



Communicating climate change: history, challenges, process and future directions

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Since anthropogenic climate change first emerged on the public agenda in the mid-to-late 1980s, public communication of climate change and—more recently—the question of how to communicate it most effectively have witnessed a steep rise. This paper synthesizes what is known, presumed, and still unknown about how to effectively communicate this problem. An introductory historical overview of climate change communication is followed by a discussion of the challenges that communicators face in trying to convey the issue (invisibility of causes, distant impacts, lack of immediacy and direct experience of the impacts, lack of gratification for taking mitigative actions, disbelief in human's global influence, complexity and uncertainty, inadequate signals indicating the need for change, perceptual limits and self-interest). The core of the paper focuses on key aspects of the communication process (purpose and scope of the communication, audience, framing, messages, messengers, modes and channels of communication, and assessing the outcomes and effectiveness of a communication). These elements are placed in relationship to several contextual factors that affect the communication process. The paper concludes with suggestions for future research on climate change communication. © 2010 John Wiley & Sons, Ltd. *WIREs Clim Change* 2010 1 31–53

'...things that are true and things that are just have a natural tendency to prevail over their opposites...'

Aristotle (from *Rhetoric*, Part I, 350 BC)

Some 2300 years ago, two learned men of Old Greece were arguing over the relative merits and appropriate forms of public communication. One of them, Plato, favored one-on-one dialogue to shed light on important issues and to assess systematically what is true and therefore meritorious about them. He had a strong distaste for the public speakers of his day who shamelessly manipulated the public, apparently without heeding the truth, just to persuade them of certain positions. His student Aristotle, by contrast, while not dismissing the importance of Socratic dialogue, saw great potential in public communication by an educated one to the lay many, and he believed that it could be done ethically. He postulated that persuasion required the ethical character of the

speaker, earnest and passionate emotions evoked by a communication in the audience, and the logical, truthful content of the spoken words. After all, time would reveal that which is true and just, thereby sifting honest speech from its deceiving opposite [Ref. 1].

At the turn of the second millennium AD, the learned contemporaries suggest climate change is one of the most concerning issues of our day. Communication about it is all around us, vying for the public's and policy-makers' attention. Although some try to convince us of the issue's seriousness, urgency, and need for action, there are shameless others—quite persuasive to some, but using distorted or outright false scientific facts, obvious only to the expert few—trying to manipulate us into believing otherwise. With humanity's power to affect the Earth system now of geologic proportions,² it may not be rational, wise, or ethical (following the precautionary principle) to wait until the full 'truth' in all its momentous implications reveals itself to see whose rhetoric was 'right.'

Now more than ever, it is crucial to ask instead how to communicate a global problem that involves less certainty and immediacy than

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most other, more familiar problems, yet which also has the potential for far graver implications than previous challenges. According to the current scientific understanding, climate change could undermine the life support system of many species, even significantly reduce the numbers of our own, and bring profound changes, challenges, and harm to societal systems.^{3–5} It also requires unprecedented cooperation, innovative policies, novel technologies, difficult trade-offs, and new ways of thinking and behaving to be addressed adequately and appropriately.^{6–9} What is known, presumed, and still unknown about how to effectively communicate a problem of such gravity and complexity is the focus of this paper.

HISTORICAL OVERVIEW OF CLIMATE CHANGE COMMUNICATION

Since anthropogenic climate change first emerged on the public agenda in the mid-to-late 1980s, public communication of climate change and—more recently—the question of how to communicate it most effectively have witnessed a steep rise. Much of the early communication was relatively narrowly focused on scientific findings and synthesis reports (such as those published periodically by the Intergovernmental Panel on Climate Change, IPCC), sometimes occasioned by particularly severe extreme events, sometimes by high-level conferences or policy meetings.¹⁰ But the implications of climate change were soon recognized as potentially pervasive and profound across world regions and economic sectors. If global climate change were in fact to unfold with the serious impacts expected by many scientists, there could soon be a strong need and legal requirement to curtail greenhouse gas emissions and limit carbon-emitting land uses. Many with a direct stake in maintaining the carbon-heavy status quo emerged as loud spokespersons against the reality of climate change and the need for mitigation policies (e.g., Refs 11–13). Some of these fossil-fuel interests employed variably credentialed and often unqualified scientists, as well as purposefully created think tanks, intentionally misleading messages, channeled through the ‘megaphones’ of the mass media, and persistent lobbying of politicians to deliberately create an impression of inadequate scientific understanding, continuing lack of scientific consensus, and legitimate alternative explanations for the growing evidence of global climate warming.^{14,15} Others were convinced about the emerging evidence and the specter of serious impacts and took on the tasks of raising public awareness, increasing understanding and engagement,

and advocating for policy change (e.g., Refs 16, 17). To the former, technical experts remained the Cassandras one should not believe, while to the latter scientists became the ‘prophets’ of an ominous truth. Mass media outlets—bound by a long-standing ‘balancing’ norm—reported on, and helped construct and magnify, the resulting climate change discourse as a ‘battle’ over unproven science between these two sides.^{18–20} Meanwhile, a public insufficiently trained and sufficiently distracted to follow the details of the debate over such complex scientific matters was caught in the communication crossfire between them all, with perceptions and levels of awareness rising and falling with the issue attention cycles in the media.^{21–25} Basic understanding of the problem thus remains superficial and vulnerable to frequent revision.^{26–28}

Today, after more than 20 years of scientific progress and a much greater scientific consensus,^{29,30} public climate change communication is no longer just a match between ‘dueling experts.’ Media practices have improved and public awareness—at least in many developed countries—is reaching saturation levels. Concern, sense of urgency, and importance vary greatly across populations, and understanding of the causes and the stakes remains limited. The issues debated in public have moved in many instances beyond whether or not climate change is happening and caused by human activities, though a non-trivial modicum of doubt and skepticism linger in various sectors of society. Public discourse has also moved beyond just the most basic impacts on physical and ecological systems. Policy debates at all levels over climate change mitigation have become widespread and are surging in the lead-up to the December 2009 international negotiations in Copenhagen, where—with renewed US engagement—a successor treaty to the Kyoto Protocol will be negotiated. The emerging evidence of climate change impacts manifesting already and faster than previously thought (e.g., Refs 31–33), as well as the growing understanding of the commitment to climate change^{9,34} have also raised the issue of adaptation higher in media and policy debates (e.g., Ref. 35).

