

THE MEASUREMENT OF KEY BEHAVIORAL SCIENCE CONSTRUCTS IN CLIMATE CHANGE RESEARCH

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Abstract

The growth and integration of social science research on climate change will be facilitated by careful, consistent measurement of its central constructs. In this paper, the relevant psycho-social literature is reviewed, with an eye toward enhancing the quality of measurement. We find that risk perception, a focus of much climate change research, has multiple dimensions that may drive behavior in different ways. Values and norms have been assessed by several indices that overlap conceptually, and study findings could be integrated if these overlaps were clarified and tested. Climate change knowledge has numerous components, only some of which may be essential in the formation of risk perceptions and behavior. Efficacy has received little attention by survey researchers, but promises to help explain behaviors and policy preferences. Climate-relevant behaviors are highly complex variables that will require further explication before we fully understand how they may best be measured. Policy preferences have been asked in terms of trade-offs between action and economic impacts, or in terms of specific regulations or tax incentives.

Keywords

measurement, reliability, validity

1. Introduction

The social science literature on climate change is likely to grow quickly over the next several years, and will be the focus of an interdisciplinary community of survey researchers. Careful, consistent measurement of the most significant variables will assist the integration of studies and improve the validity of our results.

Ensuring validity in measurement is particularly important in this research arena, given the high current levels of media attention to our work, and the ideological divide that hinders progress in combating climate change. As scholars, if we are weak in our measurement, we may in fact only amplify uncertainty about the public dimensions of the debate, slowing progress toward solutions.

The recent publication of a study of climate change knowledge and risk perceptions (Kellstedt et al., 2008) illustrates the current influence of social science research in the public opinion debate. The authors of the research concluded that people who know the most about climate change, and who trust science are *less* concerned about the issue. As we will later discuss, given the weak measure of knowledge and the particular form of perception assessed, the study's conclusion is highly tentative at best.

Understandably, to a lay audience, these technical issues are not readily apparent. *New York Times* columnist John Tierney presented the study in his blog at the newspaper's website (Tierney, Feb. 29, 2008), and the study's results were then used by commentators as support for the notion that climate change is not real. Of the 150 comments posted at Tierney's blog, the vast majority concluded: "See, those of us who understand the science, know that fears of climate change are overblown."

What this recent example makes clear is not only that careful measurement in audience research is important for informing effective public engagement and communication strategies, but also that measurement has significant implications for the policy debate. Uncertainty or inconsistency in measurement will allow public opinion to turn into an ideological Rorschach test, with each side claiming that the public either supports or opposes action. As a research community, we simply cannot afford to inhibit the progress toward solutions by publishing anything less than the strongest, most defensible investigations of public perceptions.

2. Scope and Objectives of this Review

This review draws on two sources: (1) the peer-reviewed behavioral science literature on climate change perceptions and environmental attitudes and behaviors; and (2) polls and surveys conducted by private or not-for-profit research organizations on public opinion and climate change. In our review, we give priority to those measures that have the strongest evidence of validity and reliability or that have been most frequently used. In each section, we also note, where relevant, measures we have reason to believe are flawed in important ways.

While the social scientific literature on climate change is still relatively small, environmental psychology has been a growing and active discipline for over 30 years. Much of the relevant literature addresses general environmental attitudes and behaviors, without a specific climate-change focus. Most of this research is relevant, though there are important distinctions, since local air and water pollution – the primary environmental concerns of 30 years ago – were highly visible with immediate health effects, whereas CO₂ pollution, if it may even be described as such, is invisible and not toxic.

The earliest environmentally focused research tended to be exploratory in nature; since the early '90s, however, researchers have been building on established social-psychological theories that clearly specify causal processes and have broadly accepted operationalizations of key concepts (Bamberg & Schmidt, 2003). This has necessitated the translation of concepts and measurement tools into new domains – adapting, for example, theories about risk that were developed with health risks in mind, to address climate change questions. An excellent example of this is Grothman's and Patt's (2005) use of protection-motivation theory (Rogers & Mewborn, 1976) to understand climate change risk perceptions and adaptation.

We wish, then, to survey the literature and suggest the most appropriate measures of constructs most likely to interest social researchers. The measurement questions that are most likely to interest researchers are:

- How do you validly and reliably measure the pre-cursors of concern regarding climate change?
- How do you validly and reliably measure the pre-cursors of pro-environmental actions?
- How do you validly and reliably measure the pre-cursors of support for mitigation and adaptation policies?
- How do you validly and reliably measure the pre-cursors of civic engagement and political participation?
- And for each of these above questions, how do you validly and measure the specific dependent variables of interest?

The relevant concepts and measures following from these questions include values, attitudes, risk perceptions, efficacy, knowledge, behavior, and policy preferences. Within each of these domains, across dimensions, we have looked for measures of consistent question wording and response categories, reliability, evidence of validity, and relationships to other variables. Some of the constructs have been extensively studied with well-tested research instruments readily available; others have generated little research to-date, but show promise for increasing our understanding of the dynamics shaping attitudes and behaviors.

For some of the constructs, we include measures used in public opinion polls, as well as the peer-reviewed literature, because comparability of poll and research data will facilitate the use of our research in the policy arena. Publishing peer-reviewed articles is a lengthy

process, while public opinion on climate change is in rapid movement. It is useful then to include and summarize the available polling items, drawing heavily from a recent analysis of the measures developed over the past two decades (Nisbet & Myers, 2007). One weakness of these available polling items, however, is that they reflect closely the news agenda (1995), meaning that the content of survey items is driven in part by considerations of newsworthiness and timeliness. As a result, those topics that fail to gain prominence in news coverage—such as the public health dimensions of climate change—are unlikely to be asked by news organization and independent pollsters, no matter how scientifically or sociologically relevant the topic. And although these items represent a trend baseline of opinion, they require further development in order to ensure validity and reliability.

Three general comments about the tables that follow: Within each, measures from peer-reviewed journal articles precede measures from public opinion polls, and within these two categories, measures are ordered starting with the most recent. Second, we are reporting measures taken from phone interviews, mail questionnaires, web surveys, and personal interviews, which all require somewhat different wording. In phone, personal, and web interviews, items can be adapted according to the respondent's prior answers. Parenthetical phrases in the tables indicate places where the interviewer inserts, for example, "Assuming it's happening..." when interviewing respondents who aren't sure whether climate change is real. This reduces error in the responses, and is an advantage of these methodologies. Third, reliabilities are shown in the tables where they were available, but for many measures, particularly the single items used in public opinion polls, there are no reliability estimates.

3. Values

Since the early 1990s, a growing body of research has examined the values underlying environmental actions, recognizing that disparate values may give rise to the same environmental attitudes and actions (Stern et al., 1993, 1995, 1999; Schultz & Zelezny, 1998, 1999; Slimak & Dietz, 2006). To the extent that this is true, information campaigns can target specific audience segments by carefully framing messages to resonate with the segments' values (Nisbet & Mooney, 2007). Therefore, understanding how values filter information and color perceptions is of critical importance to the design and implementation of public information campaigns.

Several strands of research have dominated in studies of values as precursors to environmental beliefs and actions. First, environmental psychologists have examined the central values, as measured by the Schwartz Value Survey (SVS), underlying environmental attitudes and actions, and have focused on self-transcendent values as motivators. Values identified by the SVS play an important role in the Value-Belief-Norm theory developed by Stern and his colleagues (1999), which has been widely used to explain environmental action.

Many studies have also utilized Schwartz's norm-activation theory, which posits that altruistic actions arise from internal moral norms (Schwartz, 1977). The Value-Belief-Norm theory incorporates both the Schwartz theories (Stern et al., 1999).

Studies in climate-change risk assessment have also built on the cultural theory developed primarily by Douglas, Dake and Wildavsky (Wildavsky & Dake, 1990; Douglas, 1999). Cultural theory posits that membership in social groups holding common values predisposes individuals to view certain risks as dangerous (or not). These studies, arising out of the risk perception literature, may be distinguished from other research on values in their explicit focus on climate change, as opposed to general environmentalism.

Values have also been used to explain consumer behavior, a focus for climate change researchers still in its infancy, using several assessment tools. In this paper we discuss the List of Values (Kahle, 1986), as a well-validated and simple-to-use measurement tool.

3.1 Schwartz Value Survey (SVS)

The Schwartz Value Survey assesses respondents' adherence to ten values along two dimensions: (1) tradition (also called conservation) vs. openness to change; and (2) self-transcendence vs. self-enhancement (see Table 1). Each dimension encompasses several related values, and adjacent values share some underlying motivations.

The SVS has been tested in more than 30 countries, is well-validated, and has predicted differences in a wide range of behaviors and attitudes, including risky and illegal behaviors; consumption; religious and sexual behavior; trust in institutions, occupation, voting, nationalism, and environmentalism (see Schwartz, 2005, for a review).

The instrument has close to 60 items (the number varies slightly in successive versions), and is comprised of adjectives and end-states that respondents rate in importance to their lives. Nine-point scales are used from 7 (of supreme importance) to 0 (not important) and -1 (opposed to my values); this unusual nonsymmetrical scale maps the way people think about values (Schwartz, 2005, p. 12).

Because the same dimension underlies multiple values, Schwartz (2007) argues against the use of exploratory factor analysis as a method of assessing the index's reliability; instead, researchers should use smallest space analysis, which can account for the correlations between related values. Nonetheless, studies using SVS have often assessed its reliability using factor analysis and calculations of Cronbach's alpha with satisfactory results.

The instrument is quite lengthy for survey researchers who wish to assess multiple variables, which has led to the development of several abbreviated versions (Stern et al., 1998; Schultz & Zelezny, 1998; Hansla et al., 2008; O'Connor et al., 1999). These abbreviated versions have successfully predicted awareness of and concern for the social, global, and personal consequences of climate change (Hansla et al., 2008); general environmental attitudes (as measured by the NEP, see #4 below) (Shultz & Zelezny, 1999; Stern et al., 1999); and several forms of pro-environmental behavior (Stern et al., 1999).

3.2 Norm-Activation Theory of Altruism

This theory posits that altruistic action results when (1) people perceive significant negative consequences of their actions (awareness of consequences or AC); and (2) they feel a sense of responsibility to avert these consequences (ascription of responsibility or AR). It has been widely used to predict environmental behavior (Schwartz, 1977).

Unlike the Schwartz Value Survey, norm activation theory has no generally used scales in the climate change literature, and operationalizations vary widely (Table 2). Measures have been developed for specific studies, and particular to the specific topic, e.g., consequences of transportation choices or green energy purchases. However, generalized measures of awareness of the consequences of climate change have also been developed (Stern et al., 1999; Garling et al., 2003).

Schultz & Zelezny (1998) used the New Ecological Paradigm scale (see #4 below) as their *measure* of awareness of consequences, while Stern et al. (1999) used the same scale to *predict* AC. Clark and colleagues (2003) combined AC & AR into a single altruism index. Many of the measures used in these indices are conceptually close to risk perceptions and response efficacy. In each of the studies cited, the norm-activation measures were significantly related to the studies' dependent measures, but the differences in operationalizations vary dramatically. Hence, it's unclear how to integrate results obtained from studies using norm-activation theory into a common body of knowledge until it is clearly specified how it differs from other environmentally relevant values and attitudes.

3.3 Cultural Theory

The most influential current approach to understanding the social and cultural underpinnings of risk perceptions (Rippl, 2002), cultural theory posits that the values held by social groups predispose their individual members to evaluate threats in terms of the danger they pose to the group's central values (Wildavsky & Dake, 1990) (Table 3).

Cultural values predict what people fear and their political orientation (Wildavsky & Dake, 1990); consumption patterns and preferences (Dake & Thompson, 1999); environmentalism (Dake, 1992); and climate change risk perceptions (Leiserowitz, 2006). However, the theory and measurement have also been critiqued for low predictive power (Slimak & Dietz, 2006; Sjoberg, 2000); the inappropriateness of individual data for testing cultural-level theory, and questionable construct validity (Rippl, 2002).

As with Schwartz's values, two dimensions underlie the cultural types: People vary according to (1) their acceptance of social controls and (2) their level of social commitment. Crossing these two dimensions yields four cultures: Hierarchism is high on both; individualism is low on both; egalitarianism is high on commitment and low on control; fatalism is low on commitment and high on control. People are not expected to fit neatly into a single pure type, but instead combine aspects of multiple cultures.

The measures most widely used are taken from Dake (1991, 1992). Rippl notes that many studies using these measures have found that values are related in ways contrary to theory. In particular, hierarchism and individualism, which should be significantly negatively related, are instead consistently positively correlated.

She has developed items that measure the underlying dimensions, rather than the four specific types, and by allowing the same item to be included in the scale for two types, has reduced the measurement problems. The item, "I don't join clubs of any kind," for example, is used in both the individualism and fatalism indices because both are low in social commitment.

She argues that the indices for the four types shouldn't be unidimensional because two underlying factors give rise to the each; hence alpha isn't appropriate – structural equation modeling, which allows multiple underlying factors to contribute to a single observed variable, is a more appropriate test of measurement adequacy.

