The Dragons of Inaction: Psychological Barriers That Limit Climate Change Mitigation and Adaptation

Article *in* American Psychologist · May 2011

DOI: 10.1037/a0023566 · Source: PubMed

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The Dragons of Inaction

Psychological Barriers That Limit Climate Change Mitigation and Adaptation

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Most people think climate change and sustainability are important problems, but too few global citizens engaged in high-greenhouse-gas-emitting behavior are engaged in enough mitigating behavior to stem the increasing flow of greenhouse gases and other environmental problems. Why is that? Structural barriers such as a climate-averse infrastructure are part of the answer, but psychological barriers also impede behavioral choices that would facilitate mitigation, adaptation, and environmental sustainability. Although many individuals are engaged in some ameliorative action, most could do more, but they are hindered by seven categories of psychological barriers, or "dragons of inaction": limited cognition about the problem, ideological worldviews that tend to preclude pro-environmental attitudes and behavior, comparisons with key other people, sunk costs and behavioral momentum, discredence toward experts and authorities, perceived risks of change, and positive but inadequate behavior change. Structural barriers must be removed wherever possible, but this is unlikely to be sufficient. Psychologists must work with other scientists, technical experts, and policymakers to help citizens overcome these psychological barriers.

Keywords: climate change, barriers, obstacles, global warming, sustainability

> It was our fault, and our very great fault—
> and now we must turn it to use.
> We have forty million reasons for failure,
> but not a single excuse.
> So the more we work and the less we talk
> the better results we shall get . . .
>
> —Rudyard Kipling, "The Lesson," 1901

If so many people are concerned about climate change, the environment, and sustainability, why are more of us not doing what is necessary to ameliorate the problems? Of course, many individuals and organizations have already taken some steps in this direction, and some have taken many steps. However, in the aggregate, humans continue to produce massive quantities of greenhouse gases that will further drive climate change, and we continue to engage in other environmentally destructive behavior patterns.

In some cases, the reasons for this behavioral deficit are structural and therefore beyond an individual's reasonable control. For example, low income severely limits one's ability to purchase solar panels, living in a rural area usually means public transport does not exist as an alternative to driving, and living in a region with cold winters restricts one's ability to reduce home-heating-based energy use. However, for almost everyone who is *not* severely restricted by structural barriers, adopting more pro-environmental choices and behaviors is possible, but this adoption is not occurring to the extent necessary to stem the increasing flow of greenhouse gases and other environmental damage. Thus, the question remains: What limits more widespread mitigation, adaptation, and sustainability actions on the part of individuals for whom such actions are feasible?

This article considers seven general psychological barriers as influences that limit environmental behavior change.[1] These barriers are my suggested elucidation of the hoary mystery surrounding the fabled gap between attitude ("I agree this is the best course of action") and behavior ("but I am not doing it") with regard to environmental problems. Some of the barriers are recognized in one psychological research domain or another, but others have not yet become part of our lexicon. Some have been researched (in other domains) much more than others. These barriers have not been considered as a group, although a few social scientists have discussed some of them (e.g., Gifford, 2008; Kollmuss & Agyeman, 2002; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007).

Psychological Barriers to Behavior Change

Once one begins looking, quite a large number of psychological obstacles to adequate (carbon-neutral) climate change mitigation and adaptation may be found. This article arranges 29 of the "dragons of inaction" into seven

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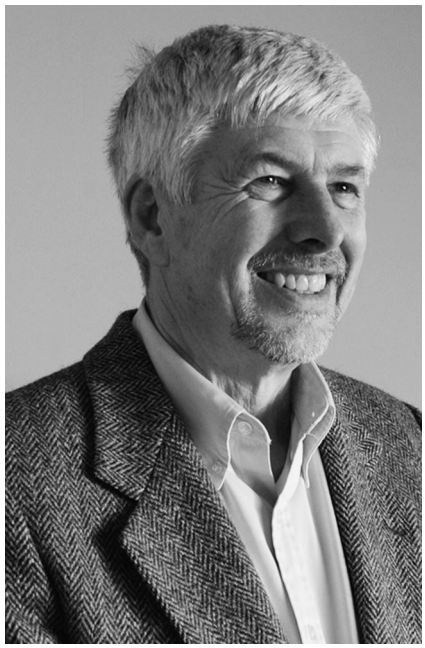
[1] These barriers may well limit change in other troublesome behavior domains, but a discussion of those domains remains for another time.

 0003-066X/11/$12.00
Vol. 66, No. 4, 290–302 DOI: 10.1037/a0023566



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categories. The dragon[2] family of seven genera with their 29 species is displayed in Table 1.

Environmental or climate-related inaction seems to have three broad phases. Genuine ignorance certainly precludes taking action. Then, if one is aware of a problem, a variety of psychological processes can interfere with effective action. Finally, once some action is taken, it can be inadequate because the behavior fades away, makes too little a difference in the person's own carbon footprint, or is actually counterproductive. The seven categories of barriers are offered as a preliminary taxonomy—a way to begin their organization and group structure.

What, then, are these dragons of inaction that thwart the widely accepted but elusive goals of anthropogenic carbon neutrality and environmental sustainability?

