Communication and Marketing As Climate Change–Intervention Assets. A Public Health Perspective

ARTICLE *in* AMERICAN JOURNAL OF PREVENTIVE MEDICINE · DECEMBER 2008

Impact Factor: 4.53 · DOI: 10.1016/j.amepre.2008.08.016 · Source: PubMed

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Communication and Marketing As Climate Change–Intervention Assets

A Public Health Perspective

Edward W. Maibach, PhD, Connie Roser-Renouf, PhD, Anthony Leiserowitz, PhD

Abstract: The understanding that global climate change represents a profound threat to the health and well-being of human and nonhuman species worldwide is growing. This article examines the potential of communication and marketing interventions to influence population behavior in ways consistent with climate change prevention and adaptation objectives. Specifically, using a framework based on an ecologic model of public health, the paper examines: (1) the potential of communication and marketing interventions to influence population behaviors of concern, including support for appropriate public policies; (2) potential target audiences for such programs; and (3) the attributes of effective climate change messages. Communication and marketing interventions appear to have considerable potential to promote important population behavior change objectives, but there is an urgent need for additional translational research to effectively harvest this potential to combat climate change.

(Am J Prev Med 2008;35(5):488–500)

Introduction

> Either we will achieve an awareness of our place in the living and life-giving organism of our planet, or we will face the threat that our evolutionary journey may be set back thousands or even millions of years. That is why we must see this issue as a challenge to behave responsibly and not as a harbinger of the end of the world.
>
> – Vaclav Havel
> former president of the Czech Republic[1]

The potential health effects of climate change have been reviewed extensively.[2–7] Earth system changes, including rising temperatures, increasing climate variability, increased rainfall in some areas and drought in others, and more frequent severe weather events, have considerable potential to affect human health. Severe weather events may result in injuries and fatalities, and heatwaves can cause direct effects such as dehydration, heat asthenia, heat exhaustion, and heat stroke; excess deaths during heatwaves result primarily from underlying cardiovascular and respiratory diseases. Ecosystem changes can increase the range, seasonality, and infectivity of some vector-borne diseases. Heavy rainfalls and related factors are associated with waterborne disease outbreaks, and these may increase the risk of foodborne illness. Higher levels of carbon dioxide and heat may promote production of allergens (e.g., pollen) by such plants as ragweed, and warmer weather may promote the formation of ground-level ozone. Humidity combined with heat facilitates fungal growth and transmission.

Potential indirect effects—for which data are less available and uncertainties are greater—include mental health consequences, population dislocation, and civil conflict. In addition, changes in the patterns of pests, parasites, and pathogens affecting wildlife, livestock, agriculture, forests, and coastal marine organisms can alter ecosystem composition and functions, and changes in these life-support systems carry implications for human health.[8] The burden of these conditions is expected to increase as climate change advances.

Successfully addressing climate change as a public health threat will require both mitigation and adaptation strategies, or, in more common public health terms, primary and secondary prevention strategies. Primary prevention requires aggressive efforts to reduce atmospheric levels of greenhouse gases, both by reducing emissions and by sequestering gases already in the atmosphere (e.g., through reforestation). Secondary prevention requires efforts to adapt to a changing climate in ways that protect population health and

From the Center for Climate Change Communication, George Mason University (Maibach, Roser-Renouf), Fairfax, Virginia; and the School of Forestry and Environmental Studies, Yale University (Leiserowitz), New Haven, Connecticut

Address correspondence and reprint requests to: Edward W. Maibach, PhD, Center for Climate Change Communication, George Mason University, 4400 University Drive, MS 6A8, Fairfax VA 22030. E-mail: emaibach@gmu.edu.

0749-3797/08/$–see front matter
doi:10.1016/j.amepre.2008.08.016

well-being. Examples of adaptation include reinforcing levees in coastal areas, implementing heatwave preparedness plans in urban areas, and reforestation.

There is an urgent need to influence people's behavior—on a large scale or population basis—to help prevent and reduce the burden of climate change on human and other populations. Social and behavioral science intervention methods offer important tools to this end. Here, two broad sets of tools—communication and social marketing—are examined as assets for mounting a public health response to climate change. *Communication* is defined as the production and exchange of information to inform, influence, or motivate individual, institutional, and public audiences, and *social marketing* as the development and distribution of products or services to influence behavior on a large scale for the purpose of societal benefit rather than commercial profit.

First, a summary is presented of what is known about the drivers of population behavior, along with a framework that organizes these influences. Current knowledge is then reviewed about (1) the potential of communication and social marketing to influence population behavior, (2) general public audiences for climate change interventions, and (3) effective message strategies to influence these audiences. It is important to note that the majority of the research cited here was conducted with people in the U.S., and that recommendations are made primarily for the current American context. Many of the general points, however, likely have relevance to other developed nations and even to developing nations.

Influencing Population Behavior: Understanding the Challenge

The public health community, like many others, was slow to recognize the threat of climate change. The themes of World Health Day 2008 (Protecting Health Against Climate Change) and National Public Health Week 2008 (Climate Change: Our Health in the Balance) make clear that the threat is now recognized. The need for the public health community to mobilize its assets against that threat is now obvious.

Fortunately, the public health community has much to offer. Perhaps most notably, this community has both breadth and depth of experience in understanding and responding to population behavior-change challenges (see Text Box for an example).

