NCDC 2003). Thus, the past three years will account for three of the four warmest years on record. Sea levels have risen 4 to 10 inches over the past century and are projected to rise an additional 3.5 to 34.6 inches by 2100, due primarily to thermal expansion, as well as melting glaciers and ice caps, with potentially devastating consequences for small island nations, coastal cities and wetland ecosystems around the world. The Arctic ice cap has decreased in area by 34,300 km<sup>2</sup> (the approximate size of the Netherlands) each year since 1978 (Mastny 2000) and has thinned over 40% in the past 35 years (IPCC 2001:4). The geographical ranges of infectious disease vectors that transmit malaria, dengue fever, and encephalitis are expanding (e.g. mosquitoes, which are highly sensitive to changes in temperature and precipitation) (Epstein 2000). Worldwide economic losses due to weather disasters have increased from under \$4 billion in the 1950s to over \$39 billion in the 1990s, adjusted for GDP (Munich Re 2000).

These initial fingerprints and harbingers of current and future climate change, however, are the result of relatively linear, gradual and incremental changes in global average temperatures. Of growing concern is the realization, based on extensive paleoclimatic reconstructions, that the Earth's climate system is inherently non-linear and capable of sudden, abrupt changes when a critical threshold is crossed. For example,

*Roughly half the north Atlantic warming since the last ice age was achieved in only a decade, and it was accompanied by significant climatic changes across the globe. Similar events, including local warmings as large as 16° C [30° F], occurred repeatedly during the slide into and climb out of the last ice age... Thus, greenhouse warming and other human alterations of the earth system may increase the possibility of large, abrupt, and unwelcome regional or global climatic events (NRC 2001:1).*

The projected impacts of relatively linear, incrementally warmer global temperatures on human societies and natural ecosystems are already dramatic. The possibility of large, abrupt swings in regional and global climate, however, are potentially even more serious. Confronted with these and many other research findings, many scientists have called for immediate, concerted action to reduce global emissions of greenhouse gases.

### Scientific Warnings

Scientific identification of anthropogenic climate change and assessments of the potential consequences date back nearly 200 years. The warming effect of an enhanced greenhouse effect was first recognized in 1827 by French scientist Jean-Baptiste Fourier.

In 1896, Svante Arrhenius, a Swedish chemist, first calculated the effect of increasing concentrations of carbon dioxide in the atmosphere and predicted that a doubling of CO<sub>2</sub> would lead to an increase in average global temperatures of 5 to 6° C (9 to 11° F), a result remarkably similar to current projections (Houghton 1994:12). He estimated, however, that it would take another 3,000 years of fossil fuel burning to reach a doubling of CO<sub>2</sub>. He further argued that this would unequivocally be a good thing, especially from the perspective of a northern European:

*By the influence of the increasing percentage of carbonic acid in the atmosphere, we may hope to enjoy ages with more equable and better climates, especially as regards the colder regions of the Earth, ages when the Earth will bring forth much more abundant crops than at present for the benefit of rapidly propagating mankind (quoted in Christianson 1999:115).*

By 1957, however, scientific assessment of the potential consequences of anthropogenic climate change began to shift with the publication of a paper by Roger Revelle and Hans Suess of the Scripps Institute of Oceanography. They argued:

*Human beings are now carrying out a large-scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future. Within a few centuries we are returning to the atmospheres and oceans the concentrated organic carbon stored in sedimentary rocks over hundreds of millions of years (quoted in Christianson 1999:155-156).*

In this same year, Charles Keeling began measurements of atmospheric carbon dioxide from an observatory on the Mauna Loa volcano in Hawaii. He soon identified what became known as the “Keeling Curve” – a graph that showed atmospheric

concentrations of carbon dioxide increasing year by year. This was a dramatic finding, as until this point most scientists believed that the oceans absorbed all the carbon emitted to the atmosphere by the human burning of fossil fuels. Instead, the Keeling Curve proved that carbon dioxide was accumulating in the atmosphere faster than the oceans or other carbon sinks (e.g., vegetation) could absorb it (Johansen 2002:40). Thus, human emissions of carbon dioxide were substantially enhancing the greenhouse effect.

By 1979, many scientists were growing increasingly concerned and began reaching out to the policy community. A group of leading researchers advised the President's Council on Environmental Quality that:

*Man is setting in motion a series of events that seem certain to cause a significant warming of world climates unless mitigating steps are taken immediately (Pomerance 1989:260).*

Also in that year, the British journal *Nature* editorialized that “The release of carbon dioxide to the atmosphere by the burning of fossil fuels is, conceivably, the most important environmental issue in the world today” (*Nature* 1979).

Throughout the early decades of research, many scientists remained cautious about whether anthropogenic climate change was in fact occurring. By the late 1980s and early 1990s, however, as convergent evidence from a variety of sources accumulated, including direct temperature measurements, historical records, paleoclimatic reconstructions, receding glaciers, computer model simulations, etc., a majority of

scientists became convinced that global warming was occurring. By the mid 1990's only a handful of "climate skeptics" remained opposed to the growing scientific consensus. As others have documented, these scientists often had direct financial ties to the fossil fuel industry, yet had a disproportionate effect on the public debate (Gelbspan 1997; Leggett 1999).

In 1988, over 300 scientists and policy makers from around the world gathered at the Toronto Conference on the Changing Atmosphere. They released an ominous warning:

*Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to nuclear war. The earth's atmosphere is being changed at an unprecedented rate by pollutants resulting from human activities, inefficient and wasteful fossil fuel use and the effects of rapid population growth in many regions. These changes are already having harmful consequences over many parts of the globe (quoted in Johansen 2002:1-2).*

The conference further called for the establishment of an international legal framework to protect the Earth's atmosphere and specifically recommended a global reduction of CO<sub>2</sub> levels 20% below 1988 levels by 2005. In 1990, the newly constituted Intergovernmental Panel on Climate Change (IPCC) released its first assessment of global change science. They concluded that stabilization of atmospheric greenhouse gas concentrations would require a reduction of global emissions of CO<sub>2</sub> by 60-80% below 1990 levels (IPCC 1990:xviii). These warnings by the scientific community led eventually to the signing of the United Nations Framework Convention on Climate Change by world leaders at the

1992 Rio “Earth Summit.” The Convention's ultimate objective was the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC 1999:6).

In 1995, the IPCC completed its Second Assessment and concluded that “the balance of evidence suggests that there is a discernible human influence on the global climate” (IPCC 1996:5). In 1997, over 2,400 scientists signed a letter to President Clinton entitled “Scientists Statement on Global Climate Disruption.” This letter warned that anthropogenic climate change was already underway and that severe consequences would result:

*...the further accumulation of greenhouse gases commits the earth irreversibly to further global climatic change and consequent ecological, economic and social disruption. The risks associated with such changes justify preventive action through reductions in emissions of greenhouse gases” (Holdren, et al. 1997).*

With the release of the Third Assessment Report in 2001, the IPCC reported that “there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities” and that atmospheric greenhouse gas concentrations continued to increase (IPCC 2001:7). Most recently, Sir John Houghton, former co-chair of the Scientific Assessment Group of the IPCC, likened global climate change to the threat from weapons of mass destruction in the wake of the September 11, 2001 terrorist attack on the World Trade Center and the American and British “preemptive” attack on Iraq:

*...our long-term security is threatened by a problem at least as dangerous as chemical, nuclear or biological weapons, or indeed international terrorism: human induced climate change...I have no hesitation in describing it as a 'weapon of mass destruction'...Global warming is already upon us (Houghton 2003).*

As demonstrated by the conclusions of the IPCC reports and various other consensus statements from natural scientists, ecologists, physicians, and economists, global climate change is now widely considered a very serious environmental risk by the scientific community, with many arguing that global warming now poses “the central environmental challenge of our time” (Dean Abrahamson, quoted in Johansen 2002:1).

### Risk

*...the climate of the future is not a given; it is the product of conscious and unconscious decisions by humans, decisions that in turn will be influenced by how climate science is interpreted...(Eder 1999:25)*

*It's harder and harder for a lay person to understand what scientists are talking about. [Yet] the lay person is eventually going to decide our policies (James Hansen, quoted in Chang 1998).*

This dissertation contributes to a large and growing literature on the study of risk and risk perception. These terms have become pervasive in the modern world, with some scholars claiming that we now live in a “risk society” characterized by threats of an unprecedented global scale (Beck 1992; 1995). Governments, industries and public interest groups have spent billions of dollars conducting formal risk analyses and



assessments to address public demands for safer and healthier food, vehicles, medicines, medical procedures, airplanes, nuclear power plants, etc. The risks associated with chemicals, pesticides, food additives, toxic waste, stratospheric ozone depletion, genetically modified organisms, weapons of mass destruction, terrorist attacks, etc. can capture the attention and drive the policy agendas of entire countries and occasionally the world as a whole.

Both “risk” and “risk perception,” however, have had different meanings in different times. Historically, the notion of risk first appeared in the Middle Ages with the rise of maritime insurance and referred to the uncontrollable dangers that could beset a ship and its crew. This concept of risk:

*...excluded the idea of human fault and responsibility. Risk was perceived to be a natural event such as a storm, flood or epidemic rather than a human-made one. As such, humans could do little but attempt to estimate roughly the likelihood of such events happening and take steps to reduce their impact (Lupton 1999:5).*

Emerging in the seventeenth century Enlightenment and growing with the rise of modernity, however, came a belief that through the scientific pursuit of objective knowledge, natural and social phenomena could be identified, measured, calculated, and accurately predicted (Lupton 1999:6). The concurrent development of statistics and the further expansion of the insurance industry meant that:

*Consequences that at first affect only the individual become “risks”, systematically caused, statistically describable and in that sense*

*“predictable” types of events, which can therefore also be subjected to supra-individual and political rules of recognition, compensation and avoidance (Beck 1992:99).*

By the twentieth century, the concept of “risk” had expanded to include both natural and human-caused events and came to have a precise technical meaning: “the probability that an outcome will occur times the consequence, or level of impact” (Kamen and Hassenzahl 1999:3). This technical definition is relatively neutral and allows for both gains and losses; thus there are potentially both “good risks” and “bad risks.” By the end of the twentieth century, however, the term “risk” predominantly came to mean “danger,” especially among the lay public (Douglas 1992:24). In everyday language, “risk tends to be used to refer almost exclusively to a threat, hazard, danger or harm” (Lupton 1999:8). We now anxiously worry about the risks of unemployment, violent crime, bad grades, unsafe products, toxic pollution, unsafe sex, falling in love with the wrong person, and even “ring-around-the-collar.” In response to the myriad hazards of modern life:

*An apparatus of expert research, knowledge and advice has developed around the concept of risk: risk analysis, risk assessment, risk communication and risk management are all major fields of research and practice, used to measure and control risk in areas as far-ranging as medicine and public health, finance, the law and business and industry (Lupton 1999:9).*

Global climate change is a case in point. An enormous international effort has been made to detail the risks of anthropogenic climate change, drawing on diverse disciplines to identify and quantify the causes, consequences and potential solutions.

New institutions have been formed to research and manage climate change risks. For example in 1989, the United States initiated the U.S. Global Change Research Program (USGCRP) to study the earth's environment. Its 1989 budget was \$134 million dollars, which quickly rose to \$659 million in 1990 (FAS 1996). Today, the USGCRP budget is \$1.7 billion per year<sup>3</sup> and involves nine Federal departments and agencies, including research programs of the National Science Foundation (NSF), National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the United States Geological Survey (USGS), the Departments of Agriculture and Energy, and the Environmental Protection Agency (EPA). Since 1990, the USGCRP has invested more than \$20 billion in climate change and global change research (NCSE 2003).

Legal frameworks to mitigate global warming are beginning to be created from the state (e.g., California, Oregon, New York, etc.) to the international levels (e.g., the United Nations Framework Convention on Climate Change). A variety of legislative policies have been proposed at the national level, including increasing fuel economy standards, subsidizing the development of renewable energies, carbon taxes, etc. New financial markets have recently been created, such as the Chicago Climate Exchange, to reduce greenhouse gas emissions through the trading of carbon credits – turning carbon dioxide emissions into a marketable commodity. Whole new industries have developed

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<sup>3</sup> Of this budget only \$121 million in the 2003 fiscal year, or roughly 7%, is dedicated to the study of human contributions and responses to climate change (USGCRP 2003). The remainder is split between space and surface-based climate observations (natural sciences).

in wind, solar, geothermal, biomass and other alternative power generation sources to replace the burning of fossil fuels.

Clearly, the risks of global climate change have already motivated a substantial institutional effort, across economic sectors and nations, to address this threat. Yet, despite the research of several decades, global greenhouse gas emissions continue to spiral upwards. The United States, with only 4% of the world's population, is currently the world's largest emitter of carbon dioxide, alone accounting for nearly 25% of global emissions. Successive U.S. administrations have been at odds with much of the world community regarding the reality, seriousness and need for vigorous action on global warming. In 2001, President George W. Bush renounced a campaign promise to regulate carbon dioxide as a pollutant, pulled the United States out of the Kyoto Protocol negotiations and the international effort to create a legal framework to reduce global emissions, and proposed national energy legislation to increase drilling for oil and natural gas, mining for coal, and to build over a thousand new fossil-fuel burning power plants across the country.

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). Americans continue to buy record numbers of sport utility vehicles and other cars with very low fuel efficiency. These and many other indicators suggest that global warming is not perceived

as a high priority by most Americans, thus there appears to be a large gap between expert and lay assessments of global warming risks. Clearly, the American public will play a critical role, both in terms of their direct consumption of fossil fuels and their support for political leaders and government policies in the effort to mitigate global climate change. They are unlikely, however, to take individual action or strongly support government policies until they view global warming as a serious risk.

### Risk Perception

Risk perception research has a long tradition of comparing expert vs. lay assessments of risk. Traditionally, researchers directly compared expert vs. lay assessments of the probabilities and severity of consequences (typically fatalities) for a given risk issue, using the technical definition of risk. These studies often found great discrepancies. Experts, for example, warned of the high probability, high consequence risks of living in flood plains or earthquake zones. The public, however, continued to build homes and live in these areas while remaining relatively unconcerned (Cutter 1993; Palm 1998). Likewise, scientists often despaired to find members of the public extremely concerned about low probability risks, such as radiation from nuclear power plants, while ignoring higher probability risks like radon exposure in the home. These and many other expert-lay public conflicts over risk led some to decry the apparent “irrationality” of the public. As Paul Slovic describes these critiques:

*Experts are seen as purveying risk assessments, characterized as objective, analytic, wise and rational – based upon the real risks. In contrast, the public is seen to rely upon perceptions of risk that are subjective, often hypothetical, emotional, foolish, and irrational (Slovic 1997:278).*

In the early 1980s, however, researchers using psychometric techniques identified a number of social and psychological dimensions of risk that are often more salient for the lay public than the relatively narrow analytical dimensions of probability and the severity of consequences preferred by technical experts. For example, these researchers identified two dominant factors in public perceptions of risk across 81 different hazards: *dread risk* (including the dimensions of “perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of risks and benefits”) and *unknown risk* (including the dimensions of “hazards judged to be unobservable, unknown, new, and delayed in their manifestation of harm”) (Slovic 1987:283). The public rated risk items like nuclear power very high on the dread and unknown risk factors, while risk items like alcohol were rated very low. Laypeople subsequently rated nuclear power as a much greater risk than alcohol, despite the fact that nuclear accidents are low probability events that have killed relatively few people. By contrast, alcohol kills thousands of people each year. Other studies found that nuclear power was highly stigmatized, with the public’s risk perceptions driven by evaluative dimensions such as the catastrophic potential of an accident, the potential impact on future generations, and the perceived lack of control over and involuntariness of such an event. Further, in the wake of events like Three Mile Island and Chernobyl, the public came to deeply distrust

the industry and government experts that promoted nuclear power. As a result, no new nuclear power plant has been constructed in the United States since 1979 (Slovic, et al. 1991; Flynn, et al. 1992; 1998), despite the relatively low number of fatalities from nuclear power generation. Thus, this research suggested that public risk perceptions are only “irrational” when considered within the narrow confines of a technical analysis of probability and fatalities. They appear rational, however, when considered within the more complex and comprehensive conception of risk used by the public, which includes a range of evaluative dimensions (e.g., perceived lack of control, dread, unequal distributions of costs and benefits, etc.) not included in technical assessments of probabilities and fatalities. Further, public risk perceptions can have an enormous social impact.

More recent research has focused on the broader sociocultural and political context of risk perception, including sociodemographic factors like sex, race, income and education and cultural factors like trust, social values and worldviews (e.g., Slovic 1997; Flynn 1992, 1998; Peters and Slovic 1996; Finucane, et al. 2000). Thus, researchers are increasingly asking not just “What does the public perceive as a risk and why?” but also “Who perceives risk and why?” This dissertation contributes to this emerging research agenda by including an in-depth examination of the political and sociocultural dimensions of public global warming risk perceptions, policy preferences and individual behaviors, using standard analyses of political identification and ideology, as well as relatively new approaches based in Cultural Theory, as described below.

This dissertation also pioneers the use of affective image analysis to investigate the role of connotative meaning in risk perception, decision making and behavior and to identify distinct “interpretive communities” among the American public:

*Of all the imps that inhabit the nervous system, that little black box in psychological theorizing – the one we call meaning – is held by common consent to be the most elusive. Yet again by common consent of social scientists, this variable is one of the most important determinants of human behavior (Osgood, et al. 1957).*

Issues like “global warming,” places like “the Arctic National Wildlife Refuge” and “the United States,” and names like “George Bush” and “Osama bin Laden” are provocative terms with strong positive or negative connotations for different people in different places. The conflict over meaning often is at the heart of political debate and decision making. Affective image analysis is an innovative, simple, yet powerful technique to “map” the range, diversity and distribution of subjective and connotative meanings within individuals, groups and populations. Affective image analysis can also quickly identify dominant associations, common misconceptions, and critical gaps in public understandings of risks. This dissertation further develops affective image analysis as a new survey methodology and identifies distinct interpretive communities within the American public; groups of individuals who share a relatively coherent and consistent set of connotative meanings. Members of interpretive communities also tend to interpret risks in a similar way and to share common attitudinal and sociodemographic characteristics. Thus, affective image analysis is an innovative technique with important



implications for survey methodology, studies of public opinion, and risk perception and communication research.

### Overview of the Dissertation

Chapter 2 provides a literature review, including a summary of public opinion research on attitudes towards global warming, previous academic studies on mental models and risk perceptions of climate change, affective image analysis as a new theoretically-grounded empirical technique, and Cultural Theory as a sociopolitical interpretation of risk perception and behavior. Chapter 3 describes the four broad research questions that guided this research:

1. Does the American public perceive global climate change as a real threat? How likely and how severe do they believe the consequences will be?
2. Does the American public support public policies to mitigate climate change?
3. What kinds of individual actions have Americans already taken to mitigate global climate change and how common are these behaviors?
4. What affective images do Americans have of global warming? Which of these images are the most salient and can they be used to identify distinct “interpretive communities” within the American public?

Chapter 3 also describes several analytical hypotheses. It was hypothesized that affective imagery and cultural worldviews would each significantly influence global warming risk perceptions, policy preferences and individual behaviors. It was also hypothesized that student climate change activists would produce a broader set of

cognitive images and stronger affective reactions to global warming than either the Oregon or American publics. Finally, in line with the predictions of Cultural Theory, it was hypothesized that student climate change activists would be more egalitarian than the American public. Chapter 3 also provides an overview of the data gathering, reduction and analysis methodologies implemented in three studies carried out among 1) student climate change activists at the 2000 World Climate Summit (COP6) at The Hague, Netherlands; 2) the American public; and 3) the Oregon public.

Chapter 4 summarizes the primary research results from the three studies, organized around the research questions and analytical hypotheses. This dissertation describes an American public with broad, but shallow concern about global warming, that strongly supports international treaties and a number of national policies, but strongly opposes higher energy or gasoline prices to reduce greenhouse gas emissions. Relatively few Americans have undertaken individual mitigation behaviors. While global warming does have negative connotations for most Americans, the thoughts and images evoked by this term primarily reflect impacts temporally and spatially distant from most people's lives. Critically, this research also finds that Americans do not currently associate global warming with any impacts on human health. Finally, this dissertation finds that affect, imagery and cultural worldviews all significantly influence public risk perceptions, policy preferences, and individual behaviors.

## CHAPTER II

### LITERATURE REVIEW

#### Global Climate Change Risk Perception

##### Public Opinion Polls

Despite the scientific warnings of previous decades, global warming did not become a national public issue until the summer of 1988 - at that time the hottest year since the middle of the nineteenth 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 global climate change. The date of the hearing happened to fall during a heat wave that swept over much of the nation and on the day temperatures reached a record 101 degrees Fahrenheit in a sweltering Washington, D.C. At the hearing, Dr. James E. 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 1999:196). 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 2002:43). 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 in September (Christianson 1999:197).

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). This is similar to the levels of awareness found in two surveys conducted as part of this dissertation. A national survey was conducted in 2002-2003 and found that 92% of Americans had heard of global warming while 8% had not. Likewise, a 2000 survey of the Oregon public found that 11% lacked any association with the term “global warming.”

Throughout the 1990s, the fossil fuel industry, represented by lobby groups like the Global Climate Coalition, spearheaded a massive public relations effort to discredit the science and deny the reality of anthropogenic climate change (see Gelbspan 1997; Leggett 1999). This campaign, while achieving several short-term victories, appears to have lost the larger war for public opinion. In 1994, at the height of the industry assault

on climate science, 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 strong majority of Americans now believe that there is scientific consensus regarding the reality of global warming. Further, virtually all polls taken since 1997 have found that a strong majority of Americans believe global warming is real. Most recently, a Harris Interactive poll conducted in September of 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 high levels of public concern about global warming. In May of 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. 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). The increase to 72% concern in the year 2000 stands out as an anomaly and may be due to the release of the 2000 IPCC report, the 2000 American presidential election in which global warming played a limited role because of the candidacy of Al Gore (D), or a combination of these and other factors.

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. Finally, as reported in this dissertation, a 2002-2003 national survey found that 70% of Americans said they were “somewhat” (45%) to “very concerned” (25%) about global warming. 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 demonstrate a high awareness of global warming, 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. 1998:77). For example, in a 2000 Gallup poll, the environment ranked 16th on Americans' list of most important problems facing the country today. Further, global warming ranked 12<sup>th</sup> 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.

There is convergent evidence for this countervailing, low level of concern in other poll results. For example, in 2000 a survey conducted by the Program on International Policy Attitudes (PIPA) at the University of Maryland found that although a majority of Americans favored action on global warming, they were divided about the need for urgency. The PIPA survey found that 39% of Americans said only "gradual steps" are needed, 39% said that immediate action is needed, and 19% said no steps should be taken. Further, global warming does not appear to be a universally decisive electoral issue. A 1998 Mellman Group poll found that 41% of voters would not change their vote

for a candidate they agreed with on most issues, if that candidate voted against efforts to reduce the threat of global warming, while 38% said they would (PIPA 2003).

While useful, public opinion polls have limited utility for explaining public risk perceptions of global warming. Most public opinion polls use only simple, holistic measures of concern (e.g., “how serious of a threat is global warming”), which provide little insight into the determinants of public risk perception. Why do some people believe global warming is a serious threat and others do not? Why do some see global warming as an urgent, immediate threat, while others view it as a gradual, incremental problem, or not a problem at all? What specifically does the public know about the causes, consequences and solutions to anthropogenic climate change? How severe and how likely do they think the impacts will be? And crucially, how do they feel about the threat of global warming? For initial answers to these deeper questions we must turn to the few academic studies that have been conducted.



## Mental Model Studies

Much of the academic research on public understanding of climate change has attempted to describe and analyze the public's accurate and inaccurate mental models of climate change (e.g., Bostrom et al. 1994; Kempton et al. 1995; Read et al. 1994). In brief, mental models are:

*...hypothesized knowledge structures embodying people's assumptions, beliefs, 'facts,' and misconceptions about the world. These assumptions and beliefs, in turn, provide a framework for interpreting new information and for determining appropriate responses to new situations (Kearney and Kaplan 1997).*

For example, Kempton et al. found that Americans assimilated information on global climate change into pre-existing mental models of ozone depletion (1995:67). The ozone hole became a public issue several years before global warming was widely reported in the media. Since individuals tend to assimilate new information into already existing mental models (Kempton 1995:68; Levy 1997:136-145), this has led to several important misconceptions and confusions between the two environmental issues. Many people mistakenly believe that ozone depletion is a cause of climate change. Many reason that if there is a "hole" in the ozone layer and a global "greenhouse" effect, then there must be a "hole" in the "greenhouse." This "hole" either allows more solar radiation into the biosphere -- warming the planet, or alternatively, the "hole" is allowing heat to escape -- cooling the planet. This metaphorical reasoning is logical, but incorrect. It is also a valuable demonstration of how people make inferences based on what they already believe. In this case, many members of the public already have a mental model

about the ozone hole, which they combine with a mental model of the greenhouse effect, and use to reason about climate change.

These mental model approaches, however, are primarily cognitive. They focus on the role of scientific information and factual knowledge in the formation of the American public's environmental beliefs and attitudes. Risk perception researchers, however, have demonstrated that increased knowledge and elaborated mental models, while important, are not sufficient to explain public concern for some risks and not others. Likewise, risk communicators (e.g., doctors, toxicologists, government agencies, etc.) are increasingly aware that providing more detailed and accurate scientific information, while important, is not sufficient to generate “appropriate” public concern for some risks or to allay public fears about others (Sjoberg 1996; Slovic and Peters 1998; Nature 2003). Mental model researchers have analyzed how people cognitively reason about climate change, but not how risk perception and behavior are guided by emotion and affect. Dake (1991:62) further argues that,

*...an understanding of who fears what and why requires serious attention to the political, historical, and social context in which risks are framed and debated...mental models of risk are not solely matters of individual cognition, but also correspond to worldviews entailing deeply held beliefs and values regarding society, its functioning, and its potential fate.*

## Risk Perception Studies

Few in-depth studies on risk perceptions of global climate change have been conducted. A notable exception is the work of Robert O'Connor, Richard Bord and Ann Fisher of Penn State University, who in 1997 conducted a national mail-out, mail-back survey (n=1225) on American risk perceptions, knowledge, and behavioral intentions. One of the primary goals of their research was to examine the relationship of knowledge, operationalized as the identification of correct and bogus causes of climate change, to risk perceptions and behavioral intentions (including both voluntary behaviors and support for government policies).

Previous risk perception research had found only weak relationships between knowledge and risk perception or knowledge and behavior across a variety of environmental issues. As O'Connor et al. summarized this research:

*Sjoberg concludes, '...there is no or little correlation between actual knowledge and perceived risk' (1996, p. 224). Similarly, research has not found strong relationships between environmental knowledge and environmentally responsible behavior (Schahn and Holzer, 1990, p. 772). Hines et al. (1986/87) report correlations around 0.30 between environmental knowledge and behavior in their meta-analysis of 17 studies (O'Connor 1998:146).*

Consistent with this previous research on other environmental risks, O'Connor et al., found that knowledge of climate change causes, while remaining a statistically

significant, independent variable in multiple regression models, explained 5% to 16% of the variance in risk perceptions and 6% to 21% of the variance in behavior (O'Connor 1998). They also found that individuals who correctly identified real causes of anthropogenic climate change (e.g., emissions from business and industry, people driving their cars, etc.) were somewhat more likely to have higher risk perceptions and more willing to sacrifice (accept costly government initiatives to mitigate climate change). By comparison, they found that individuals who identified bogus causes as contributors to climate change (e.g., nuclear power generation, ozone depletion, chemical pesticides, etc.) were more likely to have higher risk perceptions, but were not more willing to sacrifice. They concluded that accurate knowledge may not be a primary driver of risk perception, but may be important for public support for government mitigation efforts.

A second objective of their research was to test the ability of risk perceptions to predict behavioral intentions. Within the risk perception literature, most research has focused on “the nature of environmental risk perceptions, measurement considerations, and correlates with attitudinal and personal characteristics” (O'Connor 1999: 461). Most of this previous research has assumed that increased risk perception leads automatically to an increased likelihood of individuals taking voluntary actions and supporting government initiatives to deal with a particular environmental risk. This assumption, however, has rarely been tested, especially for long-term, uncertain risks like climate change.

By contrast, much of the research on general environmental beliefs and attitudes (e.g., the New Environmental Paradigm, Dunlap and Van Liere 1978) has examined the link between general beliefs and behavioral intentions, generally finding statistically significant correlations. Yet,

*...many studies report that general environmental beliefs predict behavioral intentions, but few include specific risk perceptions as independent variables. The presumption is that risk perceptions and actions correlate, but little focused research has been done (O'Connor 1999:462-3).*

O'Connor et al. examined risk perceptions and behavioral intentions (willingness to take voluntary actions or support government initiatives to mitigate climate change) and found that risk perceptions remained a statistically significant, independent variable in multiple regression models that included general environmental beliefs, and explained a moderate amount of the variance in behavior (voluntary actions 11%; support for government actions 19%). Thus:

*Our primary conclusion is that risk perceptions matter in predicting behavioral intentions. Risk perceptions are not a surrogate for general environmental beliefs, but have their own power to account for behavioral intentions...the success of the risk perception variables in accounting for behavioral intentions should encourage greater attention to risk perceptions as independent variables...[past psychometric] work has taught us much about how people conceptualize risks, but rarely looked at the consequences of these perceptions for behavioral intentions or actual behavior (O'Connor 1999: 469-470).*

A final objective of their research was to construct full multiple regression models incorporating knowledge (real and bogus causes), risk perception (likelihood of

severe consequences of climate change), general environmental belief (NEP), and sociodemographic variables (gender, age and education) to predict voluntary behaviors and support for government initiatives to mitigate global climate change. They found that each of these independent variables retained statistical significance and explanatory power in the full model, demonstrating that each remained an important predictor even in the presence of the others. The full model, however, explained 17% of the variance in voluntary behaviors and 33% of the variance in support for government action. Clearly, much of the variance in behavioral intentions remains unexplained. This dissertation considers several additional potential factors, including affect, imagery and cultural worldviews (Cultural Theory), in an attempt to explain voluntary behavior, support for government action and risk perception.