Limited Cognition

Humans are famously less rational than once believed (H. Simon, 1957; Tversky & Kahneman, 1974). This is as true for thinking about climate change as it is in other domains. Some ways in which individual thinking is not fully rational and thus acts as a barrier to mitigation and adaptation follow.

Ancient brain. The human brain has not evolved much in thousands of years. At the time it reached its current physical development, before the development of agriculture, our ancestors were mainly concerned with their immediate band, immediate dangers, exploitable resources, and the present time (e.g., Ornstein & Ehrlich, 1989). None of those are naturally consistent with being concerned, in the 21st century, about global climate change, which is slow, usually distant, and unrelated to the present welfare of ourselves and our significant others. Obviously, our ancient brain is *capable* of dealing with global climate change, but doing so does not come easily.

Ignorance. For some, ignorance can be a barrier to action in two general ways: not knowing that a problem exists and not knowing what to do once one becomes aware of the problem. Most polls (e.g., Pew Research Center, 2006) find that a proportion of respondents answer "don't know" to questions about climate change. Even today, some people around the world remain entirely unaware of climate change as a problem. Obviously, this segment of the global population is not likely to take deliberate action aimed at ameliorating climate change.[3]

The second dimension of ignorance, found among the much larger proportion of the global population that is aware of the problem, is characterized by a lack of knowledge about the cause and extent of climate change (e.g., Bord, O'Connor, & Fisher, 2000). This lack leads to ignorance about (a) which specific actions to take, (b) how to undertake actions of which one is aware, and (c) the relative beneficial impacts of different actions. Given that most people are not technical experts, they generally do not have or know the relative magnitude of beneficial impacts of various actions.

Such knowledge is developing, and in broad terms we know what should be done (e.g., Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Gardner & Stern, 2008). However, much remains to be learned, even by technical experts, partly because the answers are not always universal (e.g., a best practice in New York may not be a best practice in Vancouver) or obvious (e.g., New Zealand–raised lamb eaten in the United Kingdom has a smaller carbon footprint than United Kingdom–raised lamb eaten in the United Kingdom) and partly because life-cycle analyses of products are complex, in part because of the large number of ingredients or component parts in many commercial products (cf. Goleman, 2009). Widespread (but understandable) ignorance about the differential effectiveness of behavioral options naturally dampens the adoption of climate-related action.

Another source of uncertainty stems from mixed messages in the media. Of course, many such messages are understandably simplified translations of scientific reports, made in good faith by reporters. Others apparently are well-funded attempts to undercut science by groups with an

[2] In mythology, dragons take on a wide array of forms, and Asian dragons are even benevolent, as I learned from a polite elderly woman in a Sapporo audience. However, as a Westerner, I use dragons as a metaphor for these obstacles because no matter what their form or shape, Western dragons always seem to be blocking humans from some goal or aspiration. Perhaps another, less obvious but complementary, reason for this choice lies within the word itself: The barriers are a "drag on" progress.

[3] Some behaviors help to mitigate climate change even when that is not the person's goal. For example, one might ride a bicycle to work for health reasons or to save money, or one might eschew flying so as to spend more time with one's family (cf. Whitmarsh, 2009). In contrast to the dragons, I have called these "honeybees" because, like those invaluable insects, in the course of fulfilling their own goal (to gather honey), they unwittingly fulfill another valuable goal (pollination).

Table 1
Psychological Barriers to Climate Change Mitigation and Adaptation

General psychological barrier	Specific manifestation
Limited cognition	Ancient brain
	Ignorance
	Environmental numbness
	Uncertainty
	Judgmental discounting
	Optimism bias
	Perceived behavioral control/ self-efficacy
Ideologies	Worldviews
	Suprahuman powers
	Technosalvation
	System justification
Comparisons with others	Social comparison
	Social norms and networks
	Perceived inequity
Sunk costs	Financial investments
	Behavioral momentum
	Conflicting values, goals, and aspirations
Discredence	Mistrust
	Perceived program inadequacy
	Denial
	Reactance
Perceived risks	Functional
	Physical
	Financial
	Social
	Psychological
	Temporal
Limited behavior	Tokenism
	Rebound effect

interest in the production and use of greenhouse gases (e.g., Hoggan, 2009).

Environmental numbness. Every environment is composed of more cues and elements than individuals can wholly monitor, so we attend to environments selectively. Therefore, people are often unaware of much of their physical surroundings, particularly aspects causing no immediate difficulty, but sometimes even aspects of it that *are* causing them at least mild difficulties (Gifford, 1976). Climate change is like that for many citizens: a phenomenon outside immediate attention because it is not causing any immediate personal difficulties. Mitigative and adaptive behaviors are unlikely when this is the case.

A second form of environmental numbness occurs at the other end of the stimulus spectrum. When viewers have seen the same advertisement many times, attention to it shrinks as habituation increases (Belch, 1982; Burke & Edell, 1986). Similarly, hearing about climate change or the environment *too* often, particularly if the message is not varied, can lead to a numbness to the message and consequent attenuation of helpful behaviors that would ameliorate the problems.

