THE PERILS OF CONFIRMATION BIAS

Matt Ridley

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The Perils of Confirmation Bias

Dr Matt Ridley
Matt Ridley has been a scientist, journalist and businessman. With BA and DPhil degrees from Oxford University, he worked for the Economist for nine years as science editor, Washington correspondent and American editor, before becoming a self-employed writer and businessman. He is the author of several books, which have sold over 900,000 copies, been translated into 30 languages, been short-listed for nine major literary prizes and won several awards. He is a member of the GWPF's Academic Advisory Council.

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The Perils of Confirmation Bias

Introduction

The philosopher Karl Popper famously made the case that the distinguishing feature of a scientific theory is that it is falsifiable. Scientists set out to shoot down each other's theories and only when they fail does a hypothesis become an accepted scientific fact. For some time it has been clear that is not how most climate scientists operate.

The modus operandi of the Intergovernmental Panel on Climate Change (IPPC) has been to accumulate evidence to champion rather than challenge a hypothesis, namely that rising carbon dioxide levels will in future cause dangerous climate change.

A good example is the IPCC's claim[1] that only models that incorporate high-sensitivity carbon dioxide-induced warming countered by aerosol-induced cooling can match (or "hindcast") the recent upward progress of global average temperatures. The problem with this is that different models use different values of assumed cooling from aerosols. That is to say, the cooling effect of aerosols has been picked so that it fills the gap between observed and expected warming. The modellers are therefore in effect saying: we observe warming of X, we predicted warming of X+5, so there must have been cooling of 5, therefore our prediction is correct. Or, to quote one of the papers that examined this issue:

> "These results explain to a large degree why models with such diverse climate sensitivities can all simulate the global anomaly in surface temperature. The magnitude of applied anthropogenic total forcing compensates for the model sensitivity."[2]

Once an empirical estimate of aerosol cooling is used instead of an assumption, the models' performance is poor (see Penner et al 2011[3]).

1 http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch9s9-4-1-5.html

2 Kiehl JT, 2007. Twentieth century climate model response and climate sensitivity. GRL 34, L22710, doi:10.1029/2007GL031383.

3 http://www.pnas.org/content/early/2011/07/25/1018526108.full.pdf?with-ds=yes

Many sceptical scientists have objected to this kind of confirmation bias, but their objections have met with little interest from journalists or from the leaders of science academies. Climate scientists deny the charge, saying they are properly sceptical about their own hypotheses. Actually, a much stronger argument they could use is that they are behaving no differently from other scientists. Charles Darwin's *Origin of Species* is a long catalogue of carefully selected facts in support of natural selection. Bohr, Einstein, Wegener, Mendel, Rutherford and Hawking all won great scientific renown while pushing, rather than trying to falsify, an idea.

How is it possible for scientific theories occasionally to fall, and science to remain honest, if scientists champion ideas rather than challenge them? The answer, obviously, is that scientists challenge each other.

Every important new idea in science is "replicated" or tested by another team than the one that put forward the idea. And it is this process that has gone missing in climate science. It is unreasonable to expect a climate scientist to seek evidence against his favoured hypothesis; but it is not unreasonable to expect governments to back the partisans of other hypotheses: that man-made climate change may be real but not dangerous because of lack of positive feedbacks; that it may be less powerful than some natural causes of change; or that there are negative feedbacks that reduce the effects of man-made warming.

Instead of this, anybody who champions one of these hypotheses is often accused of "denial" or of not "believing" in climate change, and frequently subjected to a surprising level of abuse.

Climate scientists and their media champions equate such scepticism with scepticism about, say, the theory of evolution. Yet evolution is an explanation of facts; dangerous man-made climate change is a prediction about the future. Theories about the future are always less reliable than theories about the past. I can have confidence that the reports that it rained last Tuesday are true, while doubting the forecast that it will rain next Tuesday. Besides there are many examples of scientific orthodoxies that brooked little dissent in their heyday and yet were often wrong, such as behaviourism and Freudianism. In one case, the parallel with climate science is uncomfortably close. In the first half of the

twentieth century, eugenics was a theory about future danger, based on prediction, demanding short-term pain for long-term gain and insisting that its tenets were beyond reasonable challenge.