It is also possible, however, that the correlations between individualism and hierarchism reflect the fact that people simply hold inconsistent values simultaneously – that although hierarchism and individualism are conflicting value systems, people's values are sufficiently unconscious that the inconsistency goes unnoticed. This explanation flows from consistency theories in social psychology, which have long recognized our need for cognitive consistency and willingness to deceive ourselves to maintain the illusion of consistency.

3.4 Conceptual Overlap of Cultural Theory and the Schwartz Value Survey

A useful project for researchers would be the disentangling of the overlaps between the Schwartz Value Survey & Cultural Theory. Though arising from distinct research traditions, the conceptualization and some of the measures are strikingly similar. Hierarchism appears to overlap with tradition/conservation; individualism shares characteristics of self-enhancement; self-transcendence encompasses some characteristics of egalitarianism; but the remaining two types, openness to change and fatalism, are conceptually distinct.

Some work has been done by Stern and colleagues (1999) comparing the ability of the two approaches to predict environmental behavior, but as the authors note, they used a small subset of the cultural values measures (2 items per scale), which may have reduced their predictive power; a more complete comparison would be appropriate.

3.5 Kahle's List of Values (LOV)

Another simple and brief way of examining values is through use of the List of Values (Kahle et al., 1986). It successfully predicts consumer behavior, and has been used, for example, to predict purchasing of organic foods (Chrysohoidis & Krystallis, 2005). In comparisons with other indices of values underlying consumption attitudes, it compared favorably to VALS (Kahle et al., 1986), and the Rokeach Value Survey (Beatty et al.,

1984), while being short, easy to administer, and with satisfactory test-retest reliability (Table 4).

The list includes nine values; there are several methods of administration, but most commonly, respondents choose two values from the list as most important in their lives. Alternatively, they rank the values.

In two tests of LOV's test-retest reliability, 92 and 85 percent of respondents who ranked a value as most important to them, also ranked it first or second a month later (Beatty et al., 1985). The authors found that LOV explained between 8 and 39 percent of the variance in a list of consumer attitudes and behaviors (Kahle et al., 1986).

4. Climate Change Knowledge

Persuasion research going back to Hovland's work during World War II has assumed that learning leads to attitude change, which is followed by behavior change. And for almost that long, researchers have found that this simple, straightforward KAB model is inadequate. While information is generally a necessary condition for change, it is rarely a sufficient cause, and researchers on climate change are likely to focus on what types of information are needed to spur changes in behavior and build support for mitigation policies.

In explaining general perceptions of science, combined measures of basic factual technical knowledge and understanding of the scientific method have been found to explain only a small amount of variance in public opinion. On specific issues, in many cases no significant correlation is found between this basic form of science literacy and perceptions (Allum et al., 2008). Other studies show that the likely linkage between knowledge and perceptions is moderated by religiosity, ideology, or the particular social identity that might be communicated as relevant to the issue (Nisbet, 2005; Brossard et al., *in press*).

On climate change specifically, only a few studies have explored the relationship between carefully designed indices of knowledge and perceptions, despite the popular assumption on the part of scientists, journalists, and many advocates that the two are linked, i.e., if the public only understood the science better, they would see the urgency of the issue as experts do (Nisbet & Mooney, 2007). One form of knowledge that has consistently been found to correlate with risk perceptions is understanding the causes of climate change (Sundblad et al., 2007; Krosnick et al., 2006; Bord et al., 2000). It also relates to behavioral and voting intentions (Bord et al., 2000; O'Connor et al., 1999). The importance of correct understanding is highlighted by the finding that belief in "bogus causes" of climate change (such as pesticide use) was a stronger predictor of belief in a warming world than understanding of the correct causes, but was unrelated to behavioral or voting intentions (Bord et al., 2000).

Pro-environmental behavior more generally correlates at .30 with knowledge, as estimated in a meta-analysis of 17 studies by Hines and colleagues (Hines et al., 1987), though Kaiser and Fuhrer (2003) suggest that the relationship may be much stronger for

particular forms of knowledge. Their review suggests that *procedural knowledge* – knowing how to take actions – has a stronger relationship to environmental behavior than does *declarative knowledge* – knowing, for example, that energy use produces damaging CO₂ emissions. This finding parallels similar research on civic participation generally, with “mobilizing information” on who are the decision-makers, where to vote and how to get involved combining with more general public affairs knowledge to shape political behavior (Eveland and Scheufele, 2000; Goidel and Nisbet, 2006).

Given these collective findings, more complete measurement of climate change knowledge could include:

- awareness of the issue;
- belief that climate change exists and is happening;
- understanding of the science underlying climate change;
- understanding of the scientific consensus & level of agreement among experts;
- understanding of the policy options;
- knowledge of the projected impacts of climate change;
- knowledge of the behavior changes that can mitigate climate change;
- skills to make these changes (e.g., how to install weather-stripping or a thermostat);
- knowledge of the behavior changes needed to adapt to climate change in highly affected areas;
- skills to make these changes;
- knowledge of the institutions and political actors involved in the debate; and
- skills to effectively engage with these decision-makers and stakeholders.

As is apparent in Table 5, many of these dimensions have not been measured, and many surveys and polls have relied solely on self-assessments of knowledge. The most extensive measurement of knowledge was made by Sundblad and her colleagues in a survey in Sweden (2007); however, their measures would probably be extremely difficult for most Americans to answer as they assess very precise climate change knowledge.

With validity in mind, using self-assessed knowledge or “informedness” as a stand-in for actual knowledge is best avoided. If you ask respondents how informed they are about climate change, do they reflect back on what they know about the science, about the politics, or the policies involved? Do they think about how much attention they pay to media coverage or how much they talk about the issue? The measure thus conflates a number of different constructs resulting in a muddled ambiguity. The study by Kellstedt and his colleagues (2008) cited in the introduction to this article used self-assessments of knowledge, one explanation for the uncertain results they obtained.

A more appropriate use of self-assessed knowledge is found in Krosnick et al., 2006. The authors asked respondents how much they felt they knew about climate change, and how much they had thought about the issue. These traits were used to predict the individual’s *attitudinal certainty* – not belief that climate change is occurring, is a threat, etc., but rather, the strength of belief respondents felt in their opinions, whether pro or con.

5. Environmental Attitudes

5.1 The New Ecological Paradigm

Though other measurement instruments have been developed (see Fransson & Garling, 1999, for a review), the New Ecological Paradigm scale is by far the most widely used and accepted tool to assess environmental attitudes; it comprises 15 items with 5-point Likert scales (Table 6). The scale has been significantly correlated with values, norms, climate change knowledge, and risk perceptions (Stern et al, 1999; O'Connor et al., 1999; Schultz & Zelezny, 1998; Kellstedt et al., 2008).

The first version of the scale, developed in 1978, used a dozen items, and was primarily an indicator of beliefs about negative effects of humans on the environment (Dunlap & Van Liere, 1978; Stern et al., 1995). In 2000, the authors updated the instrument to reflect a broader *ecological consciousness*, as opposed to the earlier version's focus on *environmental concern* (Dunlap, et al., 2000). The new index contains half of the original items, and assesses attitudes toward the balance of nature, limits to growth and anti-anthropocentrism. The new items reflect the possibility of catastrophic environmental changes, and the notion that humans are exempt from the constraints of nature. The authors' factor analysis of the items revealed four factors, the first of which explained 31% of the variance in responses. They found no clear correspondence between the five different domains measured and the four factors; hence, they argue for the use of the single scale rather than four or five separate subscales.

5.2 Environmental Concern: Egoistic, Biospheric, and Social-Altruistic Concern

In response to suggestions from Dunlap & Van Liere (1977) that a new form of environmental consciousness was arising in the U.S., Stern and his colleagues (1993) examined whether environmental concern takes three different forms: concern about the dangers to oneself (egoistic), to other people (social-altruistic), or to all of non-human nature (biospheric). Their initial research failed to distinguish between the latter two forms of concern, and they questioned whether biospheric concern was, in fact, emerging. Other researchers have pursued the idea, however, and Schultz (2001) has successfully developed measures that distinguish among the three in confirmatory factor analysis. Tests with two different samples showed that the hypothesized three-factor solution yielded a significantly improved fit to the data, as compared to single or two-factor solutions. Schultz found the indices were significantly related to the New Ecological Paradigm scale, and Hansla and colleagues (2008) found they related to awareness of environmental consequences and values, as measured by the SVS.

6. Risk Perceptions

Climate change risk perceptions predict willingness to change behavior, even after controlling for environmental beliefs (O'Connor et al., 1999), and have been a focus of much research on climate change (Table 8). They are related to values, environmental beliefs, and climate-relevant behaviors and policy preferences (Slimak & Dietz, 2006; Leiserowitz, 2006; Krosnick et al., 2006; Grothmann & Patt, 2005).

More generally, risk perceptions have been the focus of diverse research programs with potential applicability to climate change studies: They have been the focus of cognitively oriented research programs on the heuristics and biases that guide decision-making (Slovic, 2000). And they are also central to multiple social-psychological theories, including protection-motivation theory (Rogers & Mewborn, 1976), the health belief model (Janz & Becker, 1984), and the extended parallel-processing model (Witte, 1992, 1998).¹ Risk perceptions may be assessed in multiple ways, however; the applicability of these theories is contingent on the type of risk assessed, and results may vary, contingent on which aspects of risk researchers have chosen to measure.

A conundrum for advocates of a swift response to climate change has been the consistently low issue priority assigned to the issue by a public that recognizes and acknowledges the risk climate change represents. The contradiction is explained by Weber (2006) in terms of processing biases and the attentional dominance of affective, concrete, and immediate threats over those that are conceptual, distant, and abstract. Leiserowitz's research (2005, 2006) supports these arguments: While his respondents perceived climate change to be a moderate risk, they also saw it as distant, both temporally and geographically, and were unwilling to support mitigation policies that would increase their own energy costs.

The significance of this for our purposes lies in the way it demonstrates the multidimensionality of climate change risk perceptions: In understanding the impact of risk perceptions, we must first consider the type of risk and the target. Bord and colleagues (2000), for example, found that perceptions of risk *as a societal threat* significantly predicted behavioral intentions and support for government action, while *personal risk* perceptions did not.

The climate change literature contains assessments of numerous dimensions of risk perception, but some remain unmeasured. Potential forms of risk include:

- Cognition vs. affect: Risk perceptions have both cognitive and affective dimensions. Theory suggests that the latter may be more powerful drivers of behavior than the former.
- Cognitive dimensions: Cognitive appraisals of risk have been defined in the social psychology literature as having three aspects: (1) problem recognition (Table 9); (2)

¹ In the social-psychological literature, risk is typically studied in conjunction with efficacy (see # 8 below), a variable less frequently assessed by climate researchers.

probability of occurrence (Table 10); and (3) severity of outcome (Table 11) (Brewer et al., 2007). Each of these has been measured in climate change research; pollsters have tended to focus on the first and third, with fewer measurements of the second. Turning to the risk literature we find that a number of cognitive dimensions have not been examined; this literature suggests risk perceptions comprise assessments of severity, dread, catastrophic potential, likelihood, controllability, and familiarity.

- **Affective responses:** Affective responses have typically been assessed by asking about concern, worry, or fear (Table 8 & 12). However, anecdotal observation suggests that anger also should be measured. For example, in public statements, among individuals and activists already committed to climate change as a political priority, perceived policy inaction translates into anger. Conversely, much of the messaging by conservatives who seek to downplay the urgency and reality of climate change is designed to trigger anger at a so-called liberal elite agenda.
- **Personal vs. impersonal risk:** Social-psychological theories of risk perception were developed with personal risks in mind, which may limit their applicability if people perceive climate change as primarily impacting distant peoples and places. Some research, however, shows that impersonal risk perceptions are powerful drivers of policy preferences and behavioral intentions (Bord et al., 2000). Krosnick and colleagues (2006) found that perceptions of local effects were unrelated to national seriousness ratings, whereas perceptions of impacts on distant peoples and species were strongly predictive. Acting in response to a risk that primarily affects others may be more akin to altruism than self-protection, bringing measures of this type of risk closer conceptually to the literature on values.
- **Circles of impact:** Danger to others may be conceptualized in expanding circles of impact: my family, my community, my nation, all humans, all animals, all life. And it may be seen assessed within a number of time-frames, extending from the present into the distant future.
- **Domain of impact:** The specific form of risk varies as well: There are physical risks associated with changes in the climate, rising sea levels, and extreme weather events; risks associated with changes in the availability of food and water; health risks, such as the movement north of vector-borne diseases; political risks associated with mass human migrations from highly affected regions into areas less affected, bringing with it political instability and conflict; and economic risks with changes in the job market, land values, and investment values.

These multiple risk dimensions are not independent, and ultimately, they don't all need to be measured, but without a study that examines all of them in relation to behavior and support for climate change policies, we won't be able to assess which are the important drivers of behavior. Studies that only assess a single dimension may overlook others that shape behavior and policy preferences among significant numbers of people.

Although personal risk and risk to others are clearly conceptually distinct, in practice they have been found to be highly correlated. The high correlations have permitted researchers to collapse the two categories of risk perception into single indices with accept-

able levels of reliability. Our colleague Carl Botan suggested that the correlations may be caused by that fact that people who perceive that climate change is a personal threat, also recognize that what threatens them personally threatens others as well.