### Affective Image Analysis

*What each man does is based not on direct and certain knowledge, but on pictures made by himself or given to him. . . . [T]he way in which the world is imagined determines in any particular moment what men will do (Lippmann 1922).*

As previously described, much research to date has contrasted expert vs. public knowledge and mental models of climate change and found that Americans generally lack detailed conceptual understandings of this environmental risk. Further, mental model researchers have found that Americans inappropriately apply concepts from other environmental issues, such as ozone depletion. (e.g., Bostrom, et al. 1994; Kempton, et al. 1995; Read, et al. 1994).

Risk perception researchers, however, have demonstrated that knowledge about risks, while important, is not sufficient to explain risk perceptions and behavior (e.g., Finucane 2000; Slovic 1997, 1998, 2001; Epstein 1994; Wildavsky 1991). This dissertation uses *affective image analysis* to examine public risk perceptions of climate change along both cognitive and affective dimensions.

### Affective Imagery

*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 distinguished from *emotion*, which generally refers to specific states, such as anger, fear or happiness. Affect is also distinct from *mood*, which generally refers to transitory, low-intensity feelings, which are undirected and lack specific cognitive content. By contrast, *affect* refers to a person's positive or negative evaluation of specific cognitive contents or images. It is also "an orienting mechanism that direct fundamental psychological processes such as attention, memory, and information processing" (Slovic 1997:292).

*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 1999:317-21). *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. 1998:3).

Affective images are evaluative feelings of good/positive or bad/negative associated with particular concepts or stimuli; e.g., "cancer" evokes negative images for most people, while "sushi" evokes either positive or negative images. Affective images occur rapidly and automatically; note how quickly you sensed your positive or negative feelings associated with the stimulus words cancer or sushi. Affective images also guide decision-making; seeing "sushi" on a dinner menu causes some people to react with



disgust, while others salivate in anticipation, guiding their subsequent decision-making and behavior (what to order for dinner). Further, affective images are part of an "affect heuristic;" a natural and efficient process for evaluating risk situations and making decisions (Finucane, et al. 2000; Slovic, et al. 2000).

### Affective Image Analysis

*Words are like empty balloons, inviting us to fill them up with associations. As they fill they begin to gain intrinsic force and at last to shape our perceptions and expectations (Worster 1994:191).*

*... associations are simply a remarkably easy and efficient way of determining the contents of human minds without having those contents expressed in the full discursive structure of language (Szalay & Deese 1978:9).*

Cognitive scientists, psycholinguists, and social psychologists demonstrate that affective images link to one another in complex networks of association (e.g., Anderson & Bower 1973; Deese 1965; Kess 1992; LeDoux 1996; Sadoski & Paivio 2001; Sloman 1996; Slovic 1991, 1998). As Kess describes:

*The system is like a spider web, with words in the mental network related to other words via associative links of varying strengths (Kess 1992:213).*

Psychologists have long used word association techniques (Galton 1880; Wundt 1883; Freud 1924). A wide range of fields currently use word association methods in the study of memory and cognition (e.g., Nelson & McEvoy 2000; Zeelenberg, et al. 1999;

Altarriba, et al. 1999); the structure of thought systems (McGuire & McGuire 1991, 2001); and psychotherapy (MacMillan 2001). *Affective image analysis* employs a particularly structured and systematic form of word association. Researchers have implemented affective image analysis in many different research domains. Szalay (1999), for example, used affective image analysis of word associations to examine substance abuse for the National Institute on Drug Abuse, to develop cross-cultural communication guides for the U.S. Department of Education, and to improve minority training for the National Institute of Mental Health and Office of Naval Research. Risk perception researchers have used affective image analysis of word associations to examine nuclear power (Slovic, et al. 1996), an underground nuclear waste repository (Slovic, et al. 1991); and smoking (Benthin, et al. 1995). Others have used it to predict vacation preferences and behavior (Slovic, et al. 1998), and investors' evaluations of initial public offerings on the stock market (MacGregor, et al. 2000).

In gathering word associations for affective image analysis, researchers typically present subjects with a key word or concept and ask them to provide the “first word or image” that comes to mind. Some instruments gather multiple images in addition to subjects' first answers. Example questions include:

Q1: “What is the first word or image that comes to mind when you think of nuclear energy?”

Q2: “What is the second word or image that comes to mind when you think of nuclear energy?”

Affective image analysis involves content analysis of respondents' open-ended answers to the stimulus words. The results enable researchers to describe the range, structure and salience of respondent associations with the stimulus term. This methodology is described in greater detail below.

Besides images, some instruments also gather subjects' directional, affective evaluations of both the key stimulus term and respondents' images of the stimulus. An example question measuring affective evaluation of a stimulus term is:

Q3: "When you think of nuclear energy, is your impression very negative, somewhat negative, somewhat positive, or very positive?"

Likewise, if a survey respondent provided "cancer" as an association to "nuclear energy," an example follow-up question to obtain an affective evaluation of the image might be:

Q4: "When you think of cancer, is your impression very negative, somewhat negative, somewhat positive, or very positive?"

### Unique Strengths of Affective Image Analysis

Affective image analysis minimizes researcher bias that can occur in closed-ended questionnaires. Researchers often construct closed-ended questionnaires based on a particular theory or set of academic or scientific categories. This process risks using

terms, concepts, and categories unfamiliar to, or unused by, the general public. As Cox explains,

*The categories supplied by the investigator may have quite different meanings to different individuals in the sample. Likewise the responses supplied by the investigator on the assumption that they may be exhaustive may be far from so. As a consequence, one may learn more about the behaviour of the sample in responding to a set of categories the investigator attempts to impose on them, than about the behaviour under investigation itself (quoted in Robinson 1998:389).*

Affective image analysis, however, uses an open-ended method of free association, with no imposition of researcher concepts or categories, with the exception of the stimulus term itself. This feature makes affective image analysis a particularly useful tool for examining public risk perception, as scientific analysis of risks often uses a highly technical lexicon, which members of the public may not understand or be comfortable with.

A second unique strength of this technique is that subjects' free associations are relatively unfiltered, context-free, and spontaneous. In this way, they represent a powerful way to study sensitive topics. Because they are immediate and spontaneous, they tend to bypass self-censorship or social desirability bias, which can occur in the fully articulated assertions required by standard survey questions. As Szalay and Deese explain:

*...the association method reveals the content of minds in a way that propositional language does not. We can and do reveal ourselves in associations in ways that we might find difficult [or unpleasant] ... if we were required to spell out the full propositions behind our associations (Szalay & Deese 1978:9).*

Third, affective image analysis provides a rich dataset. This technique efficiently collects a wide range and diversity of respondent interpretations of a stimulus, thus allowing researchers to map the *distribution* and *saliency* of subjective meanings held by a population. Further, this technique allows investigators to identify, compare and contrast interpretive communities – groups of individuals who share a relatively coherent and consistent set of meanings, while often differing greatly from one another.

Fourth, affective image analysis provides a less costly method for researchers to acquire some of the data richness of qualitative approaches. The time, labor, and resource costs of in-depth interviews, participant observation, and ethnography, for example, greatly exceed the relatively simple, quick and inexpensive collection of affective images. Fifth, as part of a representative survey sample, affective image results are generalizable to entire populations and can be quantitatively correlated to other behavior, attitude, opinion, and sociodemographic variables measured by the survey instrument.

Affective image analysis thus combines the strengths of qualitative and quantitative methods – providing some of the richness of qualitative methods with the generalizability of quantitative approaches. Word associations elicit short, open-ended responses (without imposing researcher categories), from a representative sample using standard survey methods. The qualitative meanings can then be coded into empirically determined categories, and subsequently correlated with other survey measures (e.g., sociodemographics).

#### Affective Imagery in Risk Perception, Decision-Making and Behavior

Most current theories of decision-making about risk are “cognitive and consequentialist” (Loewenstein, et al. 2001). They are based on the assumption that individuals assess the desirability and likelihood of possible outcomes, then rationally calculate or weigh the pros and cons of these expected outcomes to arrive at a decision. This assumption also underlies the expected-utility model that informs much of economic and psychological theory. Thus, past research has attempted to model how people make logical, rational choices. Affect and emotions are typically ignored in these models, or viewed as epiphenomena of the decision-making process. Thus, many theorists have assumed that decision-making about risk is essentially a cognitive activity.

In a critique of this predominantly cognitive paradigm, Zajonc (1980) argued that affective reactions to stimuli occur automatically and guide subsequent information processing and judgment. Affect typically arises *prior* to cognition and plays a crucial role in subsequent rational thought. A large and growing literature in cognitive science, social psychology and neurology has confirmed affect's key role in cognition, decision-making and behavior (e.g., Alhakami & Slovic 1994; Epstein 1994; Isen 1993; Johnson & Tversky 1983; Janis & Mann 1977; Kahneman & Snell 1990; Loewenstein 1996; Loewenstein et al. 2001; Mellers et al. 1996; Peters & Slovic 1996; Rozin, et al. 1993; Slovic, et. al. 1991; Slovic, et al. 1998; Slovic, et al. 2000; and Wilson, et al. 1993).

For example, cognitive neuroscientists' recent discoveries of a direct link between affect and cognition illustrate affective imagery's importance for risk perception and decision-making research. Damasio (1994, 1999) found that patients with brain damage (specifically, the ventromedial frontal cortices) retain their intelligence, memory and logic, but lose their ability to feel, including the ability to associate feelings with their actions' anticipated consequences. Through several experiments, Damasio found that such emotional deficits dramatically impaired decision-making processes and seriously compromised decision quality. Based on these and other studies, Damasio concluded that human thought largely consists of *images*, broadly construed to include ideas, words, sounds, smells, and real or imagined visual impressions. Through life experience these images become "marked" by positive or negative feelings and linked directly or

indirectly to somatic (bodily) states. A negative image sounds an alarm; a positive image becomes a beacon of incentive. Damasio argued that these positive and negative “somatic markers” greatly improve decision-making efficiency and accuracy, and guide both slow, deliberative choices and quick, intuitive responses.

Parallel to cognitive neuroscience’s efforts to trace the neural pathways between cognition and affect, social psychologists have examined the role of affect and imagery in risk perception and behavior. For example, Slovic et al. (1991) reported four surveys conducted at the national, regional, state, and local levels to examine public risk perceptions of the proposed national nuclear waste storage facility underneath Yucca Mountain, Nevada. The surveys collected 10,000 affective images from 3,334 respondents to the stimulus “underground nuclear waste repository.” Respondents’ associations coalesced around images like “death,” “cancer,” “mushroom cloud,” and “nuclear war.” Respondents evaluated these images extremely negatively, with positive imagery almost entirely absent. Slovic, et al. concluded that, “What these responses reveal are pervasive qualities of dread, revulsion and anger – the raw materials of stigmatization and political opposition” (1991:1604). Further, the researchers found that these affective images predicted public risk perceptions of nuclear energy, and correlated strongly with intended voting behavior and non-support for new nuclear power plant construction (Slovic, et al. 1991; Peters & Slovic 1996).



Building on these earlier studies, this dissertation further develops affective image analysis to describe and analyze the cognitive images and affect associated with global warming by the American public and climate change activists. It tests both affect and imagery as independent variables to predict risk perception, policy preferences and behavior regarding climate change. Finally, it uses affective image analysis to identify, compare and contrast different “interpretive communities” within the Oregon and American publics.

### Cultural Theory

*...an understanding of who fears what and why requires serious attention to the political, historical, and social context in which risks are framed and debated...mental models of risk are not solely matters of individual cognition, but also correspond to worldviews entailing deeply held beliefs and values regarding society, its functioning, and its potential fate (Dake 1991:62).*

Cultural Theory has recently emerged as a cross-disciplinary approach used by anthropologists, geographers, political scientists, social psychologists and sociologists. It has found wide applicability and continues to evolve, both theoretically and empirically. In the context of social scientific contributions to the study of global climate change, it has become "almost an orthodoxy of sorts in human dimensions research, perhaps due to its relative clarity and ease of linking with quantitative models, which has made it useful in integrated assessment analyses" (Proctor 1998: 236).

## What is Cultural Theory?

Originating in the work of anthropologist Mary Douglas (Douglas 1966; Douglas 1970; Douglas 1998; Douglas & Wildavsky 1982), cultural theory focuses on the social construction of meaning -- how different individuals and groups interpret the world in different, yet patterned ways. It "explores the different perceptual screens through which people interpret or make sense of their world and the social relations that make particular visions of reality seem more or less plausible" (Thompson 1990: xiii).

Much cultural theory research has focused on environmental risk perception -- for example, why do some people fear nuclear energy, while others do not (Slovic 1998; Peters 1996)? Why does deforestation drive some to the brink of despair, while leaving others unmoved (Thompson 1990: xiii)? Rather than seeking purely psychological explanations (e.g. risk-accepting vs. risk-avoiding personality types), cultural theory argues that risk perception is socially constructed.

Cultural theory makes a distinction between *social relations* (patterns of interpersonal relations) and worldviews (shared values and beliefs). Social relations refer to the patterns of social interaction between individuals, or social organization. "Social relations are defined...as a small number of distinctive patterns of interpersonal relations - hierarchical, egalitarian, or individualist" (Wildavsky 1990: 43-44). Worldviews (often termed 'cultural bias') refer to the shared mental representations, values and general

social, cultural and political attitudes held by a group of individuals. Worldviews serve as 'orienting dispositions' that guide people's responses in complex and uncertain situations (Slovic 1998: 165).

While Douglas argued that social relations *determine* worldviews (strong social constructivism), most subsequent scholars argue instead that the two are *dialectically* related. "No causal priority is given to cultural biases or social relations; they are always found together interacting in a mutually reinforcing manner" (Wildavsky 1990: 44). Thus, cultural theory is usually viewed as a moderate form of social constructivism, in which particular forms of social organization influence particular interpretations of reality and vice versa.

Cultural theory identifies four distinct types of social organization, based on two dimensions: group and grid. *Group* represents the degree to which an individual identifies with and is incorporated into a bounded group. "The further one moves along the group dimension, the tighter the control over admission into the group and the higher the boundaries separating members from nonmembers" (Thompson 1990: 5-6). *Grid* represents the degree to which an individual's life is circumscribed by externally imposed prescriptions and proscriptions (Thompson 1990: 5-6; Pendergraft 1998). The two axes of this schema produce four types of social organization -- hierarchy, individualism, egalitarianism, and fatalism (see Fig. 1). Cultural theory posits that individuals and groups tend to fall into one or another of these 4 types. Importantly, however, these are

only *ideal* types -- "This typology is a heuristic device; few individuals should be expected to hold to these extreme positions consistently" (Jaeger 1998: 191).

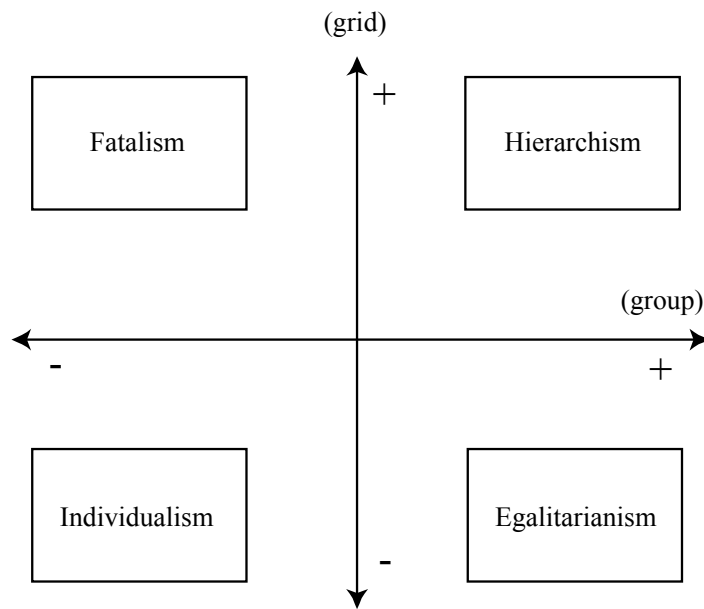


Fig.1 The Four Types of Social Organization

Worldviews are mediated by these social relations; an individual is either more group-oriented or individual-oriented. Likewise, an individual believes that many socially stratified rules are needed to control behavior, or that few rules are necessary. "In a 2 x 2 matrix of social relations by level of prescription, four basic worldviews emerge: hierarchical, fatalistic, individualistic, and egalitarian" (Peters & Slovic 1996:1430).

*Hierarchism* is characterized by strong group boundaries and binding prescriptions. Individuals strongly identify with the group, yet "are subject to both the control of other members in the group and the demands of socially imposed roles" (e.g. an officer in the military) (Thompson, et al. 1990:6). Hierarchists expect resources, opportunities, and respect to be "distributed on the basis of explicit public social classifications, such as sex, color, position in a hierarchy, holding a bureaucratic office, descent in a senior clan or lineage, or point of progression through an age-grade system" (Rayner, 1992).

*Individualism*, however, is characterized by weak group boundaries and few binding prescriptions:

*The stereotypical individualist is a self-made person, free from control by others, who strives to impose order on his or her environment...[they] oppose 'top-down' interventions by the state, preferring instead personal responsibility (O'Riordan & Jordan 1999:86-87).*

*Egalitarianism* is characterized by strong group boundaries and few binding prescriptions. It is "communitarian, holding that every member should have input into the decision-making process" (e.g. a commune) (Pendergraft 1998). *Fatalism* is characterized by individuals with weak group boundaries, yet subject to binding prescriptions.

*Fatalists are controlled from without...their sphere of individual autonomy is restricted. They may have little choice about how they spend their time, with whom they associate, where they live and work...fatalists are*

*excluded from membership in the group responsible for making the decisions that rule their life (Thompson, et al. 1990:7).*

Most cultural theorists focus their attention on hierarchists, individualists and egalitarians as these groups actively engage and contest with one another in broader social policy-making. Fatalists are typically apolitical.

### Cultural Theory and Risk Perception

Cultural theorists argue that risk perception is socially constructed -- "an understanding of who fears what and why requires serious attention to the political, historical, and social context in which risks are framed and debated" (Dake 1991: 62). Thus, hierarchists, individualists, egalitarians and fatalists each identify and define different risks -- those which threaten their preferred way of life (Milton 1996; Douglas 1982; Wildavsky 1990; Pendergraft 1998; Slovic 1998). "When environmentalists blame 'the system' for environmental damage, or when corporations proclaim a cornucopian view of nature and call for market controls on risk, or when bureaucratic organizations call for a top-down management of technological hazards, these behaviors...justify and maintain the pattern of social relations [and worldviews] from which they arise" (Dake 1992: 27-28).

Empirical research has shown that each worldview represents a different 'rationality;' a set of presuppositions about the nature of society and nature which leads

each group to perceive different risks and prefer different policy responses (Steg 2000; Slovic 1998; Peters 1996; O'Riordan 1999; Pendergraft 1998; Dake 1990; Dake 1991; Dake 1992; Wildavsky 1990). Prototypical hierarchists most fear social deviance, which threatens the structure of status quo. They call for the active management of risk by 'experts,' in whom they place great trust.

Prototypical individualists most fear restrictions on their autonomy, such as government regulation. They promote market-based strategies, which maintain their autonomy and provide opportunities for personal gain, believing that the 'invisible hand' — of self-interested actors seeking to maximize their own personal gain — leads to optimal social results. Both hierarchists and individualists tend to embrace technology, which is viewed instrumentally as providing either more social control (if sanctioned by the 'experts') or more individual efficacy, respectively. Prototypical egalitarians, however, are most concerned about injustice in the maldistribution of risk costs and benefits, tolerate or celebrate social deviance and diversity, and view technology with suspicion. They often promote participatory, democratic, and consensus-based decision-making that includes all affected parties as equals (Dake & Wildavsky 1990; Dake 1991; Dake 1992; Milton 1996; Pendergraft 1998; Slovic & Peters 1998; O'Riordan & Jordan 1999; Steg & Sievers 2000).

## Myths of Nature

Research has further demonstrated that each group is associated with a particular myth or model of nature -- nature as benign, capricious, ephemeral or perverse/tolerant. These myths are symbolized schematically by a ball in a landscape (see Fig. 2).

**42. People disagree about how the balance, or equilibrium, of nature works. The four pictures below illustrate four different perspectives. Each picture shows a ball balanced on a line, yet each one has a different ability to withstand disturbances.**

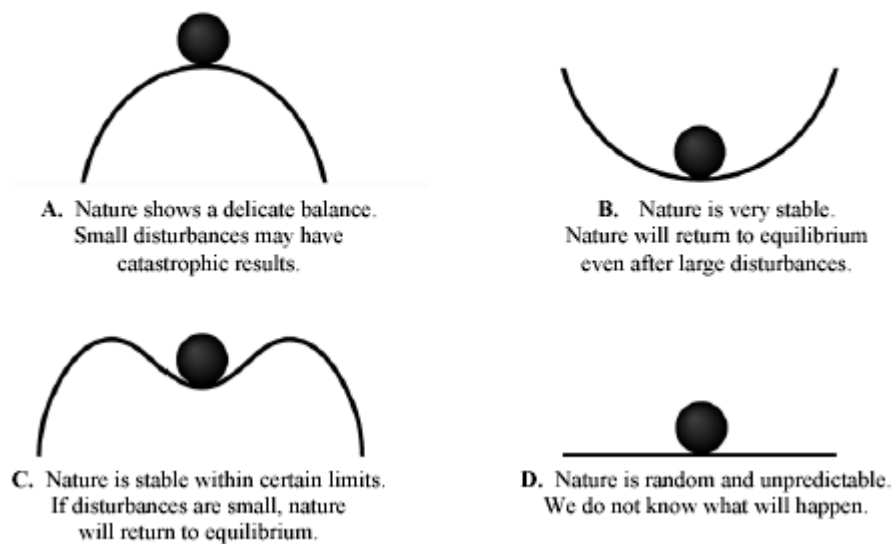


Figure 2. Myths of Nature

"The landscape symbolizes the vulnerability of nature; the ball symbolizes environment-risky behavior" (Steg 2000: 253). Egalitarians typically view nature as ephemeral, worrying "that even the slightest additional burden placed on the environment might push it over the edge into inevitable decline" (Milton 1996: 92). Thus, even a slight



perturbation to the ball can disrupt the precarious 'balance of nature.' Individualists typically view nature as benign, or cornucopian. They believe that whatever they do, the environment will recover (Milton 1996: 92). Thus, the ball always returns to a stable equilibrium. Hierarchists, however, typically view nature as perverse/tolerant. They believe that the environment will tolerate a certain amount of abuse, but no more -- thus they urge caution and central control. For example, "sustainable development is the rational environmental strategy in a hierarchical culture because this policy takes advantage of the perceived resilience of nature, but respects the 'known' limits" (Dake 1992: 29). The ball is stable, but only within expert-defined parameters. Finally, fatalists view nature as capricious. Nature is unpredictable and uncontrollable; thus they merely try to cope or adapt to the inevitable vagaries of nature. In this model, the ball can move in any direction at any time.

Recent research also demonstrates that cultural biases or worldviews are associated with different patterns of environmental concern. In general, "egalitarianism is positively correlated with environmentalism, whereas individualism is negatively correlated" (Steg & Sievers 2000:252). As one example, research on public reactions to nuclear power showed that,

*...worldviews...are highly predictive of perceptions of risk from nuclear power and support for that technology...as belief in an egalitarian worldview increased, support for nuclear power decreased. As...belief in a hierarchist or individualist worldview increased, support for nuclear power increased (Peters & Slovic 1996:1427, 1449; Slovic & Peters 1998).*

## Cultural Theory and Climate Change

According to cultural theory, hierarchists should tend to trust climate scientists and those in authority and welcome 'technofixes' as long as they are sanctioned by experts. They should support legal rules, regulations and state interventions, as long as they are appropriately legitimized by established governmental structures. Individualists should be most concerned about the imposition of constraining regulations (e.g. carbon quotas, efficiency standards, etc.) and prefer market-based policies (e.g. emissions trading), which maximize their autonomy. Egalitarians should often distrust the 'experts' and be deeply concerned about the threat of climate change — especially its disparate causes and impacts on peoples and ecosystems around the world. Strongly represented in non-governmental organizations, they should often call for radical changes in behavior and society, including drastically reduced consumption of fossil fuels, development of renewable energies, Third World debt relief, etc. Jaeger, et al. argue that,

*...the climate change issue provides ample evidence that there are abiding and sometimes contradictory views of nature and philosophies of risk management — in short, plural rationalities (Jaeger, et al. 1998:191).*

These claims, if borne out by empirical research, could have important implications for global warming policymaking and risk communication. First, to the extent that risk perceptions and subsequent actions are influenced by worldviews:

*...we can appreciate why communication of technical information about risk often has little effect on public attitudes. Our attitudes...are part of*

*'who we are'. We cannot easily change these attitudes without changing some part of our social worldviews (Slovic & Peters 1998:170).*

Thus, merely providing more technical information about climate change is unlikely to influence public concern. Second,

*...policy measures aimed at reducing environmental problems should take the different...cultural biases, into account. For example, risk communication should be in line with the cultural biases of the target group. People tend to have more trust in risk communication if the message is in line with their cultural biases (Steg & Sievers 2000:264).*

“One-size-fits-all” policies and appeals, which assume that all people are the same (e.g. all self-maximizing individualists) will fail, and in fact will create further political dissension.

Cultural theory, however, is “sometimes criticized because it lacks empirical testing via organized case studies and recognised social science techniques” (O’Riordan & Jordan 1999:88). This dissertation operationalizes cultural theory as an independent set of variables to test the theorized relationship between cultural worldviews and risk perceptions of global climate change. It includes a comparison and contrast of two study groups: student climate activists participating in the 2000 World Climate Summit in The Hague, Netherlands (n=112) and a representative national survey of the American public (n=673).

## Summary

Public opinion polls have found, paradoxically, that Americans are highly concerned about global warming as an individual issue, yet view it as less important than nearly all other national or environmental issues. Academic research to date has found that Americans often use inaccurate knowledge and flawed mental models to reason about climate change causes and solutions. For example, many Americans confuse or conflate climate change with stratospheric ozone depletion, leading them to advocate spurious solutions like a ban on aerosol spray cans, which continue to be associated with ozone depletion. Risk perception researchers, however, have found that accurate knowledge of global warming causes is not a primary driver of either risk perceptions or support for government mitigation policies. Meanwhile, other research in the cognitive sciences and social psychology has demonstrated that emotion and affect are essential components of risk perception, decision making and behavior. Likewise, Cultural Theorists argue that risk perceptions are socially constructed and mediated by cultural worldviews; thus egalitarians, individualists, and hierarchists will each emphasize those risks that they perceive to threaten their preferred social structure and associated values. This dissertation builds on the findings of these disparate fields to investigate the roles of affect, imagery and worldviews in public global warming risk perceptions, policy preferences and behaviors.

## CHAPTER III

### METHODOLOGY

#### Research Questions and Hypotheses

This research was designed to answer several broad questions:

1. Does the American public perceive global climate change as a significant threat? How likely and how severe do they believe the consequences will be?
2. Does the American public support public policies to mitigate climate change?
3. What kinds of individual actions have Americans already taken to mitigate global climate change and how common are these behaviors?
4. What affective images do Americans have of global warming? Which of these images are the most salient and can they be used to identify distinct “interpretive communities” within the American public?

This research also tests the following analytical hypotheses:

1. Affective images of global warming influence a) global warming risk perceptions, b) individual support for climate policies, and c) individual behaviors to mitigate global warming.
2. Worldviews have a separate, but related influence on a) global warming risk perceptions, b) individual support for climate policies, and c) individual behaviors to mitigate global warming.
3. Climate change activists will provide a more diverse set of cognitive images and stronger affective reactions to global warming than either the Oregon or American publics.

4. Climate change activists will be significantly more egalitarian than the American public.

### Instruments and Collected Data Sets

#### The Hague (2000)

In November 2000, I traveled to The Hague, Netherlands as part of an American student delegation to the 2000 World Climate Summit (COP6). I was credentialed with observer status inside the conference, which included access to all public negotiation sessions among national delegations, side-events sponsored by academic, industry and environmental groups, informal contacts with various national delegations, and closed-door strategy sessions of the Climate Action Network, a coalition of environmental non-governmental organizations.

In preparation for the conference, I constructed a survey instrument (see outline below) designed to measure climate change risk perceptions, hypothesized predictors, and behaviors among delegates and climate activists. The survey instrument:

1. Measured perceived risk of climate change using 6 different definitions: i) general concern about global warming; ii) human fatalities; iii) human injuries; iv) harm to natural ecosystems; v) present vs. future risks, and; vi) likelihood of starvation, disease and decreased living standards, both globally and locally (adapting likelihood measures used by O'Connor, et al. 1998).

2. Measured several hypothesized predictors of risk perception, including:
- a) Knowledge about climate change causes and solutions [e.g., “Which of the following is a direct cause of global warming?”: i) nuclear power plants; ii) damage to the ozone layer; iii) the burning of fossil fuels; iv) aerosol spray cans; etc.]
  - b) Affective imagery: Each respondent provided up to three images in response to the stimulus "global warming," using the method of continued associations (Szalay & Deese 1978; Slovic, et al. 1991; Peters & Slovic 1996). Respondents rated each image they provided on a Likert scale of extremely positive (+5) to extremely negative (-5).
  - c) Cultural worldviews: Operationalized using a set of 15 questions selected in part from scales used by Dake (1991, 1992) and Peters and Slovic (1996).
  - d) General environmental beliefs: A set of questions derived from scales used by Dake (1991, 1992) and Peters and Slovic (1996) to measure how strongly each respondent agreed with four “myths of nature” (e.g., nature as fragile vs. nature as inexhaustible, etc.).
  - e) Trust: Respondents indicated how often they trust various groups to tell them the truth about global warming risks (e.g., scientists, the national government, corporations, the media, environmental groups, etc.).
  - f) Religiosity: Operationalized with three questions on whether a respondent considered themselves personally religious or spiritual; were actively involved in a religious or spiritual organization; and how important religious faith was in their life.
  - g) Sociodemographics: Respondents were asked to indicate their sex, age, national citizenship, education, income, employment, marital status, parental status, political ideology, and membership in environmental groups.
  - h) Measured individual climate change behaviors. Behaviors included: using energy-efficiency as a selection criterion when buying a light bulb, household appliance, or motor vehicle; weatherizing one's home, purchasing alternative energy, lobbying policymakers, etc.