Uncertainty. Experimental research on resource dilemmas demonstrates that perceived or real uncertainty reduces the frequency of pro-environmental behavior (e.g., de Kwaadsteniet, 2007; Hine & Gifford, 1996). Individuals tend to interpret any sign of uncertainty, for example in the size of a resource pool or the rate at which the resource regenerates, as sufficient reason to harvest at a rate that favors self-interest rather than that of the environment. Uncertainty about climate change also quite likely functions as a justification for inaction or postponed action related to climate change. In the climate change context, presentations of the very carefully chosen level-of-confidence phrases (such as "likely" or "very likely," p. 3) from the 2007 assessment report of the United Nations Intergovernmental Panel on Climate Change (IPCC) led many individuals to interpret the phrases as having a lower likelihood than the IPCC experts intended (Budescu, Broomell, & Por, 2009).

Thus, well-intended efforts by climate change scientists to fairly characterize the degree of certainty about climate change seem to lead to a general underestimation of climate change risk on the part of the lay audience. Yet the scientific and ethical reality is that a certain degree of uncertainty is an inescapable element of any climate model—or *any* model, for that matter. Thus, climate scientists are left with a very perplexing problem: how to present the likelihood of climate change outcomes honestly without promoting misguided optimism on the part of the lay audience, which of course helps to justify inaction on the part of the public.

Judgmental discounting. Discounting in this sense refers to the undervaluing of distant or future risks. A recent study of over 3,000 respondents in 18 countries found that individuals in 15 of the countries believed that environmental conditions are worse in places other than their own (Gifford, Scannell, et al., 2009). This study and others (e.g., Uzzell, 2000) demonstrate that spatial discounting of environmental problems occurs. Although conditions often may be objectively worse in other areas of the globe, this tendency occurs even in objectively similar places, such as among inhabitants of English villages a few kilometers apart (Musson, 1974). People also tend to discount future environmental risks, although not as uniformly as risks in some other domains (e.g., Hendrickx & Nicolaij, 2004) and less than other risks (Gattig & Hendrickx, 2007). The incorrect assessment of risk may be even worse for general environmental risk, which may actually be *augmented* rather than discounted; it is expected to become worse in 25 years than at present in virtually every country, at local, national, and global levels (Gifford, Scannell, et al., 2009). However, if conditions are presumed to be worse elsewhere and later, individuals may be expected to have less motivation to act against climate change locally and in the present.

Sociologists concerned with youthful antisocial behavior proposed another form of discounting over half a

century ago, neutralization theory (Sykes & Matza, 1957), an idea foreshadowed by Rudyard Kipling in the lines that open this article. Essentially, neutralization theory describes rationalizations for a variety of deviant behaviors, the goal of which is to absolve oneself of responsibility. Recent researchers listed 13 of these rationalizations (McGregor, 2008). To the extent that these apply to environmental and climate change actions, several of these neutralization techniques could be viewed as another form of discounting.

Optimism bias. Optimism generally is a healthy, desirable outlook that can produce useful personal outcomes and technological wonders (e.g., J. L. Simon, 1981). However, optimism can be overdone, to the detriment of one's well-being. Considerable evidence suggests that people discount personal risks, such as their likelihood of a heart attack (e.g., Weinstein, 1980), but also their environmental risks, for example from radon exposure (Weinstein, Klotz, & Sandman, 1988), other environmental hazards (Hatfield & Job, 2001) or, in fact, 22 hazards (Pahl, Harris, Todd, & Rutter, 2005). Thus, one can reasonably predict that optimistic bias applies to risks from climate change, although global citizens do expect environmental conditions in general to worsen over the next 25 years . . . but not as badly where they themselves live as in other places (Gifford, Scannell, et al., 2009).

Perceived behavioral control and self-efficacy. Because climate change is a global problem, many individuals believe they can do nothing about it as individuals. This is the well-known collective action problem (Olson, 1965). Stated in psychological language, people sometimes do not act because they perceive that they have little behavioral control over the outcome (e.g., Ajzen, 1991; Huebner & Lipsey, 1981) or that they their actions will not have much impact (a lack of self-efficacy; Ajzen, 2002). Perceived behavioral control can be a very strong predictor ($r = .50–.60$) of whether a person chooses to take public transportation instead of a private car (e.g., Heath & Gifford, 2002; Kaiser & Gutscher, 2003). Closely related to the lack of individual perceived behavioral control and self-efficacy is fatalism, the sense that nothing can be done, not only by the individual but by collective human action (cf. Lorenzoni et al., 2007; O'Connor, Bord, & Fisher, 1998).

Ideologies

Some belief systems are so broad that they influence many aspects of a person's life. Among these, at least for some individuals, are religious and political views. Ideologies and worldviews (e.g., Dietz, Dan, & Shwom, 2007; Dunlap, Van Liere, Mertig, & Jones, 2000; O'Connor, Bord, & Fisher, 1999) that embody beliefs which clash with climate change mitigation and other forms of pro-environmental action are very strong barriers to behavior change.

Worldviews. One significant predictor of disbelief in global warming is belief in free-enterprise capitalism (e.g., Heath & Gifford, 2006). Capitalism clearly has produced an affluent lifestyle for millions of people, but some aspects of it, such as a belief in the freedom of the commons (Hardin, 1968), have led to the devastation of fisheries, forests, and landscapes around the world. Having an important stake in some organizations is not compatible with adopting mitigating behaviors (e.g., Dunlap & McCright, 2008).