This movement of climate change communication beyond (or at least in addition to) science and policy issues has opened up the nature of public discourse: communicators attempt to reach many more audiences, use more diverse forums, channels, a wider range of messengers, and a number of different framings. As a result, the issue now penetrates society more deeply than just a few years ago.

A number of countries, provinces, and supranational institutions have launched top-down climate change and energy-related communication campaigns

pursuing a range of goals (education, awareness raising, behavior change), for example, in the United Kingdom, Canada, and Japan; Victoria (Australia) and California (United States); the European Union, and the United Nations Development Program. Other countries—such as the United States—have not organized central communication and outreach efforts, and instead have witnessed very active bottom-up, but largely uncoordinated and sometimes contradictory climate change communications.

Far more recent than the science on climate change is a small but rapidly growing body of scholarly work on climate change communication. Typically, contributions to that field have not grown out of the long-standing field of communication studies; rather, research on communicating climate change has emerged largely as a pressing need perceived by those directly involved in communicating the issue and by those who wish to support these communication efforts through theoretically and empirically founded insights (e.g., Refs 17, 36). A respectable body of literature is now available for review and synthesis, and to further help shape the field of scholarly investigation of climate change communication.

THE CHALLENGE OF COMMUNICATING CLIMATE CHANGE

To begin, then, one may ask how communicating climate change is different from communicating other environmental problems, economic challenges, risks, health issues, policy dilemmas, or the need for political engagement and behavior change. Can the insights from those other experiences not simply be applied to climate change? After all, in the last 30–40 years, publics in developed nations have become accustomed to hearing environmental messages and health warnings; they have been bombarded with marketing and behavior change campaigns. Sophisticated educational and behavior change campaigns have also been launched in developing nations to improve public health, create better economic development options, and affect risk-related behaviors. Is a special field of scholarly attention for *climate change* communication really required?

Much progress could have been made, indeed, if climate change communicators had familiarized themselves with, and adopted, what is known already from communication and behavioral research (e.g., Refs 16, 37–45). The majority of early communicators of climate change, however, were physical scientists

and environmentalists—professional groups not necessarily familiar with such social science scholarship. Professional divisions due to specialization, disciplinary boundaries, institutional disincentives, and other factors contributed to this lack of exchange among those *doing* the communicating and those *researching* it. But institutional and training hurdles aside, is there something in the *nature* of the climate problem itself and how humans interact with the climate that makes it more challenging to communicate than other environmental, hazard, or health issues? Indeed, a number of challenging traits make climate change a tough issue to engage with (the following expands on Ref. 46).

Invisible Causes

The first of these traits of climate change can be seen looking out the window: it is not visible. This lack of visibility or immediacy has several distinct dimensions: first, the primary cause—the greenhouse gases emitted from fossil-fuel use or during land-use conversation—is literally invisible and does not have direct and immediate health implications.⁴⁷ In this way, the pollutants causing the problem are very different from many other air or water pollution problems (see the YOU HAVE THE POWER campaign by the Victorian government which tried to overcome just this hurdle, http://www.youtube.com/watch?v=6Eg_SEAnE-M).

Distant Impacts

A second dimension of the lack of immediacy is the temporal and often geographic distance between cause and effect.⁴⁷ Emitting greenhouse gases does not lead immediately to a noticeable, visible impact. Instead, emissions from any individual action, or even from those of most single nations, are relatively small by themselves, and only their cumulative impact on the atmosphere leads to detectable and attributable changes in the atmosphere, in weather and climate patterns, and ultimately in physical, ecological and social systems. Many of the changes observed to date required systematic monitoring over decades to emerge as signals of long-term change from the ‘noise’ of more immediately felt and conspicuous day-to-day, seasonal, and interannual variability in the state of the weather, climate, and the environment.^{48–50} To the casual lay observer, this shorter-term variation perceptually trumps small average change, thus it is not surprising that many have such a difficult time distinguishing weather from climate [often defined as ‘average weather’ with regionally characteristic variability (e.g., Ref. 51)]. Moreover, many of the

early signs of a changing climate have been detected in regions where most people do not live—the Arctic, at high elevations, on coral reefs and other ecosystems not visited or continuously observed by mostly urbanized populations. Moreover, these temporally and spatially distant and disconnected issues have to compete for attention with immediately felt physical needs, professional demands, economic necessities, or social obligations. Psychological research shows that direct experience and immediate demands trump vicarious experiences or abstract data almost every time (see the synthesis in Ref. 52). It is for this reason that a particularly cold winter can undermine the conviction in lay people that global warming is happening.

Insulation of Modern Humans from their Environment

A third dimension of this lack of immediacy lies in the general insulation of most modern, urbanized individuals from climate and the physical environment (e.g., Refs 53–55)—living, working, learning, and playing most hours of the day in climate-controlled buildings, moving in protective vehicles through vastly human-altered landscapes, and spending relatively little time in attentive, observing, or interactive modes in nature makes it difficult to notice subtle, incremental environmental changes (so-called ‘creeping’ environmental changes).⁵⁶ Those able to protect themselves through structural means or insurance against climate-related variability (e.g., shoreline protection, crop insurance) can further reduce their exposure and sensitivity to climatic extremes and variability, and thus dismiss any changes.

Delayed or Absent Gratification for Taking Action

The lags in the climate and social systems and the cumulative nature of emissions also make it difficult to see the link between taking mitigation action and seeing beneficial changes in the climate (such as a return to a more stable climate, fewer extreme events, etc.). It is virtually certain that no individual alive today will see the Earth’s climate return to its state under current, much less pre-industrial, concentrations of greenhouse gases and temperatures (e.g., Ref. 9), even if massive emission reduction efforts were undertaken. This is so even if it were assumed—for simplicity’s sake, though far from the more likely reality—that there is a symmetry between rising and falling greenhouse gas concentrations, the

associated climate, and the environment. This fact, hardly mentioned in climate change communication to date, poses significant cognitive, psychological, and political challenges to sustained public and policy-maker engagement.

Homo Sapiens’ Brain Versus Homo Technologicus’ Power

Communicators of climate change frequently encounter a disbelief in their audiences that humans could in fact alter the global climate (e.g., Ref. 57). From an evolutionary perspective of brain development, this disbelief is understandable. Paleolithic humans lived and had to survive in direct contact with the environment and all its immediate dangers and inherent challenges. Only those with highly developed cognitive and physical skills to fight off and overcome the immediate risks had even a chance at adapting to longer-term, slower changes (e.g., Ref. 58). Differently put, it was both rational and an evolutionary advantage to focus only on the here and now.