The survey questionnaire was pre-tested with 20 undergraduate volunteers recruited from a geography course at the University of Oregon (Environmental

Alteration). Volunteers were informed that the results of the pretest would be used only to edit and improve the questionnaire for final distribution at the 2000 World Climate Summit. Students were also informed that their participation in the pretest was completely voluntary and anonymous, and would not affect their grade or standing in the class. Human subjects approval for the pretest was obtained from the University of Oregon Human Subjects Compliance Committee. Each question was pre-tested for clarity, accuracy, validity and variability of response. The full instrument was pre-tested for flow, length, comprehensiveness, and respondent cooperation and attention. The results of the pretest were then used to revise the survey instrument.

The cover of the questionnaire informed respondents that results from the survey would be used as part of a research project to understand the range of beliefs and attitudes various people have regarding global warming. Respondents were informed that their answers were completely anonymous and voluntary, and that research results would be released as summaries in which no individual's answers could be identified. Human subjects approval for the final survey questionnaire was obtained from the University of Oregon Human Subjects Compliance Committee. Four hundred copies of the survey questionnaire were printed and transported to The Hague.



### Sampling and Data Collection

The survey was conducted using a sample of convenience<sup>1</sup>. Survey questionnaires were distributed to student climate change activists gathered for a strategy session, hosted by Greenpeace International. A brief presentation outlined the purpose of the study and informed respondents that participation was anonymous and voluntary, and that research results would be released as summaries in which no individual's answers could be identified. Survey questionnaires were passed out to those in attendance (approximately 150). Most respondents completed the survey at this time, while a few others completed it later and placed it in a drop-box in a central location. A total of 112 surveys were collected. A majority of respondents were female (59%) and represented climate change activists from campuses across the country and internationally. The majority (87%) were from the United States, with the remainder representing countries including Australia, Canada, Fiji, Mexico, the Netherlands, Senegal, and Sweden. Most were 24 years old or younger (84%) and were current undergraduate students (62%) or had a Bachelor's degree (24%). A smaller proportion had a Masters degree (7%) or a Ph.D. or other professional degree (3%).

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<sup>1</sup> In a convenience sample, the selection of units from the population is based on easy availability or accessibility. Thus, a sample of convenience is unlikely to truly represent a larger population (e.g., all climate activists), yet can be useful for exploratory research.

### National Survey (2002-03)

In December 2002 through January 2003, I conducted a national survey of American global warming risk perceptions, policy preferences and behaviors. The national survey instrument built upon the structure of the questionnaire constructed for the study of student climate change activists at The Hague. Like the activist survey, the national survey instrument:

1. Measured perceived risk of climate change
2. Measured several hypothesized predictors of risk perception, including:
  - a) Knowledge about climate change causes and solutions
  - b) Affective imagery
  - c) Cultural worldviews
  - d) Trust
  - e) Religiosity
  - f) Sociodemographics (sex, age, education, income, etc.).
3. Individual climate change behaviors

In addition to the core questions from the Hague instrument, the national instrument also measured:

1. Scale of Concern: Respondents indicated whether they were most concerned about the impacts of global warming on a) you and your local family; b) your local community; c) the United States as a whole; d) people all over the world; e) non-human nature; f) not at all concerned.

2. Policy Preferences: Respondents were asked to indicate their level of support or opposition to ten different climate change policy proposals.<sup>2</sup>
- a) Do you think the United States should reduce its emissions of the greenhouse gases (carbon dioxide, methane, etc.) that are said to cause global warming? [Likert scale ranging from (1) Definitely yes to (4) Definitely no]
  - b) In 1997, the United States and other developing countries made an agreement called the Kyoto Protocol to collectively reduce their emissions of greenhouse gases. The United States agreed to reduce its emissions by 7% by the year 2010. How much do you favor or oppose this agreement?
  - c) The United States currently emits about 20% of the world's total greenhouse gases. People disagree whether the U.S. should reduce greenhouse gases on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view? The United States should reduce its emissions... i) regardless of what other countries do; ii) only if all other industrialized countries reduce their emissions; iii) only if all other industrialized and all less-developed countries reduce their emissions; iv) the United States should not reduce its emissions; v) don't know.
  - d) One controversial proposal to solve global warming is to create an international market in greenhouse gases. In this system, all countries agree to a global cap on emissions. Each country then gets the right to emit a portion of this global amount. If a country emits more than its portion, it must buy more emission rights from other countries or else pay stiff fines. In principle, how much do you support or oppose an international market that allows countries to buy and sell greenhouse gases?
  - e) Carbon dioxide is the primary greenhouse gas said to be causing global warming and is produced by electric power plants and motor vehicles (e.g., cars, trucks and sport utility vehicles). Currently, carbon dioxide is not regulated as a pollutant. How much do you support or oppose the regulation of carbon dioxide as a pollutant?

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<sup>2</sup> Questions (a) and (b) were adapted from a national survey conducted in 1999 by the Pew Center on Global Climate Change (1999). Question (c) was adapted from a national survey conducted in 1998 by the Program on International Policy Attitudes at the University of Maryland. Questions (f) through (i) were adapted from a national survey conducted in 1997 by O'Connor, Bord and Fisher (1999). Questions (d), (e) and (j) are original questions. All questions except (a) and (c) were answered using a Likert scale ranging from (1) Strongly support to (4) Strongly oppose. Most included a "Don't know" response.

- f) The average new motor vehicle gets 29 miles per gallon of gas. Some people say we should increase average fuel efficiency to 33 miles per gallon, to help reduce carbon dioxide emissions. This would increase new motor vehicle prices by about \$1,000. How much do you support or oppose this idea?
  - g) How much do you support or oppose a 60-cent per gallon gasoline tax, over and above existing gas taxes, to encourage people to drive less and thus reduce carbon dioxide emissions?
  - h) In order to encourage people to use more fuel-efficient vehicles, some people have proposed a 5 percent “gas guzzler” tax on cars, trucks and sport utility vehicles that get less than 25 miles per gallon. This would add approximately \$1,000 to the price of a \$20,000 car. How much do you support or oppose this proposal?
  - i) To encourage industry to be more fuel efficient, some people have proposed a business energy tax. This tax would raise the average price of most things you buy, including food and clothing, by 3 percent, or approximately \$380 per person per year. How much do you support or oppose this proposal?
  - j) The United States government provides approximately \$5 billion a year<sup>3</sup> in subsidies to the fossil fuel industry (coal, oil, natural gas). Some people have proposed transferring these subsidies to the renewable energy industry (wind, solar, biomass, etc.) to develop cleaner forms of energy. This would make fossil fuels more expensive and renewable energy less expensive. How much do you support or oppose this proposal?
3. A “Volatility Index”: A set of four questions based upon and adapted from the research of Daniel Yankelovich (1991, 2002). The index measures whether current public opinion on global warming is relatively solid and stable or still volatile. Questions included:
- a) How much do you care about the issue of global warming? [Likert scale ranging from (1) “Don’t care” to (6) “Care deeply”]
  - b) On some issues people feel that they have all the information they need in order to form a strong opinion, while on other issues they would like to get more information before making up their mind. For global warming, where would you place yourself? [Likert scale ranging from (1) “Do not need any more info” to (6) “Need a lot more info”]

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<sup>3</sup> Estimate from Tax Payers for Common Sense (2002) [www.taxpayer.net/TCS/fuelsubfact.htm](http://www.taxpayer.net/TCS/fuelsubfact.htm)

- c) How often do you discuss global warming with your family and friends? [Likert scale ranging from (1) “Rarely discuss” to (6) “Often discuss”]
  - d) People have told us that on some issues they may take a position, but know that they could change their mind pretty easily. On other issues, however, they come to a position and they stick with it, no matter what. For the issue of global warming, where would you place yourself? [Likert scale ranging from (1) “Could change my mind easily” to (6) “Stick with my position”]
4. General Environmental Attitudes. Three questions from OASIS 2000 were added to the national survey for comparison between the Oregon and national studies:
- a) Do you believe it is possible for pollution levels to get so high that the environment cannot recover?
  - b) What do you think is more important – protecting the environment, even if it costs jobs, or economic growth, even if it leads to environmental problems?
  - c) When you buy things at the store, do you usually think of the impact the things you buy have on the environment?
5. New Environmental Paradigm. A set of 9 questions adapted from previous research by Dunlap and Van Liere (1978) and La Trobe and Acott (2000), which measure whether respondents hold relatively anthropocentric vs. ecocentric environmental attitudes.
6. Balance of Nature (“Myths of Nature”). Respondents were provided with the following illustration (Figure 3) and asked: “Which one of the four pictures best represents your understanding of how the balance of nature works?”

42. People disagree about how the balance, or equilibrium, of nature works. The four pictures below illustrate four different perspectives. Each picture shows a ball balanced on a line, yet each one has a different ability to withstand disturbances.

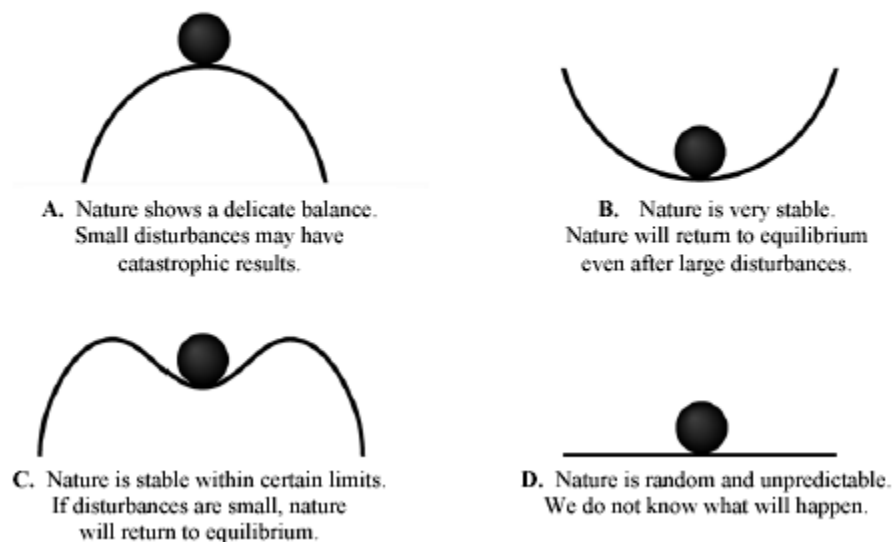


Figure 3. Myths of Nature

The national survey questionnaire went through several rounds of pre-tests. After question development in consultation with the Oregon Survey Research Laboratory (OSRL), the draft questionnaire was pre-tested first by staff members at OSRL, then by graduate students enrolled in Geography 608: Workshop on Thesis Writing, and finally by students enrolled in Sociology 311: Introduction to Social Research. Each question was pre-tested for clarity, accuracy, validity and variability of response. The full instrument was pre-tested for flow, length, comprehensiveness, and respondent cooperation and attention. The results of the pre-tests were then used to finalize the survey instrument. Human subjects approval for the final survey questionnaire was obtained from the University of Oregon Human Subjects Compliance Committee.

### Sampling and Data Collection

The national study was implemented with a mail-out, mail-back survey of a representative sample ( $n = 1600$ ) of the American public, using the Dillman (2000) tailored design method. The sample mailing list was purchased from Survey Sampling, Inc. which owns a national database of residential addresses from all 50 states, compiled using white page telephone directories and supplemented by other proprietary information sources, including school records, voter registrations, driver's licenses, credit reports, and census data. Household addresses were systematically  $n$ th-selected after the database had been stratified by county, ZIP code, area code and telephone exchange. The unit of analysis for the study was individual adults, aged 18 or older. Individual respondents were selected by use of the most recent birthday method (Dillman 2000).

Respondents received an initial notification that they would soon receive a survey entitled "American Opinions on Global Warming." This initial contact was sent on October 25<sup>th</sup>, 2002 and explained what the study was about, why it was being conducted and thanked them for their time and consideration. The second contact was sent on October 29<sup>th</sup> and included a cover letter to respondents that explained the purpose of the study, why they were selected, and that all answers were completely anonymous, confidential, and voluntary. Respondents were given the following instruction to obtain individual-level data:

*In order for the results of this survey to accurately represent all adults in the United States, it is important that the questionnaire be completed by the adult (18 years or older) living in your household who most recently had a birthday.*

The second contact also included a copy of the questionnaire and a \$1 bill as a token of appreciation and incentive to return the survey. The third contact, a follow-up postcard thanking those who had already responded and encouraging non-respondents to send their survey back, was sent on November 5<sup>th</sup>. The fourth contact was sent on November 30<sup>th</sup> and included a second copy of the survey instrument, along with a cover letter which reminded respondents of the importance and confidentiality of the survey and again requested that they return the completed questionnaire.

In January 2003, OSRL was contracted to conduct an experimental follow-up “nudge” telephone call to survey non-respondents. The purpose of the experiment was to contact non-respondents via a different mode, i.e. by telephone rather than by mail, as a means to encourage them to complete and return the survey instrument. In collaboration with OSRL, an interview script was constructed, programmed into OSRL’s CATI system, and three staff interviewers trained. Human subjects approval for the experiment was obtained from the University of Oregon Human Subjects Compliance Committee.

“Nudge” calls were placed over a two-week period to 773 non-respondents. Of these, 81 said they would complete the survey and send it back. By the end of the data collection phase, 31 or 38% of these non-respondents did in fact return their



questionnaires. An additional 162 non-respondents were identified as ineligible because of wrong, disconnected, non-working, non-residential, duplicate or fax/modem numbers, language barriers, and death or illness. 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 to population distributions from the 2000 U.S. Census, the sample over-represented 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.

#### Oregon Annual Social Indicators Survey (2000)<sup>4</sup>

An affective image question on global warming was included in the 2000 Oregon Annual Social Indicators Survey (OASIS), conducted by the Oregon Survey Research Laboratory (OSRL) November, 2000 through February, 2001. The goal of this annual survey is to “obtain statistically valid and reliable information on a variety of social, economic and public policy topics required by clients. The omnibus survey format allows organizations who cannot afford, or do not need, an entire survey to purchase question modules on a collective instrument with a standard methodology and high quality procedures” (Gwartney 1999). OASIS 2000 was sponsored by Oregon State Parks, the Oregon Department of Transportation, the Oregon Lottery, the Oregon Research Institute, and ECO Northwest. OSRL completed 901 random-digit-dial (RDD)

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<sup>4</sup> This section is adapted from the OSRL report “OASIS 1998: Summary of Survey Methodology” by Patricia A. Gwartney, January 1999.

interviews with Oregon residents. As an omnibus survey with diverse sponsorship, the survey instrument addressed a diverse set of subject areas:

1. attitudes toward Oregon, local communities, Oregon state government, Oregon State Parks, the Oregon Lottery, and individual state agencies;
2. transportation issues in Oregon;
3. camping attitudes and behavior;
4. household smoking behavior;
5. casino and WWW gambling attitudes and behavior;
6. knowledge and attitudes about local watershed councils;
7. environmental attitudes and behavior;
8. affective imagery of global warming;
9. news media credibility;
10. voting behavior;
11. attitudes towards telephone surveys and polls;
12. socio-demographics.

The survey instrument was pre-tested by OSRL's Questionnaire Review Committee, which is comprised of survey experts from their staff and university-wide advisory committee, by potential members of the survey population, and by survey sponsors. Each question was pre-tested for clarity, accuracy, validity and variability of response. The full instrument was pre-tested for flow, length, comprehensiveness, and

respondent cooperation and attention. Based on these pretests, the survey instrument was revised several times.

The survey was then programmed into OSRL's computer-aided telephone interviewing system (CATI) and further pre-tested. OSRL obtained human subject approval for OASIS 2000 from the University of Oregon Committee for the Protection of Human Subjects. Respondents were informed that their answers were completely anonymous and voluntary.

#### Sampling and Data Collection

OSRL uses a random-digit-dial (RDD) methodology that generates a strict, single-stage, equal-probability-of-selection-method (EPSEM) sample of residential telephone numbers. For this survey, every residential telephone number in the state of Oregon had an equal probability of selection, including newly-assigned and unlisted residential numbers. All households in Oregon had an equal chance of being selected, except those without telephones (4.5% according to the 1990 U.S. Census).

The survey was conducted using OSRL's computer-aided telephone interviewing (CATI) system. Interviewing was conducted at all times of the day and all days of the week November, 2000 through February, 2001 until the target sample size was achieved. A total of 18,631 calls were made to complete 901 interviews with adults age 18 and

older. Among the original 4,979 telephone numbers, 2,491 (50%) were unusable because the number was wrong, disconnected, non-working, non-residential, or a fax/modem. An additional 85 were ineligible due to language barriers, respondents deceased or too ill to complete the survey, or other. The overall CASRO response rate was 55.9%, and the refusal rate was 9.9%.

*Survey sampling errors are calculated to assist data users in assessing how much confidence to place in a particular survey result. Large random samples, as in this study, reduce sampling error. Results for survey items in which there is low variability also have less sampling error. For example, a variable with a 50/50 proportional split has wider confidence intervals than a variable with a 5/95 proportional split (Gwartney 1999).*

For this study, the margin of error for a variable from the entire sample ( $n = 901$ ) with a 50-50 proportional split is 3 percentage points, at the 95% confidence level. This means that readers of the data can be 95% sure that the true measure for this variable is between 47% and 53% (i.e.,  $50\% \pm 3$  percentage points). For a variable with a 95-5 proportional split, the margin of error is 1 percentage point, at the 95% confidence level.

## Data Reduction

### Affective Imagery

All three surveys incorporated an affective imagery component. Respondents were asked to provide the first (second, third) thought or image that came to mind when they heard the term “global warming.” This produced a rich dataset of respondent associations that often took the form of either single word responses (e.g., “disaster”) or short narrative statements. This dataset was reduced by the following procedures:

1. respondents’ images were compiled into a computer database;
2. a content analysis was performed with two independent coders; and
3. respondents’ images were coded into categories or themes that represented shared meanings.

Affective image code categories were derived in the grounded theory tradition, in which respondents’ images are inductively categorized to reveal dominant themes, rather than imposing *a priori* categories derived from theory. Idiosyncratic responses ( $n = 1$ ) were deleted from the analysis (Szalay & Deese 1978).

The affective image code categories below come from the 2000 Oregon Annual Social Indicators Survey (OASIS), which included an affective image question on global warming. These categories were also used for both the Hague and National surveys.

The categories appear in the order of most frequent use in OASIS 2000, i.e. DISASTER was the dominant category, followed by SKEPTICS, then OZONE, etc. These categories are not always mutually exclusive. Thus, a respondent who said, "Ice melting in Alaska" was coded as both ICEMELT and PLACES. A respondent who said, "The destruction of the environment" was coded as both DISASTER and NATURE. Finally, the last few categories are composite categories.

DISASTER: This category refers to a range of responses that explicitly stated negative evaluations of global climate change itself. This range included responses such as the following: "Disaster." "I think it is a very serious threat." "The destruction of the environment." "Bad...bad...bad...like after nuclear war...no vegetation." "Heat waves, it's gonna kill the world." "Death of the planet."

SKEPTICS: This category includes all responses that indicated a disbelief that climate change is happening or that it is a threat. Skeptics include:

1. flat denials of the problem ("It doesn't exist");
2. belief that global warming is natural ("Natural phenomenon, we can't control it ourselves");
3. doubting the science ("Bad science, I don't believe the data can support the hypothesis that the environment is warming");
4. doubt based on personal experience ("I think it's a myth. I don't think we are having global warming. Summers are getting shorter and winters seem to be getting damper and cooler. It seems to be going the other way"); and

5. conspiracy theorizing ("Fraud. Scientists making up some statistics for their job security" "A lot of propaganda on it...I think they try to scare us.").

OZONE: This category includes all responses that associated global warming with stratospheric ozone depletion and the ozone hole. For example: "Ozone layer." "A hole in the sky." "Temperatures rising because of the hole in the ozone." "The ozone layer has a lot to do with the majority of the global warming." "I don't like it...hair spray is part of it." "Cancer from UV."

DON'T KNOW: This category includes any responses like "Global warming -- what is that?" or "I've never heard of that." It is important to note that this category does not include responses such as the following example: "Umm...I don't know...ozone layer." This response and others like it were coded as specific images; in this example as "Ozone." The phrase, "I don't know" is often used by respondents to indicate momentary hesitation, before providing an actual response. Thus, the "Don't Know" category only includes those respondents who truly had no associated image or explicitly said they had never heard the term 'global warming' before.

HEAT: This category includes all references to rising temperatures. For example: "Becoming hotter." "Temperature is going to increase." "Warmer weather."

NATURE: This category includes all references to non-human nature, including general references to the environment, the world, and more specific references to flora,

fauna or specific species. For example: “The end of the world.” “Sick fish.” “Death of the planet.” “Environmental degradation.” “Penguins in Brazil.” “Extinction of some species.” “Mosquitoes.”

ICEMELT: This category includes all references to melting snow and ice. For example: “Melting of the ice cap.” “Melting iceberg.” “Glacier ice melting.” “The Arctic melting.”

PLACES: This category includes all references to specific geographic locations. For example: “Ice in Alaska.” “Brazil cutting all its trees.” “Sunny Florida.” “Tropics.” “Antarctica.” “Los Angeles.”

POLLUTION: This category includes all references to pollution. For example: “Pollution.” “Air pollution from autos.” “Carbon monoxide.” “Exhaust from cars.” “Manufacturing places, spewing particulates up into the air.”

NEED ACTION: This category includes all references to the need for action. For example: “We need to do something about it.” “I think we’ve got to stop using the stuff that causes global warming.” “We’d have to change our way of living.” “Not enough gets done about it.” “What can we do to help?” “They ought to monitor these big companies a little more.” “We need to replant our trees.”



EMOTION: This category includes any reference to an emotion felt by the respondent. This does not include negative evaluations of global warming itself, e.g., "Bad...bad...bad...like after nuclear war...no vegetation." Instead this category only includes direct expressions of emotion. For example: "I worry about it." "It's kind of scary." "It makes me afraid." "I'm worried about that." "Frightening." "It's a concern."

WEATHER: This category includes all references to weather or changes in the weather. For example: "Bad weather increasing." "Severe weather." "Violent storms." "Tornadoes." "No snow." "Changing weather patterns."

FLOOD/SEA LEVEL: This category includes all references to either flooding or sea level rise. For example: "Ice melting causing floods." "High waters." "Rising ocean levels." "The danger for cities near the water."

HAPPENING: This category includes all assessments that global warming is real and happening. For example: "It's true." "It's going to occur." "It is happening." "I realize there is global warming." "I think that it is coming."

CHG. CLIMATE: This category includes any references to changing seasons or climate. For example: "Changes in climates." "A lot drier climate." "The seasons changing." "Mild winters." "Summer all year." "El Niño."

AUTOS: This category includes all reference to automobiles. For example: “Motor vehicles.” “Automobile exhaust.” “Large cars and SUV’s.”

FORESTS: This category includes all references to trees and forests. For example: “Brazil cutting all its trees.” “Deforestation.” “Rainforests.” “Not enough trees.”

POLITICS: This category includes all references to politics or political figures. For example: “Al Gore.” “George W. Bush.” “Environmental policy.” “Liberals.” “Political scaring.” “It’s a smoke screen for the politicians to do what they damn well please.”

DRY/DESERT: This category includes all references to drought or a drier climate. For example: “Loss of water supply.” “Shortage of water.” “Desertification.” “Deserts.” “More arid systems.”

INFO SOURCES: This category includes all references to sources of information about climate change. For example: “I heard about that on the TV.” “School.” “The regular nightly news.” “My college class where I learned about it.” “Like the bible says we are supposed to burn up and maybe that is what is happening.”

**GREENHOUSE:** This category includes all references to the greenhouse effect. For example: “The greenhouse effect.” “CO<sub>2</sub>” “greenhouse gases.”

**INDUSTRY:** This category includes all references to industry, business or the economy. For example: “Smoke out of factories.” “Greedy corporations.” “Industrial pollution.” “Economic growth and expansion.”

**RELIGION:** This category includes all religious references. For example: “The Lord will take over before it gets too bad.” “Changes according to the scriptures.” “Like the bible says we are supposed to burn up and maybe that is what is happening.”

**FOSSIL FUELS:** This category includes all references to fossil fuels. For example: “Oil refineries.” “fumes of gasoline.” “We need to stop using gasoline.” “Too much fossil fuels.” “Big oil companies.”

**FOOD:** This category includes all references to food and agriculture. For example: “It’s affecting crops.” “Inability to grow crops.” “People falling like flies...scrounging for food.” “The dry out of crops and farming...loss of food.”

**POSITIVE:** This category includes all responses that evaluate climate change as a good thing. For example: “I kind of like it.” “Good, just that it’s good.” “Bring it on...it’s cold, it’s winter.”

**CHG. TEMPERATURE:** This category includes references to general changes in temperature. Note that this is not the same as the category HEAT. HEAT responses indicate a direction (warming) to changes in temperature. This category does not indicate a direction. For example: “Changes in the temperature.” “The temperature.” “Temperature changes.”

**FUTURE GENERATIONS:** This category includes all references to the consequences of global warming for future generations. For example: “My son and what it will be like for him to handle.” “That my grandchildren will not have the world like I want it.”

**HUMAN HEALTH:** This category includes all references to the impacts of global warming on human health. OASIS respondents provided none, but examples would be “Malaria increase.” “Deaths to heatstroke.”

**OTHER:** This category includes any responses that don’t fit the other categories.

**CAUSES:** This is a composite category comprised of the following categories:

- POLLUTION
- AUTOS
- GREENHOUSE EFFECT
- INDUSTRY
- FOSSIL FUEL

IMPACTS: This is a composite category comprised of the following categories:

- HEAT
- NATURE
- ICEMELT
- FLOOD/SEA LEVEL
- WEATHER
- CHG. CLIMATE
- FORESTS
- DRY/DESERT
- FOOD
- CHG. TEMPERATURE

SOLUTIONS: This is a composite category comprised of the following categories:

- NEED ACTION
- FOSSIL FUEL (e.g., responses calling for a shift from oil to renewable energy)
- FORESTRY (e.g., responses calling for tree planting, or halting deforestation)
- INDUSTRY (e.g., responses calling for regulation of business)

Each category represents a single nominal variable that was imported into a database of all quantitative survey answers. Statistical analyses using chi-square goodness-of-fit tests, odds ratios, linear and multiple regressions were performed, looking for correlations between the dominant affective images and climate change risk perceptions, policy preferences and behaviors (dependent variables).

Previous research on affective images has derived the following types of measures for analysis:

*Meaningfulness* measures the number of different word associations to a particular stimulus word. More meaningful stimuli elicit more associations; an unknown word or concept elicits few or none. *Dominance* measures images' relative importance, centrality, or salience to a respondent group. It is measured as a function of how many people give a particular response and with what subjective weight. Dominance is calculated by summing images' scores and then comparing results across images. For example, in response to the stimulus "nuclear waste repository," Slovic, et al. (1991) found the image "cancer" much more dominant than the image "safe."

*Affinity* measures the degree of similarity between subjects' word associations with two different stimuli, e.g., "alcohol" and "entertainment." Affinity can be measured as the correlation of two stimuli, or by constructing an Index of Inter-word Affinity (Szalay, et al. 1999). For example, Szalay (1999) found that substance users had higher affinity scores than nonusers for "alcohol" with "friends," "fun," and "party."

*Affectivity* measures the degree to which subjects evaluate stimuli and images as positive or negative, from scored Likert scales. For example, a scale range from +3 (strongly positive) to -3 (strongly negative) allows a mean affective score calculation for each stimulus and associated image.

## Indexes

Indexes are efficient data reduction devices which summarize a respondent's answers to different questions measuring different dimensions of the same complex concept in a single score (Babbie 1990). "The advantages of using multiple indicators are: greater coverage of the conceptual domain; increased precision of measurement; and, most importantly, the ratio of 'signal' to 'noise' increases with more indicators of the same construct" (Sturgis 2002).

For the Hague survey (2000) of climate change activists, several indexes were constructed for further analysis:

An "Activist Risk Perception Index" ( $\alpha = 0.75$ )<sup>5</sup> was constructed by summing 16 different variables measuring: holistic concern; holistic threat perception today and in the future; harmfulness of global warming to the natural environment currently and in the future; and likelihood measures of worldwide and local impacts of global warming on standards of living, food shortages and disease (Table 1).

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<sup>5</sup> Cronbach alpha ( $\alpha$ ) is a measure of the internal consistency of an index, i.e., whether all the items within the index measure the same construct. Values range from 0 to 1. The internal consistency of the index increases as a value approaches 1. A rule of thumb is that an  $\alpha > .9$  is excellent;  $\alpha > .8$  is good;  $\alpha > .7$  is acceptable;  $\alpha > .6$  is questionable;  $\alpha > .5$  is poor; and,  $\alpha < .5$  is unacceptable (George and Mallery, 2001).

TABLE 1. Activist Risk Perception Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>
<i>Hague Risk Perception Index</i>	43.37	3.78	0.75
How concerned are you about global warming?	3.99	0.10	0.76
Generally, how much of a risk is global warming to the world?	3.93	0.36	0.75
How serious of a threat is global warming <u>today</u> ?	3.70	0.50	0.74
How serious of a threat will global warming be <u>in the future</u> ?	4.00	0.00	
How harmful is global warming to the natural environment <u>currently</u> ?	3.61	0.55	0.74
How harmful is global warming to the natural environment <u>30 years from now</u> ?	3.94	0.28	0.76
Suppose annual average temperature increases by 3 degrees Fahrenheit (1.7 Celsius) over the next 30 years. Do you think it is very likely, somewhat likely, somewhat unlikely or very unlikely that each of the following will occur?			
Globally, many people's standard of living will decrease.	3.69	0.66	0.73
Global food shortages and starvation will occur.	3.69	0.62	0.71
Global rates of serious disease will increase.	3.88	0.41	0.73
My standard of living will decrease.	3.11	0.90	0.68
Food shortages and starvation will occur where I live.	2.59	1.08	0.72
My chances of suffering from a serious disease will increase.	3.22	0.86	0.69

*n* = 98. Scales range from 1 (none) to 4 (very).

TABLE 2. Activist Image Affect Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>
<i>Activist Image Affect Index</i>	-10.71	6.53	0.69
How strong are your negative or positive feelings about (thought or image 1)?	-3.90	2.37	0.71
How strong are your negative or positive feelings about (thought or image 2)?	-3.61	2.78	0.54
How strong are your negative or positive feelings about (thought or image 3)?	-3.19	3.12	0.48

*n* = 103. Scales range from -5 (very negative feelings) to +5 (very positive feelings).



