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Changing the Climate… of Public Opinion

By Spencer Weart

I took this photo last August, as a tourist on Baffin Island in the Arctic. Looking down the glacier, the nearby ridge of rubble is a moraine, most likely dropped since the late 19th century. The glacier is continuing to melt back, like many around the world. Our group also saw less pack ice than expected, and the bird-watchers were disappointed when they couldn't check off some high-latitude species. Such experiences are now often in the news. Physicists may find their students or nonscientific friends asking questions–or you could raise the issue yourself. People wonder, is global warming really a problem? How do we know? Can we do anything about it? Is it urgent?

One way to answer such questions would be to invoke the authority of science. Many people are not aware that the scientific community has finally reached a consensus on the risk of climate change. Public awareness has been held back by a belief that acknowledging the risk would lead to government regulation, and thus the question became politicized. Weird but true: if someone holds strong opinions about the role of government, you can usually guess from those opinions what they think about plain scientific assertions on climate change. A public relations campaign, amply funded by fossil-fuel corporations and their allies, has deliberately fostered doubt. The industrial coalition publicized the opinions of a few people who cherry-picked items from larger data sets to build unscientific counter-arguments. (For such biased selection see Michael Crichton's latest thriller, *State of Fear*.) Meanwhile a few respectable scientists took on the role, appropriate in science, of playing devil's advocate–raising counter-arguments that spurred their colleagues to more rigorous studies (which dismissed the objections). The bickering over details allowed the American media to offer a supposedly "evenhanded" view, in which any scientist explaining the risk of warming was "balanced" by one of the few skeptics.

Half a century ago, nearly all scientists thought greenhouse warming was scarcely likely to be a problem. It took decades of accumulating evidence, with many hard-fought debates, to convince them they were wrong. Panels of scientists convened on climate change hundreds of times in many countries. As scientists, most of the panelists were professional skeptics. Yet since the late 1970s essentially every such panel has concluded that warming could become a bad problem someday. In the present century, every respectable panel has concluded that it probably will be a severe problem, and soon.

Some people suspect such panels are just an old-boy-and-girl network looking out for its own research funds. History helps counter that suspicion, for the origins of the present consensus are revealing. The Reagan administration believed that any self-appointed group of scientists would issue alarmist, hyper-environmentalist statements. They forestalled that by promoting a complex international advisory structure, led by people appointed by governments rather than by the scientific community. To further impede any statements that might push toward government regulation, the advisory group's conclusions would have to be consensual –the unanimous findings of representatives of all the world's governments. The result is the Intergovernmental Panel on Climate Change (IPCC). Surprisingly, the process produced useful advice. Relentlessly confronted with the evidence and arguments of their colleagues, even the science representatives of oil-rich states eventually agreed that the world is very likely warming at an unprecedented rate, and that the most likely cause is the buildup of greenhouse gases due to human activities.

The key here is a simple matter: in such a complex issue we cannot have certainty, and we don't claim it. The scientific community, as represented by the IPCC, plus many of the world's leading science academies and societies, only says that serious global warming is more likely than not. After all, hardly anything that relates to economic or social policy is certain. The evidence that we face a serious climate risk is now stronger than the kind of evidence we normally use in deciding tax policy, investments in costly highways, and the like.

How do we know the whole world is really warming up? One quick and vivid answer is the unprecedented melting back of glaciers, exposing archeological finds like the Alpine "iceman" that had been frozen for thousands of years. The atmospheric temperature fluctuates hour by hour, so it seems a monumental task to arrive at an average global temperature and say it has gotten a few tenths of a degree warmer. It has indeed been a monumental task, the work of thousands of scientists. Most of the heat energy added by the greenhouse effect isn't stored in the wispy and inconstant atmosphere anyway. It mainly winds up in the oceans. The heat energy seeps down gradually through the seawater, a very poor conductor, or is carried down by slow-moving currents. The latest analysis of the temperature structure in all the main ocean basins shows a strong and rapid warming in recent decades. Moreover, the geographic and depth patterns closely match the predictions that computer models make for greenhouse gas warming. The patterns cannot be matched to any other cause, such as variations in the Sun.

How do we know the computer models are any good? Never before in human history have nations been asked to stake major policies on such complex scientific calculations. I find it a hopeful sign, a big advance in rationality, that all governments now take this seriously. After all, as some say, "How can scientists predict the climate a century ahead when they can't predict weather a year ahead?"

The short answer is that the problems are different, since a season's climate is the average of all the season's weather. Computers can predict the weather a couple of days ahead pretty well, if far from perfectly, and predicting climate a century ahead is at about the same stage.