7. Other Attitudes

7.1 Trust in and Deference to Scientists

The role of scientists in the policy debate around climate change has been much discussed, focusing on the interaction among (1) scientific cautiousness, (2) journalistic norms that dictate presentation of both sides of a debate, sometimes falsely, and (3) the disproportionately vocal role played by a few prominent contrarians (Nisbet & Mooney, 2007; McCright, 2007). Because the science of climate change is so complex and the vast majority of the public is unable to assess the validity of the claims scientists are making, trust in or deference towards scientists are likely part of accepting the risk and supporting measures to address climate change. Hence, this is an area in which climate researchers will likely be devoting increased attention (Table 13).

Research in this area argues that deference to scientific authority is a long-term predisposition shaped by education and reinforced by generalized depictions of science and scientists in the popular media. As a result, when disputes related to science occur, regardless of the specifics of their social, legal, or ethical context, deference to scientific authority and trust in scientists serve as strong heuristics and opinion generators (Brossard & Nisbet, 2007). Trust in experts as a factor in opinion formation is well understood by many organizations that seek to avoid policy action. Historically these advocates have been very successful at manufacturing public doubt by promoting their own rival “climate skeptics,” a handful of apparent experts who dispute the mainstream science (McCright 2007).

As summarized in Table 17, Brossard and Nisbet (2007) developed a measure for deference to scientific authority and applied it in understanding perceptions of the environmental and health risks of genetically-engineered food ($\alpha = .69$). The index is significantly related to both general and science education. This measure can be adapted in order to better understand risk perceptions relative to climate change.

The 2006 General Social Survey uses a slightly different battery of questions to tap public perceptions of the “cultural authority” of scientists relative to climate change, asking the public to rate how knowledgeable and impartial scientists might be on the matter as well as their perceived level of agreement. Pollsters have employed other single item measures tapping these dimensions.

7.2 Consumption Attitudes

While there has been limited measurement of green consumption, a number of consumer typologies have been developed to segment the audience and understand how people are thinking (or not) about the impact of their purchases on the environment. These could be adapted for measurement purposes. One option is to categorize consumers based on their willingness to engage in pro-environmental consumption. Ipsos MORI (2007), for example, presents a typology of consumers, developed by the UK Dept. of Environment, Food, and Rural Affairs (DEFRA):

- “Engaged consumers – sometimes called deep greens, pioneers or ‘highs’ - who are very engaged with the issues and proactively seek out alternatives and new behaviours;
- Aspirational consumers – otherwise known as light greens or ‘mediums’ – who are interested but passive and look to adopt behaviours established by the pioneers on an ad hoc or ‘pick and mix’ basis;
- Basic engagement consumers – often referred to as ‘lows’ – who, akin to dipping a toe in the water, do some things but are constrained from doing more; and
- Disengaged consumers - who actively resist or are constrained from undertaking environmental behaviours” (p. 35).

A second option is to categorize consumers based on cultural theory. Michaelis (2007), expanding on Dake and Thompson (1999), describes five types of consumer, built on cultural theory:

- Hierarchists eat a traditional and conventional diet;
- Egalitarians tend to be politically engaged naturalists who treat consumption as a moral choice;
- Fatalists, whose budgets are typically constrained by budget, don’t tend to actively choose, but instead “muddle through.”
- Individualists tend to be cosmopolitan in their choices, keeping up with fashions in food, furnishings, and transportation; these are conspicuous and competitive consumers.
- Finally, consumers categorized as Autonomous make choices independent of social expectations, and live simply.

DeYoung (2000) argues that there are multiple motivations for conservation behavior, though researchers have focused solely on material incentives/disincentives and altruism. He suggests intrinsic satisfaction as another important motivator, grounded in self-interest (as opposed to selfishness). Intrinsic satisfaction may be derived from a sense of competence, frugality, participation, or luxury.

One study that has assessed consumer attitudes in relation to media use and civic participation found that environmentalism predicted both socially conscious consumption and civic participation (Keum, 2004) (Table 13).

8. *Efficacy*

Because environmental problems are so large, efficacy is likely to be low, Oskamp (2000) warns. And when people feel helpless in the face of a frightening issue, defensive responses such as message avoidance, issue derogation, or denial are likely. In contrast a large body of research demonstrates that when efficacy is high, responsiveness to threats is enhanced (Witte, 1992; Floyd et al., 2000; Janz & Becker, 1984; Rogers & Mewborn, 1976). Efficacy would, therefore, appear to be an essential construct in understanding the public's varied responses to climate change: Although simply unwillingness may be a factor, low efficacy is likely to be a very important inhibitor of action, arising from structural barriers, established and difficult-to-alter routines, hopelessness, and the sense that there's little to be achieved by personal sacrifices. Thus, while there has been little research on efficacy in climate change to date, it is likely to become an important variable.

Several studies point to the construct's importance: A Swiss study using focus groups identified widespread denial in the face of climate change, arising in part from a sense of helplessness and despair at the magnitude of the problem and the smallness of individual contributions to its solution (Stoll-Kleeman et al., 2001). Kellstedt and colleagues (2008), find however, that efficacy is positively related to risk perceptions among Americans. And Grothmann and Patt (2005) have applied protection-motivation theory to understanding climate change adaptation to flooding, and found that risk and efficacy together explained 26 to 45 percent of the variance in several adaptation behaviors.

Efficacy is generally defined as having three forms: self-efficacy, the belief that one is capable of taking action; response efficacy, the belief that the action will in fact reduce the threat; and collective efficacy, belief that the group is capable of achieving its goals (Witte, 1992; Bandura, 2000). Researchers interested in examining its interactions with risk should take all three forms into account, given that each may make a unique and significant contribution to behavioral intentions (Table 14).

The measurement of efficacy for climate change behaviors is particularly difficult because of the large number of behaviors people can alter to reduce their GHG emissions. To measure three types of efficacy for 50 behaviors could fill a questionnaire (and seriously annoy a respondent). Global measures are not a good alternative, however, because they are likely to conflate several issues: For example, the self-efficacy measure "I can take actions that will help reduce global warming," implies that:

- I believe that global warming exists (if I'm a naysayer, my response to this item will be pure error – how do I reduce something that doesn't exist?).
- I know what actions will reduce global warming (many people think that reducing their use of aerosol cans will combat climate change).
- I am capable of taking the appropriate actions (this is what the item actually hopes to assess).

- My actions will be effective (perhaps I know that driving less reduces GHG emissions, and that I could do that, but I also believe that the impact of my reductions will be so miniscule as to be meaningless).

Adding the clause “Assuming it exists...” as in the ABC/Stanford poll, addresses the first problem in global measures of efficacy. Choosing specific behaviors for efficacy questions, as Zhao has done, addresses the second, third, and fourth. Balancing positive and negative items, as was done by Gallup and Porter-Novelli, facilitates the expression of low efficacy and will yield less error than single positive measures.

9. *Descriptive and Injunctive Norms*

A number of studies by Robert Cialdini have investigated the power of social norms in shaping environmentally relevant behaviors. He and his colleagues demonstrate that both *injunctive norms* – beliefs about what people are should do – and *descriptive norms* – beliefs about what people actually do – are powerful and largely unconscious shapers of behavior (Cialdini, 2007, 2003).

Much of this research has been conducted through experimental work for several reasons: people typically *say* that their actions are based on their beliefs, and that what other people think doesn't influence them, but Cialdini finds that what they actually *do* is much more influenced by norms than attitudes (2007). Hence, experimental manipulations can identify the true impact of norms, whereas survey measures will be less likely to identify their impact.

Recently, however, the prototype model of Gibbons and colleagues (Gibbons et al., 2004), which incorporates both type of norm, has been adapted for use with environmental behaviors (Ohtomo & Hirose, 2007) with some success. In a structural equation model, both norms contributed to the individual's intentions to recycle and willingness to throw recyclables into the trash if recycling bins were unavailable. Respondents were asked both what their peers believed they should do – the injunctive norm – as well as what their peers actually do – the descriptive norm. The study demonstrated that people were willing to engage in the undesirable behavior (throwing recyclables in the trash) if they believed that their peers would do the same, even if they believed that they should recycle.

While communication campaigns can work to change norms and thereby directly influence behavior, survey research assessing people's beliefs may be able to identify what the commonly held norms actually are, a useful tool for communicators. A PIPA poll of Americans, for example, recently found that respondents perceived themselves to be more supportive of action to reduce global warming than the average American (PIPA, 2007). This misperception of the societal norm works against public expressions of support for action, for people may fear to express beliefs they perceive to be outside the norm.

10. *Climate-Relevant Behavior*

A challenge for researchers interested in understanding the public's mitigation behaviors is the fact that there are literally hundreds of actions people can take to reduce their carbon emissions (Table 16). The example of Staats and colleagues (2004) is illustrative: In a longitudinal study examining the stability of behavior changes, they assessed 93 behaviors at two time points, and then shortened their questionnaire to include just 38 because respondents complained about the length. Researchers should attempt at a minimum some measurement of the major behavioral domains with environmental impacts: home energy conservation, transportation choices, consumption, and activism.

Whether these measures can or should be combined into a single index of environmental behavior or into several sub-indices is subject to debate. Kaiser (1998) argues in favor of a single index, which he developed and tested, finding both satisfactory reliability and validity. If, however, attitudes and values influence some actions more than others, a single index may miss important distinctions. Stern and colleagues (1999) found, for example, that values and norms are better predictors of activism (environmental citizenship) and willingness to sacrifice than of consumer behavior. And Roser-Renouf and colleagues (in preparation) have found that risk perceptions and efficacy are related more strongly to activism, lifestyle, and consumption behaviors than to personal energy conservation.

The most discussed dimension along which behaviors vary is their difficulty, in terms of effort, cost, and structural barriers to overcome. Several studies have demonstrated that the strength of relationship between pro-environmental attitudes and behaviors is mediated by the ease or difficulty of the action (Schultz & Oskamp, 1996; Guagnano et al., 1995): For very easy-to-perform actions, attitudes are more weakly related to behavior than is the case for moderately difficult behaviors, i.e., when little effort is demanded, less drive from the individual is required. Ideally, then, research should consider behavioral difficulty when measuring behaviors; this may be a challenge, however, since structural barriers, in particular, vary by community (availability of curbside recycling and bike lanes, for example).

Kaiser's index is scaled by behavioral difficulty, which he judged by the frequency with which his respondents performed each action. More common actions were deemed to be easier to perform. Comparing two respondent samples, however, he found that the groups varied on close to a quarter of the actions when difficulty was assessed in this manner. Further, Stern (personal communication) argues that assessing difficulty in this way is circular.

Until we better understand the drivers of behavior, researchers may be best advised to adopt an exploratory approach and compare the results obtained by combining all behaviors into a single index to the results obtained using several indices.

11. Policy Preferences

Similar to individual behavior, there are a number of relevant dimensions and measures specific to policy preferences and attitudes. From the existing polling questions, one common theme has been to weigh citizen preference for climate change action against the perceived economic costs of such actions. Other items ask about specific climate mitigation actions, either framed around incentives such as carbon taxes and tax rebates or mandates on action such as tighter regulations on industry, more efficient appliances, and more gas efficient cars. Since the polling agenda often closely tracks the news agenda, given the relative absence of news attention to climate adaptation strategies, few if any items have been developed by pollsters on these policy matters.

For academic researchers, there is more work needed to develop scales of items that tap in a reliable and valid way support for the multiple dimensions of policy actions available. Moreover, of further use would be measures that assess “opinion intensity” when it comes to policy preferences. Past research shows that while Americans might voice a strong preference for either general or specific policy action on climate change, they still do not assign a strong political priority to such action (Nisbet & Myers, 2007). Communication campaign efforts will both need to understand what shapes a preference for a specific policy but also the factors that alter the intensity of that preference. This is especially important given that past research finds that opinion intensity often drives political participation on specific issues such as abortion or stem cell research (Goidel & Nisbet, 2006).

12. Concluding Comments

In our review, we have undoubtedly overlooked some previously used measures. We are constrained in part by the cross-disciplinary nature of research on climate-relevant attitudes and behavior, the large number of disciplines publishing relevant articles in their journals, and the limitations of space in a single article covering such broad terrain. Our backgrounds in mass communication research, political science, and public information campaigns have also guided and shaped this review.

Yet despite these challenges, in this paper, we believe we have identified, evaluated, and summarized a valuable set of indicators and scales that accurately tap values, opinions, perceptions, preferences, knowledge and behavior related to climate change. The societal, environmental, and political relevance of global warming is only likely to escalate in the years to come. With increasing frequency, social scientists will be called upon by elected officials, government agencies, foundations, and journalists to provide reliable and valid data on how to effectively communicate with and engage the public. By systematically reviewing the historical record of available measures, this paper offers a blueprint for future survey measurement.