Affect was operationalized in two different ways. First, holistic affect was measured by asking, “Do you have any negative (positive) feelings about global warming?” If respondents answered yes, they then used a unipolar 5-point Likert scale to evaluate, “How strong are your negative (positive) feelings?” Second, an “Activist Image Affect Index” ( $\alpha = 0.69$ ) was created which summed three affective image variables (Table 2). After providing the holistic affective responses, respondents were asked to provide three thoughts or images that came to mind when they heard the words “global warming.” Each self-reported image was then evaluated by the respondent on a Likert affect scale ranging from  $-5$  (very negative) to  $+5$  (very positive).

Worldviews (Cultural Theory) were operationalized using a set of 15 questions derived from previous scales used by Dake (1991, 1992) and Peters and Slovic (1996). Two worldview indexes were successfully constructed. First, an “Activist Egalitarian Index” ( $\alpha = 0.68$ ) summed respondents’ answers to a series of items measuring egalitarian attitudes towards society (Table 3). Second, an “Activist Individualism Index” ( $\alpha = 0.69$ ) summed respondents’ answers to a series of items measuring individualist attitudes towards society (Table 4). Indexes were attempted for both Hierarchism and Fatalism measures (5 statements each), but each failed to achieve a satisfactory Cronbach alpha (0.44 for Hierarchism and 0.38 for Fatalism), therefore each Hierarchism and Fatalism variable was individually correlated with the dependent variables in an attempt to identify theoretically relevant predictor variables.

TABLE 3. Activist Egalitarian Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>Activist Egalitarian Index</i>	20.51	2.63		0.68
If people were treated more equally we would have fewer problems.	3.64	0.64	0.62	
The world would be a more peaceful place if its wealth were divided more equally among nations.	3.54	0.70	0.62	
I support government efforts to get rid of poverty.	3.59	0.73	0.71	
What this world needs is a more equal distribution of wealth.	3.57	0.70	0.55	
If I had to choose between freedom and equality, I'd take equality.	2.35	0.91	0.67	
We have gone too far in pushing equal rights (reverse coded).	3.82	0.47	0.65	

*n* = 92. Scales range from 1 (strongly disagree) to 4 (strongly agree).

TABLE 4. Activist Individualism Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>Activist Individualism Index</i>	7.78	2.49		0.69
In a fair system people with more ability should earn more.	2.25	0.90	0.61	
Making money is the main reason for hard work.	1.46	0.76	0.72	
It is just as well that life tends to sort out those who try harder from those who don't.	1.77	0.84	0.60	
If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it.	2.30	0.94	0.56	

*n* = 92. Scales range from 1 (strongly disagree) to 4 (strongly agree).

Finally, an “Activist Individual Action Index” ( $\alpha = 0.62$ ) summed the number of respondent actions regarding climate change, including consumer, homeowner, transportation, volunteer and political action behaviors (Table 5).

TABLE 5. Activist Individual Actions Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>Hague Individual Actions Index</i>	6.09	1.62		0.62
Used energy-efficiency as a selection criterion when buying a light bulb, a household appliance, or a motor vehicle.	0.74	0.44	0.58	
Installed insulation or weatherized your home or apartment.	0.24	0.43	0.60	
Purchased energy from an alternative source (wind, solar, geothermal, biomass).	0.22	0.41	0.60	
Used alternative forms of transportation instead of driving.	0.96	0.20	0.58	
Chosen not to buy an aerosol spray can.	0.55	0.50	0.56	
Planted a tree.	0.48	0.50	0.57	
Joined, donated money to, or volunteered with an organization working on issues related to global warming.	0.96	0.20	0.60	
Made your views on global warming clear to politicians.	0.97	0.17	0.61	
Talked to family, friends, or colleagues about ways that individuals could help solve the problem of global warming.	0.98	0.14	0.60	

*n* = 102, (Yes = 1, No = 0)

For the National survey (2003), several indexes were constructed for further analysis. First, a “National Risk Perception Index” ( $\alpha = 0.94$ ) very similar to the Activist Risk Perception Index was constructed by combining nine different variables: holistic concern; likelihood measures of worldwide and local impacts of global warming on standards of living, water shortages and disease; the seriousness of global warming for non-human nature; and the seriousness of the current impacts of global warming around the world (Table 6).

TABLE 6. National Risk Perception Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if</i>	<i>Alpha</i>
			<i>item deleted</i>	
<i>National Risk Perception Index</i>	23.63	7.34		0.94
How concerned are you about global warming?	2.89	0.89	0.94	
How likely do you think it is that each of the following will occur during the next 50 years <u>due to global warming</u> ?				
Worldwide, many people's standard of living will decrease.	2.59	1.01	0.93	
Worldwide water shortages will occur.	2.77	1.05	0.93	
Increased rates of serious disease worldwide.	2.65	1.01	0.93	
My standard of living will decrease.	2.27	1.05	0.93	
Water shortages will occur where I live.	2.42	1.06	0.94	
My chance of getting a serious disease will increase.	2.34	1.02	0.93	
How serious of a threat do you believe global warming is to non-human nature?	3.06	0.93	0.94	
How serious are the <u>current</u> impacts of global warming around the world?	2.64	0.89	0.94	

n = 590

TABLE 7. National Image Affect Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if</i>	<i>Alpha</i>
			<i>item deleted</i>	
<i>National Image Affect Index</i>	-7.12	6.88		0.87
How strong are your negative or positive feelings about (thought or image 1)?	-2.40	2.49	0.81	
How strong are your negative or positive feelings about (thought or image 2)?	-2.42	2.50	0.79	
How strong are your negative or positive feelings about (thought or image 3)?	-2.30	2.75	0.84	

n = 514. Scales range from -5 (very negative feelings) to +5 (very positive feelings).

Affect was operationalized using the same methods as the Hague survey and includes both measures of holistic affect and a “National Image Affect Index” ( $\alpha = 0.87$ ) (Table 7). A small proportion of respondents consistently misinterpreted the scales (e.g., evaluating a self-reported thought or image like “cancer” as +5: “very positive feelings,” instead of -5: “very negative feelings”). These respondents were identified in the data entry phase and their responses reverse coded to reflect the appropriate valence.

Worldviews (Cultural Theory) were also operationalized in the National survey. The National survey used an expanded set of 25 questions, including duplicate questions from the Hague survey, questions derived from Rippl (2002) and several new questions. Two worldview indexes were successfully constructed. First, a “National Egalitarianism Index” ( $\alpha = 0.77$ ) nearly identical to the Activist Egalitarianism Index was created (Table 8). Second, a “National Fatalism Index” ( $\alpha = 0.71$ ) measured fatalist attitudes towards society (Table 9). Indexes were attempted for both Hierarchism and Individualism measures (6 statements each), but each failed to achieve a satisfactory Cronbach alpha (0.50 for Hierarchism and 0.52 for Individualism), therefore each Hierarchism and Individualism variable was individually correlated with the dependent variables in an attempt to identify theoretically relevant predictor variables.

TABLE 8. National Egalitarian Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>National Egalitarianism Index</i>	17.84	4.22		0.77
We have gone too far in pushing equal rights (reverse coded).	2.58	1.04	0.76	
I support government efforts to get rid of poverty.	2.93	0.91	0.75	
What this world needs is a more equal distribution of wealth.	2.40	0.99	0.71	
Firms and institutions should be organized so everybody can influence important decisions.	2.59	0.87	0.75	
I support affirmative action.	2.45	0.95	0.73	
If people were treated more equally we would have fewer problems.	2.77	0.87	0.73	
The world would be a more peaceful place if its wealth were divided more equally among nations.	2.12	0.92	0.72	

*n* = 647. Scales range from 1 (strongly disagree) to 4 (strongly agree).

TABLE 9. National Fatalism Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>National Fatalism Index</i>	11.47	3.33		0.71
The future is too uncertain for a person to make serious plans.	1.91	0.90	0.68	
It doesn't make much difference if people elect one or another political candidate, for nothing will change.	2.23	0.97	0.67	
I feel that life is like a lottery.	2.02	0.88	0.66	
A person is better off if he or she doesn't trust anyone.	1.74	0.85	0.67	
I have very little control over my life.	1.59	0.76	0.70	
It's no use worrying about public affairs; I can't do anything about them anyway.	1.98	0.85	0.62	

*n* = 647. Scales range from 1 (strongly disagree) to 4 (strongly agree).

Climate change-related behaviors were operationalized in three ways. First, a “National Policy Preferences Index” ( $\alpha = 0.84$ ) measured respondent support for a wide range of potential government responses to climate change, including regulation, international treaties, and subsidy policies (Table 10).

TABLE 10. National Policy Preferences Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>National Policy Preferences Index</i>	19.58	3.68		0.84
Should US reduce GHG emissions?	3.41	0.73	0.80	
Support Kyoto Protocol?	3.33	0.84	0.79	
US act alone or only if other countries act?	3.66	0.75	0.82	
Support regulation of CO2 as pollutant?	3.03	0.90	0.81	
Support increase in fuel economy standards?	3.13	0.90	0.82	
Support subsidy shift to renewable energy?	3.02	0.84	0.82	

*n* = 609

Second, a “National Tax Policy Preferences Index” ( $\alpha = 0.78$ ) measured respondent support for several proposed taxes to mitigate climate change, including a gasoline tax, a business energy tax and a tax on “gas guzzlers” (Table 11).

TABLE 11. National Tax Policy Preferences Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>National Tax Policy Preferences Index</i>	6.53	2.56		0.78
Support tax on gasoline?	1.72	0.95	0.74	
Support tax on "gas guzzlers"?	2.45	1.12	0.69	
Support business energy tax?	2.01	0.99	0.66	

*n* = 595

Third, a “National Individual Action Index” ( $\alpha = 0.74$ ) nearly identical to the Activist Individual Action Index measured respondent behavior regarding climate change, including consumer, homeowner, transportation, volunteer, and political action behaviors (Table 12).

TABLE 12. National Individual Actions Index

	<i>Mean</i>	<i>Std Dev</i>	<i>Alpha if item deleted</i>	<i>Alpha</i>
<i>National Individual Actions Index</i>	2.74	2.17		0.74
Used energy-efficiency as a selection criterion when buying a light bulb, a household appliance, or a motor vehicle.	0.51	0.50	0.68	
Installed insulation or weatherized your home or apartment.	0.45	0.50	0.69	
Purchased energy from an alternative source, such as wind or solar power.	0.04	0.20	0.74	
Used alternative forms of transportation instead of driving.	0.26	0.44	0.71	
Chosen not to buy an aerosol spray can.	0.46	0.50	0.71	
Planted a tree.	0.49	0.50	0.71	
Joined, donated money to, or volunteered with an organization working on issues related to global warming.	0.15	0.36	0.72	
Made your views on global warming clear to politicians.	0.09	0.28	0.73	
Talked to family, friends, or colleagues about how to reduce or prevent global warming.	0.27	0.45	0.70	

*n* = 595, (Yes = 1, No = 0)



## CHAPTER IV

### RESULTS

#### Global Warming Risk Perception

Does the American public perceive global climate change as a significant threat? How likely and how severe do they believe the consequences will be?

To answer these questions, the national survey questionnaire included a series of risk perception questions, ranging from holistic measures of concern, to evaluations of the likelihood and severity of specific climate change impacts. The holistic measure of concern was a standard poll question: “How concerned are you about global warming?” Table 13 provides a summary and breakdown of the results of this question by political identification and ideology.<sup>1</sup>

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<sup>1</sup> Results are rounded to the nearest whole number. Columns do not always total 100% due to a small percentage of respondents who did not answer every question.

TABLE 13. National Holistic Concern

	<i>Total</i>	Political ID			Political Ideology		
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>
	%	%	%	%	%	%	
Concerned (total)	75	86	80	62	90	79	55
Very concerned	26	42	28	13	44	21	16
Somewhat concerned	49	45	51	49	46	58	39
Not concerned (total)	24	12	20	38	9	20	44
Not very concerned	18	9	12	29	6	16	31
Not at all concerned	7	3	7	9	3	4	13

*n* = 612

A clear majority of Americans (75%) expressed concern about global warming. The results of this survey are quite similar to a 2001 survey conducted by Time Magazine and CNN, which found that 76% of Americans said they were somewhat to very concerned (PIPA 2003). These results also demonstrate clear partisan differences in concern. Democrats and Independents exhibited much greater concern about global warming than Republicans. Likewise, Liberals and Independents exhibited much greater concern than Conservatives. Global warming has become a highly politicized issue in the United States, especially during the 2000 presidential election which pitted former Vice-President Al Gore (D), a long-term advocate for action on climate change, against George W. Bush (R), a former oil company executive with myriad ties to the fossil fuel industry. It is important to note, however, that these results demonstrate that even a majority of Republicans (62%) and Conservatives (55%) expressed concern about global warming.

Risk perception, however, encompasses more than holistic levels of concern. It also includes evaluations of the likelihood and severity of various consequences. Thus,

this survey also included a series of more detailed questions relating to risk perceptions of global warming (Table 14).

TABLE 14. National Risk Perceptions

	<i>Mean</i>	<i>Std Dev</i>
How serious of a threat do you believe global warming is to non-human nature?	3.06	0.93
How concerned are you about global warming?	2.89	0.89
How serious are the <u>current</u> impacts of global warming around the world?	2.64	0.89
How likely do you think it is that each of the following will occur during the next 50 years <u>due to global warming</u> ?		
Worldwide water shortages will occur.	2.77	1.05
Increased rates of serious disease worldwide.	2.65	1.01
Worldwide, many people's standard of living will decrease.	2.59	1.01
Water shortages will occur where I live.	2.42	1.06
My chance of getting a serious disease will increase.	2.34	1.02
My standard of living will decrease.	2.27	1.05

*n* = 590. Scales range from 1 (not at all) to 4 (very), with a midpoint of 2.5.

Americans as a whole perceived global climate change as a moderate risk. On a scale of 1 (none) to 4 (very), with a midpoint of 2.5, Americans were generally concerned about global warming ( $M = 2.89$ ,  $SD = 0.89$ ), believed that impacts on worldwide standards of living, water shortages and rates of serious disease are likely ( $M$ 's = 2.59 to 2.77,  $SD$ 's = 1.01 to 1.06) and that the impacts will be especially pronounced for non-human nature ( $M = 3.06$ ,  $SD = 0.93$ ). In percentage terms (not reported in the table above), 76% of Americans said that global warming is a somewhat serious (37%) or very serious (39%) threat to non-human nature.

Importantly, however, they were less likely to be concerned about the impacts of global warming on local standards of living, water shortages and rates of serious disease

( $M$ 's = 2.27 to 2.42,  $SD$ 's 1.02 to 1.06). In percentage terms, 57% of Americans said that their standard of living was somewhat unlikely (26%) or very unlikely (31%) to decrease during the next 50 years due to global warming. Similarly, 53% said that their chance of getting a serious disease was somewhat unlikely (26%) or very unlikely (27%). Thus, the public viewed global warming as a risk, but one primarily expected to impact people and places in other parts of the world. This was supported by the results of a separate question that asked respondents to indicate which geographic scale of climate change impacts was of greatest concern to them. 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) non-human nature; or, 6) not at all concerned."

TABLE 15. Scale of Concern

	<i>Percent</i>	<i>Cum. Percent</i>
You and your family	12	12
Your local community	1	13
The U.S. as a whole	9	22
People all over the world	50	72
Non-human nature	18	90
Not at all concerned	10	100
Total	100	

$n = 551$

A clear majority of respondents (68%) were most concerned about the impacts on people around the world and non-human nature (Table 15). Only 13% were most concerned about the impacts on themselves, their family or their local community. These

results may help explain why global climate change remains a relatively low priority in issue ranking surveys (e.g., Dunlap and Saad 2001). Higher-ranking national issues (e.g., the economy, education, health care, etc.) and environmental issues (clean air, clean water, urban sprawl) are all concerns that are more easily understood as having direct local relevance. “Global” climate change, however, is not yet perceived as a significant local threat. Former Speaker of the U.S. House of Representatives Tip O’Neill once famously argued that “all politics are local.” To the extent that this is true, climate change is unlikely to become a high-priority national issue until Americans consider themselves or their communities personally at risk.

By contrast, climate change activists demonstrated very strong risk perceptions of global warming, with near unanimity on questions of holistic concern, the seriousness of global warming today and in the future, impacts on non-human nature, and global impacts (Table 16). For example, 100% of activists were very concerned (99%) to somewhat concerned (1%) about global warming. Likewise, 100% of activists were very concerned (95%) to somewhat concerned (5%) about the future impacts of global warming on non-human nature. Activists also perceived the local impacts of climate change (my standard of living, food shortages where I live, my chances of serious disease) as a much higher risk than the American public as a whole. For example, 80% of activists said it was somewhat likely (40%) to very likely (40%) that their standard of living would decrease over the next 50 years due to global warming.

TABLE 16. Activist Risk Perceptions

	<i>Mean</i>	<i>Std Dev</i>
How concerned are you about global warming?	3.99	0.10
Generally, how much of a risk is global warming to the world?	3.93	0.36
How serious of a threat is global warming <u>today</u> ?	3.70	0.50
How serious of a threat will global warming be <u>in the future</u> ?	4.00	0.00
How harmful is global warming to the natural environment <u>currently</u> ?	3.61	0.55
How harmful will global warming be to the natural environment <u>30 years from now</u> ?	3.94	0.28
Suppose annual average temperature increases by 3 degrees Fahrenheit (1.7 Celsius) over the next 30 years. Do you think it is very likely, somewhat likely, somewhat unlikely or very unlikely that each of the following will occur?		
Globally, many people's standard of living will decrease.	3.69	0.66
Global food shortages and starvation will occur.	3.69	0.62
Global rates of serious disease will increase.	3.88	0.41
My standard of living will decrease.	3.11	0.90
Food shortages and starvation will occur where I live.	2.59	1.08
My chances of suffering from a serious disease will increase.	3.22	0.86

*n* = 98. Scales range from 1 (none) to 4 (very).

Interestingly, however, the mean scores for local impacts were lower than activist evaluations of the risk to global standards of living, food shortages and disease. The majority of the activists were American students, and these results suggest that even these activists believed the threat of climate change is greater globally than locally. This is particularly evident in the mean score ( $M = 2.59$ ,  $SD = 1.08$ ) of the likelihood of “food shortages and starvation where I live.” American student climate activists, like the American public, perceived climate change as a threat that will have greater impacts on other people and natural ecosystems around the world. Nonetheless, these activists also demonstrated very high levels of individual action, as discussed in further detail below. So, at least for this group of individuals, the risk perception of possible local impacts does not appear to be the primary motivator for active engagement with this environmental issue.

In summary, the American public did perceive global warming as a real threat, albeit a moderate one, posing greater danger to people and places far away. Importantly, the potential impacts on nature were perceived as the most serious threat. By comparison, student climate activists perceived global warming as a very serious threat across the board. Yet activists also perceived global warming as posing greater risks globally than locally and especially to non-human nature.

#### Global Warming Policy Preferences

Does the American public support public policies to mitigate climate change? To answer this question, the national survey questionnaire included a series of questions to measure public preferences regarding a variety of climate change policy proposals using a scale of 1 (strongly oppose) to 4 (strongly support), with a midpoint of 2.5 (Table 17). There was strong public support for a number of policies at the national and international levels, ranging from the shifting of government subsidies from the fossil fuel industry to the renewable energy industry ( $M = 3.02$ ,  $SD = 0.85$ ) to U.S. action to reduce its emissions of greenhouse gases regardless of what other countries do ( $M = 3.66$ ,  $SD = .75$ ).

TABLE 17. National Policy Preferences

	<i>Mean</i>	<i>Std Dev</i>
Should US reduce GHG emissions?	3.41	0.73
Support Kyoto Protocol?	3.33	0.84
US act alone or only if other countries act?	3.66	0.75
Support regulation of CO2 as pollutant?	3.03	0.90
Support increase in fuel economy standards?	3.13	0.91
Support subsidy shift to renewable energy?	3.02	0.85
Support 60 cent gas tax?	1.72	0.95
Support tax on "gas guzzlers"?	2.45	1.12
Support business energy tax?	2.01	0.99
Support international emissions trading market?	2.97	1.67

*n* ranges from 595 to 626. (1 = Strongly oppose; 4 = Strongly support)

In contrast, however, the public opposed three proposed tax policies, ranging from a tax on “gas guzzlers” ( $M = 2.45$ ,  $SD = 1.45$ ) to a 60-cent per gallon gasoline tax ( $M = 1.72$ ,  $SD = 0.95$ ). Overall, Americans were strong supporters of government action to mitigate climate change, but appeared unwilling to personally sacrifice through higher taxes to achieve this goal. These summary statistics, however, gloss over important variations within the results.

### National Policies<sup>2</sup>

Respondents were first asked, “Do you think the United States should reduce its emissions of the greenhouse gases (carbon dioxide, methane, etc.) that are said to cause global warming?” Over 90% of Americans supported the overarching goal of reducing U.S. emissions of greenhouse gases (Table 18).

<sup>2</sup> All policy results derive from the subset of Americans who had heard of global warming (92%).



TABLE 18. U.S. Reduce Emissions

	<i>Total</i>	Political ID			Political Ideology		
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>
	%	%	%	%	%	%	%
Yes (total)	90	94	91	87	96	91	84
Definitely yes	58	71	62	44	75	59	42
Probably yes	32	23	29	43	21	33	43
No (total)	7	4	6	12	3	6	14
Probably no	6	3	5	9	2	6	10
Definitely no	2	1	1	3	1	1	5

N = 554

N = 561

Further, overwhelming majorities of Democrats, Independents and Republicans, and Liberals, Moderates and Conservatives supported this goal. Thus, Americans were nearly unanimous in their support for action to mitigate global climate change – far more so than their elected representatives in Washington, D.C. The means to achieve this overarching goal, however, continue to be the subject of heated debate among policy elites.

For example, one of the more controversial measures in recent years has been the effort to regulate carbon dioxide (the primary greenhouse gas) as a pollutant. As a candidate for President, George W. Bush pledged to regulate carbon dioxide and three other air pollutants (sulfur, nitrous oxide and mercury) produced by fossil-fuel burning power plants. After the election, President Bush reversed course and decided not to include regulation of carbon dioxide in his proposed “Clear Skies” legislation, citing concerns about rising electricity prices and after intense lobbying from the electrical utility and fossil-fuel industries. This reversal left several moderate Republican Senators

feeling betrayed only days before they were to introduce the legislation. One, Senator Jim Jeffords of Vermont, cited this reversal on carbon dioxide and other environmental issues as one of several reasons why he subsequently decided to become an Independent, throwing control of the U.S. Senate temporarily into the hand of the Democrats.

In the survey reported here, respondents were asked, “Carbon dioxide is the primary greenhouse gas said to be causing global warming and is produced by electric power plants and motor vehicles (e.g., cars, trucks and sport utility vehicles). Currently, carbon dioxide is not regulated as a pollutant. How much do you support or oppose the regulation of carbon dioxide as a pollutant?” A strong majority (77%) supported government regulation of carbon dioxide as a pollutant (Table 19).

TABLE 19. Regulate Carbon Dioxide

	<i>Total</i>	Political ID			Political Ideology		
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>
		%	%	%	%	%	%
Support (total)	77	84	81	69	86	84	62
Strongly support	34	43	43	20	48	36	18
Somewhat support	43	41	38	49	38	48	44
Oppose (total)	20	13	16	30	12	14	36
Somewhat oppose	14	10	12	19	10	11	23
Strongly oppose	6	3	5	10	2	4	13

N = 552

N = 557

Democrats and liberals were stronger supporters of this measure than Republicans and conservatives, while Independents favored this proposal at levels very similar to Democrats. Nonetheless, a large majority of Republicans (69%) and conservatives (62%) also supported this policy, despite its emphasis on a regulatory approach. These results

demonstrate that there was strong, bipartisan support among the American public for the regulation of carbon dioxide as a pollutant.

Another policy question focused on a proposal to shift subsidies from the fossil-fuel industry to the renewable-energy industry. The IPCC estimates that stabilization of the Earth's climate will require a reduction of global greenhouse gases emissions 60-80% below 1990 levels (IPCC 2001). Since the burning of fossil fuels (coal, oil and natural gas) is the primary source of carbon dioxide emissions (the dominant greenhouse gas), many scientists and advocacy groups have urged national governments and industries to invest in the development of renewable energy sources like wind, solar, geothermal, biomass, etc. Many argue that there must be a massive effort to shift the energy foundations of modern civilization from fossil fuels to non-polluting sources. For example, in a study recently published in *Nature*, Martin Hoffert et al. concluded that stabilizing atmospheric carbon dioxide at current levels will require the production of 10 terrawatts of non-fossil-fuel energy (roughly equivalent to two-thirds of current global energy production) by 2018. If the production of that much energy is delayed until 2035, atmospheric carbon dioxide will double from today's level (approximately 372 ppm), with potentially serious consequences. Hoffert and his colleagues argued:

*...market inefficiencies may preclude timely development of such technologies at the required scale...This past century, accelerated technology development from wartime and postwar research produced commercial aviation, radar, computer chips, lasers and the Internet. Researching, developing and commercializing carbon-free primary power technologies capable of 10-30 TW by the mid-twenty-first century could*

*require efforts, perhaps international, pursued with the urgency of the Manhattan Project or the Apollo space program (Hoffert et al. 1998).*

This effort would involve not only the development of new or improved technologies, but also the establishment of a system of powerful financial incentives for the development of renewable sources, while providing disincentives for continued fossil fuel use (e.g., carbon taxes, regulation, etc.). One of the most important levers of government policy is direct subsidies to industry, to encourage or reward behaviors deemed in the public interest. As Norman Myers and Jennifer Kent argued in their book *Perverse Subsidies*:

*Were the U.S. Congress to fund renewable energy with the same amount in tax credits, financial incentives, and other subsidies that it provides for coal and oil, renewables would readily become competitive with fossil fuels. In fact, a near-complete transition to a renewable-energy economy could be readily achieved for about \$25 billion a year over the next 10 years – a sum to be compared with the \$21 billion worth of subsidies now supplied annually by the government for fossil fuels and nuclear energy (Myers and Kent 2001).*

The national survey reported here asked, “The United States government provides approximately \$5 billion a year<sup>3</sup> in subsidies to the fossil-fuel industry (coal, oil, natural gas). Some people have proposed transferring these subsidies to the renewable-energy industry (wind, solar, biomass, etc.) to develop cleaner forms of energy. This would make fossil fuels more expensive and renewable energy less expensive. How much do you support or oppose this proposal?” This question was phrased to make some of the

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<sup>3</sup> Estimate from Tax Payers for Common Sense (2002) [www.taxpayer.net/TCS/fuelsubfact.htm](http://www.taxpayer.net/TCS/fuelsubfact.htm)

tradeoffs explicit. Respondents were told that support for this policy would mean that coal, oil and natural gas would become more expensive. Other policy questions (see below) also included tangible cost estimates to encourage respondents to consider policy costs as well as benefits. A strong majority of respondents (71%) supported this policy, while only 17% opposed it (Table 20)<sup>4</sup>.

TABLE 20. Subsidize Renewable Energy

	<i>Total</i>	Political ID			Political Ideology			Region			
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>	<i>NE</i>	<i>S</i>	<i>MW</i>	<i>W</i>
	%	%	%	%	%	%	%	%	%	%	%
Support (total)	71	82	76	58	82	79	52	72	67	75	73
Strongly support	29	45	31	12	49	27	14	33	29	27	31
Somewhat support	42	37	45	46	33	52	39	39	38	49	42
Oppose (total)	17	12	12	26	12	11	29	11	21	12	22
Somewhat oppose	11	9	7	16	11	7	16	3	15	7	18
Strongly oppose	6	2	5	10	1	4	13	8	6	5	4
Don't know	9	4	9	13	3	8	15	13	8	9	5
		N = 555			N = 561			N = 575			

Democrats and liberals were more likely to support the shift in subsidies than Republicans and conservatives, while Independents and moderates favored this proposal at levels very similar to Democrats and liberals. Nonetheless, clear majorities of Republicans (58%) and conservatives (52%) also supported this proposal. Support was strong across all four geographic regions, however, the South was significantly less likely to support this policy than the Northeast, Midwest or West. This may reflect a greater concentration of Republicans and conservatives in the South. Nonetheless, these results

<sup>4</sup> Regions are based on the 2000 U.S. Census definitions: Northeast = ME, NH, VT, MA, RI, CT, NY, NJ and PA. South = DE, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, AL, MS, AR, LA, OK, and TX. Midwest = OH, IN, IL, MI, WI, MN, IA, MO, ND, SD, NE, and KS. West = MT, ID, WY, CO, NM, AZ, UT, NV, WA, OR, CA, AK, and HI.

indicate that there was strong, bipartisan support among the American public for the shifting of government subsidies from the fossil-fuel industry to the renewable-energy industry.

### International Policies

One of the most contentious climate change issues in the United States is the Kyoto Protocol. In 1992, then President George H.W. Bush signed the United Nations Framework Convention on Climate Change at the World Environment Conference in Rio de Janeiro, which was subsequently ratified by the U.S. Senate. The European Union and the Alliance of Oceanic and Small Island States (AOSIS) had pressed for a global commitment to mandatory, legally-binding cuts in greenhouse gas emissions. The Bush administration, citing doubts about the reality and urgency of climate change and concern about the potential economic impacts of emissions reductions, successfully lobbied for a treaty which called for only voluntary commitments to reduce greenhouse gas emissions to 1990 levels by the year 2000. By 1995, however, it was clear that no industrialized country, including the United States, was going to meet its voluntary reduction target; in fact, most countries' emissions were continuing to increase.

Recognizing this, and in response to the 1995 IPCC scientific report, which said there was indeed "a discernable human influence on the global climate," world leaders met in Kyoto, Japan in 1997 to negotiate a Protocol or amendment to the original

Framework Convention that would require mandatory, legally-binding emissions reductions. Just prior to the Kyoto conference, however, the U.S. Senate passed a non-binding resolution (95-0) co-sponsored by Robert Byrd (D) of West Virginia and Chuck Hagel (R) of Nebraska, which urged the Clinton administration to not accept any treaty that did not include the “meaningful” participation of all developing as well as industrialized countries, arguing that to do so would unfairly put the U.S. at a competitive disadvantage.