Suprahuman powers. Some people take little or no climate-related action because they believe a religious deity or Mother Nature (as a secular deity) either will not forsake them or will do what it wishes anyway. For example, researchers who interviewed two groups of Pacific Islanders who live on very low-lying atolls threatened by rising sea levels found that one group is already purchasing higher ground in Australia; the other group, trusting that God will not break the Biblical promise never to flood the Earth again after the flood that Noah and his entourage endured, believes that sea level rises will not affect them because there will be "fire next time" (Mortreux & Barnett, 2009). More secular individuals sometimes express the belief that Mother Nature will take a course mere mortals cannot influence. Naturally, inaction on the climate front follows from these beliefs.

Technosalvation. Mechanical innovation has a long and admirable history of improving the standard of living. Those who see its promise as a partner in mitigating climate change (e.g., Gifford, 2008; Terwel, Harinck, Ellemers, & Daamen, 2009) or even as something close to the essential solution (e.g., J. L. Simon, 1981) share their belief in its promise with some who go further and believe that technology alone (or nearly alone) can solve the problems associated with climate change (e.g., citizens quoted in Lorenzoni et al., 2007).

Some experts strongly support geoengineering as a tool in the struggle against further global warming. One organization that strongly endorses it is the United Kingdom's Institution of Mechanical Engineers (2009), whose current top two geoengineering solutions are to create artificial trees and to coat buildings with algae. However, even the Institution of Mechanical Engineers advocates geoengineering in concert with mainstream mitigation policies. However, for some citizens, overconfident beliefs in the efficacy of technology appear to serve as a barrier to their own climate-mitigating behavior.

System justification. Another belief system has been described as *system justification,* the tendency to defend and justify the societal status quo (Feygina, Jost, & Goldsmith, 2010). When citizens are fortunate enough to have a comfortable lifestyle, the tendency to not "rock the boat" or, perhaps more important, to not have *others* change the way things currently operate, grows. Once again, climate change will require adjustments; system justifiers naturally will not enthusiastically adopt mitigative actions. It is interesting, however, that Feygina et al. (2010) showed that if mitigation can be successfully portrayed as *part* of the system, this lack of action on the part of system justifiers can change.

Comparisons With Other People

Humans are very social animals; comparing one's situation with that of others is a deeply ingrained tendency. This comparison can take several forms.

Social comparison. People routinely compare their actions with those of others (Festinger, 1954) and derive subjective and descriptive norms from their observations about what is the "proper" course of action (e.g., Heath & Gifford, 2002). This tendency is recognized in the theory of planned behavior (Ajzen, 1991) and the value-belief-norm model (Stern, 2000), among other theories, and has been applied to many pro-environmental behaviors and interventions (e.g., Biel & Thogersen, 2007; Cialdini, 2003).

Social norms and networks. Norms are often cited as a potential force for progress in environmental issues, and they can be (Thøgersen, 2008), but they can also be forces for regress. The double-edged power of norms was made clear in a study of residential power use. When homeowners were told the amount of energy that average members of their community used, they tended to alter their use of energy to fit the norm (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007), that is, decreasing or increasing their energy use accordingly. Fortunately, the researchers learned that the increases could be prevented by giving low energy users positive feedback about using less energy.

Norms can also develop through social networks in neighborhoods or workplaces. Again, these can be negative in the sense that anticlimate behavior patterns can dominate, but proclimate patterns can too. Rogers (1983) documented a case in which mapping of who spoke with whom and mapping of dwelling proximity combined to explain why 7 of 44 residents (16%) installed photovoltaic panels on their homes (far more than the national average of 1%). Social networks can be powerful mitigative influences.

Perceived inequity. Perceived (in)equity is often heard as a reason for inaction: "Why should I change if they won't change?" Usually, well-known figures, other economic sectors, or other nations are cited as not cooperating, which serves as a justification for nonaction. The fear of being victimized by free-riders (Kerr, 1983; Olson, 1965) serves as a barrier for some individuals, who ask why they should contribute responsible behavior to the climate change cause when (they fear) others will not. In experimental resource dilemmas, when any sort of inequality or inequity (real or perceived) exists, cooperation tends to decline (e.g., Aquino, Steisel, & Kay, 1992).

Sunk Costs

If people changed their behaviors and allegiances very often, their lives would be more disordered than they wished, and less time and effort would be available to pursue goals deemed valuable. Thus, investments of money, time, and behavior patterns are useful—unless they are harmful to the environment or the climate (e.g., Cunha & Caldieraro, 2009; Leahy, 2009).

Financial investments. Once one has invested in something, dispensing with it is more difficult than it would have been had one not invested in it (e.g., Arkes & Hutzel, 2000; Knox & Inkster, 1968). The cardinal example in this context might be car ownership. If one has purchased a car and is now paying for its insurance and monitoring its depreciation, why should this cozy portable living room, with its many perceived benefits (cf. Reser, 1980), be left in the driveway? People generally are loss-averse and do not wish to see that expense "thrown away" in order to begin bicycling or taking public transit. Economists point out that the rational choice is to dispense with the sunk cost and move forward, but most people choose instead to hold on to the sunk cost investment, at least until its disadvantages become too painful.