ANNEX Tables 1- 17

Table 1: Schwartz Value Survey: Full Index and Three Abbreviated Forms (3 pages)

Schwartz, 2007	Stern et al., 1998	Schultz & Zelezny, 1998	Hansla et al., 2008
Full Index	two samples	5 nation com-parison: US, Mexico, Nica- ragua, Peru, Spain	
SELF-TRANSCENDENCE		alpha =.60 to .79	
Universalism	alpha = .83 & .85		alpha=.73
Protecting the environment	x	x	
A world of beauty		x	
Unity with nature	x	x	
Broad-minded		x	x
Social justice	x		x
Wisdom			
Equality	x		x
A world at peace	x		x
Inner harmony			
	respecting the earth, harmony with other species*		
Benevolence			alpha=.70
Helpful		x	x
Honest		x	x
Forgiving		x	x
Loyal		x	x
Responsible			
True friendship			
A spiritual life			
Mature love			
Meaning in life			

Schwartz, 2007	Stern et al., 1998	Schultz & Zelezny, 1998	Hansla et al., 2008
SELF-ENHANCEMENT	alpha =.67 & .70	alpha =.70 to .85	
Power			
Social Power		x	
Authority	x	x	
Wealth	x	x	
Preserving my public image		x	
Social Recognition			
Achievement			alpha=.74
Successful		x	x
Capable		x	x
Ambitious		x	xx
Influential	x	x	
Intelligent			
Self-respect			
OPENNESS	alpha =.62 & .77	alpha =.57 to .75	
Self-direction			
Creativity		x	
Curious	x	x	
Freedom		x	
Choosing own goals		x	
Independent			
Stimulation			
Daring		x	
A varied life	x	x	
An exciting life	x	x	
Hedonism			
Pleasure		x	
Enjoying life		x	

Schwartz, 2007	Stern et al., 1998	Schultz & Zelezny, 1998	Hansla et al., 2008
TRADITION (CONSERVATION)	alpha =.64 & .65	alpha =.77 to .87	
Tradition			
Devout		x	
Respect for tradition		x	
Humble		x	
Moderate		x	
Accepting portion in life			
Detachment			
Conformity			
Politeness		x	
Honoring parents and elders	x	x	
Obedient		x	
Self-discipline	x	x	
Security			
Clean		x	
National security		x	
Social order		x	
Family security	x	x	
Sense of belonging			
Reciprocation of favors			
Healthy			
*this item added by the authors to Schwartz's list.			
Note: Value dimensions are shown in block letters, and the 10 basic values are in bold type. Individual entries are the adjectives and end-states that respondents rate in importance to their lives. Items with an "x" in the second through fourth columns were used in abbreviated versions of the full index.			

Table 2: Norm Activation Theory of Altruism: Selected Measures of Awareness of Consequences, Ascription of Responsibility, and Personal Norm (3 pages)

Measures	alpha
Garling et al., 2003; Hansla et al., 2008	
Awareness of consequences for oneself	.45; .64*
Laws that protect the environment limit my choices and personal freedom	
Protecting the environment will threaten jobs for people like me	
Awareness of consequences for others: general	.42; .56*
The effects of pollution on public health are worse than we realize	
Pollution generated in one country harms people all over the world	
Awareness of consequences for the biosphere	.54; .56*
The balance in nature is delicate and easily upset	
Over the next several decades, thousands of species will become extinct	
Ascribed responsibility (AR)	.46
I am not concerned about the environment	
Every citizen must take responsibility for the environment	
Authorities rather than the citizens are responsible for the environment	
Personal norm (PN)	.84
I feel a moral obligation to protect the environment	
I feel that I should protect the environment	
I feel it is important that people in general protect the environment	
Our environmental problems cannot be ignored	
Wall et al., 2007	
Awareness of Consequences: commuting choices	.86
Avoiding car use will help to solve wider environmental problems like global warming.	
My transport choices can have an impact on the environment.	
I can help to solve my town/city's traffic problems by avoiding car use.	
I don't believe that environmental problems like global warming are caused by car use.	
I contribute to pollution.	

Measures	alpha
Clark et al., 2003	
AC & RC combined into one scale: green energy use	.70
I worry about conserving energy only when it helps to lower my utility bills.	
Contributions to community organizations can greatly improve the lives of others.	
The individual alone is responsible for his or her satisfaction in life.	
It is my duty to help other people when they are unable to help themselves.	
Many of society's problems result from selfish behavior.	
Households like mine should not be blamed for environmental problems caused by energy production and use.	
My responsibility is to provide <i>only</i> for my family and myself.	
Use of renewable energy is the best way to combat global warming.	
My personal actions can greatly improve the well being of people I don't know.	
Bamberg & Schmidt, 2003 (no alphas reported; items had satisfactory loadings on cfas)	
Awareness of Consequences: transportation choices	
Traffic related noise and air pollution reduce the quality of life in our cities.	
Constructing new roads and parking places for the increasing number of car threatens the last intact biosphere in this country.	
Ascription of responsibility	
It is not only the state and the industry who are responsible for reducing the traffic related environmental pollution, but me too, for example with my decision which travel mode I use for university routes.	
With my travel mode choice for university routes I am also responsible for the degree of traffic pollution in the environment.	
Personal norm	
If I use the car for university routes next time, I would have a "moral stomach-ache"	
Not using environmentally friendly travel modes like a bike or public transport for university routes next time would violate my principles.	
How strongly do you feel a personal obligation to use environmentally friendly travel modes like a bike or public transport for university routes next time (<i>obliged/not obliged</i>)?	

Measures	alpha
Stern et al., 1999	
Awareness of Consequences: general	.88
In general, do you think that climate change, which is sometimes called the greenhouse effect, will be a very serious problem for you and your family, somewhat of a problem for you and your family or won't really be a problem for you and your family?	
Do you think that climate change will be a very serious problem for the country as a whole, somewhat of a problem or won't really be a problem for the country as a whole?	
Do you think that climate change will be a very serious problem for other species of plants and animals, somewhat of a problem or won't really be a problem for other species of plants and animals?	
Next, I'd like you to consider the problem of loss of tropical forests. Do you think this will be a very serious problem for you and your family, somewhat of a problem or won't really be a problem for you and your family?	
Do you think that loss of tropical forests will be a very serious problem for the country as a whole, somewhat of a problem or won't really be a problem for the country as a whole?	
Do you think that loss of tropical forests will be a very serious problem for other species of plants and animals, somewhat of a problem or won't really be a problem for other species of plants and animals?	
Next, I'd like you to consider the problem of toxic substances in air, water and the soil. Do you think this will be a very serious problem for you and your family, somewhat of a problem or won't really be a problem for you and your family?	
Do you think that toxic substances in air, water and the soil will be a very serious problem for the country as a whole, somewhat of a problem or won't really be a problem for the country as a whole?	
Do you think that toxic substances in air, water and the soil will be a very serious problem for other species of plants and animals, somewhat of a problem or won't really be a problem for other species of plants and animals?	
* first alpha is from Garling et al.; second alpha is from Hansla et al.	

Table 3: Cultural Theory: Measures from Selected Studies (4 pages)

Measures	alpha
HIERARCHY	
Rippl, 2002: RMSEA: 0.07; RMR: 0.04; GFI: 0.98	
I would not participate in civil action groups. The ones in power do only allow what they like.	
We have to accept the limits in our life if we want or not.	
It is important to preserve our customs and cultural heritage.	
The police should have the right to listen to private phone calls when investigating crime.	
Order is a probably unpopular but an important virtue.	
I prefer clear instruction from my superiors about what to do.	
An intact family is the basis of a functioning society.	
Dake, 1991, 1992: no reliabilities reported	
I think there should be more discipline in the youth of today.	
I would support the introduction of compulsory National Service.	
I am more strict than most people about what is right and wrong.	
We should have stronger armed forces than we do now.	
The police should have the right to listen to private phone calls when investigating crime.	
Those in power often withhold information about things which are harmful to us.	
One of the problems with people is that they challenge authority too often.	
It is important to preserve our customs and heritage.	
I think it is important to carry on family traditions.	
In my household, family members have their own places at the dinner table.	
I always sort out clothes into separate categories before washing.	
I value regular routines highly.	
I think being on time is important.	
My time-tabling of meals is haphazard. (score reversed)	
I like to plan carefully so that financial risks are not taken.	
Wildavsky & Dake, 1990: no reliabilities reported	
I'm for my country, right or wrong.	
The police should have the right to listen in on private telephone conversations when investigating crime.	
I think I am stricter about right and wrong than most people.	

“It (the index) also expresses concern about the lack of discipline in today’s youth and supports that notion that centralization is “one of the things that makes this country great.” (Exact wording of these measures not reported)	
INDIVIDUALISM	
Rippl, 2002: RMSEA = 0.00; RMR= 0.02; GFI = 1.00	
I don’t join clubs of any kind.	
The freedom of the individual should not be limited for reasons for preventing crime.	
My ideal job would be an independent business.	
When I have problems I try to solve them on my own.	
I prefer tasks where I work something out on my own.	
Dake, 1991, 1992: no reliabilities reported	
In a fair system people with more ability should earn more.	
A free society can only exist by giving companies the opportunity to prosper.	
If a person has the get-up-and-go to acquire wealth, that person should have the right to enjoy it.	
It is just as well that life tends to sort out those who try harder from those who don’t.	
Continued economic growth is the answer to improved quality of life.	
This country would be better off if we didn’t worry so much about how equal people are.	
Making money is the main reason for hard work.	
I don’t join clubs of any kind. (score reversed)	
I tend to be skeptical of health food fads.	
Wildavsky & Dake, 1990: no reliabilities reported	
The welfare state tends to destroy individual initiative.	
If a man has the vision and ability to acquire property, he ought to be able enjoy it himself.	
The index “expresses support for continued economic growth as the key to quality of life, and private profit as the main motive for hard work. It espouses the view that democracy depends fundamentally on the existence of the free market... The scale also indicates support for less government regulation of business....” (cites given for sources they used for these measures)	
EGALITARIANISM	
Leiserowitz, 2006	.77
We have gone too far in pushing equal rights.	
I support government efforts to get rid of poverty.	
What this world needs is a more equal distribution of wealth.	

Firms and institutions should be organized so everybody can influence important decisions.	
I support affirmative action.	
If people were treated more equally we would have fewer problems.	
The world would be a more peaceful place if its wealth were divided more equally among nations.	
Rippl, 2002: RMSEA = 0.04; RMR = 0.03; GFI = 0.96	
Important questions for our society should not be decided by experts but by the people.	
In a family adults and children should have the same influence in decisions.	
It is important to me that in the case of important decisions at my place of work everybody is asked.	
Firms and institutions should be organized in a way that everybody can influence important decisions.	
The freedom of the individual should not be limited for reasons for preventing crime.	
Dake, 1991, 1992: no reliabilities reported	
If people in this country were treated more equally we would have fewer problems.	
The government should make sure everyone has a good standard of living.	
Those who get ahead should be taxed more to support the less fortunate.	
I would support a tax change that made people with large incomes pay more.	
The world could be a more peaceful place if its wealth were divided more equally among nations.	
Social Security tends to stop people from trying harder to get on. (score reversed)	
Racial discrimination is a very serious problem in our society.	
What this country needs is a 'fairness revolution' to make the distribution of goods more equal.	
Most of the meals I eat are vegetarian.	
Health requirements are very important in my choice of foods.	
I prefer simple and unprocessed foods.	
Wildavsky & Dake, 1990: no reliabilities reported	
Much of the conflict in the world could be eliminated if we had more equal distribution of resources among nations.	
I support federal efforts to eliminate poverty.	
I support a tax shift so that the burden falls more heavily on corporations and persons with large incomes.	
Misuse of scientific and expert knowledge is a very serious problem.	

FATALISM	
Leiserowitz, 2006	.71
The future is too uncertain for a person to make serious plans.	
It doesn't make much difference if people elect one or another political candidate, for nothing will change.	
I feel that life is like a lottery.	
A person is better off if he or she doesn't trust anyone.	
I have very little control over my life.	
It's no use worrying about public affairs; I can't do anything about them anyway.	
Rippl, 2002: RMSEA = 0.07; RMR = 0.03; GFI = 0.99	
I would not participate in civil action groups. The ones in power do only allow what they like.	
A person is better off if he or she doesn't trust anyone.	
We have to accept the limits in our life if we want or not.	
There is no use in doing things for other people – you only get it in the neck in the long run.	
I don't join clubs of any kind.	
Dake, 1991, 1992: no reliabilities reported	
There is no use in doing things for other people – you only get it in the neck in the long run.	
Cooperating with others rarely works.	
The future is too uncertain for a person to make serious plans.	
I have often been treated unfairly.	
A person is better off if he or she doesn't trust anyone.	
I don't worry about politics because I can't influence things very much.	
Most people make friends only because friends are useful to them.	
I feel that life is like a lottery.	
Even if you work hard you never know if that will help you do better.	
It seems to me that, whoever you vote for, things go on pretty much the same.	
I have few financial investments.	