Historically, when people fail to behave in ways that are in their own or society's best interest—as judged by public health professionals, environmental scientists, and other similar experts—the tendency has been to assume that the cause must be either a lack of relevant knowledge on their part (i.e., an information deficit) and/or misguided attitudes. The prescription that has tended to follow this diagnosis is: to change people's behavior, we must provide them with the knowledge they lack and/or persuade them to change their attitudes.[15]

In the public health community over the past several decades, this "information deficit" view of population behavior—although appealing in its simplicity and apparent face validity—has been largely supplanted by ecologic views of population behavior. The "people and places" framework (Figure 1) is one example of an ecologic model.[16,17] The framework describes population health—and environmental outcomes—as being

Text Box

Chronic disease prevention provides an example of the type of challenges that climate change poses. Over the past several decades, the public health community has focused on understanding and preventing chronic diseases through population-based intervention strategies.[9,10] Many of the underlying behavioral and economic factors that make chronic diseases so challenging to control in the modern era appear to have direct relevance to climate change control. For example:

- People have a strong innate tendency to value immediate benefits more than future benefits.[11] Although many of the costs—including monetary (e.g., retrofitting buildings with energy-efficient devices), time and effort (e.g., using active or mass transit options rather than driving in one's car), and social (e.g., challenging people's preferences about whether dinner should include meat or not)—associated with prevention and adaptation are necessarily borne in the present, many of the associated benefits don't accrue for months (e.g., reduced utility bills, reduced BMI), years, or even decades into the future (e.g., reduced global warming, heart disease averted).
- People have a tendency to consume resources in proportion to how available and affordable the resources are.[12] In societies where resources are readily available and affordable (such as the U.S.), this tendency can lead to excess consumption, that is, consumption levels that exceed the individual's—or society's—best long-term interests. Well-documented examples of such excess consumption include calories and electronic media content.[13] Production, distribution, and consumption of such resources are typically dependent on fossil fuels at present.
- People have a tendency to conserve physical effort expenditures.[14] This innate human tendency has been greatly enabled in the developed world by the proliferation of labor-saving devices (e.g., cars, home appliances, power tools). Like other resources, the production, distribution, and use of these devices currently depends on fossil fuels.