The Byrd-Hagel resolution, however, contradicted the “common but differential responsibilities and respective capabilities” principle of the original Framework Convention (UNFCCC Article 3), signed in 1992 by President Bush. The Convention stipulates that although all countries of the world share responsibility for reducing emissions, the industrialized nations bear a special responsibility because they are the world’s largest emitters of greenhouse gases, both historically and currently. The industrialized nations are also expected to lead the emissions reduction process because they have much greater technical, scientific and financial resources to solve the problem.

In line with this principle, the Clinton administration (represented by Vice-President Gore) and other world governments negotiated and agreed to the Kyoto Protocol, in which the industrialized countries pledged to collectively reduce global emissions 5.2% below 1990 levels by 2008-2012. As its share of the overall commitment, the U.S. pledged to reduce its emissions 7% below 1990 levels.

The Clinton administration, however, decided not to immediately submit the treaty to the Senate for ratification, in the hope that with time, majority support could be obtained. Meanwhile, the world continued to negotiate the rules of the Protocol (e.g., what activities would count as “reductions” and what penalties would be imposed for failure to meet a national target), which remained unsettled. In November of 2000, as the disputed American presidential election unfolded in Florida between rivals George W. Bush and Al Gore, the world failed to reach agreement on the rules for the Kyoto Protocol at The Hague World Climate Conference (COP6) and the Kyoto Protocol hung in limbo, awaiting the still unknown new American administration. Soon after taking office, President Bush unilaterally withdrew the United States from the negotiation process, effectively declaring the Protocol dead. The move sparked intense criticism from the world community, which rallied to forge a completed Kyoto Protocol in Bonn, Germany in the summer of 2001, without the participation of the world’s largest emitter, the United States. As of this writing, the Protocol awaits ratification only by Russia before going into force as international law.

This survey included two measurements of the American public’s opinion about these controversial international treaties. The first question asked, “In 1997, the United States and other developed countries made an agreement called the Kyoto Protocol to collectively reduce their emissions of greenhouse gases. The United States agreed to reduce its emissions by 7% by the year 2010. How much do you favor or oppose this



agreement?” A strong majority of Americans (88%) said they favor this agreement, while only 10% opposed it (Table 21).

TABLE 21. Kyoto Protocol

	<i>Total</i>	Political ID			Political Ideology			Region			
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>	<i>NE</i>	<i>S</i>	<i>MW</i>	<i>W</i>
	%	%	%	%	%	%	%	%	%	%	%
Favor (total)	88	94	88	83	97	92	76	96	83	90	86
Strongly favor	53	62	57	43	71	56	37	62	52	61	33
Somewhat favor	35	32	30	40	26	37	39	34	30	29	53
Oppose (total)	10	4	10	15	2	6	21	4	15	7	11
Somewhat oppose	5	3	6	7	2	4	10	1	9	3	5
Strongly oppose	5	1	4	9	0	1	12	3	6	4	5
		N = 554			N = 561			N = 576			

This support has grown 9% since a similar question was asked in a 1998 Mellman Group poll (PIPA 2003). Again, although Republican (83%) and conservative support (76%) was lower than Democrat (94%) or liberal support (97%), clear majorities nonetheless favored the agreement. Among the geographic regions, the Northeast had the strongest support (96%), while the South had the lowest (83%). These results indicate that there was strong, bipartisan support among the American public for the Kyoto Protocol, despite the position of the Bush administration.

The second question measured whether the American public agreed with the tenets of the 1997 Byrd-Hagel Senate Resolution. The question asked, “The United States currently emits about 20% of the world’s total greenhouse gases. People disagree whether the U.S. should reduce greenhouse gases on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own

point of view? The United States should reduce its emissions...i) regardless of what other countries do; ii) only if all other industrialized countries reduce their emissions; iii) only if all other industrialized and all less-developed countries reduce their emissions; iv) the United States should not reduce its emissions; v) don't know.” Contrary to the 1997 Byrd-Hagel Senate Resolution, 76% of the American public in 2003 stated that the United States should reduce its emissions regardless of what other countries do, by far the dominant answer (Table 22).

TABLE 22. U.S. Act Regardless

	<i>Total</i>	Political ID			Political Ideology		
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>
		%	%	%	%	%	%
Regardless of other countries	76	83	84	65	93	80	55
Only if all industrialized	7	5	3	11	1	6	12
Only if all other countries	8	4	4	13	1	5	17
US should not reduce	2	1	1	4	1	1	5
Don't know	5	4	5	5	2	5	9

N = 554

N = 560

This support has grown 10% since a similar question was asked in a 1998 Mellman Group poll (PIPA 2003). The strongest support for the Byrd-Hagel argument came from Republicans (13%) and conservatives (17%), yet clear majorities of both groups nonetheless agreed that the U.S. should reduce its emissions regardless of what other countries do (65% and 55% respectively). Taken together, the American public strongly supported international treaties and American action to reduce greenhouse gas emissions.

Americans do not, however, support all international policies. Another controversial approach to reduce greenhouse gas emissions is the establishment of an international market in tradable carbon emissions. This approach is based on a successful regional experiment in the Northeastern United States to reduce sulfur emissions, was strongly promoted by the Clinton administration in the climate negotiations, and was ultimately adopted into the Kyoto Protocol at the Bonn climate summit. Its advocates claim that harnessing market forces and economic efficiencies will enable countries to achieve greenhouse gas emission reductions at lower cost. Its detractors argue that the system will give countries the right to pollute, will be weakly enforced, and will turn global warming pollution into a speculative commodity. More recently, Senators John McCain (R) of Arizona and Joe Lieberman (D) of Connecticut have promised to introduce legislation in the U.S. Senate in the fall of 2003 to establish a national, market-based emissions trading system within the United States.

To gauge public support for international carbon trading schemes, the national survey reported here asked, “One controversial proposal to solve global warming is to create an international market in greenhouse gases. In this system, all countries agree to a global cap on emissions. Each country then gets the right to emit a portion of this global amount. If a country emits more than its portion, it must buy more emission rights from other countries or else pay stiff fines. In principle, how much do you support or oppose an international market that allows countries to buy and sell greenhouse gases?”

The results demonstrate that the American public was evenly split, with 40% supporting and 40% opposing an international market-based emissions trading system (Table 23).

TABLE 23. International Emissions Market

	<i>Total</i>	Political ID			Political Ideology		
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>
	%	%	%	%	%	%	
Support (total)	40	49	33	39	51	41	30
Strongly support	13	12	16	11	15	15	9
Somewhat support	27	37	17	27	36	26	21
Oppose (total)	40	34	44	41	38	37	47
Somewhat oppose	16	20	20	11	22	17	12
Strongly oppose	23	14	25	30	16	21	35
Don't know	18	15	21	19	10	20	23

N = 552

N = 559

A plurality of Democrats (49%) and a majority of liberals (51%) supported this proposal, while Republicans were nearly evenly split (39% supported, 41% opposed). Conservatives were strongly opposed (47%). Market-based emissions trading may raise contradictory feelings in Republicans and conservatives. On the one hand, they are more likely to prefer a market-based, rather than regulatory approach to reducing greenhouse gas emissions. On the other hand, they are also more likely to doubt the reality or urgency of global warming, and thus may tend to reject any policy to solve a perceived non-existent or inconsequential problem. Finally, these mixed results, along with the high levels of “don’t know” responses, show that the American public is still undecided about the market-based approach.

## Tax Policies

Tax policy is another fundamental tool governments use to provide incentives and disincentives to promote desired business and consumer behavior. One proposed approach is to use tax policy to encourage consumers to purchase more fuel-efficient vehicles. For example, the federal government currently implements a graduated “gas guzzler” tax on all passenger cars that get less than 22.5 miles to the gallon (fuelconomy.gov). This tax, however, only applies to passenger cars. Over the past 30 years, sport utility vehicles (SUV’s) have become one of the most popular consumer vehicles in America. Due to a loophole in the 1975 legislation, which established the Corporate Average Fuel Economy (CAFE) standards, SUV’s are classified as “light trucks” and are thereby exempt. The average SUV gets only 20 miles per gallon (EPA 2000) and are an important reason why carbon dioxide emissions from the American transportation sector continue to increase.

This survey measured Americans’ willingness to increase the cost of such fuel-inefficient vehicles. The question asked, “In order to encourage people to use more fuel-efficient vehicles, some people have proposed a 5 percent “gas guzzler” tax on cars, trucks and sport utility vehicles that get less than 25 miles per gallon. This would add approximately \$1,000 to the price of a \$20,000 car. How much do you support or oppose this proposal?” The phrasing included a tangible monetary cost to consumers: a substantial increase in the price of these popular vehicles. A strong majority of

Americans (54%) supported a 5% tax increase on “gas guzzlers,” while 40% opposed it (Table 24). These results were very similar to the findings of a 1997 national survey which found that 56% of Americans supported this policy while 44% opposed it (O’Connor et al. 1998).

TABLE 24. Gas Guzzler Tax

	<i>Total</i>	Political ID			Political Ideology			Region			
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>	<i>NE</i>	<i>S</i>	<i>MW</i>	<i>W</i>
	%	%	%	%	%	%	%	%	%	%	%
Support (total)	54	67	56	38	67	60	33	65	50	52	49
Strongly support	23	34	17	15	40	19	15	28	22	18	30
Somewhat support	30	33	39	23	27	42	18	38	28	34	20
Oppose (total)	40	28	36	56	29	33	59	27	42	41	46
Somewhat oppose	14	13	12	17	14	14	16	5	15	19	14
Strongly oppose	26	15	25	39	15	19	43	22	27	23	32
Don't know	3	3	4	3	1	4	5	5	4	4	1
		<i>N</i> = 553			<i>N</i> = 559			<i>N</i> = 576			

Breaking these results down by political party and ideology, however, revealed an interesting pattern. Strong majorities of Democrats (67%) and Independents (56%) supported this policy, but Republicans strongly opposed it (56%). Likewise, liberals (67%) and moderates (60%) strongly supported this tax, while conservatives strongly opposed it (59%). Assuming that Republicans and conservatives were not significantly more likely to own gas-guzzling vehicles, these results may indicate strong ideological reaction and resistance to the word “tax” – a word with negative connotations in American society generally and very strong negative affect among political conservatives, (although the affective imagery associated with this word has never been studied). Another interesting result was the significantly higher support for this policy

among Americans living in the Northeast (65%). Again, it is difficult to determine from these data whether this reflects lower ownership of gas guzzlers in this region of the country or a higher concentration of liberals who are more likely to support taxes in general. Overall, Americans did support this tax proposal, but were sharply split along partisan lines.

Another policy approach is to tax the energy used by business and industry. As the cost of energy increases, companies have a greater incentive to invest in more energy-efficient manufacturing and distribution systems. Unlike the “gas guzzler” tax, this tax does not affect the consumer directly, but does increase overall consumer spending as companies pass on some of the higher production costs to consumers. This survey measured American public opinion on this tax policy by asking, “To encourage industry to be more fuel efficient, some people have proposed a business energy tax. This tax would raise the average price of most things you buy, including food and clothing, by 3 percent, or approximately \$380 per person per year. How much do you support or oppose this proposal?” This question also included a tangible cost to consumers. A strong majority of Americans (60%) opposed this business energy tax, while only 31% supported it (Table 25).

TABLE 25. Business Energy Tax

	<i>Total</i>	Political ID			Political Ideology			Region			
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>	<i>NE</i>	<i>S</i>	<i>MW</i>	<i>W</i>
	%	%	%	%	%	%	%	%	%	4	%
Support (total)	31	35	36	25	37	35	23	42	22	25	38
Strongly support	7	11	7	2	13	6	2	9	5	4	11
Somewhat support	25	25	29	23	24	30	21	33	18	25	27
Oppose (total)	60	57	54	67	53	58	68	47	69	61	55
Somewhat oppose	23	29	18	20	30	24	16	16	29	21	22
Strongly oppose	37	28	35	46	24	34	52	31	40	40	33
Don't know	6	5	6	5	7	4	6	7	5	7	4
		<i>N</i> = 551			<i>N</i> = 562			<i>N</i> = 574			

This opposition was consistent across both political identification and ideology, although Republicans and conservatives were significantly more likely to strongly oppose this policy. Respondents in the Northeast were also against a business energy tax, but were more evenly split with 42% supporting and 47% opposing it. Of the 42% support, however, the great majority (33%) only somewhat supported this tax. Clearly, there was strong, bipartisan opposition to the idea of an increased business energy tax when an estimated financial cost to consumers is included.

A final policy approach is to directly tax fossil fuels themselves. For most Americans, the fossil fuel they most often directly purchase is gasoline at the pump. Advocates argue that a significant, direct tax on gasoline will dramatically increase the price and thereby decrease overall consumption, increase consumer demand for more fuel-efficient vehicles, and encourage more development and use of public transportation. This survey measured American opinion on this policy proposal by asking, “How much do you support or oppose a 60-cent per gallon gasoline tax, over and above existing gas



taxes, to encourage people to drive less and thus reduce carbon dioxide emissions?” A very strong majority of Americans (78%) opposed a 60-cent gasoline tax intended to reduce carbon dioxide emissions (Table 26). Further, a majority (53%) strongly opposed this policy.

TABLE 26. Gasoline Tax

	<i>Total</i>	Political ID			Political Ideology		
		<i>Dem</i>	<i>Ind</i>	<i>Rep</i>	<i>Lib</i>	<i>Mod</i>	<i>Con</i>
		%	%	%	%	%	%
Support (total)	17	24	16	10	29	14	10
Strongly support	8	13	7	4	16	5	5
Somewhat support	9	12	9	7	13	10	5
Oppose (total)	78	72	76	85	69	80	85
Somewhat oppose	25	30	25	21	29	32	13
Strongly oppose	53	43	51	64	40	48	72
Don't know	2	2	5	1	1	3	2

N = 555

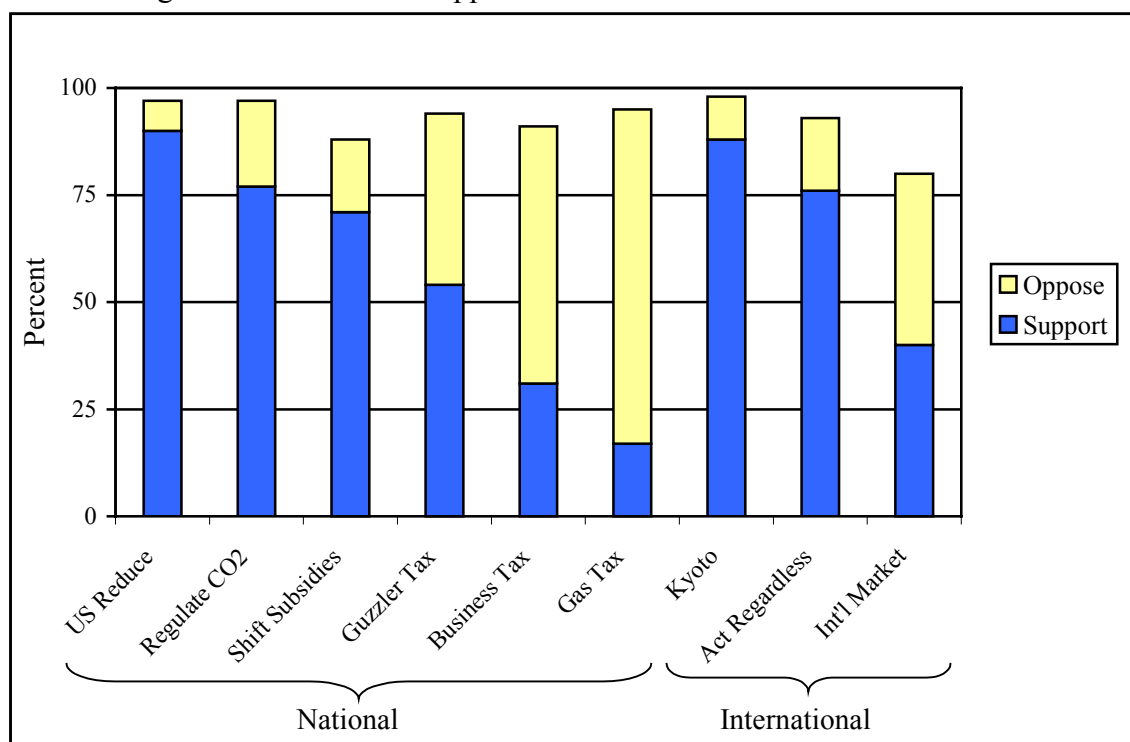
N = 559

Opposition was consistent across political identification and ideology, although Republicans and conservatives were even stronger in their levels of opposition. Clearly, there was very strong, bipartisan opposition to a substantial increase in gasoline taxes, even when respondents were told it would help reduce carbon dioxide emissions.

This research thus identifies a basic contradiction in American opinions on global warming (Figure 4). On the one hand, Americans expressed high levels of concern about the issue, strongly believed that the U.S. should reduce its greenhouse gas emissions, strongly supported national regulation of carbon dioxide as a pollutant, and strongly supported international treaties to reduce emissions, like the Kyoto Protocol. On the

other hand, the public strongly opposed an increase in business energy and gasoline taxes – both direct pocketbook issues. A majority of Americans did support a tax on “gas guzzler” vehicles, but they were evenly split regarding an international market in emissions trading. Thus, the public largely supported policy action at the national and international levels, but opposed any tax policies that would directly affect them.

Figure 4. Americans’ Support for National and International Policies



### Global Warming Behaviors

What kinds of individual actions have Americans already taken to mitigate global climate change and how common are these behaviors?

Stabilization of the Earth's climate will require more than large-scale government programs. Greenhouse gases emissions like carbon dioxide are a byproduct of countless individual decisions made by Americans every day. Almost everything we do in modern American society involves the burning of fossil fuels, whether directly by driving our cars, heating our homes, turning on a light, or indirectly through the products we buy and use. Both the American and activist surveys measured a set of individual behaviors that reduce greenhouse gas emissions (see Table 27). Also included was a bogus behavior "chosen not to buy an aerosol spray can" as a further test of respondent confusion with the issue of ozone depletion. Respondents were asked, "Have you done any of the following things because you are concerned about global warming? (*If you have done any of these things for another reason, check the "No" box.*)"

TABLE 27. Individual Actions: American Public vs. Activists

	<i>% Americans</i> ( <i>n</i> = 595)	<i>% Activists</i> ( <i>n</i> = 102)	<i>% Difference</i>
Used energy-efficiency as a selection criterion when buying a light bulb, a household appliance, or a motor vehicle.	51	74	23
Installed insulation or weatherized your home or apartment.	45	24	-21
Purchased energy from an alternative source, such as wind or solar power.	4	22	18
Used alternative forms of transportation instead of driving.	26	96	70
Chosen not to buy an aerosol spray can.	46	55	9
Planted a tree.	49	48	-1
Joined, donated money to, or volunteered with an organization working on issues related to global warming.	15	96	81
Made your views on global warming clear to politicians.	9	97	88
Talked to family, friends, or colleagues about how to reduce or prevent global warming.	27	98	71

(1 = Yes, 0 = No)

Overall, the national survey found that approximately half of Americans said they had used energy-efficiency in past consumer choices (51%) or installed insulation or weatherized their home (45%). In addition, 46% said they had chosen not to buy an aerosol spray can, which provides further evidence that many Americans continue to confuse or conflate global warming with stratospheric ozone depletion. The second highest response was planting a tree (49%), an action that has become perhaps the quintessential, symbolic “environmental act.”

Only a quarter (26%) of the American public had used alternative forms of transportation, such as rail, car-pools, walking, bicycling, etc. instead of driving. Only 4% of Americans reported purchasing alternative energy, which in part reflects limited access to renewable energy sources. Very few Americans reported political behaviors on

global warming. Only 15% said they had joined, donated money to, or volunteered with an organization working on global warming issues and only 9% said they had contacted politicians to communicate their concerns about global warming. Finally, only a quarter (27%) of Americans reported talking to family members, friends or colleagues about how to reduce or prevent global warming. A separate question asked, “How often do you discuss global warming with your family and friends?” On a 6-point Likert scale ranging from 1 (rarely discuss) to 6 (often discuss), over 43% of Americans chose the extreme value “rarely discuss.” An additional 25% chose the second-most extreme value (2), thus nearly 70% of Americans said they rarely discuss global warming within their immediate social networks. These two results are critical indicators of the depth of American risk perceptions and concerns about this issue. Until global warming becomes a “household word” or a topic commonly discussed around the water cooler, it will remain a low-priority issue for most Americans.

By contrast, student climate change activists were much more likely to have taken political action on global warming: most had joined organizations (96%), communicated to politicians (97%), and discussed the issue with friends and family (98%). They were also much more likely to have used alternative forms of transportation (96%) and used energy efficiency as a criterion when making consumer choices (74%). A higher percentage (22%) of activists reported the purchase of renewable energy, indicating that for those who were motivated, renewable energy is a growing option. Only 24% of activists reported the installation of insulation or weatherization of their home or

apartment, but this undoubtedly reflects much lower levels of home ownership among student activists than the American public at large. Surprisingly, 55% of student activists reported that they had chosen not to buy an aerosol spray can because of their concern about global warming. This indicates that the confusion of global warming with ozone depletion is found even among students highly motivated and committed to action on this issue, suggesting a failure by the higher education system to properly distinguish between and explain the two environmental issues.

Overall, however, these results show what one would expect – that climate activists are much more likely to engage in political action and other individual behaviors to mitigate global warming than the American public as a whole. They also demonstrate that although sizeable proportions of the American public reported a few energy efficient behaviors (45 to 51%), the great majority has not engaged the issue either socially or politically.

### Affective Images of Global Warming

What affective images do Americans have of global warming? Which of these images are the most salient and can they be used to identify distinct “interpretive communities” within the American public? To address these questions, holistic measures of affective response to global warming itself were gathered using separate, unipolar measures of positive and negative affect, for both the national and activist samples. Second, cognitive images were obtained using the technique of discrete association described above in Chapter 3. Third, respondents were subsequently asked to affectively evaluate each cognitive image they had provided using a bipolar measure of positive and negative affect.

#### Holistic Affective Evaluations

Neither the American public nor activists exhibited much positive affect regarding global warming (Table 28). As might be expected, activists were less likely to have holistic positive affect (only 13%) and were more likely to exhibit holistic negative affect (100%) than the American public.

TABLE 28. Holistic Affect: American Public vs. Activists

	<i>American</i>	<i>Activist</i>
Do you have any positive feelings about global warming?		
Yes	28%	13%
No	72%	87%
	<i>N</i>	596
Do you have any negative feelings about global warming?		
Yes	76%	100%
No	24%	0%
	<i>N</i>	579

Further, the positive affect intensity reported by the 14 activists who said they did have positive feelings about global warming is heavily skewed to the low end (slightly positive) of the Likert scale (Table 29).

TABLE 29. Positive Affect Intensity: American Public vs. Activists

	<i>American</i>	<i>Activist</i>
How strong are your positive feelings?		
+1 Slightly positive	32%	50%
+2	21%	14%
+3	26%	21%
+4	10%	7%
+5 Very positive	11%	7%
	Total	100%
	Mean	+2.47
	<i>N</i>	169

By contrast, both the American public ( $M = -3.31$ ,  $SD = 1.20$ ) and climate activists ( $M = -4.68$ ,  $SD = 0.66$ ) had relatively strong negative affect regarding global warming (Table 30). This time the activists were heavily skewed to the extreme values (very negative). Thus, the holistic affect measures demonstrate that both the American



public and climate activists predominantly had negative affective responses to global warming, while activists exhibited much stronger negative affect than the public at large.

TABLE 30. Negative Affect Intensity: American Public vs. Activists

	<i>American</i>	<i>Activist</i>
How strong are your negative feelings?		
-1 Slightly negative	7%	1%
-2	19%	1%
-3	31%	2%
-4	22%	21%
-5 Very negative	21%	75%
Total	100%	100%
Mean	-3.31	-4.68
<i>N</i>	442	103

### Imagery

All three surveys (national, Oregon, and activist) implemented a discrete word association task. The results of each are described below, followed by a comparative analysis. The national survey found that American associations to “global warming” fell into 24 categories (Table 31). The number of different categories indicates that “global warming” was a richly meaningful term, evoking many different connotations. Overall, the mean image affect for all first associations to “global warming” was  $-2.40$  ( $SD = 2.49$ ); further demonstrating that global warming has primarily negative connotations for most Americans.

TABLE 31. Global Warming Image Categories, National 2003

Survey Question: When you hear the words "global warming,"  
what is the first thought or image that comes to mind?

Image Categories	# of Images	(% of Persons) (n = 558)	Cum. %	(% of Images) (n = 722)	Cum. %	Affect Mean	S.D.
IceMelt	117	21	20	16	15	-2.70	1.64
Heat	99	18	38	14	29	-1.95	2.74
Nature	70	13	50	10	38	-2.56	2.77
Ozone	60	11	61	8	47	-2.83	1.67
Disaster	59	11	72	8	55	-3.20	2.17
Flood/Sea Level	56	10	82	8	63	-3.00	1.53
Chg. Climate	51	9	91	7	70	-1.26	2.81
Skeptics	37	7	97	5	75	-1.14	3.55
Weather	33	6	103	5	79	-1.52	2.79
Dry/Desert	27	5	108	4	83	-4.01	1.58
Pollution	20	4	112	3	86	-3.17	2.32
Other	20	4	115	3	89	-0.89	4.14
Places	18	3	119	2	91	-2.23	2.23
Politics	14	3	121	2	93	-3.24	2.61
Greenhouse	11	2	123	2	95	-1.44	2.95
Forests	7	1	124	1	96	-2.17	3.32
Don't Know	5	1	125	1	96	-4.29	0.00
Industry	5	1	126	1	97	-1.89	2.87
Food	4	1	127	1	98	-1.25	2.57
Future Generations	3	1	127	0	98	-2.11	2.62
Autos	2	0	128	0	98	-2.01	0.00
Positive	2	0	128	0	99	3.00	0.00
Religion	1	0	128	0	99	-5.00	0.00
Fossil Fuels	1	0	128	0	99	0.00	0.00
Need Action	0	0	128	0	99	0.00	0.00
Emotion	0	0	128	0	99	0.00	0.00
Happening	0	0	128	0	99	0.00	0.00
InfoSources	0	0	128	0	99	0.00	0.00
Chg. Temperature	0	0	128	0	99	0.00	0.00
Total	722	129*		100		-2.40	2.49

\*Some respondents (28%) provided more than one image.

Affect scale ranges from very negative (-5) to very positive (+5).

Associations to melting glaciers and polar ice (affect  $M = -2.70$ ,  $SD = 1.64$ ) were the single largest category of responses, indicating that this current and projected impact of climate change was the most salient to the American public. Examples included: “Melting polar ice caps.” “Glaciers melting.” “Antarctic melting.” Associations to heat and rising temperatures (affect  $M = -1.95$ ,  $SD = 2.74$ ) were the second-most dominant category. Examples included: “Increased global heat.” “Hot.” “Temperatures increasing.” These heat associations were typically generic and are likely associations to the word “warming” in “global warming.”

The third largest category was comprised of impacts on non-human nature, including ecosystems and species (affect  $M = -2.56$ ,  $SD = 2.77$ ). Examples included: “Rainforest depletion.” “Damage to the environment.” “Upset ecological balance.” “Animals and their habitats drying up.”

The fourth largest category was a set of associations to the ozone hole or ozone depletion (affect  $M = -2.83$ ,  $SD = 1.67$ ), providing further validation to earlier mental model studies which had found that some Americans continue to confuse or conflate these two environmental issues (e.g., Bostrum et al. 1994; Kempton et al. 1995; Read et al. 1994). Examples included: “A hole in the ozone layer.” “Hole in the atmosphere.” “Ozone depletion.”

The fifth largest category was a set of associations to disaster, ranging from relatively mild depictions of global warming as a problem to extreme visions of environmental catastrophe. Examples included: “Possible problem.” “Potential disaster.” “Environmental disasters.” “Death.” “World devastation.” “The end of the world as we know it.” “Our earth will become survival of the fittest and devastation to mankind.” Unsurprisingly, the mean affect for the “Disaster” category was one of the most negative (affect  $M = -3.20$ ,  $SD = 2.17$ ). The extreme responses indicate individuals who interpret climate change within an “environmental apocalypse” frame.

Associations to sea level rise and the flooding of rivers and coastal areas comprised the sixth largest category (affect  $M = -3.00$ ,  $SD = 1.53$ ). Examples included: “Rising ocean levels.” “Floods.” “Flooding of Manhattan.” “The movie Waterworld.” The relatively strong negative affect associated with this category suggests that flooding and sea level rise are perceived among the gravest risks of global climate change. The seventh largest category was a set of associations to changes in the climate system as a whole or to shifting seasons (affect  $M = -1.26$ ,  $SD = 2.81$ ). Examples included: “A change in climate.” “Climate change.” “Longer summers and shorter, milder winters.” “No more winter.” The relatively mild negative affect associated with this category indicates that changing climate, and in particular warmer winters, was sometimes perceived positively. The subset of respondents who provided associations to warmer winters was examined to test this ( $n = 11$ ). Of these, 5 provided positive affective evaluations of this change, raising the mean affect for this subset to  $-0.45$ , only slightly

on the negative side. This is a very small sub-sample and therefore is not necessarily representative of all Americans, but it does indicate that scientific projections of warmer winters are interpreted by some as a beneficial consequence of global warming.

Finally, the eighth largest category comprised associations indicating skepticism or cynicism about the reality of climate change (affect  $M = -1.14$ ,  $SD = 3.55$ ). Skeptics included: 1) flat denials of the problem (“A false theory.” “It will not happen in the near future.” “There is no global warming.”); 2) 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.”); 3) doubting the science (“There is no proof it exists.” “Around 10 years or so ago it was global cooling.” “Junk science.”); 4) hype (“It is not as bad as the media portrays.” “The ‘problem’ is overblown.” “Environmentalist hysteria.”); and 5) conspiracy theories (“Hoax.” “Chicken Little.” “Panic peddling for political reasons.” “Political lie.” “Environmentalist propaganda.”). The diversity of these responses indicates that climate change skeptics have many different rationales for their disbelief, which ranges from acceptance of the reality of climate change (although naturally-caused or overblown) to flat denials and outright conspiracy theories. There is a spectrum of disbelief, from those skeptics still potentially open to the possibility of anthropogenic climate change to those at an ideological extreme.