If a person has a direct financial stake in the fossil fuel industry, cognitive dissonance (Festinger, 1954) can result from hearing that burning these fuels damages the environment. Cognitive dissonance often is easier to reduce by changing one's mind ("burning these fuels is not causing a problem") than by changing one's behavior (by disposing of one's fossil fuel investments or leaving one's job in that industry). Or, as B. F. Skinner (1987) remarked, "It is often easier to escape in other ways—by ignoring or forgetting the advice or by finding a way to escape that does not require solving the problem" (p. 5).

Behavioral momentum. William James (1890) called habit the "enormous fly-wheel of society" (p. 121), although he viewed this stability of action in positive terms as a mechanism by which society remains ordered rather than chaotic. In the context of climate change (and some other behavioral contexts), habit is less benign (Ouellette & Wood, 1998).

Habit may not be a glamorous barrier, but it may be one of the most important for the mitigation of climate change impacts (e.g., Hobson, 2003) because many habitual behaviors are extremely resistant to permanent change (e.g., eating habits), and others are only changed slowly, over decades (e.g., the rates of smoking and the use of safety belts) (Maio et al., 2007). Ensconced habits do not change without a substantial push; priming and even attitude change often do not lead to behavioral change. Perhaps because it aptly expresses the sense of variation in the resistance to change, behaviorists have used the term *behavioral momentum* (Nevin, Mandell, & Atak, 1983).

Some behaviors that form key parts of the human contribution to climate change (e.g., the use of cars) have a great deal of behavioral momentum and therefore are very difficult to change (e.g., Bamberg, Ajzen, & Schmidt, 2003; Carrus, Passafaro, & Bonnes, 2008; Eriksson, Garvill, & Nordlund, 2008), although changing driving behavior is not impossible (e.g., Matthies, Klöckner, & Preißner, 2006). For example, temporarily forcing car drivers to use alternative travel modes has induced long-term reductions in car use (e.g., Fujii & Gärling, 2003).

Conflicting values, goals, and aspirations. Everyone has multiple goals and values, and these are not all compatible either with each other or with climate change mitigation (e.g., Lindenberg & Steg, 2007; Nord-

lund & Garvill, 2002; Schwartz, 1992; Stern, 2000; Vining & Ebreo, 1991). Pro-environmental values positively influence at least the willingness to accept climate change polices (McCright, 2009; Nilsson, von Borgstede, & Biel, 2004; O'Connor, Bord, Yarnal, & Wiefek, 2002), but they are not always compatible with other values, other goals, and other aspirations that inevitably lead to the production of more greenhouse gases.

The aspiration to "get ahead" often means engaging in actions that run counter to the goal of reducing one's climate change impacts: buying a larger house, flying by choice, or driving a bigger car. That environmental values and goals frequently are subsidiary to other values and goals is revealed when people are asked to rank the importance of climate change amelioration against that of other problems or concerns: They assign climate change low importance (e.g., Leiserowitz, Kates, & Parris, 2005). Adopting a phrase first used by Smillie and Helmich (1999) to describe public support for foreign aid, Vasi (2009) characterized public support for sustainable development and the actions necessary to curtail climate change as "a mile wide, but an inch deep." This characterization is consistent with the results of a Pew Research Center Project poll which reported that as many as 75%–80% of U.S. respondents said climate change was an important issue although they placed it 20th out of 20 issues surveyed ("Warming to the Topic," 2009). In sum, many citizens "don't seem to mind addressing the economic cost of climate change, as long as it doesn't come out of their own pockets" ("Warming to the Topic," 2009, p. 4).

(Lack of) place attachment. Individuals may be more likely to care for a place to which they feel attachment than for one to which they are not attached. If so, weaker place attachment should act as an obstacle to climate-positive behavior, and populations with a history of geographic mobility would be expected to care less for their present environments. The evidence for this prediction is mixed: Place attachment is sometimes (Vorkinn & Riese, 2001) but not always (Clayton, 2003; Gifford, Scannell, et al., 2009; Uzzell, Pol, & Badenas, 2002) associated with pro-environmental behavior. The role of place attachment is likely to be complex but probably acts as an impediment to action in some populations, as is perhaps indicated by local opposition to wind farms in some areas even when there is strong support for other pro-environmental policies. For example, nature-based place attachment but not civic-based place attachment seems to be related to pro-environmental behavior (Scannell & Gifford, 2010; Vaske & Kobrin, 2001.

Discredence

When individuals hold the views of others in a negative light, they are unlikely to take direction from those others. These negative views can take various forms ranging from a general lack of trust in the other, to believing that what the other offers is inadequate, to outright denial of the veracity of the other's beliefs, to reactance against following the other's advice.

Mistrust. Trust is essential for healthy relationships. When it is absent, as it sometimes is between citizens and their scientists or government officials, resistance in one form or another follows. Trust is easily damaged, and when e-mails are stolen and selectively quoted, or a single overeager scientist exaggerates future climate change outcomes even in one region, widespread distrust can be created. Trust is important for changing behavior, and although its role as an influence on pro-environmental behavior is complex (Gifford, 2007a), in general, behavior change requires one to trust others not to take advantage; to trust that the change is effective, valuable, and equitable (e.g., Brann & Foddy, 1987; Foddy & Dawes, 2008); and to trust that the other has public-service motives and is honest (Terwel et al., 2009). In sum, when trust sours, the probability of adopting positive climate change behavior diminishes.