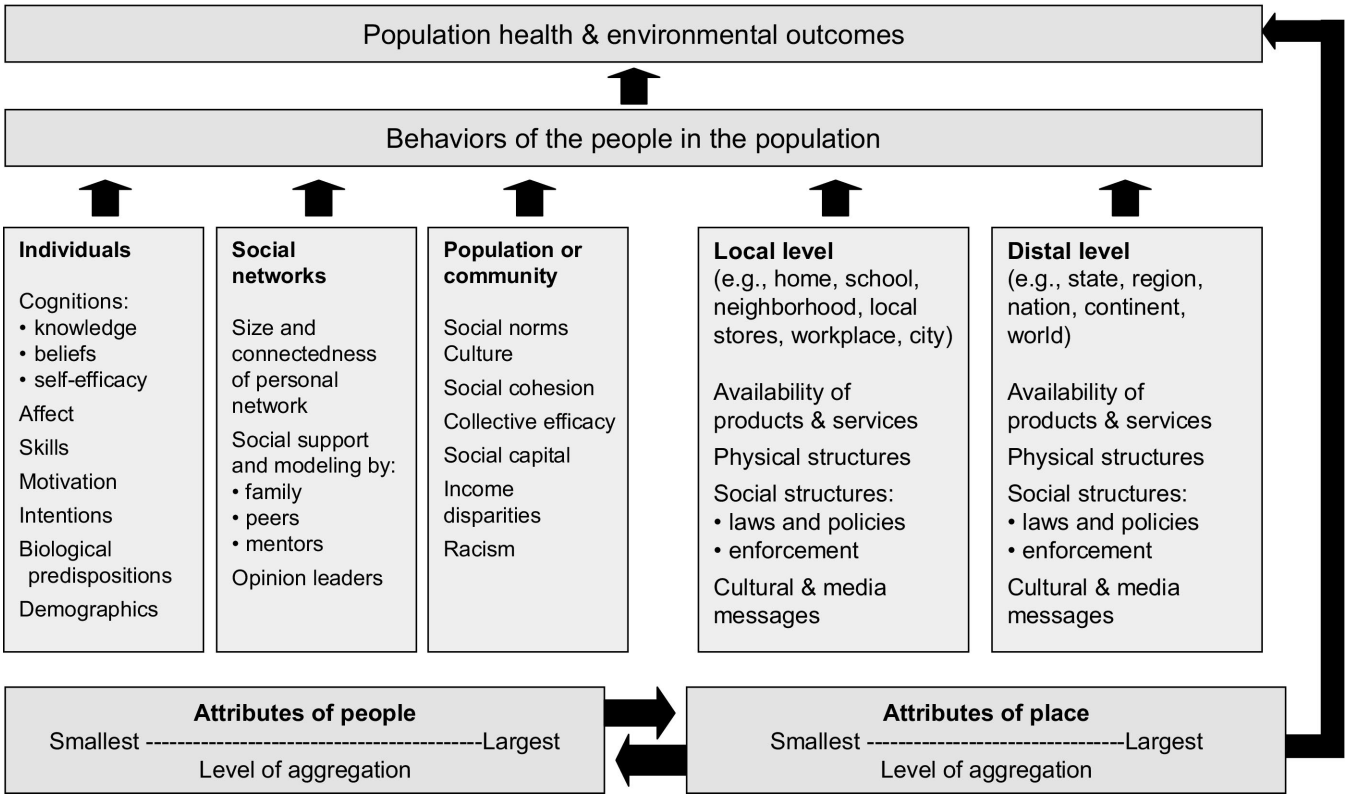

Figure 1. A "people and places" framework

determined primarily by population behavior, which, in turn, is determined by people-related and place-related factors. The people-related factors that influence population behavior are organized into three levels of analysis: individual-level factors (such as beliefs and skills), social network-level factors (such as behavioral modeling and social reinforcement), and group-, community- or population-level factors (such as social norms and collective efficacy). The place-related factors—as identified by Farley and Cohen[18]—are described in broad terms as the availability and cost of products and services, the attributes of physical structures, social structures (i.e., laws and policies), and the cultural and media messages in our communities. These place-related factors manifest at two levels of analysis: the local level and the distal level. Local-level factors describe people's immediate environment—their homes, schools, workplaces, and neighborhood shops—and influence population behavior only in a given locale. Distal-level factors originate further afield—in state, national, and multinational capitals, and in the headquarters of multinational corporations—and exert influence on population behavior over wider geographic areas. The framework also acknowledges that place-related factors—for example, harmful environmental exposures—can exert direct influence on population health and environmental outcomes, but the framework intentionally emphasizes the role of human agency in causing or preventing those environmental exposures.

The potential of communication and social marketing as means to influence population health and environmental outcomes becomes clear in the context of this framework. Specifically, most of the people- and place-based drivers of population behavior potentially can be influenced through communication and/or social marketing.

The Potential of Communication and Marketing to Influence the Drivers of Climate Change–Related Behavior

Remarkably little progress has been made in understanding how best to influence climate change–related behaviors on a population basis, especially given the likelihood of severe negative consequences that may arise—including health, environmental, and economic impacts.[19] The research literature on individual climate change–mitigation behaviors has focused primarily on four broad categories: household energy use, recycling, surface transportation behavior, and purchase of "green" products.[20] The research literature on individual-level adaptation has focused primarily on issues related to increasing household preparedness against natural disasters, such as hurricanes.[21]

Influencing Individual-Level Drivers of Population Behavior

The intervention studies conducted to date have primarily attempted to influence population behavior by targeting individual-level factors. The large majority of 38 recently reviewed household energy conservation interventions, for example, used communication to influence individual-level drivers of population behavior.[22] In this and other reviews, several modes of communication have shown promising ability to reduce energy use[23]:

- The provision of tailored or customized recommendations—based on home energy audits—has been shown in some (but not all) studies to reduce energy use in the range of 4% to 21%.[24–27]
- The provision of feedback (i.e., specific information about the amount of energy being used)—especially when the feedback is frequent or continuous—has been shown to reduce energy use in the range of 5% to 13%.[28–32]
- Encouraging people to set an energy-reduction goal—especially if they are given feedback about their progress toward the goal—has been shown to appreciably reduce household energy consumption.[33,34]
- Using mass media to model behaviors of interest has long been known to be an effective population behavior-change strategy[35]; regrettably, only a single study that has tested this approach to influence climate change–relevant behavior was found. In that study, TV was used to model ways to reduce household electricity use. The programming led to a 10% reduction in household electricity use, although the reduction was not apparent a year later.[36]
- Eco-labeling programs have been shown to influence population behavior—at least some people's behavior under certain conditions.[37] People who hold pro-environmental attitudes are most likely to be influenced. Moreover, to be effective, people must understand the label, must believe that the "green-designated" product offers meaningful environmental benefits, and must trust the organization that has given the designation (with government designations being more trusted than industry designations).[23] The effectiveness of eco-labeling programs tends to increase over time as consumers develop trust in the labeling system.
- A number of communication campaigns promoting household disaster preparedness have been evaluated. Their behavioral impact has ranged from no behavior change at all to a relatively great deal of public and household change.[21] The more successful campaigns typically used what are now commonly accepted as good campaign design practices: simple clear messages (e.g., specifying who is at risk, how severe and how certain the risk is, and what can be done to reduce the risk or diminish losses), repeated often (e.g., through a variety of interpersonal and media channels, electronically and in print), by a variety of trusted sources (e.g., scientists, community leaders, journalists).

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Marketing interventions—in which improvements are made to products or services, their prices and availability, and how they are promoted (to enhance their perceived value to potential customers)—have also shown promise as tools for population behavior management with a variety of climate change–relevant behaviors:

- Financial incentives to install energy-efficient appliances can substantially increase homeowners' purchase of such appliances, especially if the offers are aggressively promoted (i.e., communicated).[38]
- Green energy programs—in which utility companies offer their residential customers energy from renewable sources at a premium price—have a growing presence in the marketplace. Programs with more aggressive marketing features—low minimum purchase requirements, short contract lengths, and aggressive promotion—have higher customer participation and total energy purchases.[39]
- Travel demand management programs—which use a variety of marketing methods—have been shown to substantially increase use of public transportation (20%–33%) and active transport modes (including walking [16%] and cycling [6%–91%]), and to reduce the number of car trips taken (10%) and distance traveled by car (17%).[40]

Influencing Social Network–Level Drivers of Population Behavior

Relatively few studies have attempted to influence population behavior through social network–level interventions. One important exception is a series of studies in which block leaders were recruited in neighborhoods to model household recycling behavior and exhort and assist neighbors to recycle. The approach resulted in significant neighborhood-wide increases in recycling.[41–43] Opinion-leader interventions of this type deserve considerable additional research attention because of their potential to influence a wide range of climate change–mitigation and adaptation behaviors.[44]

Influencing Community-Level Drivers of Population Behavior

Communication interventions that influence people's normative beliefs—that is, people's beliefs about the behavior of others—have been shown to promote a

range of relevant behaviors including recycling,[45] reduced household electrical use,[46] and reduced hotel towel use (which has direct water-use implications).[47] Recent advances in understanding how to use these inexpensive methods to manage population behavior have readied them for widespread application.[48] And, given the rapidly growing literature suggesting that community-level variables can be far more powerful than individual-level variables in shaping population behavior,[49] there is a pressing need for intervention research on other community-level drivers of population behavior.