Several millennia later, humans have yet to catch up in their normal, regularly exercised cognitive capacities with their vastly increased technological powers. This discrepancy combined with profound socioeconomic and cultural changes, educational deficiencies, advances in information technology and the widespread phenomenon of information overload, as well as a tendency to discount the distant future tend to foster relatively superficial modes of cognitive processing of information, and a focus on the things immediately in front of us, rather than careful, systematic evaluation of all the relevant information leading to decision-making that takes long-term implications of one’s actions into account (e.g., Refs 59–62).

The challenge of reconciling human information processing habits and propensities with the human impact on the planet becomes important in the attempt to persuade people that humans can *cause* a global, systemic change and—by inference—also conceive of and implement appropriate, effective *solutions*, and do so soon enough. There is empirical evidence of individuals being deeply skeptical that society can and will indeed adequately address the climate problem (e.g., Refs 63, 64). In a nationally representative survey of Americans taken in the fall of 2008, researchers found 89% of those surveyed expressing some sort of doubt or pessimism about humanity’s willingness or ability to address climate change (Figure 1), and 69% did not believe that personal actions of individuals would make any difference (data not shown), even

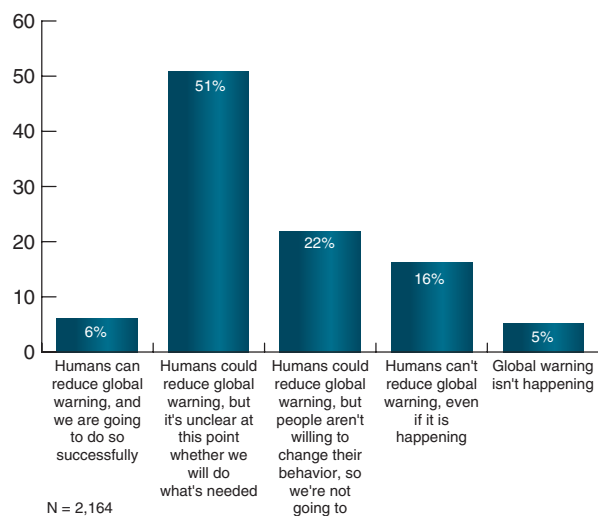


FIGURE 1 | Can and will the world reduce global warming? Survey question: Which of the following statements comes closest to your view? Source: Leiserowitz et al.,²⁸ their Figure 35, reprinted with permission by A. Leiserowitz.

though many expressed a willingness to reduce their personal energy use.²⁸ This attitude—together with deliberate delay tactics, political defense of narrow self-interests, and an apparently deep-seated psychological need to deny and suppress existential threats—may well become a self-fulfilling prophecy (e.g., Refs 65, 66).

Complexity and Uncertainty

Other key characteristics of climate change include its immense complexity and—because it is insufficiently understood and never entirely predictable—its resulting uncertainty. Uncertainty can stem from the lack of data, lack of adequate theoretical understanding of environmental system interactions, the unavoidable inadequacy of representing nature's complexity in models, limitations in the processing capacity of computers, and the inherent indeterminacy of processes in complex systems. Add to these the fundamental uncertainties and deep ignorance involved when humans, with free will and reflexivity, are brought into the picture.^{67–74}

Over the past two decades or more, science has made tremendous progress in furthering understanding of climate science, maybe emblematically represented by the consensual conclusions of the IPCC's four assessments to date. In the politics of climate communication, however, uncertainty has been used countless times to argue for a delay in action. As suggested earlier, those with significant interest in maintaining the fossil-fuel intensive status quo have deliberately created a public perception

of a lack of scientific consensus and greater uncertainty about the extent and causes of modern climate change, suggesting that a wait-and-see stance is the most responsible and scientifically justified course of action (e.g., Refs 11, 14, 15). In contrast, recognizing that uncertainties imply that a problem can turn out either less or more severe than assumed, some scientists have called for an acceleration of action in light of the potentially catastrophic underestimation of risk (e.g., Ref. 75).

For the communication of climate change to lay audiences—be they policy-makers or individuals far from the levers of national and global decision-making—uncertainties in this global, complex, invisible problem have to compete with the certainty of the near-and-dear challenges involved in feeding one's family, getting an education, maintaining a job, or retaining one's health (and health care). Most individuals (even scientists) cannot and will never fully grasp and hold this amount of scientific complexity and uncertainty in their minds, much less be able to process it systematically. And even if individuals accepted the overarching scientific consensus statements as valid, there is additional complexity and uncertainty about the technically feasible, environmentally benign, economically affordable, and morally preferable mitigation (and adaptation) responses. These have been discussed far too little in public communications to date and thus offer important opportunities for dialogue and improvements in communication. The distant, complex, and uncertain climate change could be linked effectively to the more prominent day-to-day challenges (see the next section). Moreover, clearer communication is required about the techno-economic, environmental and moral complexities, and uncertainties of responding to it. What is apparent, however, is that in the absence of better guidance through these varying uncertainties, the mental shortcuts and heuristics people employ to 'manage' cognitive and emotional complexity tend to be ill-suited to adequately respond to climate change.^{43,59}

Inadequate Signals Indicating the Need for Change

If the climate and environment do not yet clearly enough signal to the lay eye that the Earth and humanity are faced with a momentous challenge, socially constructed 'signals' could stand in to provide the relevant information and 'early warning' system. One common signal bears the face of the local currency. However, short of a brief interlude with high oil prices, such signals have been missing almost entirely. To date, climate change and the 'free' emission of carbon can serve as a prime example of a market failure

(e.g., Refs 76, 77). Only some countries and regions are currently experimenting with pricing carbon (e.g., the carbon markets of the European Union, the US Northeast, and Chicago Climate Exchange; Norway's carbon tax; and Germany's steps toward a 'green' tax reform). Other economic signals—tax incentives and other voluntary approaches—tend to be too weak to penetrate diverse populations.^{44,78}

Strong leadership, uniform and steady messaging, public prioritization of climate policy, widespread and visible consistency between words and deeds, unambiguous social norms, and possibly a supportive narrative that portrays 'climate protection' as a source of a socially desirable identity are other examples of signals that could indicate to a population the need for behavior and policy change. In many countries, maybe most conspicuously in the United States, these signals did not begin to emerge until very recently; in others, they are still missing.