Table 4: List of Values (Kahle, 1986)

Self-respect	Sense of accomplishment	Being well respected
Security	Self-fulfillment	Fun and enjoyment in life
Warm relationships with others	Sense of belonging	Excitement

Table 5: Climate Change Knowledge (6 pages)

Study	Question Focus	Measures	Correlates*
Kellstedt et al., 2008	Self-informedness	How informed do you consider yourself to be about global warming and climate change?	risk perceptions (negatively related)
Sundblad et al., 2007	climate changes	Items are true/false & each is accompanied by a 5-pt scale of certainty: The global average temperature in the air has increased approximately 3.1 degrees Celsius during the last 100 years. The global average temperature in the air has increased approximately 0.6 degrees Celsius during the last 100 years. The global average temperature in the air has been approximately stable during the last 100 years. The 1990 decade was the warmest during the last 100 years. The 1990 decade had a normal average temperature compared to other decades during the last 100 years. The global change in temperature the latest 100 years is the largest during the last 1000 years. It is not possible globally to establish if the latest 100 years had a divergent temperature compared to the earlier 1000 years. The precipitation has increased in the last 100 years in most areas in the middle and northern part of the northern hemisphere.	cognitive and affective risk perceptions
Sundblad et al. (continued)	causes	Climate change is mainly caused by increased concentration of green house gases. Climate change is mainly caused by the ozone hole. Climate change is mainly caused by a natural variation in sunbeam and volcanic eruption.	cognitive and affective risk perceptions

Study	Question Focus	Measures	Correlates*
Sundblad et al. (continued)	causes (continued)	<p>The carbon dioxide concentration has increased more than 30% in the atmosphere during the latest 250 years.</p> <p>The carbon dioxide concentration has increased between 20% and 30% in the atmosphere during the latest 250 years.</p> <p>Methane has increased more than 20% in the atmosphere during the latest 250 years.</p> <p>Carbon dioxide is responsible for approximately 80% of the emissions of green house gases.</p> <p>Carbon dioxide is emitted in the use of fossil fuels.</p> <p>Methane is emitted mainly from the use of fossil fuels.</p> <p>The increase of green house gases is mainly caused by human activities.</p> <p>The increase of green house gases is mainly caused by a surplus of heat from tempered buildings.</p> <p>The increase of green house gases is mainly caused by air pollutions from the industry.</p>	cognitive and affective risk perceptions
Sundblad et al. (continued)	consequences	<p>The blanket of snow in the Northern hemisphere has decreased approximately 10% since the 1960 decade.</p> <p>The blanket of snow in the Northern hemisphere is currently approximately the same as in the 1960 decade.</p> <p>The number of storms and flooding has increased prominently in the latest 100 years.</p> <p>It is not possible to establish globally if the number of storms and flooding currently are more or fewer than during the latest 100 years.</p> <p>The global precipitation will increase the next 100 years.</p> <p>The global precipitation will decrease the next 100 years.</p> <p>The global sea level has risen approximately 0.2m the latest 100 years.</p> <p>The global sea level has risen approximately 1.1m the latest 100 years.</p> <p>The global sea level has been stable the latest 100 years.</p> <p>A cause to the rising sea level is the melting of glaciers and snow.</p>	cognitive and affective risk perceptions

Study	Question Focus	Measures	Correlates*
	consequences (continued)	<p>A cause to the rising sea level is the increasing temperature of the seawater.</p> <p>In 100 years from now the sea level rise will be less than what is possible to measure.</p> <p>In 100 years from now the sea level rise will be approximately 1m.</p> <p>In 100 years from now the sea level is expected to rise approximately 3–5m.</p> <p>The ice mass of Arctic is expected to increase in the next 100 years.</p> <p>If the Greenland ice will melt down completely in the future the sea level will rise approximately 6m.</p> <p>If the Greenland ice will melt down completely in the future the sea level will rise approximately 12m</p> <p>If the sea ice in the North pole will melt down completely in the future the sea level will rise approximately 3m</p> <p>It is probable that an increasing number of mosquitoes and ticks within 50 years will cause more cases of human diseases in Sweden, due to climate change</p> <p>Climate change will increase the risk in Sweden for diseases transferred by water (i.e. diarrhoea) the next 100 years</p> <p>It is probable that the mortality by lung oedema and heart problems during heat waves in Sweden will increase the next 50 years</p> <p>Negative health impacts caused by climate change will globally affect humans on the countryside more than humans living in cities</p> <p>An increasing amount of green house gases risks to cause more UV radiation and therefore a larger risk for skin cancer</p> <p>The health effect that might come up due to climate change the next 50 years only concerns humans who stay in tropical areas</p>	cognitive and affective risk perceptions

Study	Question Focus	Measures	Correlates*
Leiserowitz, 2004	conceptual model of climate system	Which one of the five pictures below best represents your understanding of how the climate system works? (Five pictures followed, accompanied by text below.) Climate is stable within certain limits. If the changes are small, climate will return to equilibrium. If they are large, there will be abrupt and catastrophic impacts. Climate is random and unpredictable. We do not know what will happen. Climate is slow to change. Global warming will gradually lead to dangerous impacts. Climate shows a delicate balance. Small changes will have abrupt and catastrophic impacts. Climate is very stable. Global warming will have little or not impact.	viewing the film <i>The Day After Tomorrow</i>
O'Connor et al., 1999	causes	"Knowledge' is measured by subtracting scores on a scale comprised of inaccurate causes of climate change from scores on a scale comprised of accurate causes of climate change. The introductory material is: 'Now, let's focus on just one of these issues, global warming. Regardless of whether you know much about global warming, please indicate whether you think each of the following is a major or primary cause of global warming, a minor or secondary cause, or not a cause at all.' For each item, responses range from 1 (not a cause at all) to 3 (major or primary cause). The accurate causes are pollution/emissions from business and industry, people driving their cars, use of coal and oil by utilities or electric companies, people heating and cooling their homes, and destruction of tropical forests. Inaccurate causes are use of aerosol spray cans, use of chemicals to destroy insect pests, depletion of ozone in the upper atmosphere, and nuclear power generation," (p. 466).	voluntary actions; voting intentions; risk perceptions; environmental beliefs
ABC News 2006 & 2007	Self-informedness	How much do you feel you know about global warming, a lot, a moderate amount, a little, or nothing?	
Gallup 1992 to 2007	Self-informedness	Next, thinking about the issue of global warming, sometimes called the "greenhouse effect", how well do you feel you understand this issue-would you say very well, fairly well, not very well, or not at all?	

Study	Question Focus	Measures	Correlates*
Ipsos MORI, summer, 2007	1. human causes; 2. scientific confidence; 3. scientific consensus	1. Human activity does not have significant effect on the climate. 2. Climate change is too complex and uncertain for scientists to make useful forecasts. 3. Many leading experts still question if human activity is contributing to climate change.	
Nathan Cummings Foundation, Aug-Sept 2007	reality	Switching topics now, from what you've read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?	
Harris Poll, Oct. 2007	reality	Do you 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?	
AP/Stanford/Ipsos, Sept. 2007	reality	You may have heard about the idea that the world's temperature may have been going up slowly over the past 100 years. What is your personal opinion on this? Do you think this has probably been happening, or do you think it probably hasn't been happening?	
Newsweek/Princeton, Aug. 2007	scientific consensus	Do you think most climate scientists agree that human activities, such as burning coal and oil, are a major cause of global warming, or do you think there is a lot of disagreement among climate scientists about whether human activities are a major cause?	
Gallup, July 2007	reality	How convinced are you that global warming is happening -- would you say you are -- completely convinced, mostly convinced, not so convinced, or not at all convinced?	
Pew, Jan. 2007	reality	From what you've read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?	

Study	Question Focus	Measures	Correlates*
PIPA, 2004 & 2005	Knowledge of expert agreement	Which of the following statements is closest to your own opinion? There is a consensus among the great majority of scientists that global warming exists and could do significant damage. There is a consensus among the great majority of scientists that global warming does not exist and therefore poses no significant threat. Scientists are divided on the existences of global warming and its impact.	
ABC News, 2006 & 2007	Knowledge of expert agreement	Do you think most scientists agree with one another about whether or not global warming is happening, or do you think there is a lot of disagreement among scientists on this issue?	
Gallup 2001 & 2006	Knowledge of expert agreement	On the environmental issue known as global warming, just your impression, which one of the following statements do you think is most accurate: Most scientists believe that global warming is occurring, most scientists believe that global warming is not occurring, or most scientists are unsure about whether global warming is occurring or not?	
GSS 1994 & 2005	Factual knowledge	(And for each these statements, just check the box that comes closest to your opinion of how true it is—definitely true, probably true, probably not true, definitely not true. In your opinion, how true is this?)...Every time we use coal or oil or gas, we contribute to the greenhouse effect. ...The greenhouse effect is caused by a hole in the earth's atmosphere.	
ABC/Wash Post/Stanford, April 2007	reality	You may have heard about the idea that the world's temperature may have been going up slowly over the past 100 years. What is your personal opinion on this? Do you think this has probably been happening, or do you think it probably hasn't been happening?	

* In this and subsequent tables showing correlates, we omit demographics and report only psycho-social and behavioral relationships.

Table 6: New Ecological Paradigm Scale

	full scale	abbreviated versions	
	Dunlap et al. (2000)	Clark et al. (2003)	Stern et al. (1999)
alpha	.83	.80	.73
We are approaching the limit of the number of people the earth can support.		x	
Humans have the right to modify the natural environment to suit their needs.			
When humans interfere with nature it often produces disastrous consequences.			
Human ingenuity will insure that we do NOT make the earth unlivable.		x	
Humans are severely abusing the environment.			x
The earth has plenty of natural resources if we just learn how to develop them.			
Plants and animals have as much right as humans to exist.		x	
The balance of nature is strong enough to cope with the impacts of modern industrial nations.		x	x
Despite our special abilities humans are still subject to the laws of nature.			
The so-called "ecological crisis" facing humankind has been greatly exaggerated.		x	x
The earth is like a spaceship with very limited room and resources.		x	x*
Humans were meant to rule over the rest of nature.		x	
The balance of nature is very delicate and easily upset.		x	
Humans will eventually learn enough about how nature works to be able to control it.		x	
If things continue on their present course, we will soon experience a major ecological disaster.		x	x
Note: "x" indicates items used in shortened versions of the scale. *slight wording difference; item omitted the word "very."			

Table 7: Environmental Concern: Egoistic, Social-Altruistic, and Biospheric Concern

Schultz, 2001; Study 1: GFI=0.95; RMSEA=0.07; Study 2: GFI=0.94; RMSEA=0.08	Hansla et al., 2008
I am concerned about environmental problems because of the consequences for: (7-pt. scale)	
Biospheric Concern	.91
Plants	
Marine Life	
Animals	
Birds	
Social-Altruistic Concern	.87
All people	
Children	
My Children	
People in my country	
Egoistic	.91
Me	
My health	
My lifestyle	
My future	

Table 8: Research Measures of Climate Change Risk Perception (3 pages)

Study	Risk Dimension(s)	Risk Measure(s)	Reliability	Correlates
Kellstedt et al., 2008	cognitive; proximal	Global warming and climate change will have a noticeably negative impact on my health in the next 25 years. Global warming and climate change will have a noticeably negative impact on my economic and financial situation in the next 25 years. Global warming and climate change will have a noticeably negative impact on the environment in which my family and I live. In your opinion, what is the risk of global warming and climate change exerting a significant impact on public health in your state? In your opinion, what is the risk of global warming and climate change exerting a significant impact on economic development in your state? In your opinion, what is the risk of global warming and climate change exerting a significant impact on the environment in your state?	.87	Efficacy; NEP; conservative ideology; low confidence in science; low self-assessed knowledge; low trust in media
Sundblad et al., 2007	cognitive; proximal & distant effects	How likely is it that serious negative climate consequences will affect (5-pt. scale from very improbable to very probable): Sweden approximately 5 years from now? Sweden approximately 50 years from now? Sweden approximately 100 years from now? Holland approximately 5 years from now? Holland approximately 50 years from now? Holland approximately 100 years from now? Bangladesh approximately 5 years from now? Bangladesh approximately 50 years from now? Bangladesh approximately 100 years from now?	.91	knowledge of causes; knowledge of health consequences

Study	Risk Dimension(s)	Risk Measure(s)	Reliability	Correlates
	affective; proximal & distant effects	Are you worried that serious negative climate consequences will affect (5-pt. scale from not at all to very much): Sweden approximately 5 years from now? Sweden approximately 50 years from now? Sweden approximately 100 years from now? Holland approximately 5 years from now? Holland approximately 50 years from now? Holland approximately 100 years from now? Bangladesh approximately 5 years from now? Bangladesh approximately 50 years from now? Bangladesh approximately 100 years from now?	.93	knowledge of causes (p=.06); knowledge of health consequences
Leiserowitz, 2006	holistic; includes cognitive & affective dimensions; problem recognition; personal & distant effects	How concerned are you about global warming? How likely do you think it is that each of the following will occur during the next 50 years <i>due to global warming</i> ? Worldwide, many people's standard of living will decrease. Worldwide water shortages will occur. Increased rates of serious disease worldwide. My standard of living will decrease. Water shortages will occur where I live. My chance of getting a serious disease will increase. How serious of a threat do you believe global warming is to non-human nature? How serious are the <i>current</i> impacts of global warming around the world?	.94	policy preferences; affect & affective imagery; cultural values