Influencing Place-Based Drivers of Population Behavior

Despite the importance of the attributes of place, little intervention research has been conducted to test strategies for influencing these attributes. Some illustrative real-world examples, however, include:

- The limited availability and higher up-front costs of compact fluorescent lighting (CFL) have, until recently, depressed demand for the product.[50] Prior to 2007, retail shelf space and marketing promotion for CFLs was severely limited, and prices were exorbitantly high by comparison.[51] Each of these factors has improved recently, in part due to retailing giant WalMart's successful initiative to sell one million CFLs in 2007.[52]
- Sidewalks and certain other physical attributes make some communities more walkable than others. Residents in walkable neighborhoods get more physical activity and do more of their errands on foot, than do residents in less walkable neighborhoods.[53] A small but growing number of campaigns are advocating neighborhood/city reconfigurations to make them more supportive of active living.[54]
- Low gasoline taxation in the U.S. fosters higher consumption. It is estimated that increasing the gasoline tax to $2/gallon would reduce short-term consumption by ≥15% and long-term consumption by ≥60%. Similarly, federal subsidies on a range of products—including oil production and large sport utility vehicles—lower their price to encourage consumption, thereby creating taxpayer-supported greenhouse gas pollution. A range of individuals and organizations are advocating for substantial increases in the federal gas tax, or more generally for a carbon tax or a cap-and-trade system to limit carbon emissions, but their efforts thus far have failed to gain political traction due to lack of broad public support.[55]
- Advertisements and other types of media can reinforce, or even help create, consumerist values and behaviors. A recent study in China, for example, demonstrated that exposure to consumption-related and Western-originated media content is contributing to the growth of consumerist values.[56] Conversely, a media campaign in England by the Alliance Against Urban 4x4s is attempting to reverse the rising trend of SUV sales by creating and sustaining a public debate in the media about the use of SUVs in the urban environment, highlighting their effect on society and the environment, and countering images depicted in industry advertising (www.stopurban4x4s.org.uk).

When communication and marketing interventions are used to influence place-based drivers of population behavior, they often target different audiences and use different methods than campaigns seeking to influence people-based factors. Segments of the general public—or, stated differently, segments of the voting or purchasing public—can be targets of these initiatives when rallying grassroots support for the proposed place-based modifications is helpful. The ultimate target audiences, however, are the people whose decisions control the attributes of place (e.g., elected officials). Elected, appointed, and career officials at all levels of government (local, state, national, as well as multinational government organizations [e.g., the European Union]) are one such category of target audience. Government officials, through acts of commission and omission, have the capacity to influence the physical and social structures of communities directly, and have the capacity to influence the availability and cost of products and services indirectly through regulation and, to a lesser extent, the prevalence of media messages. Decision makers in a wide range of businesses and nongovernmental organizations (NGOs) are a second such category of target audience. Through their operating decisions, these people directly influence the availability and cost of products and services, the physical structures, and the media messages in communities. They also play a number of important roles in influencing community social structures indirectly (through their support or opposition). All of these should be considered important target audiences for climate change communication and social marketing initiatives.

The Potential of Multi-Level Interventions

As has been illustrated above, initiatives that seek to influence population behavior with single-level interventions—that is, attempting to create change in one, but only one, of the five levels of influence on population behavior—can have a measurable impact on population behavior. In most cases documented thus far, however, the impact has been modest.

That single-level interventions typically have only a modest population impact makes perfect sense in the context of ecologic models of behavior. The causes of population behavior are multifactorial, thus interventions targeting only one of those factors are likely to

have only modest success. The literature suggests that multi-level interventions hold greater promise.[57]

An important interplay also exists between people and the attributes of place. Using a traditional public health example, programs to prevent micronutrient malnutrition have been shown to be most successful when two conditions are ensured: (1) fortified staple foods are made widely available in the community (i.e., influencing place) and (2) promotional efforts are implemented to heighten consumer demand for those fortified foods (i.e., influencing people).[58] Similarly, the effectiveness of incentive programs to promote the purchase of energy-efficient household appliances has varied by a factor of 10, depending on how aggressively they were promoted to members of target households.[59] In short, active communication plays an important role in stimulating the uptake of useful new products and services.

There exist only a few examples of multi-level climate change interventions. A compelling one was a social marketing initiative implemented in Hood River OR that resulted in a 15% decrease in community-wide electrical consumption as a result of a multi-level intervention targeting households.[60,61] Built on the basis of extensive marketing research, the program influenced attributes of place by offering financial incentives and in-home assistance to help residents install various energy-conserving devices, and it influenced people—both individuals and social networks—through aggressive use of media and word-of-mouth initiatives. In sum, this program modified the Hood River community in a variety of ways that made it easier and more normal for residents to adopt energy-saving measures.