Perceived program inadequacy. Policymakers have considered and implemented many programs designed to encourage sustainable or climate-friendly behavior choices. However, most climate-related programs to date are voluntary for individuals; few are mandatory or are backed with enforced sanctions for noncompliance. Thus, citizens choose whether to accept the offer, and often they decide the program is not good enough for their participation (cf. Pelletier, Dion, Tuson, & Green-Demers, 1999). Cognitive dissonance can occur here as elsewhere; it can be easier to change one's mind about the adequacy of a program than to change one's behavior by engaging in the program.

Denial. Uncertainty, mistrust, and sunk costs can easily lead to active denial of the problem (e.g., Norgaard, 2006). This may include denial that climate change is occurring, that it has any anthropogenic cause, or that one's own actions play a role in climate change. Polls vary, but substantial minorities of people in most countries believe that climate change is not occurring or that human activity has little or nothing to do with it (McCright & Dunlap, 2010).

Those holding this view tend to be outspoken in proportion to those who accept that a problem exists. For example, a news story in *USA Today* about several environmental presentations at the American Psychological Association (APA) 2008 convention in Boston (Jayson, 2009) drew 115 reader responses. An informal content analysis of the comments that Sonya Frey and I conducted showed that about 100 of the responses essentially denied that the problem exists; two typical explanations were that climate change is a problem invented by "scientists who are pursuing a phantom issue" and that scientists are ignoring research "proving" the problem is overestimated or does not exist. One reader's comments are typical of the emotional intensity experienced by some deniers:

> It figures that a bunch of psychologists need to mess with people's heads to get them to fall in line with this "eco-friendly" nonsense. . . . "News stories that provided a balanced view of climate change reduced people's beliefs that humans are at fault." Yep, there ain't nothing more that enviro-crazies hate than balanced news reporting.

A sample of 115 comments is not representative of the population, but it does reflect the views of a voluble segment of society. Upon hearing about APA's climate change task force report (American Psychological Association Task Force on the Interface Between Psychology and Global Climate Change, 2009), the host of a popular show on a leading U.S. television network held up a copy of Aldous Huxley's *Brave New World* and said, "The shrinks are trying to brainwash us again."

Such statements suggest that emotion, including fear, plays an important role in denial. More research about the emotional elements underlying the denial of climate change and its human connections is needed; it would help in the design of more effective ways to communicate about climate change (Comeau & Gifford, 2011; Marx et al., 2007; Moser, 2007).

Terror management theory (e.g., Goldenberg, Pyszczynski, Greenberg, & Solomon, 2000) suggests that people may deny the problem because it is a reminder of their mortality (Vess & Arndt, 2008).

Reactance. Ample evidence suggests that many people distrust messages that come from scientists or government officials (e.g., Earle, 2004; MacGregor, Slovic, Mason, & Detweiler, 1994). Some strongly react against advice or policy that seems to threaten their freedom (Brehm, 1966), partly because it is based on a lack of trust in those who give the advice or set the policy (Eilam & Suleiman, 2004). Among others, those with an interest in the fossil fuel industry have been seeking, with increasing success (Newport, 2010), to promote mistrust of the scientific consensus on climate change and create opposition to mitigation (cf. Hoggan, 2009; McCright, 2007; Oreskes & Conway, 2010).

Perceived Risk

What might happen to individuals who consider changing a behavior as a step toward reducing their greenhouse gas emissions or improving their environment-related actions? Changing behavior (of any sort) potentially holds at least six kinds of risk (Schiffman, Kanuk, & Das, 2006).

Functional risk. Will it work? If one purchases, for example, a plug-in electric vehicle (PHEV) it may, as a new technology, have battery problems. The same could be said for many new green technologies that now exist or have been proposed as mitigative or adaptive solutions.

Physical risk. Some adaptations may have, or at least be perceived as having, some danger associated with them. Is this PHEV (for example) as crash-safe as the sport utility vehicle that was traded in to buy the PHEV? To take another example, bicycles burn virtually no greenhouse gases after they are manufactured, but they result in quite a few visits to emergency rooms.

Financial risk. Many green solutions require capital outlays. How long is the payback? If the product becomes a fixed part of a residence (e.g., solar panels), will the owner recoup the installation costs or accrue enough energy savings before moving on? That PHEV's purchase price probably includes a premium over equivalent gas-powered vehicles; will the money spent buying and operating it be lost?

Social risk. Others notice many of our choices; they become part of our public face. This leaves one open to judgment by one's friends and colleagues, which could lead to damage to one's ego or reputation: If I buy a PHEV, will these significant others laugh or scoff at me, deride me behind my back? They may invoke any of the first three risks as my failure to reckon carefully.

Psychological risk. This risk, which closely follows the fourth, perhaps is less likely for most people but can occur. If one is teased, criticized, or even rebuked by one's significant others for buying the PHEV, one risks suffering damage to one's self-esteem and self-confidence.

Temporal risk. A more common, perhaps almost universal, risk is the potential that the time spent planning and adopting the new course of action might fail to produce the desired results. Most people, one supposes, would spend a nontrivial amount of time deciding whether to buy a PHEV, deciding whether to become a vegetarian, planning how to bicycle to the day's activities, or making any other significant mitigative choice. If the choice does not result in the desired benefits, the time spent researching and purchasing items involved in the climate-change-related behavior choice will have been wasted.