Self-Interest, Justice, and Humanity's Common Fate

Part of the reason for the absence of clear signals, of course, is the self-interest of many powerful forces in society that insist on the status quo. This self-interest ranges from the unintentional, unconscious intent of the vast majority of people in western and westernized societies to defend the comforts of their modern lifestyles or, as Dickinson⁶⁶ recently hypothesized, to avoid confrontation with their own mortality to the understandable, if misguided, and sometimes deliberately misleading, efforts of special interests to secure their financial fortunes (e.g., Refs 13, 79, 80). Besides the various self-interested motivations to *not* act on climate change are others that make acting on climate change a matter of personal or civic responsibility, duty, or of social justice (see Ref. 81 for a review of the concept of 'ecological citizenship' and its application to climate change⁸²). As such, these motivations can be equally 'self-interested' as they speak to underlying values and a particular identity an individual may wish to uphold. Of course, what is just vis-à-vis other people, nations, species, or future generations, and how individuals see themselves, their roles and actions, their rights and responsibilities fitting into the larger social and ecological whole are some of the 'moral uncertainties' that can perplex people. In fact, it may be one of the greatest challenges to climate communication to help people navigate these complexities, and—maybe in new dialogic forums—jointly develop compelling narratives (call them worldviews, meaning-giving stories, or modern mythologies) that allow people to see their place in the context of humanity's and the Earth's common fate.

From local to global levels, these issues color the politics of the climate change debate—though not always consciously or constructively—and, often, the interpretation of climate science.⁸³ Narrowly defined self-interests, fights over the many facets of climate justice, and lack of a better understanding of the implications of the existing understanding of climate change have interfered with political leaders and lay audiences fully grasping that there is no escaping of the future we are creating for ourselves (e.g., Ref. 8).

Implications for Climate Change Communication

The implications of these challenges for communicating climate change are important to realize. First, climate change is difficult to perceive and understand for most lay audiences, thus demanding that communicators find clearer, simpler metaphors, imagery, and mental models as well as compelling framing to lay the foundation for more appropriate cognitive processing. Second, climate change—no matter how certain and urgent to experts—for now, and maybe for some time, is fundamentally a mediated, ambiguous problem for most audiences and easily trumped by more direct experiences. This means that lay audiences need to receive ample, clear, sufficiently strong, and consistent signals that support the necessary changes. This clear signaling task cannot be underestimated given the hurdles of cognition, the human-nature disconnect, climate and societal system lags, and other matters competing for constant attention.

Third, although further education and increases in scientific literacy are essential and welcome for many reasons, it is far too simplistic to assume that individuals merely lack education, information, or understanding of climate change, and if these knowledge gaps could be filled and lay individuals somehow could be forced to interpret the findings in a particular way, they would automatically act to reduce their energy consumption and carbon footprint (e.g., Refs 84–86).^a The complexities of socially embedded use of scientific knowledge by lay individuals, decision-making, and the knowledge and mechanisms available (or not) to translate understanding and concern into practice must be addressed through relevant communication and supporting mechanisms. That said, it is unlikely that policy-makers at any level or the wider public come to support a comprehensive climate policy (involving the equally necessary components of mitigation and adaptation) at the level required to substantially reduce greenhouse gas concentrations if they do not have a much clearer picture of the urgency of the situation, the lack of

a ‘backdoor,’ and the common-but-differentiated fate that the interconnected inhabitants of this planet now face.

Finally, scientists have long held and will continue to hold a privileged position as knowledge holders, messengers, and interpreters of climate change. To be effective, scientists and other communicators must become more familiar with the scholarship on communication. It becomes apparent then that a communication between highly educated speakers and a lay, variably interested, and unevenly motivated audience requires substantial effort for this exchange to lead to greater understanding and constructive engagement.

KEY ELEMENTS OF THE COMMUNICATION PROCESS

The challenges of communicating climate change and their implications bring us back to Aristotle and his offering of one of the earliest theories of communication. In his *Rhetoric*, he did not restrict himself to the mechanistic exchange of information (the speech) between a messenger and a receiver. Rather, as many theoreticians of the communication process do today (e.g., Ref. 87), he illuminated some of the psychological impacts of communication and how audiences process information, the interaction between speaker and audience, the rhetorical skills and credibility of the speaker, the actual content and meaning of the information conveyed, and the role such rhetorical interaction plays in the larger context of society.

Historical and modern communication studies have been conducted in a diverse range of disciplines, ranging from theology to humanistic and rhetorical studies early on, to the more scientific investigations since the beginning of the 20th century in psychology, sociology, anthropology, cognitive science, linguistics, computer science and information theory, to the practice-oriented fields such as journalism, mass communication, and advertising. Together, they have produced a differentiated, critical, if not always coherent understanding of the communication process and its role in society (e.g., Ref. 88).^b

What we know from this rich body of work is that a fuller understanding of the challenges and opportunities for the effective communication of climate change must consider several basic questions:

- What are the goals (scope and purpose) of the communication?

- Who is the audience (individuals, specific sub-populations, particular interest groups or socioeconomic sectors, etc.)?
- How is the issue framed? What language, metaphors, images, etc. are used?
- What messages, what information is conveyed and how can the content be made most useful and accessible? Content also relates to questions about the sources of information on climate change and their credibility [e.g., government, media, scientists—directly or scientific institutions, non-governmental organizations (environmental or other civic groups), or industry]?
- Who are the messengers (e.g., politicians, scientists, advocates, pundits, business people, celebrities, people of different ethnic or socioeconomic background and of different ages).
- Through which channels and through which media and modes does the communication occur?
- How do we know the communication had the intended effect?

Answering these questions only begins to illuminate some of the challenges and opportunities for communication. Much finer understanding of the messenger and the audience is necessary to insure that the information conveyed or the dialogue occurring between them meets the desired goals of the interaction. Below the most important of these questions are discussed in more detail along with what is known about them from climate communications research.