In an excellent review of communication as a policy instrument through which to alter environmentally significant behaviors, Stern[62] concludes that communication can influence certain important drivers of behavior (i.e., personal capabilities, habits and routines, values, attitudes, beliefs and personal norms, and the social context in which behaviors are or are not performed), but has no capacity to influence the potentially more important institutional, economic, and technologic drivers of behaviors (including laws and regulations, financial costs and rewards, available technology, and convenience). Stern concludes that larger and more sustainable changes in population behavior are likely to require use of the full range of policy instruments, including communication, voluntary collaborative actions by industry, command and control, economic instruments, and service and infrastructure. We suggest that, when focused appropriately, communication and marketing can be used to effect change among the institutional, economic, and technologic drivers of behavior. Specifically, although communication and marketing are typically thought of as means to influence populations, they also provide means to influence the people who control the attributes of *place* that drive population behavior.

Governments can—and in many instances have—sponsored communication and social marketing campaigns targeting climate change–related behaviors. Government campaigns typically target people-based drivers of population behavior, but they can also be used to target place-based factors that are controlled by the private and NGO sector. California's success at holding its per-capita energy consumption constant over the past several decades provides an excellent example.

When government policies contribute to the problem, NGO- and citizen-sponsored campaigns can be used to advocate changes in government policy. The public health literature uses various concepts and terms to describe the use of communication and marketing to influence the attributes of place in this manner. These include policy advocacy, media advocacy, and dissemination of evidence-based practices. Organizations in the private sector have a different set of concepts and terms to describe these activities including business-to-business marketing and lobbying.

Audiences for Climate Change Communication and Marketing Campaigns

Recent polls indicate that about half of U.S. residents believe that climate change is already having dangerous effects on people or will within the next decade[63]—an increase of 20 percentage points since 2004—and 19% believe it is a very serious threat to them and to their families. Anecdotally, the frightening projections of rising seas, flooding, mass extinctions, and displaced populations arouse concern and motivate action in some, but leave others with feelings of indifference, despair, disbelief, powerlessness, or cynicism. This highlights a fundamental truth: There is no such thing as "the general public." To reach and influence audiences effectively, campaigns must be targeted on the basis of audiences' interests, values, and current behavioral patterns.[64,65]

Audience segmentation has traditionally been based on demographic traits, but demographics alone are ineffective predictors of global warming attitudes and practices.[66] Segmentation using a variety of psychosocial variables, a method with a long history in the public health arena, is likely to offer a more promising approach.[15,67] For example, recent research has identified several distinct interpretive communities of risk (i.e., audience segments) based on differences in global warming risk perceptions, policy preferences, values, beliefs, and media use.[68,69]

Interpretive Communities of Risk

Leiserowitz and Slovic conducted a nationally representative survey of adults in the U.S. (n=810) in 2005 and

identified five distinct interpretive communities based on people's perceptions of ten varied hazards (terrorism, the Iraq War, global warming, nuclear power, pesticides, genetically modified food, gun control, marijuana, legal abortion, and homosexuality) (AL, unpublished observations, 2008). Each segment exhibited a consistent pattern of perceptions across the various risks, driven in part by the group's underlying values. Each segment also exhibited unique sociodemographic, political, and religious characteristics, which were used to label them.

Focusing specifically on the issue of global warming, three audience segments, representing 63% of people in the U.S., were found to have high perceptions of risk associated with climate change:

- **The Liberal Left** (14% of the total sample). These people tended to be high SES, nonreligious, white, Democratic women with egalitarian values and a liberal political orientation. They also were much more likely to perceive a high degree of risk associated with environmental and technologic threats, and a low degree of risk associated with moral threats (homosexuality, abortion, and marijuana use).
- **Alarmists** (12% of the total sample). This interpretive community tended to be religious, low SES, minority women who were politically disaffected. They perceived a higher than average degree of risk associated with all of the risks assessed (environmental, technologic, national security, and moral).
- **Mainstream Americans** (37% of the total sample). This segment tended to have a high school education, be politically independent, and hold moderate political views. They tended to perceive all hazards as relatively moderate risks, with the exception of global warming, the Iraq War, and terrorism, which they rated as high to very high risks.

Conversely, two other interpretive communities had relatively low perceptions of risk associated with climate change:

- **Optimists** (21% of the total sample). Optimists tended to be high SES, white, nonreligious, conservative, Republican urban men. They perceived all of the hazards, including global warming, as relatively low risks to U.S. society. They also tended to hold strong anti-egalitarian and pro-individualist values.
- **The Religious Right** (16% of the total sample). The Religious Right tended to be white, highly religious, conservative, Republican rural men. They perceived moral issues such as legal abortion, homosexuality, and marijuana as very great risks to U.S. society, but saw nuclear power, global warming, and the Iraq War as relatively low risks. They held strong hierarchical values, and like Optimists, also held strong anti-egalitarian and pro-individualist values.

This study supports the view that there are diverse audiences within the U.S. population, each predisposed to interpret global warming, along with other hazards, in different ways, drawing on different life circumstances, experience, social networks, and value orientations. This understanding of the underlying worldview of the various audience segments could be used to tailor messages that resonate with the values and predispositions of each group.

Although the example provided here focuses on segmenting the general public for purposes related to promoting climate change prevention, the rationale for segmenting audiences and tailoring messages is equally compelling when targeting more specialized audiences, especially those who influence the attributes of place (e.g., elected and appointed government officials, small business owners, corporate officials). Moreover, segmentation will also be an asset when pursuing climate change–adaptation objectives.

Effective Climate Change Messages

Fear Appeals

The climate change literature contains frequent warnings to avoid fearful messages,[70–72] yet the more general persuasive communication literature indicates that fear appeals are effective in motivating behavior change, especially if they are accompanied by efficacy-enhancing information.[73–75] Witte and Allen's meta-analysis[75] of 93 fear appeal experiments, for example, demonstrated that there is a positive, albeit small, average correlation (0.16) between fear and behavioral outcomes, and that the effects of fear are significantly augmented with stronger fear messages and when fear messages are accompanied by efficacy-enhancing messages.