A longer answer would start by noting what an impressive achievement it is that computers can make models that look much like Earth's actual climate. It's a hugely complicated system, but models get the winds and sea currents and rain and snow in all the right places. More impressive still, the models can track all this through the seasons, as if the same model worked for two radically different planets: Summer and Winter. But perhaps the most impressive is the natural experiment conducted in 1991. That was when the volcano Pinatubo blew a cloud the size of Iowa into the stratosphere. A relatively simple model predicted in advance the temporary global cooling this would produce. Current models are even better at reproducing the event's consequences.

The modelers can get these results only by adjusting a lot of parameters that are poorly known, such as the numbers in the model that tell how clouds are formed. What if they're unconsciously fudged, or just wrong? The shortest answer is yes, they might be wrong. If they're wrong one way, we might have no serious change. But if they're wrong the other way, we will have catastrophic climate change. Amidst this uncertainty we can only say, again, that a damaging change is more likely than not.

If pressed for a more complete answer, I would tell about the study so big it needs more computer power than any group commands. So it uses distributed computing. Your PC can join the effort in its idle time: go to http://Climate Prediction.net. You'll get a set of parameters for a simplified model, and run it to see if it will reproduce the 20th century's climate (one of my runs ended up with no clouds, other people had all the water precipitate as ice at the poles, etc.). Once you get a set of parameters that gives a fair approximation to the known past climate, you can double the carbon dioxide in the atmosphere and run it again. The results from thousands of runs with different parameter sets are revealing. A few sets of parameters give no warming. A larger number of sets produces shockingly large warming, up to 11°C by the end of the century. Most of the parameter sets, however, get climates that group near the results from single runs of the most advanced models, showing a warming somewhere in the range 1-5°C. That confirms what modelers have found ever since the 1970s: if you can make any kind of model that gets the past climate roughly right, it takes serious fudging to get it not to warm up when you add greenhouse gases. (For explanations and updates on many other questions see http://www.RealClimate.org.)

Photo of glacier on Baffin Island

Photo credit: Spencer Weart

But is there anything we can do? Here we are impeded by a viewpoint, supported by interests that are afraid to change their business models or their political models, which insists that it is impossible to reverse the rise of greenhouse gases without wrecking our economy. Yet any physicist can see that people can take many steps that actually save them money and benefit the overall economy. For instance, we can use more efficient light bulbs. Beyond that are collective actions that will be beneficial in many ways, such as reducing the inefficiencies in cars that not only add to global warming but make many countries spend huge sums to get foreign oil. For a start, why not stop subsidizing global warming? Currently tens of billions of taxpayer dollars are wasted in open and hidden subsidies of fossil fuel industries and other contributors to greenhouse emissions. (Many groups are working on this; one starting point is the Pew Center for Climate Change, http://www.pewclimate.org/.)

What we need is a change in the climate–of opinion. Americans in particular ought to make their nation not the world's laggard, but its leader in addressing the problem. We should be challenging other nations to match us in staving off global warming. Many tools are already at hand and many more can be developed. If the climate does turn bad, we may have to use most of them. The necessary large change in public attitudes is certainly possible, for leaders of many corporations, state and local governments, and others have noticed the danger and are starting to take action on their own.

How urgent is it? We don't know, and therefore it's urgent. Come again? Well, if you don't know whether your house is on fire, but there's a good chance it might be, that's urgent. Even if there's only a small chance that it will ever catch fire, you're willing to spend a significant fraction of your wealth on insurance. For climate, one mechanism that suggests we are at urgent risk can be explained to almost anyone able to grasp elementary physics. As cold regions grow warmer, the bright snow and ice cover that reflect sunlight back into space are retreating earlier in the spring, exposing dark soil and open water, which absorb sunlight, which leads to further warming, and so on. That's why global warming is showing up first in the Arctic: an effect scientists have predicted since the 19th century. You might also mention a second risk, recognized more recently. The world's vast expanses of frozen tundra store fossil carbon, and as the permafrost melts, methane bubbles out; methane is an even more potent greenhouse gas than carbon dioxide, and leads to further warming. Geoscientists have identified several other mechanisms that might possibly push the climate abruptly into a dangerous state. Possibly we are approaching a tipping point.

We can probably arrest the process before it becomes irreversible. The cost may be no worse than we spend on other kinds of insurance. But not if we keep putting off effective action. Every scientist has a public responsibility to be well enough informed about climate change to answer the questions that we may be asked. And we all have a responsibility to engage in the effort to change the climate of opinion, and quickly, on what might be the most crucial issue of our times. Just possibly might. Actually, more likely than not.

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Further Reading:

Weart, Spencer R., 2003. The Discovery of Global Warming. Cambridge, MA: Harvard University Press; more extensive and updated text at http://www.aip.org/history/climate.

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