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

references 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, E-coli, giardia, etc.), or vector and rodent-borne disease (e.g., malaria, West Nile Virus, Hantavirus Pulmonary Syndrome, etc.) all of which are likely consequences of global climate change (Patz et al. 2000; Epstein 2000). There were some associations to sunburn or skin cancer, but these represent confusions with the health impacts of ozone depletion.

This finding (or the lack thereof) that Americans do not currently associate global warming with impacts on human health is supported by the results of four questions which asked respondents to estimate the current and future human health effects of global warming. On average, Americans said that current deaths and injuries due to global warming each number in the hundreds, and in the future will number in the thousands. By contrast, the activists said that current deaths and injuries each number in the thousands, and in the future will number in the millions<sup>5</sup> (Table 32).

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<sup>5</sup> A recent study by the World Health Organization and the London School of Hygiene and Tropical Medicine estimated that 160,000 people (primarily children in developing countries) currently die every year due to the side-effects of global warming. This number is projected to nearly double by 2020 (Doyle 2003). Thus, activist estimates of human health impacts appear to be relatively accurate.

TABLE 32. Human Health Effects: American Public vs. Activists

	Americans		Activists	
	Mean	Std Dev	Mean	Std Dev
Worldwide, how many people do you think...				
are <u>currently</u> injured or become ill each year...	2.16	1.09	3.32	0.66
will be injured or become ill <u>50 (30) years from now...</u>	2.82	1.15	3.90	0.33
<u>currently</u> die each year...	1.93	0.97	2.74	0.71
will die each year <u>50 (30) years from now...</u>	2.69	1.11	3.76	0.48
...due to global warming?				
	<i>N</i>	307 to 330		95 to 103

scale: 1 = none, 2 = hundreds, 3 = thousands, 4 = millions

"(30) years from now" from activist questionnaire

Activists clearly perceived a greater risk to human health than the American public, yet both groups estimated future impacts as significantly more severe than current impacts. More importantly, however, the distribution of “don’t know” differed substantially between the two samples. Of the activists, only 5 to 12% selected this response option, depending on the question. Of the American public, however, 38 to 41% said “don’t know” – by far the dominant response for each of the four questions. This is another strong indication that Americans are not currently associating global warming with significant human health impacts.

An affective image analysis was also conducted on both the OASIS 2000 and climate activist samples. The OASIS survey used a different methodology (phone interviews) and only collected cognitive images associated with global warming (i.e. no explicit affect measures). The OASIS survey found that Oregonians’ associations to “global warming” fell into 29 categories (Table 33).

TABLE 33. Global Warming Image Categories, OASIS 2000

Survey Question: What is the first thought or image that comes to your mind when you think of "global warming"?

Image Categories	# of Images	(% of Persons) (n = 899)	Cum. % (% of Images)	Cum. % (n = 1234)	Cum. %
Disaster	134	15	15	11	11
Skeptics	116	13	28	9	20
Ozone	107	12	40	9	29
Don't Know	95	11	50	8	36
Heat	83	9	60	7	43
Nature	80	9	68	6	49
IceMelt	69	8	76	6	55
Places	62	7	83	5	60
Pollution	50	6	89	4	64
Need Action	47	5	94	4	68
Emotion	42	5	99	3	71
Weather	41	5	103	3	75
Flood/Sea Level	41	5	108	3	78
Happening	36	4	112	3	81
Chg. Climate	33	4	115	3	83
Autos	27	3	118	2	86
Forests	25	3	121	2	88
Politics	23	3	124	2	89
Dry/Desert	18	2	126	1	91
InfoSources	17	2	128	1	92
Greenhouse	17	2	130	1	94
Industry	16	2	131	1	95
Other	12	1	133	1	96
Religion	12	1	134	1	97
Fossil Fuels	11	1	135	1	98
Food	7	1	136	1	98
Positive	7	1	137	1	99
Chg. Temperature	3	0	137	0	99
Future Generations	3	0	137	0	100
Total	1234	137*		100	

\*Some respondents (29%) provided more than one image.



The number and diversity of these categories again indicates that “global warming” was a highly meaningful term, with many associated images and connotations. The diversity of associated images partially reflects the complexity of the problem itself. For example, many of the categories referred to potential impacts of climate change, including rising temperatures, melting of the polar ice caps, sea level rise, drought, etc. Importantly, however, most of these impact categories evoked relatively few responses. In addition, these impact responses were often relatively general or abstract, not specific, vivid, and/or concrete (e.g., general responses like "heat" vs. more specific responses like "melting of the Arctic ice cap"). This finding suggests that the concept of “global warming” lacked a clear, central, affective image among the Oregon public.

Approximately half of the sample provided an image in one of the four dominant categories: "Disaster," "Skeptics," "Ozone" and "Don't Know." Here I focus on these four categories of images and respondents. "Disaster" was the single largest category of images (11%). This category refers to a range of responses that explicitly stated negative evaluations of global climate change. This range includes responses such as: "I think it is a very serious threat." "The destruction of the environment." "Bad...bad...bad...like after nuclear war...no vegetation." "Heat waves, it's gonna kill the world." "Death of the planet." These images clearly indicated negative affect and a perception that global climate change is a serious risk.

"Skeptics" was the second largest category of images (9%) and refers to responses indicating disbelief that climate change is happening or that it is a threat. Skeptics included: 1) flat denials of the problem ("It doesn't exist"); 2) belief that global warming is natural ("Natural phenomenon, we can't control it ourselves"); 3) doubting the science ("Bad science, I don't believe the data can support the hypothesis that the environment is warming"); 4) doubt based on personal experience ("I think it's a myth. I don't think we are having global warming. Summers are getting shorter and winters seems to be getting damper and cooler. It seems to be going the other way"); and 5) conspiracy theorizing ("Fraud. Scientists making up some statistics for their job security" "A lot of propaganda on it...I think they try to scare us."). Many of these responses also indicated negative affect, although with a very different ultimate meaning than "Disaster" respondents. While "Skeptics" also evaluated the term 'global warming' negatively, the meaning associated with their negative response is different -- it indicates a strong emotional component to their disbelief.

"Ozone" was the third largest category (9%) and represents associations to stratospheric ozone depletion and the ozone hole. Most of these were straightforward: "Ozone layer." "A hole in the sky." "Temperatures rising because of the hole in the ozone." "The ozone layer has a lot to do with the majority of the global warming." "I don't like it...hair spray is part of it." These images again demonstrate that many members of the public continued to associate, confuse, and even conflate these two different environmental issues. Many of these responses did not explicitly state positive

or negative affect (i.e. we do not know for sure whether someone who says "ozone layer" evaluates that positively or negatively), but we can make the reasonable assumption that references to the ozone layer (and thus the problem of ozone depletion) indicated negative affect and a strong perception of risk.

"Don't Know" was the fourth largest category (8%) and included many responses like "Global warming -- what is that?" or "I've never heard of that." It is important to note that this category did not include responses such as the following example: "Umm...I don't know...ozone layer." This and similar responses were coded as specific images; in this example as "Ozone." The phrase "I don't know" is often used by respondents to indicate momentary hesitation, before providing an actual response. Thus, the "Don't Know" category only included those respondents who truly had no associated image or explicitly said they had never heard the term 'global warming' before. These were people who had no associations with the stimulus 'global warming' and therefore no indication of either positive or negative affect.

Thus, three of the top four categories ("Ozone," "Skeptics" and "Don't Know") were made up of respondents who misunderstood the issue, didn't believe it, had no association with it, or had never heard of it, accounting for about 35% of all respondents.

The Hague survey of student climate change activists also gathered affective images of global warming (Table 34).

TABLE 34. Global Warming Image Categories, Activists (2000)

Survey Question: When you hear the words "global warming,"  
what is the first thought or image that comes to mind?

Image Categories	# of Images	(% of Persons) ( <i>n</i> = 112)	Cum. %	(% of Images) ( <i>n</i> = 178)	Cum. %	Affect	
						Mean	S.D.
Disaster	45	40	40	25	25	-4.38	1.99
Nature	27	24	64	15	41	-3.08	3.27
Flood/Sea Level	26	23	88	15	55	-4.67	0.76
Weather	14	13	100	8	63	-3.85	2.27
Heat	13	12	112	7	70	-2.77	3.32
IceMelt	12	11	122	7	77	-4.50	0.80
Dry/Desert	8	7	129	5	82	-4.71	0.49
Chg. Climate	7	6	136	4	85	-4.71	0.49
Places	6	5	141	3	89	-4.40	0.89
Greenhouse	3	3	144	2	91	-3.00	2.00
Chg. Temperature	2	2	146	1	92	-4.00	0.00
Other	2	2	147	1	93	-5.00	0.00
Fossil Fuels	2	2	149	1	94	-4.50	0.71
Food	2	2	151	1	95	-5.00	0.00
Pollution	1	1	152	1	96	-4.00	0.00
Skeptics	1	1	153	1	96	1.00	0.00
Need Action	1	1	154	1	97	5.00	0.00
Emotion	1	1	155	1	97	-5.00	0.00
Autos	1	1	156	1	98	-5.00	0.00
Industry	1	1	156	1	99	-4.00	0.00
Happening	1	1	157	1	99	-5.00	0.00
Future Generations	1	1	158	1	100	-5.00	0.00
Positive	1	1	159	1	100	3.00	0.00
Religion	0	0	159	0	100	0.00	0.00
Don't Know	0	0	159	0	100	0.00	0.00
Politics	0	0	159	0	100	0.00	0.00
InfoSources	0	0	159	0	100	0.00	0.00
Forests	0	0	159	0	100	0.00	0.00
Ozone	0	0	159	0	100	0.00	0.00
Total	178	159*		100		-3.85	2.43

\*Some respondents (47%) provided more than one image.

Of the 29 image categories used by the OASIS respondents, only 23 were used by the activists. The mean affect for all associations provided by the activist sample was ( $M = -3.85$ ,  $SD = 2.43$ ), indicating the connotations of global warming were very negative for this sample. Over 88% of all activists provided images in the top three categories ("Negative," "Nature" and "Flood/Sea Level"). Relative to the Oregon and American publics, student climate change activists shared a core set of affective images about global warming.

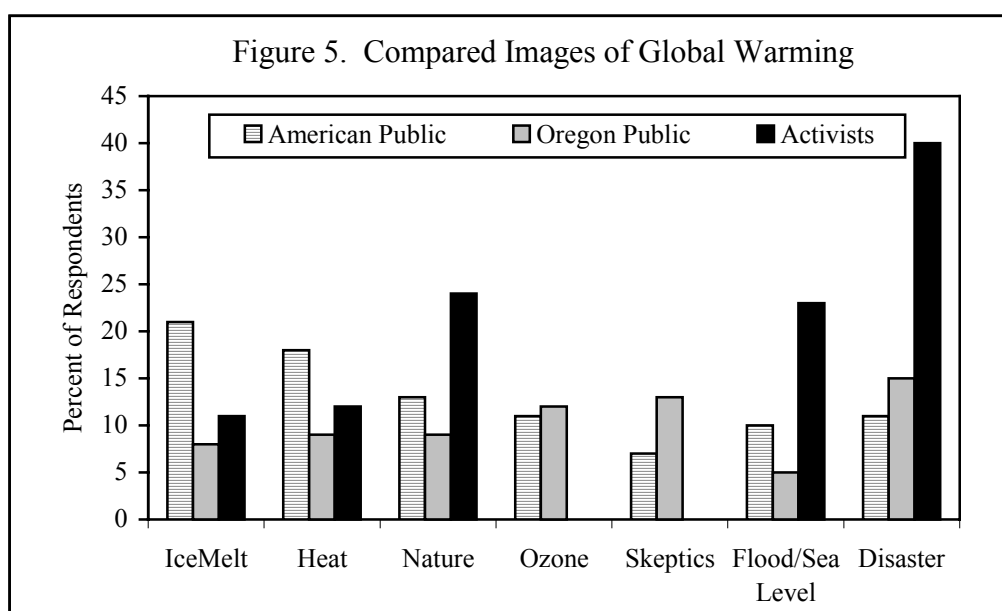
"Disaster" was by far the dominant category, with 40% of activists providing a disaster-related association to "global warming." Examples included: "Difficult living." "Death." "Ecological destruction." "Ecological catastrophe." "The end of civilization." The mean affect for "Disaster" was ( $M = -4.38$ ,  $SD = 1.99$ ) on a scale ranging from  $-5$  (extremely negative) to  $+5$  (extremely positive). These images clearly demonstrate a perception of global climate change as a very serious risk. The second-largest category was "Nature." Examples included: "Ecological destruction." "Species extinction." "Polar bears." "The Earth on a bonfire." The mean affect for "Nature" was ( $M = -3.08$ ,  $SD = 3.27$ ), indicating great concern about the impacts of climate change on natural ecosystems and species around the world.

The third-largest category comprised associations to Flooding and Sea Level Rise. Examples included: "Rising sea level." "Islands going under water." "Flooded coasts." "Flooding wiping out a village." The mean affect for this category was ( $M = -4.67$ ,  $SD =$

0.76), indicating that among these activists, the impacts of flooding and sea level rise were perceived as one of the greatest risks of climate change.

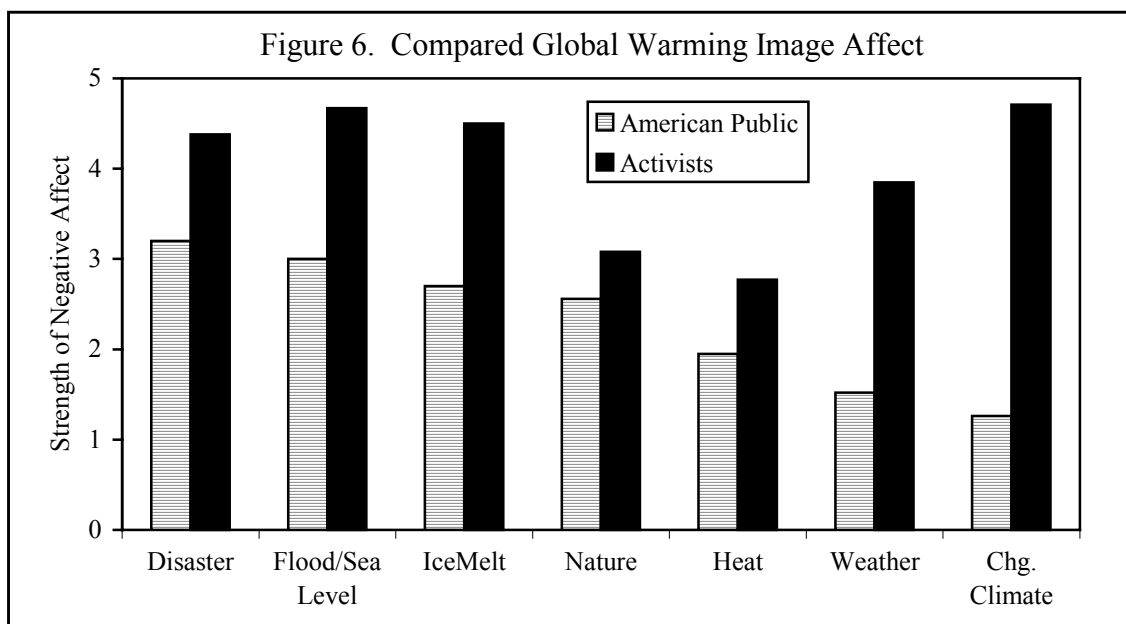
#### Comparisons (National vs. Oregonian vs. Activist)

Comparisons of the top seven categories across all three surveys reveals striking differences between the American and Oregon publics and the activists (Figure 5). Climate change activists coalesced around three primary images of global warming: Disaster, Nature and Flooding/Sea Level Rise. By comparison, the American and Oregon publics were much more evenly distributed across the image categories. Also, unlike the American and Oregon publics, activists provided no “Skeptic” or “Ozone” responses.



Associations to disaster were significantly higher among activists (40%) than either the American public (11%) or the Oregon public (15%). Disaster was by far the largest category among activists. Climate change activists were also substantially more likely to associate global warming with impacts on non-human nature (24%) than either the American (13%) or the Oregon publics (9%). The impacts of climate change on individual species and whole ecosystems were highly salient for activists; perhaps indicating a more ecocentric than anthropocentric worldview. Climate change activists were also much more likely to associate global warming with "Flooding and Sea Level Rise" (23%) than either the American (10%) or Oregon publics (5%). Again, the high response suggests that sea level rise and increased flooding were highly salient impacts of climate change for this sample -- more than melting glaciers and polar ice caps, extreme weather, rising temperatures, or drought, etc.

A comparison of American vs. activist image affect intensity reveals that even when both groups produced the same associations to global warming, activists reacted with much stronger negative affect (Figure 6). Across the board, activists rated each of these images as substantially more negative than the American public. For example, the subset of activists who provided images of "Disaster" rated these associations ( $M = -4.38$ ,  $SD = 1.99$ ) much more negatively than the subset of Americans who also provided images of "Disaster" ( $M = -3.20$ ,  $SD = 2.17$ ).



The disparity is greatest, however, for the image category “Changing Climate.” Americans who provided these associations ( $n = 51$ ) did not exhibit extreme values of negative affect ( $M = -1.26$ ,  $SD = 2.81$ ). The few activists ( $n = 7$ ) who provided these associations, however, did exhibit extreme values of negative affect ( $M = -4.71$ ,  $SD = 0.49$ ). Further, for these activists the scientific term “climate change” connoted the same level of negative affect as the more popular term “global warming” ( $M = -4.68$ ,  $SD = 0.66$ ). This indicates, within the limitations of the very small sample of activists, that both terms were highly stigmatized. For the public, however, the terms “climate change” or “changing climate” did not apparently carry such intensely negative connotations.



## National Interpretive Communities

Finally, an exploratory analysis was performed to identify distinct “interpretive communities” within the American public, using affective imagery analysis. An interpretive community is loosely defined as a group of individuals who share a relatively coherent and consistent set of associative and connotative meanings regarding a particular risk (in this case “global warming”). For example, those individuals who provided a “Skeptic” association to global warming were hypothesized to interpret this issue in a common manner. Members of such communities tend to share a common worldview and interpret risks in a similar way. I further hypothesized that these individuals will share a common set of other attitudinal, behavioral and sociodemographic characteristics.

To test this hypothesis, several affective image categories were correlated against a range of covariates. The first covariate was risk perception, operationalized with the Index of Risk Perception described in Chapter 3. A second set of covariates were two different measures of affect, including holistic negative evaluations of global warming and specific affective evaluations of the cognitive images provided by the respondents. The third covariate was worldview (Cultural Theory), operationalized with the Egalitarianism and Fatalism Indexes described in Chapter 3. Environmentalism was used as a fourth covariate and operationalized with a set of questions measuring environmental attitudes and behaviors:

1. “Do you believe it is possible for pollution levels to get so high that the environment cannot recover?”
2. “What do you think is more important – protecting the environment, even if it costs jobs, or economic growth, even if it leads to environmental problems?”
3. “When you buy things at the store, do you usually think of the impact the things you buy have on the environment?”
4. “Do you or a member of your household donate money or belong to any environmental or conservation organizations (e.g., Sierra Club, Audubon, Nature Conservancy, Greenpeace, local groups, etc.)?”

The response categories were Yes or No. In part, these questions were selected for consistency and comparability with the earlier OASIS survey of the Oregon public.

Global warming behavior, the fifth covariate, was operationalized with the Individual Action Index, the General Policy Preferences Index, and Tax Policy Preferences Index described in Chapter 3. A sixth covariate was the Main Source of News. All respondents were asked to identify their main source of news (all news, not just about global warming) from a list that included newspapers, news magazines, television, radio, the world-wide-web, or friends and relatives. The analysis found that only television and radio were significantly correlated with any of the interpretive communities, so only these have been included in the table below.

Each interpretive community was correlated with a set of standard demographic variables, including sex, age, education level, income, political identification (Democrat,

Independent, Republican), political ideology (liberal, moderate, conservative), and registered voter status. A geographic region variable was also constructed using U.S. census definitions for the Northeast, Midwest, South and West.

Each interpretive community (affective image category) was converted to a dummy variable with a 1 indicating a respondent who provided an image in that category. Correlations were obtained using two different methods. For all covariates with ordinal or ratio-level data (e.g., education, age, etc.), linear regressions were run with the interpretive communities as the independent variables. The standardized regression coefficients ( $\beta$ )<sup>6</sup> and  $p$  values<sup>7</sup> are reported in the table below. For all covariates with nominal-level data (e.g., sex, media source, etc.), chi-square goodness-of-fit tests<sup>8</sup> and odds ratios<sup>9</sup> were calculated to determine the significance, strength and direction of the correlations.

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<sup>6</sup> Beta ( $\beta$ ) is a standardized score, which allows for direct comparison of the relative strengths of relationships between variables.  $\beta$  varies between +/- 1.0; a Beta weight of 0 represents no relationship between variables, while a score of +/- 1.0 represents a perfect linear correlation (i.e., as variable x increases by 1, variable y increases by 1). In a multiple regression, Beta is a partial correlation, in which the influence of all other variables in the equation has been partialled out. Thus Beta is the unique contribution of one variable to explain another variable. (George and Mallory 2001)

<sup>7</sup>  $p$  is a standard measure of statistical significance and identifies the likelihood that a particular outcome may have occurred by chance. A  $p$  value less than .05 is generally considered statistically significant, i.e. when there is less than a 1 in 20 probability that a certain outcome occurred by chance. A smaller  $p$  value increases the confidence that the findings are valid. (George and Mallory 2001)

<sup>8</sup> A Chi-square ( $\chi^2$ ) goodness-of-fit test determines whether observed values differ significantly from expected values.

<sup>9</sup> Odds ratios (OR) are a measure of effect direction and strength. An odds ratio of 1 shows no direction or strength of an effect. The higher an odds ratio, the greater the strength, e.g., an odds ratio of 5.36 indicates a much stronger effect than an odds ratio of 1.25. For a 2 x 2 table of (women / men) by (yes / no):  
OR = odds for women / odds for men = (women yes / women no) / (men yes / men no)

This analysis demonstrated that affective imagery can be used to identify several distinct interpretive communities (Table 35). Disaster, Skeptics and Believers each correlated strongly with a wide range of covariates. Global warming skeptics tended to have lower risk perceptions of global warming ( $\beta = 0.39, p < .001$ ) and were less likely to be egalitarian ( $\beta = 0.37, p < .001$ ). They tended to disagree that pollution levels can get too high for environmental recovery ( $OR = 4.44, p < .001$ ) and very strongly preferred protection of economic growth over the environment ( $OR = 12.19, p < .001$ ). For general environmental behaviors, Skeptics tended not to consider the environmental impacts of their purchases ( $OR = 4.24, p < .001$ ) or contribute to environmental organizations ( $OR = 2.92, p < .05$ ). For specific global warming-related behaviors, Skeptics tended not to have taken individual actions to mitigate global warming ( $\beta = 0.28, p < .001$ ), and strongly opposed both general climate policies ( $\beta = 0.48, p < .001$ ) and increased taxes on gasoline, business energy use or gas guzzlers ( $\beta = 0.24, p < .001$ ). Finally, Skeptics were more likely to be male ( $OR = 2.73, p < .001$ ), were slightly more likely to have a higher level of education ( $\beta = 0.12, p < .01$ ), tended to get their news from radio ( $OR = 3.74, p < .001$ ), tended not to live in the Northeastern United States ( $OR = 4.62, p < .01$ ) and were more likely to be Republican ( $\beta = 0.19, p < .001$ ), conservative ( $\beta = 0.29, p < .001$ ) and registered voters ( $OR = 5.08, p < .001$ ).

TABLE 35. National Interpretive Communities:  
Odds Ratios and Linear Regressions

Factors and Covariates	<i>Skeptics</i> ( <i>n</i> =37)	<i>Believers</i> ( <i>n</i> =431)	<i>Disaster</i> ( <i>n</i> =59)
<i>Risk Perception</i>	0.39 <sup>---</sup>	0.26 <sup>+++</sup>	0.17 <sup>+++</sup>
<i>Affect</i>			
Holistic negative affect			0.13 <sup>++</sup>
Image affect (negative)	0.12 <sup>--</sup>		0.12 <sup>++</sup>
<i>Worldviews</i>			
Egalitarianism	0.37 <sup>---</sup>	0.25 <sup>+++</sup>	0.19 <sup>+++</sup>
Fatalism	0.10 <sup>-</sup>	0.13 <sup>++</sup>	
<i>Behavior</i>			
Individual Actions	0.28 <sup>---</sup>	0.16 <sup>+++</sup>	
General Policy Preferences	0.48 <sup>---</sup>	0.32 <sup>+++</sup>	0.12 <sup>++</sup>
Tax Policy Preferences	0.24 <sup>---</sup>	0.19 <sup>+++</sup>	0.15 <sup>+++</sup>
<i>Environmentalism</i>			
Pollution can go beyond recovery*	4.44 <sup>---</sup>	1.88 <sup>++</sup>	
Protect environment over economy*	12.19 <sup>---</sup>	2.48 <sup>+++</sup>	
Consider environ. impact/shop*	4.24 <sup>---</sup>		
Membership in environ. org.*	2.92 <sup>-</sup>		
<i>Main Source of News</i>			
Television*	1.81 <sup>-</sup>	1.97 <sup>+++</sup>	
Radio*	3.74 <sup>+++</sup>	1.91 <sup>--</sup>	
<i>Demographics</i>			
Female*	2.73 <sup>--</sup>		
Northeast*	4.62 <sup>--</sup>		
Registered voter*	5.08 <sup>+++</sup>		2.04 <sup>-</sup>
Republican	0.19 <sup>+++</sup>	0.21 <sup>---</sup>	
Conservative	0.29 <sup>+++</sup>	0.26 <sup>---</sup>	0.13 <sup>--</sup>
Education	0.12 <sup>++</sup>		

+ means Yes/More likely; -- means No/Less likely

+/- =  $p \leq .05$ ; ++/- =  $p \leq .01$ ; +++/- =  $p \leq .001$

\*odds ratios – all other values are standardized regression coefficients.

Total  $n = 558$

By contrast, “Believers” tended to have higher risk perceptions of global warming ( $\beta = 0.26, p < .001$ ) and were more likely to be egalitarian ( $\beta = 0.25, p < .001$ ). They tended to believe that pollution levels can get too high for environmental recovery ( $OR = 1.88, p < .01$ ) and were more likely to prefer protection of the environment over economic growth ( $OR = 2.48, p < .001$ ). For specific global warming-related behaviors, Believers tended to have taken individual actions to mitigate global warming ( $\beta = 0.16, p < .001$ ) and were more likely to support both general climate policies ( $\beta = 0.32, p < .001$ ) and increased taxes on gasoline, business energy use and gas guzzlers ( $\beta = 0.19, p < .001$ ). Finally, Believers were more likely to get their news from television ( $OR = 1.97, p < .001$ ), tended to be Democrats ( $\beta = 0.21, p < .001$ ) and politically liberal ( $\beta = 0.26, p < .001$ ). Within the composite Believers category, respondents who provided images of Disaster also tended to have higher risk perceptions and were more likely to be egalitarian. They were more likely to support both general climate policies and increased taxes on gasoline, business energy use and gas guzzlers. Finally, they tended to be liberals, but not registered voters.

These results demonstrate that affective imagery can be used to identify groups of individuals who share common interpretations, attitudes, behaviors and sociodemographic characteristics. This type of analysis may be helpful to scientists, environmental advocates and risk communicators in their design of risk messages and education campaigns.

### Hypotheses 1 and 2

Hypothesis 1 predicted that affective images of global warming would influence a) global warming risk perceptions, b) individual support for climate policies, and c) individual behaviors to mitigate global warming.

Hypothesis 2 predicted that worldviews would have a separate, but related influence on risk perceptions of a) global warming risk perceptions, b) individual support for climate policies, and c) individual behaviors to mitigate global warming.

To test these hypotheses multiple regression models<sup>10</sup> were constructed to examine the separate and combined influence of affect, imagery, cultural worldviews, and sociodemographics (independent variables) on several dependent variables: 1) global warming risk perception (Risk Perception Index); 2) climate change policy preferences (General Policy Preferences Index); 3) climate tax policy preferences (Tax Policy Index); and 4) individual mitigation behaviors (Individual Actions Index).

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<sup>10</sup> A multiple regression analysis shows the influence of two or more independent variables on a designated dependent variable.

TABLE 36. Multiple Regressions on National Risk Perception

Independent Variables	<i>Model 1</i>		<i>2</i>		<i>3</i>		<i>4</i>		<i>5</i>	
		<i>Affect</i>	<i>Images</i>	<i>Worldviews</i>	<i>Sociodems</i>				<i>Full</i>	
Holistic Negative Affect		0.41 ***								0.32 ***
Image Affect		0.26 ***								0.19 ***
Skeptics			-0.32 ***							-0.21 ***
Disaster			0.14 ***							0.06
Politics			-0.17 ***							-0.09 *
Don't Know			-0.11 **							-0.07
Dry/Desert			0.18 ***							0.09 *
Egalitarianism					0.45 ***					0.11 *
The government should get out of our way. (I)					-0.11 **					-0.05
When the risk is very small, it is OK for society to impose that risk on individuals without their consent. (H)					-0.15 ***					-0.04
Female								0.22 ***		0.10 *
White/Caucasian								-0.15 ***		-0.07
Ideology								-0.24 ***		0.00
Registered Voter								-0.13 ***		0.04
Member of environmental groups								0.14 ***		0.10 **
Newspaper								0.09 *		0.04
	<i>F</i>	93.95 ***	34.75 ***	65.57 ***	23.04 ***					22.76 ***
	Adjusted <i>R</i> <sup>2</sup>	0.32	0.24	0.26	0.20					0.47
	<i>N</i>	403	548	551	540					388

Dependent variable: National Risk Perception Index

Entries are standardized regression coefficients.