This contradiction—between the warnings to avoid fear in climate change communication and experimental evidence indicating its effectiveness—may be driven, in whole or part, by an artifact of the research methods. Most research on fear appeals has been conducted in lab settings with students as subjects, whereas in natural settings, the probability that people will choose not to attend to fearful messages can be quite high.[76] Witte and Allen's meta-analysis, however, found that defensive reactions are also prevalent in lab studies, with stronger fear appeals engendering stronger defensive responses, particularly when combined with a weak efficacy message. Given the potential importance of fear in climate change communication, additional research—ideally a combination of laboratory and field research—is urgently needed to resolve the contradiction.

Pending further research, we recommend that when potentially fearful content is presented, it be accompanied by strong efficacy-enhancing messages. Relevant

efficacy-enhancing information can include identifying recommended actions through which to reduce the threat, persuasive affirmations that collectively the audience is capable of implementing these actions (i.e., enhancing perceptions of collective efficacy), and supporting the individual audience members' sense of personal efficacy in taking action.

Further, we recommend a more nuanced approach to presenting fear-based or threatening information. More accurate perceptions of the threat of global warming might be raised with tailored descriptions of the potential impacts. Much of the description of global warming to date has focused on the threat to people, places, and species psychologically, spatially, and temporally distant from most residents of the U.S. For example, descriptions of the potential impacts of climate change on polar bears have become increasingly common. It is likely, however, that not all audiences respond equally to the potential threat to these charismatic animals. Other segments may be more motivated by descriptions of the potential human health, national security, economic, or theological implications of climate change, particularly given the importance (as described below) of **personal** risk as a motivator.[77]

Self-Protection Versus Altruism

Risk communication research typically finds that people must feel personally threatened for messages to influence behavior.[78] However, the political science literature on sociotropic motivations suggests that it is not perceptions of personal threat but rather perceptions of societal threat that influence people's support for public policies.[79] Our current research is suggesting that both forms of perceived risk—personal and societal—may be relevant in shaping climate-relevant behaviors (CR, unpublished observations, 2008). Respondents to a nationally representative survey were asked to assess the seriousness of global warming as a threat to (1) themselves, (2) future generations, and (3) all life on earth. They were also asked which of 14 pro-environmental behaviors they perform. Correlating these two sets of measures, behavior was found to be more highly correlated to the perceived threat of global warming to future generations ($r=0.25$) than to the perceived threat to self ($r=0.21$) or to all life on earth ($r=0.22$; $N=11{,}269$, $p<0.001$, two-tailed). These correlations suggest that people choose environmental behaviors for multiple reasons, with concern for human progeny as the strongest of the three.

Cognitive Outcomes

Although polling data indicate that the vast majority of U.S. residents believe climate change is happening, many do not understand the science underlying the phenomenon (e.g., there is a persistent erroneous belief that the hole in the ozone is letting in too much heat),[77] the human causes of climate change, or the scientific consensus on this point.[63] Clearly, there is a great deal that could be taught: the science, the potential consequences, the contribution of people's actions to the problem, the changes people can make both to mitigate and adapt, and the skills needed to make these changes. A few of these issues are addressed below. It should be noted, however, that in the absence of structural changes that make the promoted behaviors considerably easier, knowledge changes are likely to be ineffective, except among those who are already strongly motivated.

Improving people's understanding of the science. The argument can be made that so long as people know that climate change is dangerous, and they understand that reducing fossil fuel use is the most viable means for preventing further climate change, a full understanding of the physical causes and mechanisms of climate change is unnecessary. The limited research on this position, however, is unclear. Bord and colleagues[80] assessed the importance of actual knowledge about global warming in explaining people's intentions to do something about it; they found that the most powerful predictor of stated intentions to take voluntary actions was knowing what causes climate change and what does not. In a recent study, Leiserowitz,[81] however, found no significant relationship between accurate knowledge of climate change causes and solutions on the one hand and risk perceptions, policy preferences, or reported behaviors on the other. He found that, in the U.S., climate literacy—knowledge of the causes of and solutions to global warming—was extremely poor. For example, he found that most people incorrectly believed that nuclear power plants, toxic waste, and aerosol spray cans cause global warming. Ultimately, he found that overall climate literacy was so poor that it couldn't explain any of the variance among U.S. residents in terms of risk perceptions, policy preferences, or behaviors.

This does not mean, however, that more substantial and accurate knowledge is not vitally important. It simply suggests that many people in the U.S. are currently relying on a variety of factors other than scientific knowledge of the causes and solutions to form their climate change attitudes, preferences, and behaviors. It also suggests that given the limited attention and mental storing capacity available to most people for problems like global warming, there is a critical need for research that identifies exactly what factual knowledge is the most important and useful—either to help people understand the potential risks or to guide their preferences and behaviors.[82]

Likewise, many researchers have identified the need for an effective metaphor to explain climate change. Communicators have been searching for bridging metaphors, and first-rung theories—simple analogies such

as "the heart is a pump" to convey the essential processes and significance of climate change.[72,83] An analogy is the "ozone hole"—commonly thought of as a "hole in the ceiling"—which is often presented as a successful example of a first-rung theory; it was highly effective in conveying the problem and motivating support for policies to address it—so successful, in fact, that it's been difficult to separate it from climate change in the public mind.