Purpose and Scope of Communication

The purpose of climate change communication is a critical first consideration. There can be a diversity of purposes behind communication efforts, in part determined by the intent of the communicators, in part colored by what is culturally accepted. For example, in the United Kingdom, it is culturally more readily accepted that government plays a role in fostering individual behavior change, as is evident in its “Tomorrow’s Climate—Today’s Challenge” campaign (accessible via <http://www.nationalarchives.gov.uk/>; see also Ref. 92, and its more recent ‘ACT ON CO₂’ campaign (<http://campaigns.direct.gov.uk/actonco2/home.html>). In the United States, by contrast, there is a greater reluctance to engage in what is sometimes derogatorily called ‘social engineering,’ particularly if it is geared toward reducing consumption.^c

For simplicity's sake then, one may distinguish three categories of communication purposes without suggesting that they necessarily follow or build on each other nor that communication can directly or easily lead to these desired goals. The distinction is made instead to suggest that the intended outcome has important implications for the design of, and the demands on, the communication effort, and its effectiveness has to be assessed to determine whether the intended goal has indeed been achieved. The first then is essentially *to inform and educate individuals about climate change*, including the science, causes, potential impacts, and possible solutions. In addition, communication may be aimed at increasing a population's understanding of the level of the scientific consensus about the fundamentals of climate change, or fostering an appreciation of the magnitude of the problem. Educating people about the need for comprehensive risk management involving both mitigation and adaptation may be another goal of an informational/educational campaign. To some extent, basic news reporting also falls into this category as it is not intended to tell people what to do in response to a problem, but to inform readers and viewers of new developments, and thus has a basic, if minimal, educational function.^{94d} Many communication efforts in the past have assumed that simply informing and educating people about climate change (particularly the science of climate change) would suffice to change beliefs and attitudes which in turn would mobilize audiences for action. The persistent disconnect between people's concerns and attitudes about climate change and the extent of their energy- and climate-relevant behaviors—the climate-specific variant of the more general problem of the so-called attitude-behavior gap—defies this assumption in fundamental ways (e.g., Refs 95–97).

The second basic purpose of communication efforts is *to achieve some type and level of social engagement and action*. Such engagement may be behavioral (consumption-related action) and/or political (civic action), such as actively supporting particular politicians, policies, or programs (e.g., Refs 41, 95, 102, 103). The principal difference to campaigns in the first category is that they aim not just to touch and engage the mind, but facilitate active behavioral engagement. This requires that climate change and the actions proposed to affect it are made personal, local, and urgent. Campaigns try to motivate individuals to act on the problem, and empower and enable them to translate their values and motivations into real action. They may illustrate in words and images what can be done; and they typically portray such actions as relatively easy, generating personal

and social benefits (such as cost savings, a better lifestyle, greater social acceptance, peace of mind, etc.). Or, they may depict an 'all hands on deck' situation—as was done, for example, in the war-time mobilization efforts in Allied Nations during World War II^{104,105}—linking engagement with deeply held values such as patriotism, national security, being a good neighbor or team player, self-sufficiency, etc.¹⁰⁶

The third category of communication efforts aims even deeper by trying to foster not just political action or context-specific behavior modification, but *to bring about changes in social norms and cultural values* that act more broadly. Despite a persistent gap between the attitudes individuals hold on the one hand and the actions they take on the other deeply held values are generally decent predictors of behavioral *intentions* across a wide range of socially and environmentally significant behaviors (though behavioral *enactment* of these intentions may still be hampered by various barriers) (e.g., Refs 96, 106–120). In other words, through efforts to influence behavior not just situationally, but fundamentally—via early education, effective interventions later in life, and pervasive modeling of certain behavioral norms—it is possible to set new or change existing social norms, portray less consumption-oriented, energy-intensive lifestyles, promote new values and ideals around family size and reproduction, and lay a foundation for broad acceptance of policy interventions (e.g., Refs 95, 97, 121–124). If accompanied by supportive policy, infrastructure, pricing signals, and technological changes, these efforts can have more far-reaching effects than those in the second category. Supportive, if not essential, here are dialogic forms of interaction, which can be used to involve audiences in shaping the new lifestyles and visions of a more sustainable society rather than simply 'deliver' them from some external, higher authority to the public for implementation.¹²⁵

Depending on the desired outcome, the scope of the communication campaign may be narrow and action-specific, or aim at mass mobilization; it may be very time-limited or involve a long-term commitment. Although there has been a long-term collective effort at changing understanding, attitudes, and levels of engagement around climate change, most campaigns on climate and energy to date have been short-lived. To advance climate communication and research, campaigns should identify clear goals from the outset to help guide all subsequent choices related to building an effective communication effort.

Audience

Purpose and audience choice are closely linked, or should be. Although communication experts and researchers emphasize the importance, if not primacy, of considering the audience in determining all other aspects of the communications process, attention paid to audience needs and differences in communicating climate change has been limited historically. Reasons for this may lie in the nature of climate change—initially communicated as a matter of science by scientists and transmitted through mass communication channels largely incapable of providing ‘retail communication,’ but also in the lack of communications expertise among messengers.

Greater attention to audience needs has come from different audiences themselves and from non-scientist messengers ‘making climate change their own.’ Policy-makers at different levels of government, business managers, religious leaders, environmentalists, or minorities suffering from air pollution have diverse interests and goals vis-à-vis climate change, need different information, frame the issue differently, appeal to different values, and can enact different measures and behaviors.

More recently, climate change communication research has produced a number of audience segmentation studies and case studies of communication to particular audiences, which suggest that different audiences require distinct frames, goals, messages, and messengers (e.g., Refs 126–133). Appealing to different audiences with tailored communication that resonates with, and can bring together, different audiences to work in coalition toward a desired common policy goal has been recognized as an important strategic choice (e.g., Refs 134, 135).

Framing

If a particular communication goal has been set and an audience chosen, the way in which the climate change story is told is an inevitable element of communication, a powerful influence on how the audience is to interpret the information provided, and a strategically important choice (Refs 25, 136–146). Frames construct a problem, provide a perspective from which to interpret it, even help us perceive some aspects of it, while disregarding or overlooking others, and deeply influence how persuasive we find the information being communicated.

