FILM: CLIMATE

Trying to Get Us to Change Course

Rush Holt

An Inconvenient Truth

Davis Guggenheim, Director

Paramount Classics, Hollywood, CA, 2006. 97 minutes. DVD, $29.99. www.climatecrisis.net/

An Inconvenient Truth
The Planetary Emergency of Global Warming and What We Can Do About It

by Al Gore

Rodale, New York, 2006. 328 pp. Paper, $21.95, C$28.95. ISBN 9781594865671.

Scientists can learn much from *An Inconvenient Truth*, the widely viewed film and companion book of the same name, by former U.S. Vice President Al Gore. They are important works: Not for the science, although Gore does no injustice to that and no doubt through his presentation has taught some good science to many people. Nor for the visual images, although those too are well chosen, clear, and attractive. Rather, their importance lies in the author's successful attempt to do something even harder than modeling climate, deciphering ecological relationships, or designing low-carbon energy sources. What he has done is to help bring about a change of opinion in a resistant public. Scientists would be wise to take some of his methods to heart.

As Gore reminds us, for more than two decades scientists have been issuing warnings that the release of greenhouse gases, principally carbon dioxide (CO_2), is probably altering Earth's climate in ways that will be expensive and even deadly (*1*, *2*). The American public yawned and bought bigger cars. Statements by the American Association for the Advancement of Science (*3*), American Geophysical Union (*4*), American Meteorological Society (*5*), Intergovernmental Panel on Climate Change (*6*), and others underscored the warnings and called for new government policies to deal with climate change. Politicians, presented with noisy statistics, shrugged, said there is too much doubt among scientists, and did nothing.

So, why is it that only recently the American public and their representative policymakers have begun to pay attention? How does conventional public opinion change? Is it a kind of phase change, where a seed can cause large crystals to drop out of solution, or maybe where a school of fish change direction almost at once from an indistinguishable signal? Whatever the metaphor, change has occurred. The public now widely believes that climate change is under way and that it is induced by humans (*7*). Those are two major conceptual shifts. The public has not yet crossed the conceptual barriers to the recognition that the present climatic changes present a serious threat and that solutions are possible, although they may be close to clearing those third and fourth hurdles as well.

Adding to our atmosphere.

Gore can be given as much credit as anyone for these developments. The film earned over $24 million at the box office, the book has been a best seller (760,000 copies are in print), and 1.5 million DVDs have been sold. Students are being shown the film in school, and municipalities are scheduling viewings in public spaces. Word of mouth and this year's Academy Award for Best Documentary Feature have also fueled *An Inconvenient Truth*'s success.

It is instructive to consider how Gore did it. First, he worked for several years on the presentation, meeting with climate experts, energy engineers, and ecologists again and again. He collected some of the best images available, including time-lapse pictures of melting glaciers, schematics of ocean circulation, and newsreels of storm flooding. And he practiced his talk perhaps hundreds of times in front of many different audiences—politicians, scientists, business leaders, and a variety of others. I myself heard him give it several times in the years before he made the film.

I find Gore's science solid. More important, those who are expert in the relevant fields tell me that they are at least comfortable with his explanations of the science and in some cases admiring of his clarity and accuracy. Certainly, they say, he has the gist. Of course, critics will find points to dispute. They may note that he is wrong when he indicates diverted ocean currents will cause Europe to cool—although to be fair, it was only recent modeling that now shows the ocean cooling is insufficient to overwhelm the atmospheric warming. Gore makes provisional conclusions sound more definite than a practicing scientist might. He takes some worst-case outcomes (such as the catastrophic melt of all Greenland ice) and then presents the resulting effects, leaving the viewer to expect those results. Not what a scientist would do, perhaps, but recall that researchers had been trying for years to draw any attention to the matter.

Most significant, Gore structured the presentation with a shrewd recognition of how people learn and how they make decisions. He tells stories, personal stories. Scientists typically try to present their work to nonscientists by simplifying the life out of it. Simplification may be necessary, but that is not the key. Scientists should not simply distill their analysis. If they want their work to have any relevance beyond their specialty, they should create movement, present contests and conflicts, and develop personalities.

As Gore develops the story of scientific understanding of the effects of atmospheric CO_2, he shows graphs with hardly a mention of the numbers on the axes and uses animation of

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the graphs to move the story. It is, he says, just as predicted by his wise former professor Roger Revelle (*8*). Then, in a denouement worthy of a detective novel, he shows that the temperature record over 600,000 years matched the record of CO_2 concentration over the same period. "Aha!" concludes the viewer. CO_2 is exposed as the cause of the deadly hurricanes, the spreading disease vectors, and the vanishing landscapes. Gore leaves the viewer with the mistaken impression that CO_2 is the driver of climate change in that historic record. Nonetheless, it is true that climate models including the CO_2 concentration as a coupled feedback provide excellent retrospective fits, and it is reasonable to accept the models' prediction that a CO_2 concentration several times greater than recorded in that record will result in temperatures similarly off scale.