\*significant at 0.05; \*\*significant at 0.01; \*\*\*significant at 0.001



### Multiple Regression Models of Global Warming Risk Perception

Model 1 found that holistic negative affect and image affect were very significant predictors of global warming risk perception and explained 32% of the variance ( $F(2, 402) = 93.95, p < .001, R^2_{adj.} = .32$ ) (Table 36). As negative affect increased, risk perception increased. Model 2 found that several cognitive images including Skeptics, Disaster, Politics, Don't Know, and Dry/Desert significantly predicted global warming risk perception and together explained 24% of the variance ( $F(5, 542) = 34.75, p < .001, R^2_{adj.} = .24$ ). Skeptics, Politics and Don't Know were associated with decreased levels of risk perception. Disaster and Dry/Desert, however, were associated with increased levels of risk perception. Together, the results of Models 1 and 2 supported Hypothesis 1(a): affective imagery influences risk perception.

Model 3 found that three cultural worldview measures were significant predictors of global warming risk perception, including the Egalitarian Index, an individualism variable and a hierarchism variable. As described in Chapter 3, individualism and hierarchism indexes were attempted, but could not be satisfactorily constructed. Instead, each individualism and hierarchism question was regressed on risk perception to identify potential predictors in line with Cultural Theory. Two measures were identified: the individualism statement, "The government should get out of our way" and the hierarchism statement, "When the risk is very small, it is OK for society to impose that risk on individuals without their consent." Egalitarianism was correlated with increased

risk perception, while individualism and hierarchism were correlated with decreased risk perception. The full worldview regression model significantly predicted global warming risk perception and explained 26% of the variance ( $F(3, 547) = 65.57, p < .001, R^2_{adj} = .26$ ). Thus, this model supported Hypothesis 2(a): worldviews influence risk perception.

Model 4 found six sociodemographic variables that were significant predictors of global warming risk perception. Females, minorities, liberals, members of environmental groups and newspaper readers all tended to perceive global warming as a greater risk. Whites, males, conservatives and registered voters, however, all tended to perceive global warming as a smaller risk. The full sociodemographic model significantly predicted global warming risk perception and explained 20% of the variance ( $F(6, 533) = 23.04, p < .001, R^2_{adj} = .20$ ).

Finally in Model 5, the four models were combined to determine which variables were the strongest predictors of global warming risk perception, controlling for the others. Holistic affect was the single most powerful predictor ( $\beta = 0.32, p < .001$ ). The image “Skeptics” was the second-most powerful predictor ( $\beta = -0.21, p < .001$ ), again demonstrating that skeptics tended not to perceive global warming as a risk. The third-largest predictor was Negative Image Affect ( $\beta = 0.19, p < .001$ ). The fourth-largest predictor was Egalitarianism ( $\beta = 0.11, p < .05$ ), showing that egalitarians tended to perceive global warming as a greater risk. Thus, the full multiple regression model

demonstrated that affect, imagery and cultural worldviews were stronger predictors than the sociodemographic variables. Furthermore, the full model significantly predicted global warming risk perception and explained 47% of the variance ( $F(16, 371) = 22.76$ ,  $p < .001$ ,  $R^2_{adj.} = .47$ ).

### Multiple Regression Models of Global Warming Policy Preferences

A similar analysis (Table 37) was performed on the National Policy Preferences Index, comprised of measures of support and opposition to six proposed national and international policies (see Chapter 3).

Model 1 found that holistic negative affect significantly predicted support for national policies to address global warming, explaining 12% of the variance ( $F(1, 417) = 60.38$ ,  $p < .001$ ,  $R^2_{adj.} = .12$ ). As holistic negative affect increased, so did support for these national policies. Model 2 found that several images also significantly predicted national policy support. Skeptics, Politics, and Don't Know were all more likely to oppose national policies, while Dry/Desert was more likely to support them. The full model was very significant and explained 29% of the variance ( $F(4, 551) = 57.84$ ,  $p < .001$ ,  $R^2_{adj.} = .29$ ). Together, these two model results provided support for Hypothesis 1(b): affective imagery influences support for national climate policies.

TABLE 37. Multiple Regressions on National Policy Preferences

Independent Variables	<i>Model 1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	
	<i>Affect</i>	<i>Images</i>	<i>Worldviews</i>	<i>Sociodems</i>	<i>Full</i>	
Holistic Negative Affect	0.36 ***				0.26 ***	
Skeptics		-0.43 ***			-0.31 ***	
Politics		-0.18 ***			-0.06	
Don't Know		-0.14 ***			0.01	
Dry/Desert		0.11 **			0.02	
Egalitarianism			0.48 ***		0.23 ***	
When the risk is very small, it is OK for society to impose that risk on individuals without their consent. (H)			-0.18 ***		-0.10 **	
The government should get out of our way. (I)			-0.16 ***		-0.06	
Making money is the main reason for hard work. (I)			0.11 **		0.08 *	
Government and industry can be trusted to make the right decisions about technological risks. (H)			-0.10 **		-0.04	
Ideology				-0.33 ***	-0.13 **	
Female				0.11 **	-0.09 *	
Member of environmental groups				0.14 ***	0.03	
Radio				-0.09 *	0.01	
Registered Voter				-0.12 **	-0.06	
	<i>F</i>	60.38 ***	57.84 ***	60.59 ***	27.61 ***	22.11 ***
	Adjusted <i>R</i> <sup>2</sup>	0.12	0.29	0.35	0.19	0.44
	<i>N</i>	419	556	562	553	398

Dependent variable: General Policy Preferences Index

Entries are standardized regression coefficients.

\*significant at 0.05; \*\*significant at 0.01; \*\*\*significant at 0.001

Model 3 found that the Egalitarianism Index and two individualism and two hierarchism measures significantly predicted national policy preferences. Egalitarianism correlated with increased support for national policies, while hierarchism correlated with increased opposition. The two individualism measures were split: those who agreed with the statement, “The government should get out of our way” tended to oppose national policies to address global warming, while those who agreed with the statement, “Making money is the main reason for hard work” tended to support national policies. The full model was very significant, explained 35% of the variance ( $F(5, 556) = 60.59, p < .001, R^2_{adj.} = .35$ ), and supported Hypothesis 2(b): worldviews influence support for national climate policies.

Model 4 found that five sociodemographic variables significantly predicted national policy support. Liberals, females, and members of environmental groups were more likely to support national policies to address global warming, whereas conservatives, males, radio-listeners and registered voters were more likely to oppose these policies. The full model was very significant and explained 19% of the variance ( $F(5, 547) = 27.61, p < .001, R^2_{adj.} = .19$ ).

Finally, in Model 5, the four models were combined into a single multiple regression model, which significantly predicted national policy preferences and explained 44% of the total variance. “Skeptics” was the single most powerful predictor ( $\beta = -0.31, p < .001$ ) of support or opposition to national policies on global warming. The second-

most powerful predictor was holistic negative affect ( $\beta = 0.26, p < .001$ ), followed by egalitarianism ( $\beta = 0.23, p < .001$ ). Thus, the full multiple regression model demonstrated that affect, imagery and cultural worldviews were better predictors of support for global warming policies than all sociodemographic variables, including political identification and ideology.

#### Multiple Regression Models of Global Warming Tax Policy Preferences

Another multiple regression model tested predictors of support for an index of three national tax policies to mitigate climate change (Table 38). Model 1 found that holistic negative affect significantly predicted support for national tax policies, with increased negative affect associated with increased support. The model, however, while highly significant, explained only 5% of the variance ( $F(1, 411) = 21.07, p < .001, R^2_{adj} = .05$ ). Model 2 found that five cognitive images (Skeptics, Chg. Climate, Politics, Disaster, and Don't Know) significantly predicted tax policy support. These images correlated with opposition to higher taxes, with the exception of Disaster: respondents in this category were more likely to support higher taxes. The full model was highly significant and explained 13% of the variance ( $F(5, 539) = 16.57, p < .001, R^2_{adj} = .13$ ).

TABLE 38. Multiple Regressions on National Tax Policy Preferences

Independent Variables	<i>Model 1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	
	<i>Affect</i>	<i>Images</i>	<i>Worldviews</i>	<i>Sociodems</i>	<i>Full</i>	
Holistic Negative Affect	0.22 ***				0.16 ***	
Skeptics		-0.21 ***			-0.10 *	
Chg. Climate		-0.19 ***			-0.06	
Politics		-0.14 ***			-0.04	
Disaster		0.11 **			0.06	
Don't Know		-0.11 **			-0.01	
Egalitarianism			0.46 ***		0.22 ***	
Families need a strong authority figure. (H)			-0.12 **		-0.03	
Fatalism			-0.18 ***		-0.07	
If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it. (I)			-0.14 ***		-0.13 **	
People with less talent or ability should earn less. (I)			0.15 ***		0.08	
Organizations need a strict line of command to be successful. (H)			-0.10 **		-0.11 *	
Ideology				-0.28 ***	-0.16 **	
Education				0.19 ***	0.13 **	
Member of environmental groups				0.17 ***	0.09	
White				-0.14 ***	-0.11 *	
Female				0.10 **	-0.03	
	<i>F</i>	21.07 ***	16.57 ***	36.55 ***	24.86 ***	10.50 ***
	Adjusted <i>R</i> <sup>2</sup>	0.05	0.13	0.28	0.18	0.29
	<i>N</i>	413	545	552	540	392

Dependent variable: Tax Policy Preferences Index

Entries are standardized regression coefficients.

\*significant at 0.05; \*\*significant at 0.01; \*\*\*significant at 0.001

The results supported Hypothesis 1(b): affective images influence support for higher taxes to mitigate climate change.

Model 3 found that the Egalitarianism Index, the Fatalism Index, two hierarchism and two individualism measures significantly predicted tax policy support. Egalitarians were more likely to support higher taxes. Fatalists and hierarchists were more likely to oppose them. The two individualism questions were split, with those who agreed with the statement, “If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it” more likely to oppose higher taxes. Respondents who agreed with the statement, “People with less talent or ability should earn less” were more likely to support higher taxes. Only the results of the first individualism question are consistent with Cultural Theory. The full model was very significant and explained 28% of the variance ( $F(6, 545) = 36.55, p < .001, R^2_{adj.} = .28$ ). These results supported Hypothesis 2(b): worldviews influence support for tax policies to mitigate climate change.

Model 4 found that five sociodemographic variables significantly predicted tax policy support. Conservatives, whites, and males were more likely to oppose higher taxes to mitigate climate change, while liberals, females, minorities, individuals with increased education levels, and members of environmental groups were more likely to support higher taxes to mitigate climate change. The full model was very significant and explained 18% of the variance ( $F(5, 534) = 24.86, p < .001, R^2_{adj.} = .18$ ).



Model 5 combined the four models, significantly predicted support for higher taxes to mitigate climate change and explained 29% of the total variance. Egalitarianism was the single most powerful predictor ( $\beta = 0.22$ ,  $p < .001$ ) of support. The second-most powerful predictor was holistic negative affect ( $\beta = 0.16$ ,  $p < .001$ ), followed by political ideology ( $\beta = 0.16$ ,  $p < .01$ ). Skeptics, individualism, hierarchism, education, and whites remained significant, though weaker predictors in the full model. Thus, cultural worldviews and affect were stronger predictors of support for tax policies than the sociodemographic variables, with the exception of political ideology.

#### Multiple Regression Models of Global Warming Mitigation Behaviors

A final multiple regression model (Table 39) tested the ability of affect, imagery, worldviews and sociodemographics to predict individual behaviors using the National Individual Actions Index, comprised of nine climate change mitigation behaviors (see Chapter 3).

TABLE 39. Multiple Regressions on National Individual Actions

Independent Variables	<i>Model 1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	
	<i>Affect</i>	<i>Images</i>	<i>Worldviews</i>	<i>Sociodems</i>	<i>Full</i>	
Holistic Negative Affect	0.41 ***				0.31 ***	
Skeptics		-0.28 ***			-0.13 **	
Chg. Climate		-0.13 ***			-0.05	
Food/Agriculture		-0.11 **			-0.02	
Dry/Desert		0.12 **			0.06	
Flood/Sea Level		0.11 **			0.10 *	
Egalitarianism			0.34 ***		0.06	
Government and industry can be trusted to make the right decisions about technological risks. (H)			-0.13 ***		0.01	
When the risk is very small, it is OK for society to impose that risk on individuals without their consent. (H)			-0.12 **		-0.02	
Member of environmental groups				0.34 ***	0.27 ***	
Ideology				-0.21 ***	-0.11 *	
Newspaper				0.17 ***	0.13 **	
WWW				0.13 ***	0.10 *	
White/Caucasian				-0.14 ***	-0.09 *	
Income				-0.10 *	-0.12 **	
	<i>F</i>	85.23 ***	16.97 ***	35.72 ***	27.93 ***	14.78 ***
	Adjusted <i>R</i> <sup>2</sup>	0.17	0.13	0.16	0.24	0.36
	<i>N</i>	415	549	553	501	368

Dependent variable: National Individual Actions Index

Entries are standardized regression coefficients.

\*significant at 0.05; \*\*significant at 0.01; \*\*\*significant at 0.001

Model 1 found that holistic negative affect significantly predicted individual behaviors, with increased negative affect associated with a greater number of actions. The model was highly significant and explained 17% of the variance ( $F(1, 413) = 85.23, p < .001, R^2_{adj.} = .17$ ).

Model 2 found that five cognitive images significantly predicted individual behaviors. Skeptics, Chg. Climate and Food/Agriculture correlated with fewer actions, while Dry/Desert and Flood/Sea Level correlated with more. The model was highly significant and explained 13% of the variance ( $F(5, 543) = 16.97, p < .001, R^2_{adj.} = .13$ ). The results supported Hypothesis 1(c): affective images influence individual behaviors to address climate change.

Model 3 found that the Egalitarianism Index and two hierarchism measures significantly predicted individual behavior. Increased egalitarianism correlated with a greater number of actions, while increased hierarchism correlated with fewer. The model was very significant and explained 16% of the variance ( $F(3, 549) = 35.72, p < .001, R^2_{adj.} = .16$ ). These results supported Hypothesis 2(c): worldviews influence individual behaviors to address global warming.

Model 4 found that six sociodemographic variables significantly predicted individual behavior. Members of environmental groups, liberals, newspaper readers, world wide web users, minorities and lower income individuals were more likely to have

taken individual actions to address global warming. Conservatives, whites and higher income individuals were less likely to have taken individual actions. The full model was very significant and explained 24% of the variance ( $F(6, 494) = 27.93, p < .001, R^2_{adj} = .24$ ).

Model 5 combined the four models, significantly predicted individual behaviors to address climate change, and explained 36% of the total variance. Holistic negative affect was the single most powerful predictor ( $\beta = 0.31, p < .001$ ) of behavior. The second-most powerful predictor was membership in an environmental group ( $\beta = 0.27, p < .001$ ), followed by Skeptics ( $\beta = -0.13, p < .01$ ) and newspaper readers ( $\beta = 0.13, p < .01$ ). Flood/Sea Level, ideology, world-wide-web users, race and income all remained significant, though weaker predictors in the full model. Thus, the full model demonstrated that affect and imagery strongly predicted individual behaviors to address global warming, although membership in environmental groups was a stronger predictor than imagery. Egalitarianism, however, ceased to be a significant predictor in the full model.

#### Hypothesis 4

Hypothesis 4 predicted that climate change activists would be significantly more egalitarian than the American public. This hypothesis was tested with a series of independent means t-tests, comparing American and activist mean responses to the same egalitarianism, individualism, fatalism and hierarchism questions (Table 40). On average, activists were significantly more likely to agree with egalitarian principles than the American public: they were much more likely to support government efforts to get rid of poverty,  $t(717) = 6.31, p < .001$ ; agree that the world needs a more equal distribution of wealth,  $t(717) = 12.47, p < .001$ ; say that if people were treated more equally there would be fewer problems,  $t(717) = 12.70, p < .001$ ; and agree that the world would be more peaceful if its wealth was divided more equally among nations,  $t(714) = 13.63, p < .001$ .

Activists, however, were significantly more likely to *disagree* with individualism principles than the American public. Activists strongly disagreed that making money is the main reason for hard work,  $t(718) = -12.86, p < .001$ ; or that life tends to sort out those who try hard from those who don't,  $t(713) = -7.99, p < .001$ . Finally, they sharply disagreed with the American public that those who acquire wealth should have the right to enjoy it,  $t(716) = -12.05, p < .001$ .

TABLE 40. Worldviews: American Public vs. Activists

	<i>Americans</i>			<i>Activists</i>			<i>Mean Difference</i>	<i>p</i>
	<i>Mean</i>	<i>SD</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>		
<i>Egalitarianism</i>								
I support government efforts to get rid of poverty.	2.99	0.89	612	3.56	0.76	107	0.57	***
What this world needs is a more equal distribution of wealth.	2.51	0.98	612	3.52	0.73	107	1.01	***
If people were treated more equally we would have fewer problems.	2.76	0.88	612	3.64	0.62	107	0.88	***
The world would be a more peaceful place if its wealth were divided more equally among nations.	2.21	0.93	612	3.51	0.74	104	1.30	***
<i>Individualism</i>								
Making money is the main reason for hard work.	2.53	0.95	612	1.45	0.78	108	-1.08	***
It is just as well that life tends to sort out those who try harder from those who don't.	2.56	0.90	612	1.80	0.83	103	-0.76	***
If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it.	3.41	0.67	612	2.28	0.92	106	-1.13	***
<i>Hierarchism</i>								
We have gone too far in pushing equal rights.	2.33	1.01	612	1.22	0.53	111	-1.11	***
People should be rewarded according to their position in society.	1.78	0.84	612	1.52	0.84	108	-0.26	**
When the risk is very small, it is OK for society to impose that risk on individuals without their consent.	1.57	0.75	612	1.50	0.73	103	-0.07	
Government and industry can be trusted to make the right decisions about technological risks.	1.94	0.79	612	1.24	0.55	108	-0.70	***
<i>Fatalism</i>								
The future is too uncertain for a person to make serious plans.	1.90	0.90	612	1.80	0.81	110	-0.10	
It doesn't make much difference if people elect one or another political candidate, for nothing will change.	2.25	0.98	612	1.58	0.83	109	-0.67	***
I feel that life is like a lottery.	2.05	0.91	612	2.10	0.97	106	0.05	
I have very little control over my life.	1.55	0.75	612	1.52	0.76	108	-0.03	
It's no use worrying about public affairs; I can't do anything about them anyway.	1.97	0.87	612	1.14	0.42	110	-0.83	***

(1 = Strongly Disagree; 4 = Strongly Agree)

\*\* =  $p \leq .01$  \*\*\* =  $p \leq .001$

Activists were also significantly more likely to disagree with hierarchism principles than the American public. They strongly disagreed with the statement that “we have gone too far in pushing equal rights,”  $t(721) = -17.21, p < .001$ . They also disagreed that people should be rewarded according to their position in society,  $t(718) = -2.97, p < .01$  or that government and industry can be trusted to make decisions about technological risks,  $t(718) = -11.43, p < .001$ .

Activists were not significantly different than the American public on three fatalism measures, but were significantly different on two others. Both activists and the American public disagreed with the fatalist principles that “the future is too uncertain to make serious plans,” that “life is like a lottery,” or that “I have little control over my life.” Activists, however, exhibited much stronger disagreement with the principles that elections don’t matter because nothing will change,  $t(719) = -7.50, p < .001$  or that “it’s no use worrying about public affairs because I can’t do anything about them anyway,”  $t(720) = -15.76, p < .001$ .

Taken as a whole, these results strongly supported the hypothesis that climate change activists would be more egalitarian than the American public. They also validate a central finding and prediction of Cultural Theory – that environmental activists tend to be strongly egalitarian.

### Summary of the Hypotheses

These findings provide evidence that affect is a critical component of risk perception. Perceived risk is not merely the analytical calculation of probabilities and severity of consequences; it is imbued with affective evaluations. Affect was consistently the strongest predictor of global warming risk perceptions, policy preferences and individual behaviors. Furthermore, cognitive images or associations to global warming were also significant predictors of these dependent variables. Importantly, however, the affect and imagery measures were domain-specific; respondents were specifically asked their affective evaluations and first associations to “global warming.” In this sense, the strong correlations between these measures and risk perceptions, policy preferences and individual behaviors, although highly significant, were less surprising.

Perhaps more surprising, however, were the significant contributions of worldview in the final models. The worldview measures were explicitly non-domain specific. None of the worldview questions were about either global warming or the environment. They were statements reflecting abstract, general principles and values or preferred organizational structures for society. Yet, these seemingly unrelated worldview variables correlated strongly with global warming risk perceptions, policy preferences and individual behaviors, and in the case of tax policy preferences, were the single strongest predictor. In particular, those individuals committed to egalitarian principles were much more likely to perceive global warming as a serious threat, support national,



international and tax policies to address it, and undertake individual actions to reduce their own contributions to climate change.

One might assume that egalitarianism and political liberalism were synonymous. A linear regression between the two variables does show that they were related ( $\beta = 0.46$ ,  $p < .001$ ), with increased egalitarianism associated with increased liberalism. Yet each variable remained an independent predictor of the variance in three of the four full-model multiple regressions (general policy preferences, tax policy preferences and individual behavior). Thus, egalitarianism and political liberalism do not appear to be the same thing. Further, egalitarianism was a stronger predictor of global warming risk perception, policy preferences and individual behavior than political ideology, suggesting that egalitarianism is a different, yet highly predictive variable.

## CHAPTER V

### DISCUSSION AND CONCLUSION

#### Discussion

Natural scientists warn that global climate change is a very serious risk with potentially devastating consequences for human societies and natural ecosystems around the world. Meeting this challenge will require concerted local, national and global efforts to dramatically reduce anthropogenic greenhouse gas emissions. These efforts will require committed action by individual citizens and public support for political leaders and government mitigation policies. The United States, as the world's single largest emitter of greenhouse gases, will play a pivotal role. As part of a democratic and free market system, the American public will have a decisive influence on the future direction and severity of global climate change, with myriad consequences for people and places around the world.

A growing body of social science research has demonstrated that individuals and groups respond to threats based on their perception of the risks. Further, risk perception researchers have identified a number of social and psychological dimensions of risk, including affect, imagery and cultural worldviews, that are often more salient for the lay public than the quantitative assessments of probability and severity of consequences

preferred by technical experts. This dissertation examined whether the American public perceives global warming as a real threat, supports public mitigation policies, or has taken individual actions to mitigate climate change. This research also analyzed the roles of affect, imagery and cultural worldviews in public global warming risk perceptions, policy preferences and individual behaviors among three populations: the American public, the Oregon public and student climate change activists attending the 2000 World Climate Conference (COP6) at The Hague, Netherlands. Finally, it explored whether affective image analysis could identify distinct “interpretive communities” within the American public.

### Risk Perceptions of Global Warming

This research found that a clear majority of Americans (75%) expressed concern about global warming. Although there were clear partisan differences, with Democrats and Liberals showing significantly more concern than Republicans and Conservatives, strong majorities of Americans across the political spectrum voiced concern about the issue. Respondents were asked to evaluate the likelihood of a variety of local to global impact scenarios, including decreased standards of living, water shortages, and increased rates of serious disease. On average, Americans viewed the global scenarios as somewhat likely. By contrast, they believed that the local scenarios were somewhat unlikely. This suggests that Americans view global warming as a spatially distant threat. Respondents were also asked to estimate the number of people worldwide annually

killed, injured or made ill by global warming currently and fifty years from today. On average, Americans estimated that only hundreds are currently affected each year, while thousands will be in the future. This suggests that Americans believe global warming will be relatively more serious in the future. Further, the seriousness of the threat global warming poses to non-human nature received the single highest mean score of all the risk perception questions. In sum, these results suggest that the American public as a whole, while concerned about global warming, view it primarily as a temporally and spatially distant threat to people and places far away or to non-human nature.

These conclusions were supported by the results of a separate question which asked respondents to indicate the geographic scale of climate change impacts that was of greatest concern to them. By a very large majority, 50% of Americans were most concerned about the impacts on people all over the world, followed by 18% who were most concerned about the impacts on non-human nature. Only 13% were most concerned about the impacts on themselves, their family or their local community.

Another important measure of current levels of concern was the question, “How often do you discuss global warming with your family and friends?” Nearly 70% of Americans reported that they rarely discuss global warming within their immediate social networks. This is another important indicator that global warming is not currently a highly salient issue for the American public. In a related vein, the psychologist Neil Weinstein has identified “preoccupation” as a highly significant factor in risk perception

and behavior. He defines preoccupation as the frequency and availability of thoughts regarding a hazard; the more often individuals think about the hazard and the more vivid and easily brought to mind these thoughts are, the more likely they are to take protective action (Weinstein, et al., 2000). “Preoccupation,” however, is not merely an individual, psychological phenomenon – it is also fundamentally social and cultural. One’s individual thoughts, images and affect about a risk are further amplified or attenuated by one’s immediate social network (Kasperson, et al. 1988). We often discuss our preoccupations with our closest friends, family and colleagues – and talking about an issue like global warming increases the frequency and availability of thoughts about it, as well as increasing the number of associations to it as one “learns” more (regardless of whether these associations are scientifically accurate or not). Further, beyond immediate social networks, individuals are also linked to broader social networks of media, economic and political relations. Americans currently receive relatively few “amplifying signals” regarding global warming from any of these broader networks. For example, a recent media analysis conducted by the Center for Media and Public Affairs found that, since 1990, television network coverage of global warming declined by 50%, while national newspaper coverage dropped by 25% (FrameWorks Institute 2001). Meanwhile, the relative focus of national news shifted dramatically over the decade:

*In 1990, the amount of environmental coverage on evening news was more than triple that devoted to the entertainment industry (377 v. 134). By 1993, there were more stories on popular culture (239) than there were on the environment (140). By 1998 news of the entertainment industry accounted for twice as many stories as the environment (211 v. 106) (FrameWorks Institute 2001).*

The fact that most Americans rarely talk about global warming indicates that the issue is not highly salient – we are not preoccupied with this risk – either as individuals or as a society.

Taken together, these findings help to explain the risk perception paradox identified by public opinion polls. Opinion surveys have consistently found that Americans say they are quite concerned about global warming, yet when asked to rank global warming in relation to other environmental concerns, Americans place global warming 12<sup>th</sup> out of 13 environmental issues (Dunlap and Saad 2001). This dissertation found that Americans currently view climate change as a temporally and spatially distant threat to people and places far away, or to non-human nature. Furthermore, they rarely talk about the issue with their friends or family, while media coverage has declined since 1990. It is highly unlikely that global warming will become a national priority until these trends are reversed.

By contrast, student climate change activists exhibited extreme levels of risk perception across nearly all the measures. Activists believed that decreased standards of living and rates of disease were very likely, both globally and locally. They further believed that food shortages and starvation were very likely globally and somewhat likely locally. Activists estimated that the number of people worldwide annually killed, injured or sickened by global warming currently ranges in the thousands and 30 years from now will range in the millions. Activists were also very concerned (95%) about the future

impacts of global warming on non-human nature. And significantly, 98% of activists reported discussing global warming with their friends and family. Clearly, global warming was a highly salient issue among climate activists, who believed that there are already large impacts on human health and that serious local impacts are very likely.

This research also operationalized four hypothesized predictors of risk perception among the American public, including negative affect, imagery, cultural worldview and sociodemographics. A series of five multiple regression models were constructed to test these predictors of risk perception (see Table 36). This analysis found that negative affect, imagery, cultural worldviews, and sociodemographics were each significant predictors of global warming risk perception. When all four sets of predictors were combined in a single model, however, the analysis found that negative affect and imagery (Skeptics) were the strongest predictors of risk perception, followed by cultural worldview (Egalitarianism); as negative affect or egalitarianism increased, risk perception increased. By contrast, the “Skeptic” interpretive community perceived global warming as a much lower risk. These hypothesized predictors were stronger than any sociodemographic variable, providing evidence that affect, imagery and worldview are indeed significant determinants of risk perception. Further research and analysis is needed to compare these factors with other commonly used explanatory variables, such as knowledge, trust and general environmental attitudes.

## Global Warming Policy Preferences

Does the American public support public policies to mitigate climate change?

The answer to this question has important implications for the global effort to address global warming, as the United States remains the world's single largest emitter of greenhouse gases. Without strong public support for policy action, it is highly unlikely that political leaders will take the requisite steps to dramatically reduce U.S. emissions. This research measured American public support for a variety of policy proposals to mitigate global warming at the national and international levels. It found that of those Americans who had heard of global warming (92%):

- Over 90% thought the United States should reduce its greenhouse gas emissions.
- A strong majority (77%) supported government regulation of carbon dioxide as a pollutant and a shift in subsidies from the fossil fuel industry to the renewable energy industry (71%).
- A strong majority (88%) supported the Kyoto Protocol and (76%) wanted the United States to reduce greenhouse gas emissions regardless of what other countries do.
- While a majority favored a tax on "gas guzzlers" (54%), strong majorities opposed a gasoline tax (78%) or a business energy tax (60%) to reduce greenhouse gas emissions.
- Americans divided evenly (40%) regarding a market-based emissions trading system, while 18% were uncertain.
- Majorities of Republicans and Conservatives supported most climate change policies.
- Democrats and Liberals expressed stronger support for climate change policies than Republicans and Conservatives.



- Independents and Moderates showed levels of support more similar to Democrats and Liberals than to Republicans and Conservatives.

These results demonstrated strong, bipartisan support among the American public for action at the national and international levels to reduce emissions of greenhouse gases. Significantly, strong majorities of the public approved of the regulation of carbon dioxide as a pollutant, supported the Kyoto Protocol, and wanted U.S. action regardless of what other countries do – all contrary to the current policies of the Bush administration and the U.S. Congress.

On the other hand, a contradiction in American policy attitudes was identified in these results. While Americans demonstrated high awareness and concern for global warming and strongly supported a variety of government actions, they were not willing to accept higher fossil fuel-based energy or gasoline prices to achieve this goal – one of the most powerful and direct economic incentives to reduce fossil fuel use and encourage more energy efficiency (e.g., improved vehicle fuel economy, high efficiency appliances and machinery, etc.).

It thus appears that Americans have not fully confronted the contradiction between their strong support for greenhouse gas emission reductions and opposition to policies that would directly discourage fossil fuel use by consumers. This suggests that, as a whole, the American public is currently in a “wishful thinking” stage of opinion

formation (Yankelovich 1991, 2002), in which they hope the problem can be solved by someone else (government, industry, etc.), without changes in their own priorities, decision making or behavior.