Study	Risk Dimension(s)	Risk Measure(s)	Reliability	Correlates
Slimak & Dietz, 2006	issue importance	An index of global environmental risk importance was formed based on factor analysis. The index included global warming, ozone depletion, acid rain, and population growth; it used a single measure of each of these, asking how important the risk was to the respondent; items for the index were selected from 24 environmental risks.	.78	NEP; altruism, as measured by SVS
Grothmann & Patt, 2005	personal	Exact measures not reported. Individuals living in a flood-prone area were asked about the risk of future flooding.	not reported	adaptation behaviors
O'Connor et al., 1999	cognitive; mostly distant effects, but one personal measure	Suppose annual average temperature does increase by 3 degrees Fahrenheit over the next 50 years. Then how likely do you think each of the following would be? (5-point scales) Many people's standard of living will decrease. My standard of living will decrease. Starvation and food shortages will occur in much of the world. Starvation and food shortages will occur where I live. It will be necessary for richer countries to make large donations of financial aid to poorer countries. Rates of serious disease will increase. My chances of suffering from a serious disease will increase.	.88	knowledge; environmental beliefs; voluntary actions; voting intentions

Table 9: Selected Measures of Problem Recognition

Source	Measure
Gallup, 1993 to 2007	Thinking about what is said in the news, in your view is the seriousness of global warming--generally exaggerated, generally correct, or is it generally underestimated?
AP/Stanford/Ipsos, Sept. 2007	If nothing is done to reduce global warming in the future, how serious of a problem do you think it will be for the world?
Nathan Cummings Foundation, Aug-Sept 2007	How big a problem do you think that global warming is? Would you say that global warming is a very big problem, a fairly big problem, not a very big problem, or would you say that global warming is not a problem at all?
Porter-Novelli May-Jun 2007	Global warming is a very serious problem. (5-pt. scale)
Pew, Jan 2007	In your view, is global warming a very serious problem, somewhat serious, not too serious, or not a problem? (4-pt. scale + dk)
Eco-America Fall 2006*	Too much fuss is made about global warming.
Eco-America Fall 2006*	Our country is in more danger from environmental hazards such as air pollution and global warming than it is from terrorists
ABC/Wash Post/Stanford, Apr. 2007	(Assuming it's happening,) if nothing is done to reduce global warming in the future, how serious of a problem do you think it will be (would be) for the United States – very serious, somewhat serious, not so serious, or not serious at all (4-pt. scale + dk/no opinion & na/refused)
Time/ABC/Stanford, Mar 2006	(Assuming it's happening,) if nothing is done to reduce global warming in the future, how serious of a problem do you think it will be (would be) for the world – very serious, somewhat serious, not so serious, or not serious at all (4-pt. scale + dk/no opinion & na/refused)
Krosnick et al., 2000	“I'd like to ask you about a series of specific issues that may challenge this country in the future. You may think some of these are likely to be serious problems and others are not likely to be serious problems. Here are the issues: unemployment, prices, crime, public education, the environment, health care availability, and change in the world's climate. Now I'll repeat each of these issues, and I'd like you to tell me for each one, whether you think it is likely to be no problem at all, a slightly serious problem, a pretty serious problem, a very serious problem, or an extremely serious problem. How serious of a problem do you think changes in the world's climate is likely to be? No problem at all, slightly serious, pretty serious, very serious, or extremely serious?” The order of the issues was varied across respondents.
* report was issued in Oct. 2006; date of data collection is not reported.	

Table 10: Selected Measures of Perceived Likelihood

Study	Measures
O'Connor et al., 1999; Bord et al., 2000	How likely do you think it is that average annual temperatures will increase by 3 degrees Fahrenheit within the next 50 years? (5-point scale)
Gallup, 1993 to 2007	Which of the following statements reflects your view of when the effects of global warming will begin to happen? They have already begun to happen. They will start happening within a few years. They will start happening within your lifetime. They will not happen within your lifetime, but they will affect future generations. They will never happen.

Table 11: Selected Measures of Threat Severity

Source	Measures
Newsweek/Princeton Aug. 2007	Looking ahead 50 years from now, do you think global warming will be a major threat to human life on earth, a minor threat, or not a threat?
Porter-Novelli, May-Jun 2007	Global warming is a threat to my future well-being and safety. Global warming is a threat to future generations' well-being and safety. Global warming is a threat to all life on the planet.
Gallup, 1993-2007	Do you think that global warming will pose a threat to you or your way of life in your lifetime? How serious of a threat is global warming to _____ -- very serious, somewhat serious, not very serious, or not at all serious? -- plants and animals -- people in other countries -- people in the United States -- you and your family -- your local community.
GSS	In general, do you think that a rise in the world's temperature caused by the 'greenhouse effect' is extremely dangerous for the environment, very dangerous, somewhat dangerous, not very dangerous, or not dangerous at all for the environment? Can't choose Do you think that global warming will pose a threat to you or your way of life in your lifetime? In general, do you think that a rise in the world's temperature caused by the "greenhouse effect" is...extremely dangerous for the environment, very dangerous, somewhat dangerous, not very dangerous, or, not at all dangerous for the environment? In general, do you think that a rise in the world's temperature caused by the "greenhouse effect" is...extremely dangerous for you and your family, very dangerous, somewhat dangerous, not very dangerous, or, not at all dangerous for you and your family?

Source	Measures
ABC/ Stanford, Apr 2007	<p>(Assuming it's happening), do you think global warming threatens (would threaten) a great deal, somewhat, not so much, not at all (dk/no opinion; na/refused)</p> <ul style="list-style-type: none"> -- the world's environment -- you personally -- other Americans -- people living now in other modern industrialized countries -- poor people in undeveloped countries around the world today -- future generations of people -- plants and animal species <p>INSERT "Assuming it's happening" and "would threaten" only if "extremely or very sure" global warming is not happening.</p>

Table 12: Selected Measures of Concern

Source	Measure
Porter-Novelli May-Jun 2007	When I think about global warming, I feel afraid of what might happen.
Ipsos MORI, Summer 2007	How concerned, if at all, are you about climate change, sometimes referred to as global warming?
EcoAmerica Fall 2006	I am worried about the greenhouse effect (global warming).
Gallup, Mar 2008	<p>Please tell me if you personally worry about this problem (the 'greenhouse effect,' or global warming)</p> <ul style="list-style-type: none"> - a great deal - a fair amount - only a little - not at all

Table 13: Trust and Deference to Scientists

Source	Measure
Gallup	How much do you trust the things that scientists say about the environment-completely, a lot, a moderate amount, a little, or not at all?
Brossard & Nisbet, in press	(1) Scientists know best what is good for the public. (2) It is important for scientists to get research done even if they displease people by doing it. (3) Scientists should do what they think is best, even if they have to persuade people that it is right. (4) Scientists should make the decisions about the type of scientific research on [insert issue].
GSS	When making policy decisions about global warming, to what extent do you think [Environmental scientists/Business leaders/Elected officials] would support doing what is best for the country as a whole or what serves their own narrow interests?
GSS	How well do the following groups understand: causes of global warming...[Environmental scientists/Business leaders/Elected officials]
GSS	<i>How much influence should each of the following groups have in deciding: global warming policy...</i> [Environmental scientists/Business leaders/Elected officials]

Table 14: Consumption Attitudes (2 pages)

Keum et al., 2004	alpha
Status Consciousness = Appearance Consciousness + Brand Consciousness	.78
Appearance Consciousness	
I want to look a little different from others.	
I enjoy getting dressed up.	
I have much better taste than most people.	
I like to pamper myself.	
For each word, please circle the number that best describes how much or how little you would like to be seen by other people.	
-- glamorous	
-- sexy	
-- stylish	
-- trendsetter	

Brand Consciousness	
When I have a favorite brand I buy it – no matter what else is on sale.	
I try to stick to well-know brand names.	
I prefer to buy products with designer names.	
Environmental Orientation	
I would be willing to accept a lower standard of living to conserve energy.	
Status Consumption	not reported
Frequency in past 12 months of each:	
Fashion:	
-- purchased clothes at high-end department store.	
-- bought hair care products from a salon	
Luxury travel:	
-- stayed at a luxury priced hotel while on a non-business trip.	
-- traveled to another country.	
Gourmet food:	
-- visited a gourmet coffee shop.	
-- had wine with dinner.	
Socially Conscious Consumption	
Green:	.53
-- I try to buy products that use recycled packaging.	
-- I make a strong effort to recycle everything I possibly can.	
-- Contributed to an environmental or conservation organization.	
Cause related:	
-- I make a special effort to buy from companies that support charitable causes.	

Table 15: Selected Measures of Efficacy (2 pages)

Study	Type of Efficacy	Measures	alpha
Zhao, in preparation	response efficacy	How much would your _____ help reduce your personal contribution to future global warming? (randomize order; 7-pt. scale from “would not help” to “would help a lot.”) <ul style="list-style-type: none"> • Changing the light bulbs at your home to more energy saving ones • Shutting off your home computer when you are not using it • Turning down thermostat during night or when gone • Driving less and using more public transportation • Recycling paper, beverage containers, and other recyclable products • Using cold water to wash clothes • Purchasing energy efficient home appliances 	.90; .95
	self-efficacy	How sure are you that you could _____, if you wanted to? (randomize order; 7-pt. scale from “not at all sure” to “completely sure.”) <ul style="list-style-type: none"> • Change the light bulbs at your home to more energy saving ones • Shut off your home computer when you are not using it • Turn down thermostat during night or when gone • Use cold water to wash clothes • Purchase energy efficient home appliances 	.83
Kellstedt et al., 2008	perceived efficacy	I believe my actions have an influence on global warming and climate change. My actions to reduce the effects of global warming and climate change in my community will encourage others to reduce the effects of global warming through their own actions. Human beings are responsible for global warming and climate change.	.63

Study	Type of Efficacy	Measures	alpha
ABC/Wash Post/Stanford, Apr. 2007	response efficacy for mitigation	(Assuming it's happening), how much do you think can be (could be) done to reduce the amount of future global warming -- a great deal, a good amount, just some, or hardly anything?	
ABC/Wash Post/Stanford, Apr. 2007	response efficacy for adaptation	(Assuming it's happening), how much do you think can be (could be) done to reduce global warming's effects on people and the environment – a great deal, a good amount, just some, or hardly anything?	
Ipsos MORI, summer 2007	national collective efficacy global collective efficacy	To what extent do you agree or disagree that Britain can make a real difference in stopping climate change? Ultimately, I am confident that the world community can find a solution to the problems posed by climate change.	
Gallup, 1993-2007	national collective efficacy self-efficacy response efficacy	The United States can take actions that will help reduce global warming. The actions of a single country like the United States won't make any difference in reducing global warming. You can take actions that will help reduce global warming. The actions of a single person won't make any difference in reducing global warming.	
Porter-Novelli, May-Jun, 2007	self-efficacy response efficacy	I can take actions that will help reduce global warming. The actions of a single person like me won't make any difference in reducing global warming. There is nothing we can do to stop global warming. The actions we take can prevent global warming from becoming more severe.	

Table 16: Selected Measures of Pro-Environmental Behavior (5 pages)

Measures	alpha
Roser-Renouf et al., in preparation: 3 indices of pro-environmental behavior	
Respondents were asked how many of the actions listed below they currently do (dichotomous measures)	
Personal Energy Conservation	.67
<ul style="list-style-type: none"> • Use less energy at home (lights, AC, heat) • Buy energy-efficient appliances/insulation • Use less gas (by driving less or getting a more fuel-efficient car) 	
Lifestyle and Consumption	.74
<ul style="list-style-type: none"> • Buy products made from recycled paper/plastic • Buy environmentally friendly products • Buy products that use less packaging • Have a simpler lifestyle that uses less products • Recycle at home • Take fewer trips by airplane • Buy organic food 	
Environmental Activism	.67
<ul style="list-style-type: none"> • Punish companies with bad environmental records by not buying their products • Remind others to be environmentally conscious • Vote for candidates with the best environmental records • Donate to organizations that support environmental causes 	
O'Connor et al., 1999: Voluntary Actions	.74
Taking into consideration the <i>costs and inconvenience</i> for each action, how likely is it that <i>YOU PERSONALLY</i> would do each of these things? (5-pt. scales)	
Choose a car that gets good gas mileage (this would reduce the purchase of trucks, vans, and Bronco-type vehicles)	
Install more insulation and weatherize homes and apartments	
Car pool and drive less by using trains and buses more often	
Replace older appliances with more energy efficient new models (refrigerators, furnaces, dishwashers, and others)	
Use less air conditioning in the summer and less heat in the winter	

Measures	alpha
Stern et al., 1999: Three Indices of Pro-Environmental Behavior	
Consumer Behavior (4-pt. scales)	.72
<ul style="list-style-type: none"> • How often do you make a special effort to buy fruits and vegetables grown without pesticides or chemicals; also known as organic fruits and vegetables? • How often do you make a special effort to buy paper and plastic products that are made from recycled materials? • How often do you avoid buying products from a company that you know may be harming the environment? • How often do you make a special effort to buy household chemicals such as detergent and cleaning solutions that are environmentally friendly? 	
Willingness to Sacrifice (4-pt. scales)	.78
<ul style="list-style-type: none"> • I would be willing to pay much higher taxes in order to protect the environment. • I would be willing to accept cuts in my standard of living to protect the environment. • I would be willing to pay much higher taxes in order to protect the environment. 	
Environmental Citizenship (dichotomous measures)	.77
<ul style="list-style-type: none"> • Are you a member of any group whose main aim is to preserve or protect the environment? • In the last twelve months, have you read any newsletters, magazines or other publications written by environmental groups? • Signed a petition in support of protecting the environment? • Given money to an environmental group? • Written a letter or called you member of Congress or another government official to support strong environmental protection? • Boycotted or avoided buying the products of a company because you felt that company was harming the environment? • Voted for a candidate in an election at least in part because he or she was in favor of strong environmental protection? • Some people feel the environmental movement does a great deal of good and strongly support it, others feel the environmental movement does more harm than good and strongly oppose it. Where do you stand? Do you strongly support, somewhat support, somewhat oppose or strongly oppose the environmental movement? (Scores for this measure coded 0, .33, .67, and 1 to match the 0-1 scoring of other items in the scale.) 	