The metaphor of the greenhouse effect has been criticized because many people aren't familiar with how greenhouses work, and greenhouses are generally perceived as good things. Likewise the warming metaphor embedded in the term *global warming* may sound like a positive change to some individuals.[84] In response, Lovelock[85] has suggested the name *global heating*. One research paper that has been influential in the environmental community argues that describing climate change as "a blanket of carbon dioxide around the world that is trapping heat" is easily understood and improves people's understanding.[72] Unfortunately, however, although the blanket metaphor may be useful for explaining how these gases trap heat, it carries no connotative sense of the threats posed by this process. In fact, warm blankets are likely to evoke positive images and feelings among an American audience. Metaphors engage people's embodied experiential knowledge, schemas, and mental models (e.g., a hole in a ceiling is a bad thing and needs to be fixed) and can strongly determine subsequent inferential processing, leading people to particular conclusions about the significance or proper response to an issue. Climate change still lacks a single, powerful, and encapsulating metaphor.

The "controversy." Public uncertainty about the reality and causes of climate change is fed by an emphasis on controversy in news stories. The belief that there is a lot of disagreement among scientists over the reality of climate change is held by 40% of the public, and only 57% understand that humans are the cause.[63] Although dated, research by Wilson[86] found that most journalists didn't understand climate change, exaggerated the debate, and underplayed the scientific consensus, and Wilkins[87] identified the tendency for global warming stories to emphasize a technologic fix frame rather than individual contributions and policy solutions. The impact of these frames is largest with audience members who hold ideologies that are not pro-environmental[88]; specifically, the people least inclined to accept climate change as a serious risk find confirmation of their beliefs in the balanced reporting styles, which present both sides of the controversy when none actually exists.

In combating the misconception that the scientific community disagrees about climate change and its human causes, one body of research suggests that communicators should **not** repeat the assertions of the doubters. "Myth-busters" research has found that when a false statement is repeated in order to refute it, the repetition merely serves to reinforce the false belief.[89] Over time the refutation is forgotten, but the false belief has been reinforced simply because the audience member has heard it repeated again. New assertions that make no reference to the false claims are more effective for refuting myths.[90] For example, rather than counter the statement "Climate change is part of a natural weather cycle" in a manner that repeats the assertion, it is preferable to state: "The scientific evidence is clear; human activity *is* contributing to climate change."

Potential consequences. Studies show that the public has difficulty understanding the projections and probabilities scientists use to estimate the potential impact of climate change. Moreover, debate around the projected consequences can result in public apathy and stall policy change.[91] Communication, then, should emphasize what we know, rather than what we don't know. Moser and Dilling advise communicators to "lead with the strongest argument—that is, with the greatest scientific certainty and confidence."[71]

Krosnick and colleagues[92] conducted research to identify specific cognitions or beliefs that predict people's perception of climate change as a serious national issue that warrants federal public policy response. In essence, they demonstrated five key beliefs that predispose people to support an aggressive public policy response: (1) climate change is real, (2) I am *certain* it is real, (3) is it human caused, (4) it is harmful to people, and (5) the problem can be solved. These beliefs, therefore, can be considered important objectives for climate change–communication campaigns.

Skills. Although "smart meters" are rapidly gaining market share in some nations, home energy use in the U.S. is still essentially invisible. People receive monthly home energy bills, which is analogous to receiving a single non-itemized bill at the end of the month for all food purchases.[93] This lack of timely and specific feedback discourages involvement and skill development in energy-reduction strategies.

Formative Research

The list of options to reduce energy consumption is extensive, and presenting consumers with a long list of recommended actions may create an overwhelming and confusing disincentive to action. Efforts to encourage behavior change should be preceded by an analysis of which behaviors will have the greatest impact in reducing carbon emissions.[94] After the most relevant behaviors have been identified, a careful study of audience knowledge is needed to ensure that the campaign is providing new information, not repeating

what the audience already knows or overlooking informational gaps that render audience members incapable of complying with message recommendations.[82] However, identifying the lack of knowledge is not enough. Research must also identify the other barriers that prevent people from changing their behavior, including time and financial resources, social norms, lack of skills, and structural opportunities to change. With all this in mind, campaigners may then select and target behaviors that (1) will have the maximum impact on carbon emissions, (2) are not overly constrained by structural barriers, and (3) are new to the audience.

Values and Framing

Audiences are most receptive to content that is consistent with their existing attitudes and beliefs; selective attention and avoidance make it less likely that inconsistent information will be received.[95,96] Some segments of the U.S. population may reject or ignore information about climate change if they feel it conflicts with their values (e.g., libertarian values) or core beliefs (e.g., religious beliefs that assert we should exercise dominion over nature).[69]

Choosing message frames for climate change that are consistent with the values of target groups is one important way to make the recommended behaviors or policies easier to accept. Conservation messages, for example, can use an economic frame (*This is an excellent way to save money*); an energy independence frame (*This is a means for our country to free itself from dependence on foreign oil*); a legacy frame (*This is a way to protect our children's future*); a stewardship frame (*This is how I honor my moral obligation to protect the abiding wonders and mystery of life*); a religious frame (*This is a way to serve God by protecting His creation*); or a nationalist frame (*Innovative technology will keep our nation's economy strong*). Each of these frames is likely to resonate more effectively with the values of different segments of people in the U.S.

Messaging Suggestions

Given these considerations, some educated guesses can be made about the most effective communication strategies for the five audience segments introduced above. These suggestions, however, are only educated guesses, and should be tested empirically.