### Global Warming Behaviors

Stabilization of the Earth's climate will require more than large-scale government programs and international treaties. All levels of American society are complicit in the production and emission of the world's highest per capita rate of greenhouse gases. Greenhouse gas emissions like carbon dioxide are partly the byproduct of the countless decisions made by individual Americans every day. Almost everything we do in modern American society involves the burning of fossil fuels, whether directly by driving our cars, heating our homes, turning on a light, or indirectly through the products we buy and use. Thus, individual behavior will be a critical component of the overall strategy to reduce American emissions of greenhouse gases.

This dissertation reports the results of a series of questions intended to identify what kinds of individual actions Americans have already taken to mitigate global warming and to determine how common these behaviors are. It found that approximately half of Americans said they had used energy-efficiency as a selection criterion when buying a light bulb, a household appliance or a motor vehicle (51%) or installed insulation or weatherized their home (45%). These results indicate that energy efficiency

and conservation have become important decision making factors for many Americans. Unfortunately, 46% said they had chosen not to buy an aerosol spray can because of their concern about global warming, which provides further evidence that many Americans continue to confuse or conflate global warming with stratospheric ozone depletion. Thus, many Americans hold inaccurate beliefs about the causes of global warming, which leads them to support inappropriate solutions. These “solutions” can range from choosing not to buy an aerosol spray can, despite the fact that “sprays containing CFC’s have been banned in the US for [three] decades (Cutter, 1993:53), to the solution proposed by one survey respondent:

*The problem of global warming is the hole in the ozone layer over Antarctica, right? Scientists can produce ozone in labs, right? The solution is simple. A huge amount of ozone should be created, then a team should fly it to Antarctica. Once there, a plane should fly at a high altitude, meanwhile releasing the ozone into the torn ozone layer. Then, the pollution worldwide should TRY to be regulated. Hey, I’m not saying it’ll work, but it’s worth a try.*

Another preferred individual action reported by Americans was tree planting. Forty-nine percent (49%) of Americans claimed to have planted a tree because of their concern about global warming – perhaps the quintessential, symbolic “environmental act.” Planting trees to mitigate global warming, however, is highly controversial. Planting trees has even become a major issue of debate at the world climate conferences. Trees absorb carbon dioxide from the air and store it in cellulose as part of the process of photosynthesis. This carbon sequestration by living trees and forests is part of an enormous biological carbon sink responsible for removing millions of tons of carbon

dioxide from the atmosphere each year. Some industrialized nations (e.g., the United States, Canada, Russia, etc.) have demanded credit for the carbon absorbed by the trees and forests in their territories. Others have further argued that a massive, global, tree-planting program should be undertaken to absorb additional carbon dioxide. This approach has come under enormous criticism from scientists, environmental advocates and indigenous peoples for a host of reasons well beyond the scope of this dissertation (e.g., Meyer, et al. 1998; Englin and Callaway 1995; Scholes 1999). It is significant, however, that planting a tree is one of the most common mitigation behaviors reported by the American public, because it suggests that they are strongly predisposed to support tree planting programs as a (partial) solution to global warming.

Only 4% of Americans, however, had purchased energy from an alternative source, such as wind or solar power and only 26% reported using alternative transportation instead of driving. Finally, Americans demonstrated very low levels of political or social behavior regarding global warming. Only 27% reported talking to family friends or colleagues about the issue, while nearly 70% of Americans said they rarely discuss global warming within their immediate social networks. Only 15% reported joining or donating money to organizations working on issues related to global warming and only 9% had made their views on global warming clear to politicians. Overall, these results indicate that while nearly 50% Americans have taken actions like energy efficiency and conservation (both national priorities years before global warming became a public issue), relatively few have engaged the issue either socially or

politically. Until global climate change becomes a high public priority, democratically-elected political leaders are unlikely to take the concerted actions necessary to stabilize the global climate system, especially in the face of powerful special interests that seek to maintain the status quo.

### American Affective Images of Global Warming

Recent research has found that public risk perceptions involve more than the analytical calculation of probabilities and consequences or the mere accumulation of scientific facts and knowledge; rather they are constructed from multiple evaluative dimensions, including affect and imagery (associations). This dissertation further developed affective image analysis to investigate the role of connotative meaning in risk perception, decision making and behavior and to identify distinct “interpretive communities” among the American public. It found that the term “global warming” had negative connotations for both the American public and climate change activists. On a five-point scale ranging from “slightly negative” (-1) to “very negative,” (-5) activists overwhelmingly rated global warming as very negative ( $M = -4.68$ ), while the American public rated global warming as moderately negative ( $M = -3.31$ ). In subsequent multiple regression models constructed to predict global warming risk perceptions, policy preferences and individual behaviors, holistic negative affect was consistently the single most powerful predictor – more powerful than cognitive imagery, cultural worldviews or

sociodemographic variables. These results provided further evidence that affect is a critical component of risk perception, decision making and behavior.

This research also explored the role of imagery, or the cognitive component of connotative meaning, in global warming risk perceptions, policy preferences and behaviors. Respondents from the American, Oregon and activist samples were asked to free associate the first thought or image that came to mind when they heard the word “global warming.” This produced a rich dataset of responses, which were used to identify and describe the dominant connotative meanings held by each group. It was found that “global warming” was a richly evocative concept for all three groups, with a great diversity of associations. The dominant image in the American public mind was melting polar or glacier ice in the Arctic or Antarctica. This was followed by images of heat, non-human nature, and the ozone hole. Thus, two of the four dominant images (melting ice and non-human nature), representing 34% of all respondents, referred to impacts on places or natural ecosystems distant from the everyday experience of most Americans. Most Americans do not live near glaciers, the Arctic Circle or Antarctica. To the extent that melting ice remains the most salient association to global warming, climate change will probably remain a low-priority issue for most people. Likewise, impacts on non-human nature are probably perceived within the larger cultural context of anthropocentrism, whereby animals, plants and insects are viewed as having less moral value or importance (if any) than human beings. To the extent that global warming

continues to be primarily associated with impacts on non-human nature, it also is likely to remain a low-priority issue.

Most of the references to “heat” were relatively generic in nature and likely indicated associations with the “warming” in “global warming.” Finally, 11% of Americans provided associations to the separate environmental issue of stratospheric ozone depletion, again 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 completely different environmental problem.

This technique also identified two extreme interpretations of global warming. First, 11% of Americans provided associations of disaster and catastrophe to the stimulus term “global warming.” Many of these respondents associated global warming with social and environmental collapse, mass extinctions, and the end of the world. By contrast, 7% of Americans provided associations of profound skepticism and even cynicism about global warming and the scientists, activists and political leaders that claim global climate change is a real and significant threat. Combined with the results from the Oregon survey, six different types of skeptics were identified: those who flatly deny that global warming exists; those who believe that global warming is just part of a normal, natural phenomenon; those that believe the scientific case is still unproven; those who doubt based on personal experience of extreme cold weather; those who believe that

global warming is real, but overly hyped by the media or environmentalists; and finally conspiracy theorists who believe global warming is a hoax perpetrated on the public by scientists, politicians or environmental groups.

One of the most important findings was what was not found in these results. There were no associations to the impacts of climate change on human health. There were no references 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, E-coli, giardia, etc.), or vector and rodent-borne disease (e.g., malaria, West Nile Virus, Hantavirus Pulmonary Syndrome, etc.) all of which are likely to be impacted by global climate change (Patz et al. 2000; Epstein 2000). Scientists project that the human health impacts of climate change are likely to be some of the most threatening consequences for human societies, especially for the poor and children in developing countries who lack access to adequate nutrition, clean water or medical care. A recent study by the World Health Organization and the London School of Hygiene and Tropical Medicine estimated that 160,000 people (primarily children in developing countries) currently die every year due to the side-effects of global warming. This number is projected to nearly double by 2020 (Doyle 2003).

Americans are unlikely to perceive climate change as a highly salient risk until it is understood as a serious threat to human health. Again, there are probably geographical



and historical dimensions to this lack of concern, in that Americans have relatively little recent experience with infectious diseases like malaria, dengue fever, cholera, etc. which continue to plague much of the developing world. To a great extent, Americans are insulated and protected from many of these diseases due to the great sophistication and resiliency of the American medical system. Nonetheless, Americans do not currently associate global warming with any impacts on human health, whether in the United States or in the less-developed world. This finding (or the lack thereof) identifies a critically important gap in current public understandings of global warming and its consequences.

Another important pattern in the affective image results was the relative lack of associations to either the causes of or solutions to climate change. Only 5% of the total number of images referred to any of the causes of climate change (e.g., fossil-fuel burning, automobiles, industrial emissions, etc.), while none referred to potential mitigations (e.g., renewable energy, fuel efficiency standards, geo-engineering, etc.). First associations to global warming occurred almost exclusively within an impact or problem frame of reference, not a causal nor a solution frame. This suggests that the causes and solutions to climate change did not come “readily to mind” and were not among the most salient features of Americans’ conceptions of global warming.

### National Interpretive Communities

An important application of affective imagery is its use as a tool to identify distinct “interpretive communities.” An interpretive community is defined here as a group of individuals who share a relatively coherent and consistent set of associative and connotative meanings regarding a particular risk. Further, members of such communities tend to share a common worldview and interpret risks in a similar way. Two distinct communities were identified: Skeptics and Believers. Each of these groups correlated strongly with a wide range of covariates in highly significant and predictable ways. For example, Skeptics were much more likely to be conservative, better educated, Republican males, who preferred to get their news from the radio, and who were much more likely to be registered voters. These skeptics had lower global warming risk perceptions, strongly opposed climate change policies and were less likely to have taken mitigation actions. They also tended to have an anti-egalitarian worldview and to hold anti-environmental attitudes. In particular, they were much more likely to prefer protection of the economy over protection of the environment. Thus, a distinct interpretive community of “skeptics,” was identified, who share common interpretations of global warming and common attitudinal and sociodemographic characteristics.

These findings also provided convergent evidence for the existence of a “white male effect” in risk perception, similar to the findings of Flynn et al. (1994). In a national study of risk perceptions across 25 hazards, they found that politically conservative and

better educated white males with higher incomes exhibited significantly lower risk perceptions than all other combinations of race and sex. Further, this subgroup was also much more likely to trust institutions and authorities, and to exhibit anti-egalitarian attitudes. Affective image analysis is an entirely different methodological technique, yet identified a very similar subgroup of respondents who exhibited many of the same sociodemographic, attitudinal, worldview and risk perception characteristics. Further research is needed to corroborate these findings, which imply that risk perception goes well beyond issues of scientific literacy, analytical reasoning and knowledge. These and other findings reported in this dissertation suggest that risk perceptions, policy preferences and individual behaviors are strongly influenced by sociopolitical factors (Finucane, et al. 2000b; Slovic 1997).

### Activist Affective Images of Global Warming and Hypothesis 3

As expected, student climate change activists exhibited stronger negative affective reactions to global warming than either the Oregon or American publics. It had been hypothesized (Hypothesis 3), however, that activists would produce a greater diversity of associations to global warming than the general public, reflecting their greater knowledge and understanding of the issue. Surprisingly, the opposite was found: activists coalesced strongly around three images (Disaster, Nature, and Flooding/Sea Level Rise), while the Oregon and American publics varied much more evenly across a wider range of images.

Interpreting these results, there appears to be an important difference between the number of associations and the diversity of associations. All of the above analyses were conducted with the set of first thoughts or images provided by all three samples. If the surveys had asked for the second, third, fourth, fifth, etc. images, activists may have compiled a much larger number of associations overall, reflecting their greater knowledge and interest in the subject. In this sense, “global warming” should be more meaningful for activists than the general public.

The lower diversity of activists’ associations may partially reflect their relative homogeneity as a sample and interpretive community. They were predominantly American, young, college-educated, environmental activists who had all flown to The Hague, Netherlands to take part in the 2000 World Climate Conference. The results of the risk perception and other measures described above demonstrate that they were often nearly unanimous in their evaluations of climate change risks. As highly motivated political actors, it is perhaps not surprising that they predominantly shared an image of “Disaster” (40%) when associating to the term “global warming.” Associations to “Nature” perhaps reflect a more ecocentric set of values one might expect among an environmental activist sample.

The third category “Flooding and Sea Level Rise,” however, is harder to interpret. Fully 23% of activists provided an association in this third-largest category – a higher percentage than either of the number one categories among the American (IceMelt =

21%) or Oregon publics (Disaster = 15%). One possible interpretation was the location of the climate conference. The Hague, Netherlands is below sea level and there were numerous references throughout the conference and surrounding activities to the dangers that flooding and sea level rise pose to the Netherlands, which has a long cultural history connected to these issues (e.g., the dike and polder system). The most powerful symbolic action of the many protests that swirled around the meeting was the construction, early in the week, of an enormous symbolic sea wall that surrounded the conference center. Built with thousands of sandbags and standing over 4 feet high, the sea wall confronted conference delegates and this student activist sample with a daily reminder of this particular climate change impact. In fact, many of the student activists participated in its construction. I surmise that this sample was primed by the social and political context to associate global warming with flooding and sea level rise. If this is correct, it would be an example of how particular associations or connotations can be amplified through political action, repetition, and social discourse to influence the interpretation of an issue, person or event. Although the original hypothesis was found to be incorrect, the results provide tantalizing clues for future research.

### Global Warming vs. Climate Change

This research also identified a very large disparity between American and activist affective evaluations of the terms “global warming” and “climate change.” The mean value of American evaluations of the term “global warming” was –3.31 on a five point

scale. The sub-sample of the public who provided the association “climate change,” however, rated this term at only -1.26 on a five point scale. By contrast, activists rated both “global warming” (-4.68) and the association “climate change” (-4.71) as extremely negative. One would expect that activists would exhibit stronger negative affect for these terms than the American public and this is in fact what was found. More importantly, however, activists rated both terms as equally negative, while Americans rated the two terms quite differently. This suggests, within the limitations of these studies, that the two terms carry very different affective connotations.

The apparent disparity in the connotative meaning between the two terms “global warming” and “climate change” has already been exploited for political gain. Prior to the 2002 elections, Frank Luntz, a leading Republican pollster and strategist, gave the Bush administration the following advice in a secret memo on how to win the “environmental communications battle” on a number of issues, including global warming. The memo was obtained by the Environmental Working Group and released to the public:

*It's time for us to start talking about 'climate change' instead of 'global warming'... 'Climate change' is less frightening than 'global warming.' As one focus group participant noted, climate change 'sounds like you're going from Pittsburgh to Fort Lauderdale.' While global warming has catastrophic connotations attached to it, climate change suggests a more controllable and less emotional challenge (Luntz 2002).*

In a similar vein, Luntz recommended that Republicans stop identifying themselves as “environmentalists” or “preservationists” and instead call themselves

“conservationists.” He argued that, “The term ‘conservationist’ has far more positive connotations than either of the other two terms. It conveys a moderate, reasoned, common sense position...[while]... ‘Environmentalist’ can have the connotation of extremism to many Americans, particularly those outside the Northeast.”

His advice was apparently heeded at the highest levels. The New York Times reported that the terms “global warming” and “environmentalist” appeared in a number of President Bush’s environmental speeches in 2001, but after Luntz’s memo, the White House shifted to consistently use “climate change” and “conservationist” instead (Lee 2003).

This suggests that the specific terms used to describe and communicate scientific findings, news and policy about this environmental issue – and more broadly all risk issues – may have significant impacts on public risk perception and behavior. The use of the scientific term “climate change” does not carry strong negative connotations for the American public; this emotional neutrality is one of the reasons for its popularity among the scientific community<sup>1</sup>. Nonetheless, when scientists communicate their findings to non-specialists, the terms they use enter complex political and social systems of meaning,

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<sup>1</sup>Additionally, the term ‘climate change’ allows for spatially heterogeneous impacts. Some areas are projected to get warmer, while others will get colder; some areas will get more precipitation, while others will get less. From this perspective, ‘global warming’ is a misnomer, because it wrongly suggests a homogenous warming trend worldwide – which is true only in an average, statistical sense. The term ‘climate change,’ however, can also be critiqued because it is abstract and does not distinguish between anthropogenic and natural climate change. Unfortunately, both ‘global warming’ and ‘climate change’ are less than ideal terms on cognitive and affective grounds.

where the terms used can have significant impacts on the risk perceptions and behaviors of political and cultural elites and ordinary citizens. As Kathleen Hall Jamieson and Paul Waldman argue in their analysis of media coverage of political affairs,

*Language choices not only reflect individual disposition but influence the course of policy as well. Tax cuts or tax relief? Religious or faith-based? Death penalty or execution? Estate tax or death tax? Civilian deaths or collateral damage? In the early stages of almost any policy debate, one can find a battle over which terms will be chosen. Because the terms we use to describe the world determine the ways we see it, those who control the language control the argument, and those who control the argument are more likely to successfully translate belief into policy (Jamieson and Waldman 2003:xiv).*

Thus, the decision by many scientists to exclusively use the relatively neutral term “climate change” constitutes a political act, however inadvertent or unintended. As Luntz’s memo to the White House demonstrates, the seemingly innocuous decision to use the term “climate change” may provide tacit support for the political aims of one group over another. On the other hand, it is clear that connotative meanings are dynamic and can change, sometimes quite rapidly. “Climate change” has already become a highly stigmatized term among the activist community and perhaps much of the scientific community as well. With repeated use, it could be argued that over time it will also acquire strong negative connotations among the general public as well. In the short term, however, it appears that the relative neutrality of the term “climate change” is being exploited to advance a particular political agenda.



### Implications for Risk Communication

For scientists, policymakers and risk communicators concerned about global climate change, the findings from the American and Oregon publics may be troubling news. They suggest, however, that multiple strategies are needed to communicate about climate change. First and most importantly, this research identified the complete absence of associations to the projected human health impacts of global climate change among the American public. Risk communicators need to articulate and emphasize these health impacts, which are among the most serious consequences of projected climate change. Human health impacts are also more likely to elevate public concerns about global warming, especially compared to the associations currently dominant (melting ice, generalized heat, and impacts on non-human nature).

A different strategy would be needed, however, for those people who confuse global warming with the ozone hole. Risk communicators should probably target the source of the confusion – the inappropriate application of knowledge about the ozone hole to the problem of global warming – by explicitly attempting to disassociate these two environmental problems. This research found that these respondents were already inclined to believe government and media sources and exhibit pro-environmental attitudes and behaviors; thus they should be relatively open to risk communications about global climate change. As many already have negative affect associated with ozone

depletion, risk communicators could try to link this negative affect to a more accurate image and elaborated mental model of global climate change.

An entirely different set of strategies would be needed to convince “Skeptics” that global warming is a serious concern. These people will be difficult to reach, as they appear to distrust both government and the media. This may help to explain why increased amounts of scientific information and media exposure have not successfully persuaded this vocal segment of the public (who are also more likely to vote). In fact increased science and media coverage may serve only to strengthen some skeptics' disbelief, to the point of conspiracy theory. Further research is needed on this subpopulation to identify the arguments, values and information sources that they do trust.

"Disaster" respondents already exhibit grave concern regarding the issue. They strongly support policies to mitigate climate change and are already predisposed to be attentive to and believe scientific, government and environmentalist messages regarding climate change risks. On the other hand, in contrast with climate change “Skeptics,” “Disaster” respondents were significantly less likely to be registered voters. In addition, some of these respondents provided extremely negative affective images that went well beyond scientific assessments of climate change risks. These extreme responses were often apocalyptic, predicting "the end of the world" or the "death of the planet." These are overreactions to an otherwise very serious problem and represent individuals with

extreme risk perceptions. Future research will attempt to describe the prevalence of this type among the public and environmental activists.

Finally, scientists and risk communicators need to do a better job reaching those people who have never heard of the issue ("Don't Knows"). Fortunately, these people do not already confuse global warming with the ozone hole. On the other hand, they also tend to have non-environmental attitudes and behaviors. This may indicate a lack of salience for most environmental issues; making these respondents relatively unresponsive to risk messages about climate change or other environmental problems. Further research is needed to characterize this group.

In short, the technique of affective image analysis demonstrates great potential to disaggregate "the public" and identify interpretive communities sharing subjective, affective meanings regarding various environmental risks, and to identify dominant associations, common misconceptions, and critical gaps in understanding.

## Worldviews and Global Warming

This dissertation operationalized Cultural Theory as an independent set of variables to test the theorized relationship between worldviews and global warming risk perceptions, policy preferences and individual behaviors. Each worldview (egalitarianism, individualism, hierarchism and fatalism) was operationalized with a set of 6 questions adapted from previous research or constructed for these surveys. Indexes were successfully constructed for egalitarianism and fatalism. Indexes for individualism and hierarchism were attempted, but could not be satisfactorily constructed, therefore each individualism and hierarchism question was tested as a possible predictor in line with Cultural Theory.

Egalitarianism proved to be a very significant predictor of American risk perceptions, general policy preferences, and tax policy preferences, even when controlling for affect, imagery, and sociodemographics, including sex, race, education, and income. Egalitarianism was strongly correlated with increased global warming risk perception, increased support for government policies, and increased levels of individual mitigation behavior. These results are all the more remarkable because the egalitarianism measures were not related to global warming, the risk under study, in any direct way. By contrast, both the affect and imagery measures explicitly asked respondents to either rate their feelings or provide associations to global warming. The egalitarianism measures, however, asked respondents how much they agreed or disagreed with statements like,

“What this world needs is a more equal distribution of wealth” or “Firms and institutions should be organized so everybody can influence important decisions.” Despite these non-domain-specific nature of these measures, they nonetheless proved to be highly significant predictors. These results support the predictions of Cultural Theory – that egalitarians are generally more concerned about environmental risks like global warming.

Fatalism, however, was not a significant predictor of American risk perception, general policy preferences or individual actions. It was slightly correlated with tax policy preferences, but this association disappeared in the full multiple regression model, which also included affect, imagery and sociodemographic variables. Cultural theory predicts that fatalists are typically apolitical, resigned to merely endure the binding proscriptions of more powerful groups and external forces, and do not work to change economic, political or cultural systems. As Tim O’Riordan and Andrew Jordan argue,

*[Fatalists] are resigned to their fate and see no benefit from trying to re-shape it. Consequently they do not join pressure groups, do not get involved in societal debate and see no sense in society trying to “learn” about how to mitigate and/or adapt to climate change because, ultimately, it is hopeless (O’Riordan and Jordan 1999:87).*

These research results provide evidence that these predictions are correct. Fatalists did not express significantly higher or lower risk perception, support or oppose global warming policies, or report more or fewer mitigation actions. Instead, they agreed with the statement, “It’s no use worrying about public affairs; I can’t do anything about

them anyway.” Thus, we would not expect fatalist risk perceptions, policy preferences or individual behaviors to vary significantly from the mean.

The inability to construct adequate indexes of individualism and hierarchism suggests that the measures used in this research did not adequately distinguish individualists or hierarchists among the American public. Other researchers (e.g., Marris, et al., 1998; Peters and Slovic 1996; Rippl 2002; Steg and Sievers 2000) have reported similar methodological difficulties with the original questionnaire items developed by Karl Dake (Dake 1990, 1991, 1992), adapted and used in many subsequent studies, including this one. The research reported here supports these earlier findings and provides further evidence that methodological research is needed to find more valid and reliable measures of these worldview dimensions.

Finally, it was hypothesized that climate change activists would be significantly more egalitarian than the American public. This hypothesis was derived from Cultural Theory and the many empirical studies that have found strong correlations between egalitarianism and pro-environmental attitudes and membership in environmental organizations (e.g., Marris, et al., 1998; Peters and Slovic 1996; Rippl 2002; Steg and Sievers 2000). This dissertation research found that activists were significantly more likely to agree with egalitarian principles than the American public. Furthermore, it was found that activists were significantly more likely to disagree with individualism, hierarchism and two fatalism principles than the American public, indicating that climate

activists indeed tended to be prototypical egalitarians. Thus egalitarian values appear to be a significant component of pro-environmental attitudes and activism.

### Summary

Overall, these research results suggest that American public global warming risk perceptions and support for mitigation policies are currently broad, but shallow. Strong majorities exhibited holistic concern, negative affect, and assessments that global warming is somewhat likely to have serious impacts. They further displayed strong support for national and international policies to reduce emissions of greenhouse gases. Yet most produced imagery of impacts on places spatially distant, as well as on non-human nature, and reported that they rarely discuss the issue with their immediate social networks. Finally, they also displayed strong opposition to higher energy or gasoline prices that would impact their pocketbook directly and report relatively few mitigation behaviors. Thus, these research results suggest that the American public is currently in a “wishful thinking” stage of opinion formation, and has not yet fully considered the trade-offs required to stabilize atmospheric concentrations of greenhouse gases.

## Conclusion

Global climate change is perhaps the preeminent environmental risk confronting the world in the 21<sup>st</sup> century. The anthropogenic emission of carbon dioxide and other greenhouse gases from the developed world is the primary cause, followed by land use change and increasing industrial emissions in the developing world. As one survey respondent commented:

*We can't know where global warming is going, how far it will go, or whether we will be able to arrest it if it progresses past a certain point. All we know with reasonable certainty is that it's happening, it's big, and we're contributing to it. My impression, which I think is shared by most scientists (I'm not a scientist) concerned with the subject, is that there's a non-trivial risk of widespread death and destruction if we continue doing what we're doing...*

The consequences will be global and especially severe for the poor, children, future generations and countless plant and animal species. Thus climate change raises deep questions of global justice, as those who will suffer the greatest impacts are not the ones who have obtained the greatest benefits from the exploitation of fossil fuels. With only 4% of the world's population, the United States alone produces over 20% of the world's greenhouse gas emissions. The reduction of American emissions in the effort to limit global climate change will require significant social, political and economic changes at all levels of society, including the individual. There will be costs and benefits, winners and losers, and consumers will have to make different choices in service of the local, national and global effort to shift modern civilization from dependence on fossil fuels to



non-carbon energy sources. The American public, in their collective actions as voters and consumers, will therefore play a decisive role in the future trajectory of global warming.

This dissertation suggests that the American public is now potentially at a critical turning point. Americans are aware and concerned about global climate change and predisposed to support political leaders and mitigation policies across party lines. Global warming is not a national priority, however, and Americans have not yet confronted the tradeoffs and sacrifices that will ultimately be required to reduce greenhouse gas emissions.

Fortunately, however, many measures to slow and reverse the upward curve of greenhouse gas emissions, can be achieved at relatively low cost or even a profit. As just a few examples, the Union of Concerned Scientists reported that using existing, off-the-shelf technology, the Ford Explorer (the most popular SUV sold) could increase its gas mileage from 19.3 to 34.1 mpg., reducing its lifetime emissions of greenhouse gases from 117 tons to 67 tons, without sacrificing comfort, safety or power for approximately \$935 per vehicle (UCS 1999).

The cost of electricity produced from non-polluting wind (3 to 4 ¢/kWh) is already economically competitive with coal (3.5 to 4 ¢/kWh), the primary fossil fuel used in electric power plants. If the currently externalized health and environmental costs of

burning coal are included (e.g., asthma, respiratory and cardiovascular disease, acid deposition, smog, etc.), the cost of coal increases to 5.5 to 8.3 ¢/kWh (Jacobson and Masters 2001:1438). The wind energy industry has grown approximately 30% a year since 1994 (Mazza 2000:6). Federal government researchers concluded in the early 1990s that “12 central states had wind potential to produce four times the amount of electricity consumed nationwide. North Dakota alone could then have met 36 percent of U.S. energy needs” (Lavelle 2001:36). Yet wind currently generates less than 1% of the nation’s energy. Shifting from fossil fuel-based electricity production to wind and other renewable energy sources will clearly be an enormous task, but could be done with concerted effort. In a recent article in *Science*, Mark Jacobson and Gilbert Masters calculated that the United States could displace 10% of U.S. coal burning by building 36,000 to 40,000 wind turbines using existing technology at a cost of \$61 to \$80 billion, but at no net federal cost by investing 3 to 4% of one year’s \$2.02 trillion dollar budget and selling the electricity over 20 years (Jacobson and Masters 2001:1438).

Projects such as these, however, will require political leadership and political will. In the past, Americans have been willing to “bear any burden and make any sacrifice” in the service of other national goals, such as winning World War II, the Cold War or implementing the Marshall Plan. This research shows that Americans – across political party and ideological lines – are already predisposed to support government action, even though global warming is not currently a national priority.

A national dialogue is urgently needed to facilitate this process and move the debate past sterile arguments over the reality of global climate change, blanket calls to just “do something,” and wishful thinking that there are easy answers to this global problem. Importantly, this effort should not be a unidirectional attempt to merely “educate” the lay public and policy-makers about the technical details of global warming science. A dialogue is needed between diverse stakeholders at multiple scales that includes not only discussions of the causes, consequences and solutions to global warming, but also an explicit articulation of divergent underlying emotions, values and ethical concerns. These are essential components of a process to publicly articulate, weigh and choose among policy alternatives and begin serious efforts to mitigate global warming.

Affect and cultural worldviews are each important dimensions of public risk perceptions, policy preferences and behaviors, yet affect and divergent ethical values are seldom explicitly considered by political leaders or regulators making climate change policy decisions based on technocratic assessments of scientific probabilities and consequences, or economic costs and benefits. Technical solutions crafted and implemented in the absence of such considerations are likely to instigate strong resistance from the public and other interested stakeholders who use other “yardsticks” to assess risks and policies (e.g., affect, equity, public participation, etc.) and feel ignored or left out of the decision making process. This is not to suggest that a seat at the decision-making table and an airing of divergent feelings and values will magically produce

consensus; on the contrary, this kind of open dialogue is very hard work. Yet the alternative breeds distrust, resentment and polarizing conflict that can easily degenerate into raw power politics.

Structured dialogue that works to articulate underlying and unstated value commitments and assumptions is an emerging medium of public policy decision-making that has already achieved some success in a variety of local environmental conflicts over estuaries, old-growth forests and mining (e.g., Gregory 2002, 2000; Gregory and Keeney 1994) and may hold some promise as a means to encourage a public conversation about global climate change risks and mitigation strategies. Governments across Europe are now taking significant steps to increase public participation in decisions about social and technological risks (Nature 2003). The U.S. National Research Council has recently advocated replacement of the “translation” model of risk characterization and decision making (in which experts merely attempt to translate technical risk analyses into lay terms) with a more inclusive, deliberative and participatory process of public assessment and decision making about risks (NRC 1996). Further research is needed to examine when and how these emerging deliberative approaches can improve decision making about global climate change mitigation and adaptation at different and interlocking scales.

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