I explored the problem of "confirmation bias" in science and its application to climate science in particular for a series of articles originally published in *The Wall Street Journal*. These are reprinted in this pamphlet. In essence, the argument is that confirmation bias is to be expected in climate science as in any science, but that a monopoly focus on a single hypothesis is not. For the health of this science, governments should fund groups that intend to explore alternative hypotheses about the likely future of climate as well as those that explore the dangerous man-made climate change prediction. Only then will that theory be properly tested.

Matt Ridley

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How scientists collect positive evidence rather than test theories

There is a myth out there that has gained the status of a cliché: that scientists love proving themselves wrong, that the first thing they do after constructing a hypothesis is to try to falsify it. Professors tell students that this is the essence of science.

Yet most scientists behave very differently in practice. They not only become strongly attached to their own theories; they perpetually look for evidence that supports rather than challenges their theories. Like defence attorneys building a case, they collect confirming evidence.

In this they are only human. In all walks of life we look for evidence to support our beliefs, rather than to counter them. This pervasive phenomenon is known to psychologists as "confirmation bias." It is what keeps all sorts of charlatans in business, from religious cults to get-rich-quick schemes. As the philosopher/scientist Francis Bacon noted in 1620:

> "And such is the way of all superstition, whether in astrology, dreams, omens, divine judgments, or the like; wherein men, having a delight in such vanities, mark the events where they are fulfilled, but where they fail, though this happen much oftener, neglect and pass them by."

Just as hypochondriacs and depressives gather ample evidence that they are ill or ill-fated, ignoring that which implies they are well or fortunate, so physicians managed to stick with ineffective measures such as bleeding, cupping and purging for centuries because the natural recovery of the body in most cases provided ample false confirmation of the efficacy of false cures. Homeopathy relies on the same phenomenon to this day.

Moreover, though we tell students in school that, as Karl Popper argued, science works by falsifying hypotheses, we teach them the very opposite - to build a case by accumulating evidence in support of an argument.

The phrase "confirmation bias"[4] itself was coined by a British psychologist

4 http://psy2.ucsd.edu/~mckenzie/nickersonConfirmationBias.pdf

named Peter Wason in 1960. His classic demonstration of why it was problematic was to give people the triplet of numbers "2-4-6" and ask them to propose other triplets to test what rule the first triplet followed. Most people propose a series of even numbers, such as "8-10-12" and on being told that yes, these numbers also obey the rule, quickly conclude that the rule is "ascending even numbers." In fact, the rule was simply "ascending numbers." Proposing odd numbers would have been more illuminating.

An example of how such reasoning can lead scientists astray was published last year.[5] An experiment had seemed to confirm the Sapir-Whorf hypothesis that language influences perception. It found that people reacted faster when discriminating a green from a blue patch than when discriminating two green patches (of equal dissimilarity) or two blue patches, but that they did so only if the patch was seen by the right visual field, which feeds the brain's left hemisphere, where language resides.

Despite several confirmations by other teams, the result is now known to be a fluke, following a comprehensive series of experiments by Angela Brown, Delwin Lindsey and Kevin Guckes of Ohio State University. Knowing the word for a colour difference makes it no quicker to spot.

One of the alarming things about confirmation bias is that it seems to get worse with greater expertise. Lawyers and doctors (but not weather forecasters who get regularly mugged by reality) become more confident in their judgment as they become more senior, requiring less positive evidence to support their views than they need negative evidence to drop them.

The origin of our tendency to confirmation bias is fairly obvious. Our brains were not built to find the truth but to make pragmatic judgments, check them cheaply and win arguments, whether we are in the right or in the wrong.

5 http://www.journalofvision.org/content/11/12/2.full.pdf

What keeps scientists accurate is rivals' scepticism, not their own

If, as I argued above, scientists are just as prone as everybody else to confirmation bias - to looking for evidence to support rather than test their ideas - then how is it that science, unlike cults and superstitions, does change its mind and find new things?