Limited Behavior

Many people are engaged in at least minimal action that helps to limit the emission of greenhouse gases. Some people are much more active than others. However, most people could do more than they are doing, and in some pilot studies, almost everyone agrees that they could do more. Two major forms of this tendency are tokenism and the rebound effect.

Tokenism. Once individuals move past environmental numbness, denial, judgmental discounting, habit, and perceived risk and believe that they have some behavioral control and a sense that their own community, to which they feel some (natural) attachment, might be threatened, they may finally begin to engage in proclimate behavioral change. Which changes are most likely? Some climate-related behaviors are easier to adopt than others but have little or no impact on greenhouse gas emissions. However, their ease of adoption means these actions tend to be chosen over higher cost but more effective actions. This tendency has also been called the low-cost hypothesis (e.g., Diekmann & Preisendörfer, 1992; see also Kempton, Harris, Keith, & Weihl, 1985). Pro-environmental intent may not correspond with pro-environmental impact (Stern, 2000).

The rebound effect. A further problem with initially proclimate choices is the rebound effect. After some mitigating effort is made, the gains made are diminished or erased by subsequent actions. For example, persons who buy fuel-efficient vehicles may drive farther than they did when they owned less efficient vehicles. The phenomenon has also been called the Jevons paradox (Jevons, 1865) and the Khazzoom–Brookes postulate

(Brookes, 1990; Khazzoom, 1980). The rebound effect was demonstrated in a recent resource dilemma study in which participants who had been warned about the decline of the resource restricted their harvests for a few seasons but then returned to prewarning levels soon after (Joireman, Posey, Truelove, & Parks, 2009).

Toward a Taxonomy of the Psychological Barriers to Behavior Change

Existing Models

The foregoing set of barriers cries out for organization. No such taxonomy or research model has been developed specifically for climate-related constructs, although some very tentative starts have been made (Gifford, 2008; Kollmuss & Agyeman, 2002; Lorenzoni et al., 2007). In terms of formal models, the closest ones were developed for other purposes, although they can be used for climate change research. The most widely known of these models are the theory of planned behavior (TPB; Ajzen, 1991) and the value-belief-norm (VBN) model (Stern, 2000). The basic TPB model includes subjective norms and perceived behavioral control and has been widely used in health and safety research as well as in environmental research (e.g., Bamberg & Schmidt, 2003), but researchers have shown that its predictive ability can be improved by extending it in various ways (e.g., Conner & Armitage, 1998; de Groot & Steg, 2007; Haustein & Hunecke, 2007; Heath & Gifford, 2006; Kaiser, 2006). However, even extended versions of it do not include many of the other barriers described earlier.

Stern's (2000) VBN model begins with one's values. The more biospheric and altruistic, and the less egoistic, one's general values are, the more one should believe the main tenets of the New Ecological Paradigm, a worldview that envisions the planet as a delicate, threatened, and interconnected system, which leads to the belief that acts that harm the environment have adverse consequences. However, according to the VBN model, people will still not act in a pro-environmental way if they do not also believe that they are able to reduce those consequences. If all this is in place, a person should then have a sense of obligation and develop the norm to engage in any of four kinds of pro-environmental actions: environmental activism, public nonactivist behaviors, private behaviors, and actions within an organization. VBN theory has also received empirical support; it does a good job of accounting for nonactivist environmental behaviors (e.g., Steg, Dreijerink, & Abrahamse, 2005).

Four other models for behavior change have received less attention but deserve mention. Geller's (1992) DO-RITE model eschews attitudes, values, and other mental constructs in favor of a focus on observable behavior and intervention, as follows: Define (D) the target behavior to be changed; observe (O) the target behavior; record (R) the rate of occurrence of the behavior; intervene (I) with a program that changes the consequences of engaging in that behavior; test (T) the impact of the program by comparing the frequency of the behavior before and after the program; and evaluate (E) the program. Grob's (1995) model focuses on values, awareness, emotions, and perceived control. Pelletier et al.'s (1999) model centers on global helplessness, which they suggested arises from individuals' beliefs that they lack effective strategies to solve the problem, sufficient capacity to solve the problem, or the ability to sustain sufficient effort to solve the problem. Frantz and Mayer (2009) adapted Latané and Darley's (1970) five-stage bystander intervention model, which includes awareness of the problem, viewing the situation as an emergency, feeling responsible, knowing what to do, and acting.

Parsimony Versus Comprehensiveness

As a family of seven genera incorporating 29 species, the dragons of inaction implicitly raise the question of whether the existing models are too simple. Parsimony is a cardinal virtue, but might the existing models sacrifice important elements in the pursuit of this virtue? If the pursuit of greater understanding and its practical manifestation, predictive power, are also virtues, then more members of the dragon family should have a place in models and theories of proclimate behavior. Table 1's preliminary taxonomy, a more inclusive set of barriers to change, should be heuristic to researchers, offer suggestions to model makers, and be thought-provoking for policymakers.

These dragons in Table 1 are not solitary creatures. They certainly interact. Indeed, their "DNA" undoubtedly is shared in some cases. Social comparison probably is related to social risk. Mistrust must often underlie denial. Technosalvation might well presuppose perceived program inadequacy. Perceived inequity probably is associated with reactance. However, related constructs are not necessarily redundant constructs. My colleagues and I have begun to sort out the connections and interactions in this family (Gifford, Iglesias, & Casler, 2009); once their empirical interrelations are better known, they should significantly improve the understanding and prediction of pro- and anticlimate behavior. In turn, this increased understanding should lead to the promotion of positive climate actions.