Gore identifies CO_2 as the cause, though not the culprit. Gore creates flesh-and-blood heroes and villains. Revelle is presented as a modern day Paul Revere sounding the alarm. For villains, Gore invokes comparisons with the tobacco companies, who by sowing doubt about the epidemiology of smoking caused the deaths of many people (*9*), including Gore's beloved sister. Similarly, he says, those who would ruin our planet are sowing doubt about climate change. The film and book present a compelling story reminiscent of Rachel Carson's *Silent Spring* (*10*), which by dramatizing science changed public perception and policy.

Using the conceptually simple "wedge model" of Robert Socolow and Stephen Pacala (*11*), Gore suggests that a half-dozen approaches to energy efficiency, alternative energy generation, and carbon capture could collectively pull our planet back from the brink of runaway climate change. The responses he calls for are not so much advanced technology as immediate, extensive, even bold, applications of methods currently available for reducing carbon in the energy mix: stop energy waste, choose efficient transportation, insulate buildings, use renewable energy, and capture and store CO_2. Gore has since gone on to propose an immediate freeze on new emissions, taxes on carbon emitters, a ban on incandescent lights, increased fuel efficiency requirements for American cars, and a mortgage association to help homeowners save energy (*12*). He tells the viewers that they are now part of the story. He intends to leave his audience with a sense of responsibility and empowerment, not despair.

Through *An Inconvenient Truth*, Gore has personalized the climate change debate and made it accessible in a way that has not only reversed public apathy but also motivated citizens to seek real policy changes. It is a lesson for all of us who believe science can serve public policy, giving us a clear understanding of how to engage people in a debate.

References and Notes

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WOMEN IN SCIENCE

Can Evidence Inform the Debate?

Marcia C. Linn

Almost everyone has an opinion about the relative dearth of women in science. *Why Aren't More Women in Science?* offers evidence to enrich, strengthen, question, or even refute commonly held views. The 15 essays bring to life recent findings on the involvement of women and men in science courses and careers. Editors Stephen Ceci and Wendy Williams, developmental psychologists at Cornell University, enticed 19 leading researchers on gender differences in ability to contribute succinct, informative essays summarizing their studies. The contributors present their strongest arguments, support those with their best data, and articulate their beliefs about the current participation of women in science. I encourage readers to note their views about the issue, read the essays, reflect on their own beliefs, and then take advantage of the editors' cogent introduction and thoughtful conclusions.

Why Aren't More Women in Science?
Top Researchers Debate the Evidence

Stephen J. Ceci and Wendy M. Williams, Eds.

American Psychological Association, Washington, DC, 2007. 274 pp. $59.95. ISBN 9781591474852.

My main quibbles with the book are the focus on exceptional scientific attainments (Ph.D. level) and the emphasis on small differences between males and females. Although important, these discussions overshadow the stunning increases in participation of women in science and may reinforce stereotypes that affect selection and career decisions.

In recent decades, the participation in science of women relative to men has increased dramatically. For example, in her essay Janet Hyde reports that, in 1966, women earned only 4.5% of the U.S. doctoral degrees in physical sciences but by 2000 this percentage had risen to 24.6%. For the biological sciences, women earned 12% of the doctoral degrees in 1966 and 42% in 2000. Similarly, Diane Halpern reports that in the biological sciences (including medicine, from which women were actively excluded not very long ago) the participation of men and women in Ph.D. and medical programs is now approximately equal. However, as Virginia Valian notes, women progress through the ranks less rapidly and get fewer of the most prestigious jobs and promotions after completing their final degree.

Against this encouraging backdrop of women's increasing participation in science, the essayists focus on three main areas of scholarship. They largely agree that subtle beliefs about who can participate in science—held both by those who instruct and select participants and by those who decide whether to participate—affect participation and persistence. They offer disparate interpretations of well-documented findings about cognitive abilities that might contribute to success in science, as indicated by mathematics test scores and spatial reasoning scores. They discuss the emerging methodologies and findings about a wide range of biological indicators, including prenatal hormones, brain development, brain lateralization, evolutionary processes, and brain activation patterns measured while individuals engage in science-related tasks.

Many essays showcase the role of subtle beliefs in decisions concerning the participation of men and women in science. A series of studies of selection decisions illustrates these phenomena. These studies provided respondents with a portfolio, a job application, an

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