Measures	alpha
Kaiser, 1998: Scale of General Ecological Behavior (GEB) (dichotomous measures, but author notes that scales could be used with these items; easy-to-perform behaviors are followed by (e) and hard-to-perform behaviors are followed by (h).	.74
Subscale: Prosocial behavior	
<ul style="list-style-type: none"> • Sometimes I give change to panhandlers. (h) • From time to time I contribute money to charity. (e) • If an elderly or disabled person enters a crowded bus or subway, I offer him or her my seat. (e) • If I were an employer, I would consider hiring a person previously convicted of a crime. • In fast food restaurants, I usually leave the tray on the table. (e) (flip) • If a friend or relative had to stay in the hospital for a week or two for minor surgery (e.g., appendix, broken leg), I would visit him or her. * • Sometimes I ride public transportation without paying a fare. (flip) * • I would feel uncomfortable if Turks lived in the apartment next door. (flip) 	
Subscale: Ecological garbage removal	
<ul style="list-style-type: none"> • I put dead batteries in the garbage. (e) (flip) • After meals, I dispose of leftovers in the toilet. • I bring unused medicine back to the pharmacy. • I collect and recycle used paper. (e) • I bring empty bottles to a recycling bin. (e) 	
Subscale: Water and power conservation	
<ul style="list-style-type: none"> • I prefer to shower rather than to take a bath. • In the winter, I keep the heat on so that I do not have to wear a sweater. (flip) • I wait until I have a full load before doing my laundry. • In the winter, I leave the windows open for long periods of time to let in fresh air. (flip) • I wash dirty clothes without prewashing. 	
Subscale: Ecologically aware consumer behavior	
<ul style="list-style-type: none"> • I use fabric softener with my laundry. (flip) • I use an oven-cleaning spray to clean my oven. (flip) * • If there are insects in my apartment, I kill them with a chemical insecticide. (flip) • I use a chemical air freshener in my bathroom. (flip) • I use chemical toilet cleaners. (h) (flip) • I use a cleaner made especially for bathrooms rather than an all purpose cleaner. (flip) • I use phosphate-free laundry detergent. 	

Measures	alpha
Kaiser, 1998: Scale of General Ecological Behavior (GEB) (dichotomous measures, but author notes that scales could be used with these items; easy-to-perform behaviors are followed by (e) and hard-to-perform behaviors are followed by (h).	.74
Subscale: Garbage inhibition	
<ul style="list-style-type: none"> • Sometimes I buy beverages in cans. (flip) * • In supermarkets, I usually buy fruits and vegetables from the open bins. (h) • If I am offered a plastic bag in a store, I will always take it. (h) (flip) * • For shopping, I prefer paper bags to plastic ones. * • I usually buy milk in returnable bottles. (flip) 	
Subscale: Volunteering in nature protection activities	
<ul style="list-style-type: none"> • I often talk with friends about problems related to the environment. • I am a member of an environmental organization. (h) * • In the past, I have pointed out to someone his or her unecological behavior. • I sometimes contribute financially to environmental organizations. * 	
Subscale: Ecological automobile use	
<ul style="list-style-type: none"> • I do not know whether I may use leaded gas in my automobile. (e) (flip) • Usually I do not drive my automobile in the city. • I usually drive on freeways at speeds under 100 kph (62.5 mph). (h) • When possible in nearby areas (around 30 km; i.e., 18.75 miles), I use public transportation or ride a bike. 	
Ipsos MORI, summer 2007	
What is the number one thing you are doing to tackle climate change?	
<ul style="list-style-type: none"> • I am not doing anything • Low energy light bulbs • Turn down heating • Switch off lights • Save electricity/switch off appliances • Recycle/recycling • Don't use/less use of car • Loft/home insulation • Save/use less energy • Change car/get more fuel efficient car/smaller car 	

Measures	alpha
General Social Survey	
How often do you make a special effort to sort glass or tins or plastic or newspapers and so on for recycling? Always (1) Often (2) Sometimes (3) Never (4) (Recycling not available where I live) (5)	
And how often do you cut back on driving a car for environmental reasons?	
Are you a member of any group whose main aim is to preserve or protect the environment?	
In the last five years , have you ...	
<ul style="list-style-type: none"> • signed a petition about an environmental issue? • given money to an environmental group? • taken part in a protest or demonstration about an environmental issue? 	

Table 17: Policy Preferences (3 pages)

Preference for Action Versus More Research or Potential Costs	
Cambridge Research Associates	Some people have expressed concern that the greenhouse effect could result in some of the world's most productive agricultural areas becoming too arid for farming. Which of the following views about the greenhouse effect is closest to your own opinion?... 01. Based on the scientific community's current understanding of the greenhouse effect, the federal government should pass environmental laws to help solve the problem. 02. The federal government should pass some initial laws now to begin to curb the greenhouse effect but should avoid costly control programs until more research is done to find out exactly what causes the greenhouse effect and what its impact will be. 03. Before passing any new environmental laws to help curb the greenhouse effect, the federal government should finance more research efforts to find out exactly what causes the greenhouse effect and what its impact will be.
PIPA	There is a controversy over what the countries of the world, including the US, should do about the problem of global warming. I'm going to read you three statements. Please tell me which statement comes closest to your own point of view. [Rotated] 1. Until we are sure that global warming is really a problem, we should not take any steps that would have economic costs. 2. The problem of global warming should be addressed, but its effects will be gradual, so we can deal with the problem gradually by taking steps that are low in cost. 3. Global warming is a serious and pressing problem. We should begin taking steps even if this involves significant costs.
Gallup, Harris, and Cambridge Research Associates	(Now I am going to read you some things that might happen if the United States was the only country to take actions to prevent the greenhouse effect. As I read each one please tell me whether or not you think the United States should single-handedly take the actions to prevent the greenhouse effect, even if that thing happens.)... If it increased unemployment in the United States. Your utility bills went up? Unemployment increased? There was a mild increase in inflation? If unemployment went up a great deal?
Specific Policy Proposals	
Cambridge	To help prevent the greenhouse effect, would you favor or oppose taxing oil, coal, and natural gas to provide economic incentives for shifting away from the use of fossil fuels?
ABC	For each of the following please tell me whether you favor or oppose it as a way for the federal government to try to reduce future global warming? Increased taxes on electricity so that people use less.

Gallup	<p>Next I am going to read some specific environmental proposals. For each one, please say whether you generally favor or oppose it.</p> <p>How about setting higher auto emission standards for automobiles?</p> <p>How about setting higher emission standards for business and industry?</p> <p>Expanding the use of nuclear energy?</p> <p>How about imposing mandatory controls on carbon dioxide emissions and other greenhouse gases?</p> <p>Spending more government money on developing solar and wind power?</p>
PIPA	<p>Here is a list of possible approaches to reducing greenhouse gas emissions that may contribute to climate change. For each one please say whether you favor or oppose it: Provide tax incentives to utility companies to encourage them to sell environmentally clean energy, such as solar and wind power, to consumers.</p> <p>Provide tax incentives to utility companies to encourage them to sell environmentally clean energy, such as solar and wind power, to consumers.</p> <p>Give cash incentives like tax credits and rebates to individual households that upgrade to more energy efficient appliances like refrigerators and air conditioners.</p> <p>Would you favor or oppose requiring that by 2010, half of all new cars produced are hybrid-electric or some other type that is very fuel efficient?</p> <p>Do you favor or oppose continuing the tax credit for purchasing a hybrid-electric car?</p>
ABC	<p>For the next items, please tell me for each one whether it's something the government should require by law, encourage with tax breaks but not require, or stay out of entirely?</p> <p>Building cars that use less gasoline.</p> <p>Give cash incentives like tax credits and rebates to individual households that upgrade to more energy efficient appliances like refrigerators and air conditioners.</p> <p>Would you favor or oppose requiring that by 2010, half of all new cars produced are hybrid-electric or some other type that is very fuel efficient?</p> <p>Do you favor or oppose continuing the tax credit for purchasing a hybrid-electric car?</p>
ABC	<p>For the next items, please tell me for each one whether it's something the government should require by law, encourage with tax breaks but not require, or stay out of entirely?</p> <p>Building cars that use less gasoline.</p> <p>Building air conditioners, refrigerators, and other appliances that use less electricity.</p> <p>Building new homes and offices that use less energy for heating and cooling.</p> <p>Lowering the amount of greenhouse gases that power plants are allowed to release into the air.</p>

	Support for International Agreements
PIPA	Based on what you know, do you think the U.S. (United States) should or should not participate in the following treaties and agreements?... The Kyoto agreement to reduce global warming.
Gallup	Next, turning to the agreement on global warming that was drawn up at a world conference in Kyoto, Japan several years ago....Based on what you have heard or read, do you think the United States should--or should not--agree to abide by the provisions of the Kyoto agreement on global warming?
	Voting Intentions (alpha = .78)
O'Connor et al., 1999	Here are some other steps we might take to decrease the amount of CO ₂ released to the atmosphere. For each one, indicate how you would <i>vote in a national referendum</i> on these steps. NOTE THAT <i>EACH OF THESE WOULD REDUCE U.S. EMISSIONS BY 2%, 100 MILLION TONS (4% 200 MILLION TONS) PER YEAR.*</i>
	Government support for a new international organization that would enforce international treaties to reduce CO ₂ emissions and help poor nations reduce greenhouse gases. This would cost taxpayers \$100 (\$200) million per year.
	A government program to preserve rain forests throughout the world (forests absorb CO ₂). This would cost taxpayers \$100 (\$200) million per year.
	A requirement that automobile fuel efficiency be increased from the current average of 8 mpg to 33 mpg. To maintain comfort and performance, new car prices would go up by
	an average of \$1000 (\$2000).
	A law requiring all public buildings (offices, schools, stores, libraries, etc.) to keep thermostats set at 65 (62) degrees or below in the winter and 75 (80) degrees or above in the summer. This would reduce the use of fuels that produce CO ₂ .
	A 60-cent (\$1) a gallon tax on gasoline, over and above existing gas taxes, to reduce driving, thus reducing CO ₂ emissions.
	A 5 (10) percent "gas guzzler" tax on cars and vans that get less than 25 miles to the gallon (an added \$1000 (\$2000) to the price of a \$20,000 car). This would encourage the use of fuel-efficient cars.
	An energy use tax on businesses to encourage greater fuel efficiency. This tax would raise the average price of most things you buy, including food and clothing, by 3 (6) percent \$380 (\$775) per person per year).
* Cost and impact of the proposals were varied, with half the respondents receiving the information in parentheses. These variations had no impact on the relationships found in the research.	

References

- ABC/Washington Post/Stanford University Poll. April 5-7, 2007. Accessed at: <http://www.pollingreport.com/enviro.htm>.
- Allum, N., Sturgis, P., Tabourazi, D., and Brunton-Smith, I. (2008). Science knowledge and attitudes across cultures: a meta-analysis. *Public Understanding of Science*, 17, 1, 35-54.
- Bamberg, Sebastian, and Peter Schmidt. 2003. Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environment and Behavior* 35, no. 2: 264-285.
- Bandura, Albert. 2000. Exercise of human agency through collective efficacy. *Current Directions in Psychological Science* 9, no. 3: 75-78.
- Beatty, Sharon, Lynn, Kahle, Pamela Homer, and Shekha Misra. 1985. Alternative measurement approaches to consumer values: The list of values and the Rokeach value survey. *Psychology and Marketing* 2, no. 3: 181-200.
- Bord, Richard J., Robert E. O'Connor, and Ann Fisher. (1999). In what sense does the public need to understand global climate change. *Public Understanding of Science* 19, no. 3: 461-471.
- Brewer, Noel, Gretchen B. Chapman, Frederick X. Gibbons, FX, Meg Gerrard, Kevin D. McCaul, and Neil D. Weinstein. 2007. Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology* 26, no. 2: 136-145.
- Brossard, D. & Nisbet, M.C. (2007). Deference to scientific authority among a low information public: Understanding American views about agricultural biotechnology. *International Journal of Public Opinion Research*, 19, 1, 24-52.
- Brossard, D., D.A. Scheufele, E. Kim, and B.V. Lewenstein. In press. Religiosity as a perceptual filter: Examining processes of opinion formation about nanotechnology. *Public Understanding of Science*.
- Chrysohoidis, George M., and Athanassios Krystallis. 2005. Organic consumers' personal values research: Testing and validating the list of values (LOV) scale and implementing a value-based segmentation task. *Food Quality and Preference* 16: 585-599.
- Cialdini, Robert B. 2003. Crafting normative messages to protect the environment. *Current Directions in Psychological Science* 12, no. 4: 105-109.
- Cialdini, Robert B. 2007. *The Secret to Using Social Norms to Reduce Household Energy Consumption*. Paper presented at the Behavior, Energy, and Climate Change Conference, Sacramento, Nov. 7-9, 2007.
- Clark, Christopher F., Matthew J. Kotchen, and Michael M. Moore. 2003. Internal and external influences on pro-environmental behavior: Participation in a green electricity program. *Journal of Environmental Psychology* 23, no. 3: 237-246.
- Dake, Karl, and Michael Thompson. 1999. Making ends meet, in the household and on the planet. *GeoJournal*: 47: 417-424.
- Dake, Karl. 1991. Orienting dispositions in the perception of risk: An analysis of contemporary worldviews and cultural biases. *Journal of Cross-Cultural Psychology, Special Issue on Risk and Culture* 22: 61-82.
- Dake, Karl. 1992. Myths of nature – culture and the social construction of risk. *Journal of Social Issues* 4: 21-37.
- De Young, Raymond. 1993. Changing Behavior and Making it Stick: The Conceptualization and Management of Conservation Behavior. *Environment and Behavior* 25, no. 3: 485-505
- De Young, Raymond. 2000. Expanding and evaluating motives for environmentally responsible behavior. *Journal of Social Issues* 56, no. 3: 509-526.