Motivation and Emotion

Although specific forms of motivation have been identified and motivation is obviously an important human dimension (e.g., Deci & Ryan, 2000; Goldenberg et al., 2000), the present assumption is that the barriers, collectively, lead to a general amotivation to act in climate-friendly ways and that their removal would increase the motivation to act. Emotions, in the present formulation, are viewed as integral aspects of some barriers: Fear presumably is part of perceived risk, for example, and anger presumably is part of reactance, perceived equity, and justice.

On the other hand, emotion does not seem to be a central aspect of many other barriers, such as habit, tokenism, discounting, ignorance, or the rebound effect. Some

evidence suggests that even though cognitive systems are engaged about climate change, affective systems are not (Weber, 2006), although they are sometimes predictive (Grob, 1995). Other evidence suggests that affect is important only when one's attitude toward a pro-environmental behavior is weak (Smith, Haugtvedt, & Petty, 1994). Thus, in sum, motivation seems to be either everywhere or nowhere, and emotion may be less important for most barriers but important if one's attitude toward climate change is not strong.

Conclusion

Certain key structural barriers stand in the way of behavioral changes that would help limit climate change, but many psychological barriers remain for individuals who do not face stiff structural barriers. Many people already are taking action in response to the challenges from climate change, but many others are hindered by one or more of these barriers to action. The structural barriers should be removed by such forces as legislation and urban renewal, but this action is not likely to be sufficient. Psychologists and other social scientists have an important role to play if the many psychological barriers are to be overcome (e.g., Gifford, 2007b, 2008; Spence, Pidgeon, & Uzzell, 2009; Vlek, 2000).

Research and practice are needed to examine each barrier more closely in the context of climate change. Some suggested starting points follow. First, good theory informs and directs scientific progress; the taxonomy proposed here should be examined and improved if necessary. Some dragons may be missing, and empirical studies may well find significant links or overlap between them. Second, the extent of barriers faced by individuals in different groups and contexts should be examined. Presumably, different population and cultural segments experience different barriers and therefore will respond differently to different kinds of messages, policies, and interventions; clarifying these differences will increase the effectiveness of mitigation efforts. Third, one might expect that facing multiple barriers cumulates to increase an individual's amotivation to act; this proposition could be tested. Fourth, denial remains a particularly troubling barrier for social and climate scientists because behavior change cannot occur as long as the problem is not seen as a problem. Fifth, more research is needed to better understand how individuals can overcome these barriers. For instance, scientific integrity demands confidence intervals, but confidence intervals invite inaction by many community members. Sixth, look for opportunities to promote social networks to spread the adoption of mitigative and adaptive technology choices (cf. Rogers, 1983).

Psychologists are a resourceful and optimistic lot. The dragons of inaction can be beaten back, if not slain. Five essential strategies can help overcome the barriers described in this article:

- Analyze specific barriers at the behavioral level. Define very specifically the behavior that is holding individuals back from more climate-friendly choices in transportation, food, energy, and other carbon-reliant aspects of our lives, then observe and record it, intervene, test the intervention's impact, and evaluate the program (Geller, 1986, 1992). At the societal level, Skinner (1987, p. 7) implicitly advocated wresting control of the "reinforcers of daily life" from governments, religions, and capitalistic systems as long as the immediate "contingencies of selection" are in conflict with the long-term welfare of the species.
- After creating better measures of the carbon cost associated with various behavior choices (in cooperation with other scientists), create better ways to feed information back to consumers and citizens, using best-practice human factors design in the machines we use (Abrahamse, Steg, Vlek, & Rothengatter, 2007).
- Improve understanding of the bases for public support of, and opposition to, policies and technologies for limiting climate change, which should include optimizing messaging strategies in general and for particular population segments and testing the diffusion of innovation and social network processes (e.g., Maibach, Roser-Renouf, & Leiserowitz, 2008; Moser & Dilling, 2004). For example, in a telephone survey experiment of 1,000 Ontario residents, empowering messages were found to produce more intended proclimate action than were sacrifice messages (Comeau & Gifford, 2011).
- Design and conduct more intervention studies aimed at important carbon-related behavior choices, such as travel mode choice and energy use (e.g., Steg & Vlek, 2009).
- Work closely with other disciplines, with government agencies, and with technical experts; climate change cannot be accomplished by any one of these groups no matter how well they do their own job (e.g., Schoot Uiterkamp & Vlek, 2007).

As in other behavior domains that were strongly resistant to behavior change, such as smoking and the use of safety belts, the dragons of inaction can be overcome, although the effort will take time and will never be complete. However, through a combination of appropriately targeted messages, effective leadership, improved technical knowledge, equitable policies, enabling infrastructure, the development of norms, the setting of reasonable goals, in-your-face feedback, the spreading of social norms through social networks, and appropriate personal rewards, it will be done. These steps must be taken expeditiously; we may not have the four or five decades that it has taken to get most people to stop smoking and wear a safety belt to ease our profligate spewing of greenhouse gases, manage the blow it will already have caused, and prevent even stronger blows.

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