- **The Liberal Left,** with relatively high SES and high levels of education, has a greater propensity to seek and process information deeply, and can likely be reached through a variety of print channels. Because this group already perceives climate change as a high risk, the information of greatest value to them may be the relative efficacy of various actions they can take (and how to take those actions) and policies they can support, to reduce their personal and their community's carbon emissions.[97]
- **Alarmists** also already perceive climate change as a high risk, but some may lack basic knowledge, skills, financial resources, or structural opportunities to change their climate-related behaviors. Efficacy-enhancing messages, as well as messages that highlight the monetary benefits of some behavioral changes, are likely to be of value. As their primary source of information, television is probably the most effective medium.
- **Mainstream Americans** are also highly concerned about climate change. Like the Liberal Left and Alarmists, however, they probably lack a clear understanding of the changes in behavior they might make, and the possible costs and benefits to themselves, their communities, and the world at large associated with those behaviors. Given the size, position, and importance of this segment, we encourage immediate in-depth investigation of this group's climate change perceptions and behaviors with appropriate research methods.
- **Optimists,** with strongly individualist worldviews and low perceptions of climate change as a threat, are unlikely to be receptive to most environmentalist messages about climate change. Messages emphasizing energy independence and the economic benefits of conservation are more likely to resonate with them. They may best be reached through newspapers and the Internet—their primary sources of information.
- **The Religious Right,** who also generally do not perceive climate change as a significant threat, may be most receptive to messages framed in moral terms, including the stewardship ethic found in Genesis and the moral duty of Christians to help the poor and needy (i.e., those millions likely to be most affected by climate change). Television and talk radio may be the most effective channels for reaching members of this audience.

Conclusion

A recent meta-analysis of the health campaign literature found that, on average, persuasive media campaigns evoke personal behavior change among 9% of their target audience.[98] Somewhat larger effect sizes were found among campaigns that (1) promoted behaviors enforceable by law (e.g., seatbelt use); (2) achieved a higher than average exposure to the campaign (i.e., greater message reach and frequency) among members of the target audience; and (3) presented new information (versus information that had already been communicated previously in other ways). Regrettably, to the best of our knowledge, no similar analysis has been conducted to assess the impact of campaigns seeking to generate public support for policy solutions.

For a variety of reasons—including the conservative nature of meta-analysis, the modest levels of funding

typically devoted to health communication campaigns, and the fact that all campaigns reviewed sought to influence only individual-level drivers of population behavior—we see this 9% level as establishing the lower bounds for behavior change that can be accomplished with public health communication campaigns. More aggressive communication and marketing campaigns (or multiple overlapping campaigns) that target both people- and place-based drivers of population behavior, including public policy, when sustained over longer periods of time, have the potential to multiply the minimum effect size into a broad-based shift in societal beliefs, norms, and practices. The National High Blood Pressure Education Program—which is credited for having helped lower U.S. stroke mortality rates by >60%—is one example of such a campaign (www.nhlbi.nih.gov/about/nhbpep/),[99] and the Campaign for Tobacco-Free Kids is a second illustrative example focused exclusively on influencing public policies to support the public's health (www.tobaccofreekids.org).

At the individual level efforts should be made to craft communication and marketing campaigns targeting various strategically important audiences. Among the five audiences identified by Leiserowitz and Slovic, for example, Mainstream Americans appear to be a particularly important target audience given their proportion in the overall population and their apparent interest in changing their climate-related behaviors. Communication campaigns targeting such audiences should be focused tightly on providing information that will help audience members pursue both personal and societal (i.e., policy) action. Marketing campaigns targeting such audiences should improve the availability of products and services that make it easier for audience members to reduce their use of fossil fuels and act in other ways that reduce greenhouse gas emissions. Additional audience segmentation research is urgently needed to validate and refine, or replace, the segments described here, and to improve understanding of the information and other factors that will move members of each segment to action at a personal, family, and societal level. This will entail conducting formative research to identify cognitive and skills deficits, social and environmental barriers that can be modified, and effective framing strategies.

At the social-network level there is an urgent need to identify and activate popular opinion leaders within all strata of society, including the government and commercial sectors. Personal influence, especially that of community opinion leaders, is a powerful source of social change that will be needed to engage U.S. residents in responding rapidly to the issue of climate change.

At the community level, there are fewer models of success on which to base climate change interventions, yet the emerging literature in public health indicates the importance of community-level attributes in driving population behavior. Social norms campaigns, which have been shown to be an effective way to influence population rates of a range of conservation behaviors, should be made a high priority both for their potential effectiveness and low cost. Campaigns that specifically address people's collective efficacy—the belief that this is a problem we can solve—may help overcome the tendency to continue to overuse common resources (e.g., as happens in the "tragedy of the commons").

At the place level—local and distal—aggressive strategies need to be implemented to improve the availability and price of products and services that help people reduce their carbon emissions, remove structural barriers to behavior change, and implement policies that encourage energy conservation. Among other things, this will require building public support (or demand) for local, state, federal, and multinational policies that dramatically reduce greenhouse gas emissions and help people adapt to unavoidable climate changes.

All of these actions will require investment of public and philanthropic resources. A portion of those resources should be directed to conducting translational research that will help to ensure that communication and marketing programs created with public, philanthropic and private sector resources are, in fact, effective at motivating and supporting the necessary changes in population behavior. If the experience of the National High Blood Pressure Education Program is a valid indicator, public and philanthropic investments in such research will, in turn, stimulate large investments in program development by organizations in the private sector.

No financial disclosures were reported by the authors of this paper.

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