Frames are triggered by words, imagery, symbols, and non-verbal cues such as messengers, music, tone of voice, and gestures. Describing climate change as a threat bigger than terrorism, showing side by side images of destruction from the terrorist

attacks on September 11, 2001 and hurricane Katrina, and using former US Central Intelligence Agency Director, James Woolsey, as a spokesperson, frames climate change as a violent issue, a threat to national security (e.g., Refs 147–149). Contrast that with a frame that emphasizes in religious language the human obligation to be stewards of creation and safeguard social justice and protect the poor and vulnerable (e.g., <http://www.creationcare.org/>; Ref. 150). The ‘What Would Jesus Drive?’ campaign is one example of such a ‘creation care’ frame (<http://www.whatwouldjesusdrive.org/>). In short, frames resonate with some audiences, and not with others. As such, they also mobilize some individuals to action, and rally others to resistance or opposition.¹³⁵ It is for this reason that frames are all-important communication choices^{141,146} with critically important implications for persuasiveness, attitude change, trust, and engagement.¹⁵¹

One of the challenges that has affected, and in some instances undermined, climate change communication to date is that there rarely is just one frame to communicate a high-stakes issue. Climate contrarians, for example—particularly in the United States, but also in the United Kingdom and Australia—have used the power of frames to advocate for no action. The skilful use of responsibility, economic conservatism, uncertainty, and related frames has served to create persistent doubt in audiences’ minds about the reality and urgency of the issue, and about key messengers. In most public policy issues more than one frame exists; they compete for the ear of, and are successful with, different audiences. At times, that fact can be usefully exploited to build broader coalitions; at others multiple frames can be confusing and undermine building a broad constituency.

Messages

No matter how climate change communication is framed, the question still remains what specifically to convey. ‘What message should we give to people?’ The first answer to these questions may seem rather unsatisfactory, namely, ‘It depends!’ This is, however, the only truly adequate answer that can be given in abstract. What to tell an audience depends on who the audience is (including values, attitudes, concerns, knowledge of climate change, which language resonates, personal and social aspirations, etc.); who conveys the message (messenger characteristics and reception); the channels through which a message is being conveyed; the place and context in which audiences receive the information; how they are likely

to process the message received; the goals of the communication (i.e., desired outcomes, opportunities audiences have to affect these outcomes, and the barriers they may face in taking these actions). Despite this context-dependency, some general guidelines can be provided (e.g., Refs 17, 127, 152, 153).

First, it is important that messages are internally consistent in all aspects—a message that particularly emphasizes scientific uncertainty or public dispute over the scientific consensus, or does not establish that climate change is a human-caused problem requiring action, but then asks people to take certain actions, is internally inconsistent. This point does not mean scientific uncertainty cannot be acknowledged (for further discussion see Ref. 154); the main message and emphasis of a communication, however, must be in harmony with its intent. A message emerging out of the general frame of ‘creation care’ delivered by a messenger not recognized as a religious person is internally inconsistent. Moreover, messages must resonate with the target audience through the language used, the values to which the message appeals, and the social aspirations of the audience. Inconsistencies and audience-message mismatches produce cognitive dissonances that undermine the credibility and persuasiveness of the message (e.g., Ref. 155).

Second, effective messages create or tap into mental models that help people make sense of the problem and at the same time direct them toward the appropriate behavioral response. Mental models are simplified cognitive constructs of how the world works. Several studies have examined people’s climate change related mental models (e.g., Refs 43, 51, 156–160). To be effective, messages and the mental models that are imbedded in them must help overcome the challenges of communicating climate change discussed above. The distant problem must be brought home; the invisible causes and impacts must be made visible; the inconceivable solutions must be illustrated; perceived and real barriers to action must be shown as something ‘people like me’ have overcome.

Third, messages are more than the words or information conveyed. Messages are accompanied by, and inseparable from, imagery, the tone of voice, and the emotions that are being evoked by pictures, symbols, color schemes, and music. Their emotional impact on the audience must be considered carefully as it can be far stronger than the impact of words alone. Social marketing practice as well as psychological research suggests that this emotional impact is desirable to the extent it leads to the intended behavioral outcome. Messages that increase worry, concern, or even fear, for example, must be accompanied by information that allows audiences

to translate their feelings into remedial action, lest communicators risk that audiences only manage their internal emotional experience (i.e., fears), rather than the external danger evoked by the message (e.g., Refs 64, 161–164).

Fourth, messages must keep the audience’s attention. For some, suspense will work, for others humor or a surprising punch line; compelling imagery, or the allusion to an historical opportunity and challenge, or tapping into people’s curiosity through intriguing facts. The multi-media story of ‘Mr. W.’ uses several of these elements (see http://www.youtube.com/watch?v=2mTLO2F_ERY).

Finally, to increase the chances that messages will produce the intended impact, they must be tested prior to full-fledged outreach campaigns. Attitudes, opinions, and information needs change over time. At different stages in the behavior change process, people require different types of motivations and practical information. Thus, a challenging balance must be struck between audience-specific messaging and widespread consistency (not to be confused with sameness) among messages to different audiences. Moreover, it is important to both sustain communication over time, but not conveying the same message regardless of how the audience evolves in its understanding of climate change.

Messengers

Those who convey a message are traditionally called ‘messengers,’ though in dialogue, it is probably more appropriate to simply speak of ‘communicators’ or participants in the communication. Messengers are integral aspects of the framing; they are also critically important in establishing the credibility of the information conveyed. Messengers give ‘seals of approval’ to information that an audience might otherwise have a hard time assessing as ‘right’ or ‘trustworthy’.^{165–169} People tend to find some individuals or professionals (e.g., scientists, environmental groups) more trustworthy on certain issues than others (e.g., ‘the media,’ industry representatives) (e.g., Refs 28, 131). This fact has been exploited by ‘climate contrarians,’ who have used PhD-carrying messengers (even if they were not active climate scientists) to convey a contradictory message to lay audiences otherwise ill-equipped to judge the accuracy or reasonableness of their arguments.^{11,14,170,171}

Communications research generally recognizes messenger choice as a critically important element of the communications process, but little climate change-specific research is available to date on the difference that particular messengers make. One recent study

of the American public examined the relationship between climate change knowledge, concern, party affiliation, and varying degrees of trust in scientists as messengers, and found that trust in the messenger is a strong mediating influence on how people interpret the knowledge conveyed to them, i.e., whether they were more or less concerned even if they had the same amount of knowledge.¹⁷² The study also confirmed that people accept and trust messages more readily when conveyed by people with similar views (e.g., Republicans trusting Republican/conservative messengers; Democrats believing Democratic/liberal leaders; people of color finding messengers of the same racial background more credible; suburban women with children being more easily convinced by women in similar life situations; business leaders becoming persuaded by other business leaders) (e.g., Refs 128, 173, 174). The growing disparity between Republican/conservative and Democratic/liberal/Independent views on global warming has been interpreted as at least partially influenced by the communication activism of former Democratic Vice President Al Gore.^{175–177}