The answer was spelled out by the psychologist Raymond Nickerson of Tufts University in a paper written in 1998[6]:

> "It is not so much the critical attitude that individual scientists have taken with respect to their own ideas that has given science the success it has enjoyed... but more the fact that individual scientists have been highly motivated to demonstrate that hypotheses that are held by some other scientist(s) are false."

Most scientists do not try to disprove their ideas; rivals do it for them. Only when those rivals fail is the theory bomb-proof. The physicist Robert Millikan (who showed minor confirmation bias in his own work on the charge of the electron by omitting outlying observations that did not fit his hypothesis) devoted more than 10 years to trying to disprove Einstein's theory that light consisted of particles (photons). His failure convinced almost everybody but himself that Einstein was right.

The solution to confirmation bias in science, then, is not to try to teach it out of people, for that goes too much against the grain of human nature. Dr. Nickerson points out that the history of science is replete not only with examples of great scientists tenaciously persisting with theories "long after the evidence against them had become sufficiently strong to persuade others without the same vested interests to discard them" but also with brilliant people who remained wedded to their pet hates.

Galileo rejected Kepler's lunar explanation of tides; Huygens objected to Newton's concept of gravity; Humphrey Davy detested John Dalton's atomic theory; Einstein denied quantum theory.

No, the reason that science progresses despite confirmation bias is

6 http://psy2.ucsd.edu/~mckenzie/nickersonConfirmationBias.pdf

partly that it makes testable predictions, but even more that it prevents monopoly. By dispersing its incentives among many different centres, it allows scientists to check each other's prejudices. When a discipline defers to a single authority, and demands adherence to a set of beliefs, then it becomes a cult. Medicine did this with Galen and psychoanalysis with Freud.

A recent example is the case of malaria and climate. In the early days of global-warming research, scientists argued that warming would worsen malaria by increasing the range of mosquitoes. "Malaria and dengue fever are two of the mosquito-borne diseases most likely to spread dramatically as global temperatures head upward," said[7] the Harvard Medical School's Paul Epstein in *Scientific American* in 2000, in a warning typical of many.

Carried away by confirmation bias, scientists modeled the future worsening of malaria, and the Intergovernmental Panel on Climate Change accepted this as a given. When Paul Reiter, an expert on insect-borne diseases at the Pasteur Institute, begged to differ - pointing out that malaria's range was shrinking and was limited by factors other than temperature - he had an uphill struggle.

> "After much effort and many fruitless discussions," he said, "I ... resigned from the IPCC project [but] found that my name was still listed. I requested its removal, but was told it would remain because 'I had contributed.' It was only after strong insistence that I succeeded in having it removed."[8]

Yet Dr. Reiter has now been vindicated. In a recent paper[9], Peter Gething of Oxford University and his colleagues concluded that widespread claims that rising mean temperatures had already worsened malaria mortality were "largely at odds with observed decreasing global trends" and that proposed future effects of rising temperatures are "up to two orders of magnitude smaller than those that can be achieved by the effective scale-up of key control measures."

7 http://chge.med.harvard.edu/about/faculty/journals/sciam.pdf

8 http://en.wikipedia.org/wiki/Paul_Reiter

9 http://www.nature.com/nature/journal/v465/n7296/full/nature09098.html

The IPCC, in other words, learned the hard way the value of letting mavericks and gadflies challenge confirmation bias.

Climate science needs gadflies

I argued above that the way to combat confirmation bias - the tendency to behave like a defence attorney rather than a judge when assessing a theory in science - is to avoid monopoly. So long as there are competing scientific centres, some will prick the bubbles of theory reinforcement in which other scientists live.

For constructive critics, this is the problem with modern climate science. They do not think it is a conspiracy theory, but a monopoly that clings to one hypothesis (that carbon dioxide will cause dangerous global warming) and brooks less and less dissent. Again and again, climate sceptics are told they should respect the consensus, an admonition wholly against the tradition of science.