- Douglas, Mary. 1999. Four cultures: The evolution of a parsimonious model. *GeoJournal* 47: 411-415.
- Dunlap, Riley E. and Kent D. Van Liere. 1978. The "new environmental paradigm": A proposed measuring instrument and preliminary results. *Journal of Environmental Education* 9: 10-19.
- Dunlap, Riley E., Kent D. Van Liere, Angela G. Mertig, and Robert E. Jones. 2000. Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues* 56: 425-442.
- EcoAmerica. October, 2006. *The American Environmental Values Survey: American Views on the Environment in an Era of Polarization and Conflicting Priorities*. Accessed at: http://ecoamerica.typepad.com/blog/2006/12/american_enviro.html.
- Eveland, W.P., Jr., and D.A. Scheufele. 2000. Connecting news media use with gaps in knowledge and participation. *Political Communication* 17: 215-237.
- Floyd, Donna L., Steven Prentice-Dunn, and Ronald W. Rogers. 2000. A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology* 30, no. 2: 407-429.
- Fransson, Niklas, and Tommy Gorling. 1999. Environmental concern: Conceptual definitions, methods, and research findings. *Journal of Environmental Psychology* 19, no. 1: 369-382.
- Gallup Poll. 2007. Accessed at: <http://www.pollingreport.com/enviro.htm>.
- General Social Survey. 2008. Accessed at: <http://www.norc.org/GSS+Website>.
- Gibbons, Frederick X., Meg Gerrard, Linda S. Vande Lune, Thomas A. Wills, Gene Brody, and Rand D. Conger, R. D. 2004. Context and cognitions: Environmental risk, social influence, and adolescent substance use. *Personality and Social Psychology Bulletin* 30: 1048-1061.
- Goidel, K. & Nisbet, Matthew C. 2006. Exploring the roots of public participation in the controversy over stem cell research and cloning. *Political Behavior*, 28, no. 2: 175-192.
- Grothmann, Torsten, and Anthony Patt. 2005. Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Global Environmental Change* 15: 199-213.
- Guagnano, Gregory A., Paul C. Stern, and Thomas Dietz. 1995. Influences on attitude-behavior relationships: A natural experiment with curbside recycling. *Environment and Behavior* 27, no. 5: 699-718.
- Hansla, Andre, Amelie Gamble, Asgeir Juliusson, and Tommy Garling. The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology* 28: 1-9.
- Hines, J.M., H.R. Hungerford, and A.M. Tomera. 1986/1987. Analysis and synthesis of research on responsible environmental behaviour: A meta-analysis. *Journal of Environmental Education* 18: 1-8.
- Ipsos MORI. 2007. *Turning Point or Tipping Point: Social Marketing and Climate Change*. Accessed at: http://www.ipsos-mori.com/publications/srireports/climate_change.shtml.
- Janz, Nancy K. and Marshall H. Becker. 1984. The health belief model: A decade later. *Health Education and Behavior* 11, no. 1: 1-47.
- Kahle, Lynn, Sharon Beatty, and Pamela Homer. 1986. Alternative measurement approaches to consumer values: The list of values (LOV) and values and life style (VALS). *Journal of Consumer Research* 13, no. 3: 405-409.
- Kaiser, Florian G. 1998. A general measure of ecological behavior. *Journal of Applied Social Psychology* 28, no. 5: 395-422.

- Kaiser, Florian G., and Urs Fuhrer. 2003. Ecological behavior's dependency on different forms of knowledge. *Applied Psychology: An International Review* 52, no. 4: 598-613.
- Kellstedt, Paul M., Sammy Zahran, and Arnold Vedlitz. 2008. Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis* 28, no. 1: 113-126.
- Keum, Heejo, Narayan Devanathan, Sameer Deshpande, Michelle N. Nelson, and Dhavan V. Shah. 2004. The citizen-consumer: Media effects at the intersection of consumer and civic culture. *Political Communication* 21: 369-391.
- Krosnick, Jon A., Allyson L. Holbrook, and Penny S. Visser. 2000. The impact of the fall 1997 debate about global warming on American public opinion. *Public Understanding of Science* 9: 239-260.
- Krosnick, Jon A., Allyson L. Holbrook, Laura Lowe, and Penny Visser. 2006. The origins and consequences of democratic citizens' policy agendas: A study of popular concern about global warming. *Climatic Change* 77: 7-43.
- Leiserowitz, Anthony. 2004. Before and after *The Day After Tomorrow*: A U.S. study of climate change risk perception. *Environment*, 46, no. 9: 22-37
- Leiserowitz, Anthony. 2005. American risk perceptions: Is climate change dangerous? *Risk Analysis* 25 (6): 1433-1442.
- Leiserowitz, Anthony. 2006. Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Climatic Change* 77: 45-72.
- Marx, Sabine M., Elke U. Weber, Benjamin S. Orlove, Anthony, Leiserowitz, David H. Krantz, Carla Roncolia, and Jennifer Phillips, J. 2007. Communication and mental processes: Experiential and analytic processing of uncertain climate information. *Global Environmental Change*, 17: 47-58.
- McCright, Aaron. 2007. Dealing with climate change contrarians. In *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*, edited by Susanne C. Moser and Lisa Dilling, 200-212. New York: Cambridge University Press.
- Michaelis, Laurie. 2007. Consumption behavior and narratives about the good life. In *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*, edited by Susanne C. Moser and Lisa Dilling, 251-265. New York: Cambridge University Press.
- Nathan Cummings Foundation. 2007. Failure to Address Energy Anxiety Could Derail Global Warming Policies, Survey Finds. Accessed at: <http://foundationcenter.org/pnd/news/story.jhtml?id=190000008>.
- Nisbet, Matthew C. In press. Framing Science: A New Paradigm in Public Engagement. In *New Agendas in Science Communication*, edited by L. Kahlor & P. Stout, New York: Taylor & Francis.
- Nisbet, Matthew C., and Chris Mooney. 2007. Policy forum: Framing science. *Science*, 316: 5821, 56.
- Nisbet, Matthew C., and Teresa Myers. 2007. The polls – trends: Twenty years of public opinion about global warming. *Public Opinion Quarterly* 71, no. 3: 444-470
- O'Connor, Robert E., Richard J. Bord, and Ann Fisher. (1999). Risk perceptions, general environmental beliefs, and willingness to address climate change. *Risk Analysis* 9: 205-218.
- Ohtomo, S & Hirose, Y. (2007). The dual process of reactive and intentional decision-making involved in eco-friendly behavior. *Journal of Environmental Psychology*, 27: 117-125.
- Oskamp, Stuart. 2000. Psychological contributions to achieving an ecologically sustainable future for humanity. *Journal of Social Issues* 56, no. 3: 373-390.

- Pew Research Center. July 12, 2006. Little Consensus on Global Warming: Partisanship Drives Opinion. Accessed at: <http://people-press.org/reports/display.php3?ReportID=280>.
- PIPA. (2007). American attitudes: Perceptions of others' support for action. Accessed at: http://www.americans-world.org/digest/global_issues/global_warming/gw7.cfm.
- Porter-Novelli and Center of Excellence in Climate Change Communication Research, George Mason University. Feb. 2008. What Are Americans Thinking and Doing about Climate Change? Results of a National Household Survey. Accessed at: http://www.porternovelli.com/site/pdfs/PN_GMU_Climate_Change_Report.pdf.
- Rippl, Susanne. 2002. Cultural theory and risk perception: A proposal for better measurement. *Journal of Risk Research* 5, no. 2: 147-165.
- Rogers, Ronald W., and Mewborn, C.R. 1976. Fear appeals and attitude change: Effects of a threat's noxiousness, probability of occurrence, and the efficacy of the coping responses. *Journal of Personality and Social Psychology* 34: 54-61.
- Roser-Renouf, Connie, Xiaoquan Zhao, Nithya Muthuswamy, and Edward Maibach. (in preparation). Threat, efficacy, and pro-environmental behavior.
- Schultz, P. Wesley, and Lynnette C. Zelezny. 1998. Values and proenvironmental behavior: A five country survey. *Journal of Cross-Cultural Psychology* 29, no. 4: 540-558.
- Schultz, P. Wesley, and Lynnette C. Zelezny. 1999. Values as predictors of environmental attitudes: Evidence for consistency across 14 countries. *Journal of Environmental Psychology* 19: 255-265.
- Schultz, P. Wesley, and Stuart Oskamp. 1996. Effort as a moderator of the attitude-behavior relationship: General environmental concern and recycling. *Social Psychology Quarterly* 59, no. 4: 375-383.
- Schwartz, Shalom H. 1977. Normative influences on altruism. In *Advances in Experimental Social Psychology* 9, edited by L. Berkowitz, 221-279. New York: Academic Press.
- Schwartz, Shalom H. 1994. Are there universal aspects in the structure and contents of human values? *Journal of Social Issues* 50: 19-45.
- Schwartz, Shalom H. 2005. Basic Human Values: An Overview, <http://www.fmag.unict.it/Allegati/convegno%207-8-10-05/Schwartzpaper.pdf>
- Schwartz, Shalom H. 2007. Draft Users Manual: Proper Use of the Schwartz Value Survey, version 10 September 2007, compiled by Romie F. Littrell. Auckland, New Zealand: Centre for Cross Cultural Comparisons, <http://www.crossculturalcentre.homestead.com>.
- Sjoberg, Lennart. 2000. Factors in risk perceptions. *Risk Analysis* 20, no. 1: 1-12.
- Slimak, Michael W. and Thomas Dietz. 2006. Personal values, beliefs, and ecological risk perception. *Risk Analysis* 26, no. 6: 1689-1705.
- Slovic, Paul. 2000. *The Perception of Risk*. London: Earthscan.
- Staats, Henk, Paul Harland, and Henk A.M. Wilke. 2004. Effecting durable change: A team approach to improving environmental behavior in the household. *Environment and Behavior* 36, No. 3: 341-367.
- Stern, Paul C., Thomas Dietz, and Gregory A. Guagnano. 1995. The new ecological paradigm in social-psychological context. *Environment and Behavior*, 27 (6), 723-743.
- Stern, Paul C., Thomas Dietz, and Gregory A. Guagnano. 1995. Values, beliefs, and proenvironmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology* 25, no. 18: 1611-1636.
- Stern, Paul C., Thomas Dietz, and Gregory A. Guagnano. 1998. A brief inventory of values. *Educational and Psychological Measurement*, 58 (6), 984-1,001.
- Stern, Paul C., Thomas Dietz, and Linda Kalof. 1993. Value orientations, gender, and environmental concern. *Environment and Behavior* 25, no. 3: 322-348.

- Stern, Paul C., Thomas Dietz, Troy Abel, Gregory A. Guagnano, and Linda Kalof. 1999. A value-belief-norm theory of support for social movements: the case of environmentalism. *Research in Human Ecology* 6, no. 2: 81 – 97.
- Sundblad, Eva-Lotta, Anders Biel, and Tommy Garling. 2007. Cognitive and affective risk judgements related to climate change. *Journal of Environmental Psychology* 27: 97-106.
- Tierny, J (Feb. 29, 2008). Global warming paradox? *The New York Times*. Accessed online at: <http://tierneylab.blogs.nytimes.com/2008/02/29/>.
- Trumbo, Craig W. 1995. Longitudinal modeling of public issues: an application of the agenda-setting process to the issue of global warming. *Journalism and Communications Monographs* 152.
- Wall, Rob, Patrick Devine-Wright, and Greig A. Mill. 2007. Proenvironmental intentions: The case of commuting-mode choice. *Environment and Behavior* 39, no. 6: 731-753.
- Weber, Elke U. 2006. Experience-based and description-based perceptions of long-term risk: Why global warming doesn't scare us (yet). *Climatic Change* 77: 103-120.
- Wildavsky, Aaron and Karl Dake. 1990. Theories of risk perception: Who fears what and why? *Daedalus* 119 (4): 41-60.
- Witte, Kim. 1992. Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs* 59: 329-349.
- Zhao, Xiaoquan. (in preparation). The effect of self-affirmation on global warming perceptions.