Trust in messengers, however, is context-dependent. Religious leaders may be trusted as climate change communicators if the issue is framed as a moral one, but not necessarily if the issue is framed as a security, scientific or energy issue.¹⁷⁸ The argument to focus climate communication on key opinion leaders, who in turn influence even broader audiences only underscores the importance of trusted messengers (both as primary communicators and as secondary interpreters of information). The choice and strategic use of messengers for key frames and audiences is thus widely apparent in the politics of climate change communication.¹⁷⁹

Modes and Channels of Communication

Another important aspect in communicating climate change is the mode and channel employed. One can distinguish *written* (e.g., newspaper, letter, and report) from *verbal* (e.g., lecture, storytelling, and conversation) and *non-verbal* (e.g., gestures, body language, sign language, and facial expressions) modes of communication. The communication channel through which communication occurs—face-to-face (e.g., a dialogue or lecture) versus mediated (in print, such as newspapers, magazines, leaflets, or electronically via email or the web) determines whether these modes of communication can occur simultaneously or not. In addition, it is important to take into account whether the communication is between two individuals, within a small-group setting, or via mass communication.

Mode, channel, and setting of the communication determine what can be said, how it can be conveyed, in how much time and space, by what means, and whether or not there is opportunity for dialogue, reflection, and social learning—all of which affect the ultimate impact of a communication. Communications, psychological, political, and marketing research show, for example, that different modes and channels of communication differentially affect the persuasiveness of communication (e.g., Refs 37, 109, 180–184). In general, face-to-face communication tends to be more persuasive and impactful on personal behavior than mass-media(ted) communication.^{52,185} One-way, written or verbal communications tend to enable learning and active engagement less well than dialogic and interactive forms of communication.^{186–188} The latter are also better suited for discussing differences in opinion and values, transcending social divides, and visioning a common future.^{125,189–191}

Communication Outcomes: Assessing Effectiveness

Most concerted communication campaigns on climate change to date have not been guided or carefully assessed by follow-up evaluation studies to discern whether the goals set initially have been achieved, and if not, why not. All too often, the success of a communication campaign is measured by such quantities as printed pamphlets delivered, media hits, or website visits. Alternatively, broad-brush opinion surveys have been used to generally assess and track over time how audiences think and feel about climate change. Individual researchers and polling institutions have followed attitude changes over the years (see the reviews in Refs 26, 27). Such studies have been used, for example, to realize and trace the impact of persistent contrarian climate change communication on public opinion in the United States. A few studies are available that specifically assessed the changes in attitudes before and after specific communicative events, such as viewing Al Gore's film *An Inconvenient Truth*, attending or watching the *Live Earth Concerts* in 2007, or viewing the action thriller *The Day After Tomorrow*.^{192–197}

These studies fall far short, however, of carefully examining what worked and did not work in a deliberate communication campaign. Researchers working with organizations interested in pre-testing frames, narratives, imagery and messages, improving their communication and engagement practices, and documenting the impact of an individual campaign could offer both valuable practical and theoretical insights. To keep communication efforts fresh and

responsive to the changing needs of audiences, close monitoring, testing, evaluating and updating of communication efforts will be required over time.

SELECTED CONTEXTUAL FACTORS INFLUENCING CLIMATE CHANGE COMMUNICATION

Over the course of the time in which climate change has been publicly communicated, tremendous changes have occurred in the mass media. The explosive emergence of the internet as an increasingly common channel for information dissemination, virtual dialogue, and social mobilization is maybe the most visible and important. Inseparable from that is the invention of new communication spaces such as the blogosphere. Possibilities of interaction have expanded rapidly, at the same time that there is some concern over simultaneous social isolation, and narrowed discourses in homophilous groups.^{198–201} As Moser¹⁷⁹ notes,

[Homophily] can lead to restricted information exchange between the members of different, socially-identified group, attraction to similar kinds of issue framings, a certain amount of discounting or even rejection of information that does not reflect the values, attitudes, and opinions held by the members of one's group, and a tendency to communicate with people of similar socioeconomic and attitudinal background.'

The implication, of course, is that it is more challenging to reach into close-knit social groups with distinctly different views, or be heard with information that does not conform to already-held views (all the more important are trusted messengers and opinion leaders). It takes extra effort to reach out to those from whom one is otherwise isolated and to overcome any resistance to considering information or acting in ways that could potentially disconnect oneself from one's social peer group.

The capabilities of communication technologies such as the internet, new media (e.g., blogs, wikis, twitters, computer games, participatory and mobile media), and visualization technologies also have expanded tremendously. Some view these as promising avenues for increasing communication, engagement, and deeper penetration into society, including—potentially, but by no means necessarily—as means to fulfill knowledge needs, enhance learning, and overcome societal divisions and disengagement (e.g., Refs 202–210). The plethora of new media outlets, however—many of which serve only narrow population segments—can also magnify

existing societal divisions and spread misinformation without quality control. Little empirical research on climate change communication using new media is available to date, or on the actual use, usefulness, benefits and drawbacks for understanding, attitude change, social relations, social capital, engagement, behavior change and civic actions. Similarly, visual communication is a relatively new and understudied aspect of climate communication and holds both promise and important ethical implications for bringing the abstract issue of climate change 'home' through impactful imagery (e.g., Refs 211–216).

Changes in the globalized media industry are equally important for the communication of climate change, including continued media consolidation, loss of science or environment 'beat' reporters, and a narrowing of the news agenda.^{217–221} For the United States alone, it has been estimated that, 'roughly 5000 full-time newsroom jobs were cut, or about 10%, in 2008. By the end of 2009, the newsrooms of American daily newspapers may employ somewhere between 20 and 25% fewer people than in 2001'.²²² In almost all other American news outlets except for cable network news, staff cuts, insolvencies, radio stations closures, and 'bloodletting' in news magazines aggravated the situation. These trends intensified by the current macro-economic crisis, affect the content, quality, frequency, and geographic coverage of news reporting that audiences receive, deeply impacting which issues are on people's minds, what and how much they will learn about them, and how ethically they are being reported.^{223,224}

Academic institutions still value and reward scholarly achievement by their scientists more highly than public outreach, work with the media, or other science-popularizing communications (e.g., Refs 225, 226). Maybe this is one of the reasons why most scientists still do not receive media or communications training and why there remains considerable distrust and misunderstanding between scientists and journalists.^{227,228} Specialized programs—such as the media training courses offered by the British Royal Society, the US-based Aldo Leopold Leadership Program, the communication, media, and policy-focused programs of the American Association for the Advancement of Science—are critical pioneers in changing the 'cultural norm' within academia, but cannot compensate for the lack of ongoing training at academic institutions. Funding and institutional (administrative, organizing, logistical) support is also required to enable more scientists to engage in this important public service.