Last month saw two media announcements of preliminary new papers on climate. One, by a team led by physicist Richard Muller of the University of California, Berkeley, concluded[10] "the carbon dioxide curve gives a better match than anything else we've tried" for the (modest) 0.8 Celsius-degree rise in global average temperatures over land during the past half-century - less, if the ocean is included. He may be right, but such curve-fitting reasoning is an example of confirmation bias. The other, by a team led by the meteorologist Anthony Watts, a sceptical gadfly, confirmed[11] its view that the Muller team's numbers are too high - because "reported 1979-2008 U.S. temperature trends are spuriously doubled" by bad thermometer siting and unjustified "adjustments."

Much published research on the impact of climate change consists of confirmation bias by if-then modeling, but critics also see an increasing

10 http://www.nytimes.com/2012/07/30/opinion/the-conversion-of-a-climate-change-skeptic.html?pagewanted=all

11 http://wattsupwiththat.com/2012/07/29/press-release-2/#more-68286

confusion between model outputs and observations. For example, in estimating how much warming is expected, the most recent report of the Intergovernmental Panel on Climate Change uses three methods, two based entirely on model simulations.

[Here[12] is the actual wording:

> "Basing our assessment on a combination of several independent lines of evidence, as summarised in Box 10.2 Figures 1 and 2, including observed climate change and the strength of known feedbacks simulated in GCMs, we conclude that the global mean equilibrium warming for doubling CO2, or 'equilibrium climate sensitivity', is likely to lie in the range 2°C to 4.5°C, with a most likely value of about 3°C."]

The late novelist Michael Crichton, in his prescient 2003 lecture criticizing climate research, said[13]:

> "To an outsider, the most significant innovation in the global-warming controversy is the overt reliance that is being placed on models.... No longer are models judged by how well they reproduce data from the real world-increasingly, models provide the data. As if they were themselves a reality."

It is not just models, but the interpretation of real data, too. The rise and fall in both temperature and carbon dioxide, evident in Antarctic ice cores, was at first thought to be evidence of carbon dioxide driving climate change. Then it emerged that the temperature had begun rising centuries earlier than carbon dioxide. Rather than abandon the theory, scientists fell back on the notion that the data jibed with the possibility that rising carbon dioxide levels were reinforcing the warming trend in what is called a positive feedback loop. Maybe - but there is still no empirical evidence that this was a significant effect compared with a continuation of whatever first caused the warming.

The reporting of climate in the media is full of confirmation bias. Hot summers (in the U.S.) or wet ones (in the U.K.) are invoked as support for climate alarmism, whereas cold winters are dismissed as weather. Yale

12 http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch10s10-5.html

13 https://www.cfa.harvard.edu/~scranmer/SPD/crichton.html

University's Dan Kahan and colleagues polled 1,500 Americans and found[14] that, as they learned more about science, both believers and nonbelievers in dangerous climate change

> "become more skillful in seeking out and making sense of - or if necessary explaining away - empirical evidence relating to their groups' positions on climate change and other issues."

As one practicing scientist wrote[15] anonymously to a blog in 2009:

> "honestly, if you know anything about my generation, we will do or say whatever it is we think we're supposed to do or say. There is no conspiracy, just a slightly cozy, unthinking myopia. Don't rock the boat."

Bring on the gadflies.

14 http://reason.com/archives/2011/07/12/scientific-literacy-climate-ch

15 http://www.theatlantic.com/business/archive/2009/12/climategate-was-data-faked/31540/

The Global Warming Policy Foundation is an all-party and non-party think tank and a registered educational charity which, while open-minded on the contested science of global warming, is deeply concerned about the costs and other implications of many of the policies currently being advocated.

Our main focus is to analyse global warming policies and their economic and other implications. Our aim is to provide the most robust and reliable economic analysis and advice.

Above all we seek to inform the media, politicians and the public, in a newsworthy way, on the subject in general and on the misinformation to which they are all too frequently being subjected at the present time.

The key to the success of the GWPF is the trust and credibility that we have earned in the eyes of a growing number of policy makers, journalists and the interested public.

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For further information about the GWPF or a print copy of this report contact:

The Global Warming Policy Foundation
1 Carlton House Terrace, London SW1Y 5DB
T 020 7930 6856
M 07553 361717
www.thegwpf.org

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