A final set of contextual factors pertains to all those non-climatic issues that compete for

attention, that create barriers to engagement, or—by contrast—that can enable or facilitate people’s ability to act on the information and knowledge they receive. The former are virtually countless, but it is important to recall, and always keep in mind, that the nature of climate change gives climate change very little ‘home court advantage’—it is invisible, remote, abstract, global, complex, uncertain, and people see very little opportunity to affect it directly or meaningfully. Daily, more pressing challenges and—maybe less noticeably, but equally powerfully—deep-seated habits make it challenging to break out of communication and behavioral routines.^{229–231} More challenging yet, even the greatest understanding, the deepest conviction, and the most passionate motivation to act on climate change will need to overcome a wide range of structural hurdles that can undermine people’s desires and attempts to ‘act green.’ Only communication campaigns that are accompanied by policy and structural changes that will allow people to realize their ‘climate-friendly’ intentions, e.g., will allow these behavioral changes to occur (see Further Reading and a fuller discussion in Refs 17, 36, 124, 179, 232–234).

CONCLUSION: FUTURE DIRECTIONS FOR CLIMATE CHANGE COMMUNICATION

Climate change communication—after years of practice without a solid foundation of research—is now of keen interest to those interested in increasing public engagement, and is emerging as a field of research in its own right. To date, numerous surveys (public or for research purposes) and some focus group studies are available that have measured public attitudes, opinions, levels of understanding, and policy support in various countries over time. Moreover, a few studies (sometimes proprietary) have tested particular messages, framings, and audience responses and yielded important insights. A number of studies have examined media coverage of climate change. More recently, such studies have investigated news reporting beyond just the printed press in the United States and Western Europe (e.g., Refs 99, 235–239). Much of the rest of what is known or assumed about climate change communication is inferred from studies in other fields (e.g., risk communication, science communication, mass media communication, advertising and social marketing, and rhetoric). This renders the field of climate change communications increasingly vibrant, but also in need of much more detailed research and testing in application.

Among the emerging issues for future research and practice are the following:

- *Key elements of the communication process.* More longitudinal, case-specific, and cross-national research is required on audience-specific messaging and framing; the impact of framing for active engagement, the importance of different messengers for different audiences; the promise and limits and most appropriate uses of new media for different types of public engagement; contextual influences on communication; and the effectiveness of different communication efforts.
- *Communication technologies and modes.* Relatively little research to date is available on the effective and ethical use of visualization to convey climate change information. The role of the arts—while increasingly involved in making climate change accessible and used in attempts to increase public involvement—has also not been critically evaluated to date.
- *Communicating mitigation and adaptation.* Although general lessons about effective communication may hold across the different response options to climate change, little direct research has been undertaken to date on how the public perceives the issue of adaptation, how to communicate the need for adaptation, and what—if any—relevant differences there may exist to communicating mitigation.
- *Long-term and deeper engagement.* Since climate change is irreversible on human timescales and will not be ‘solved’ quickly or easily, important questions arise for communicating an issue that ‘does not go away,’ requires long-term engagement, and may produce frustration as mitigation will not yield quick positive feedback from an ‘improving’ environment. Already, there is considerable media attention on ‘green fatigue,’ and reporters decry the lack of ‘newsworthiness’ of this persistent, pervasive issue. Yet little is known about how to communicate an issue, and how to keep societal actors engaged, over very long periods of time. Such research could also solidify our understanding of the role of visions and visioning in long-term engagement processes.
- *Mass mobilization.* In light of the seriousness and urgency of climate change, writers have suggested mass mobilization may be required. What such an effort would look like, however, has not yet been examined. In-depth examination of how to communicate urgency without overwhelming and paralyzing audiences would be an important aspect of such research.

- *Dialogic forms of communication.* One-way information delivery and two-way, interactive, dialogic forms of communication have very different potentials, impacts, benefits, and limits. Some view them as counterintuitive to the notion of (and potential need for) mass mobilization, whereas others consider them counterweights to an increasingly technocratic policy- and decision-making process around this global issue. Future research must explore empirically the role of dialogue for engagement, decision-making, democracy, and society's response to climate change.

NOTES

^aExperts are bound just as much by the social norms, structures, identities, professional incentives, etc. that lay individuals experience, and thus often are no better at climate-relevant behaviors (this author—though trying—being no exception).

^bGiven the increasingly critical role that science and technology play in modern societies, and that a fundamental understanding of important issues is

considered critical to enable lay audiences to effectively participate in democratic society,^{89–91} it is astonishing that basic communication training is not part of the required canon of scientific and professional training.

^cSocial engineering—in political and the social sciences—involves a broad spectrum of formal and informal activities oriented toward social control, i.e., changing the attitudes, values, and behaviors of individuals. Some forms of policy and market-based approaches are commonplace, accepted, and, in fact, expected of government, whereas overly manipulative and invasive interventions are typically rejected. The line is not easily drawn and appears to depend on context and perceived intent (e.g., protection of safety or promotion of healthy behavior is more acceptable than perceived betrayal and political deceit).⁹³

^dCritical communications research asks, for example, what is and what is not reported in the media, the reasons behind this selectivity, and the impacts it has on an audience's ability to make critical sense of the world. More such research, especially cross-nationally and specifically in the context of climate change, is required (e.g., Refs 21, 98–101).

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FURTHER READING

1. Environmental Communication Network: <http://www.esf.edu/ecn>
2. The Communication Initiative: <http://www.comminit.com/index.html>
3. The Frameworks Institute: <http://www.frameworksinstitute.org/>
4. Ankelohe conversation on climate change communication: http://www.opendemocracy.net/globalization-climate_change_debate/ankelohe_3550.jsp
5. Yale Project on Climate Change: <http://research.yale.edu/environment/climate/>
6. GMU's Center for Climate Change Communication: <http://www.climatechangecommunication.org/>
7. Fostering Sustainable Behavior (listserve archive): <http://www.cbsm.com/forums/search.lasso>
8. Tools of Change: <http://www.toolsofchange.com./English/firstsplit.asp>