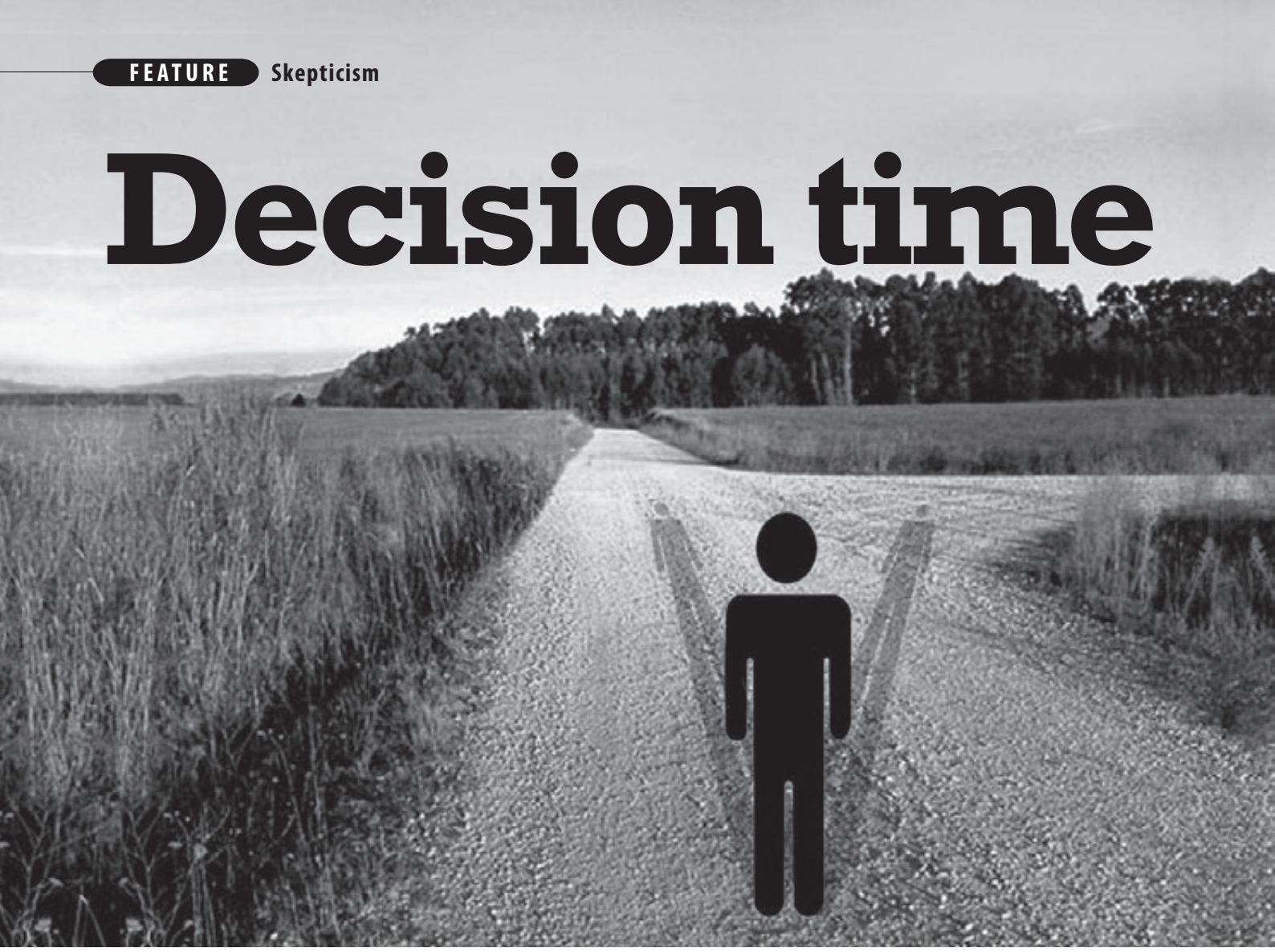
Decision time



Martin Bridgstock suggests a way in which skeptics can make sense of abstruse scientific controversies, including climate change.

How should skeptics deal with scientific issues? I am not talking about paranormal claims of the kind we often see analysed in these pages. I am talking about controversies where scientists themselves seem to disagree, where a decision has to be made about what to do, and yet the arguments concern arcane scientific considerations. The safety of genetically modified crops is one example. So is the question of how long our fossil fuels will last. On many important issues, the non-scientific public needs to make judgements, and yet we do not have the expertise to do so.

This paper shows one way in which a non-expert can arrive at a reasoned judgement about an important scientific issue. I will use the issue of anthropogenic global warming (AGW) as an example of how the method works. At the end of this article I will come to a conclusion about AGW, and you can then decide what you think of my method and my conclusions.

THE CONTESTED TERRAIN

What is the AGW argument about? The key proposition in AGW is that human activity – cars, agriculture and so on – is increasing the proportion of certain gases in the atmosphere. These greenhouse gases – the best-known is carbon dioxide – have a well-established property. They are transparent to visible light, but not to infrared. So the sun's rays shine through the atmosphere and warm the Earth. The Earth, warming, then re-emits the energy as infrared, which is then partly absorbed and held close to the Earth by the greenhouse gases. It is logical to infer that, as the concentration of greenhouse gases increases, the Earth will be warmed as well.

However, that simple inference does not necessarily follow. There is a whole set of processes happening, some of which lead to the Earth's warming, and some of which might restrain that process. For example, both an increase in carbon dioxide and a warming of the Earth could be conducive to the growth of more plant life. Plants absorb carbon dioxide, and so would tend to reduce any warming effects.

There are many other factors, and clouds are one of the most complex. On the one hand, clouds hold in warmth from the Earth. Most of us are aware that a cloudy night is usually warmer than a clear night. On the other hand, clouds tend to throw off the sun's

rays, reflecting them back into space. Therefore, whether clouds contribute to global warming, or restrain it, varies according to circumstances.

Imagine these types of process, and many more, being used to explain trends in the Earth's climate. To make matters more complex, land and ocean behave quite differently in affecting the climate, as do the various layers of the atmosphere, the ice caps and much more. It seems clear that the only way to understand and predict the Earth's climate is to construct huge computer models of how the climate behaves, building in all the many variables which may be important. The values of the variables must be closely estimated and the interactions between the variables properly described. Then, inside a computer, the model can be set going and the future predicted.

IS GLOBAL WARMING A SKEPTICAL MATTER?

Should skeptics become involved in the AGW controversy? My first tentative conclusion is that, as far as I can tell, skepticism does not apply to the climate change issue. Why not? Well, according to the Australian Skeptics (2010), skepticism concerns the scientific investigation of paranormal and pseudoscientific claims. That is the heart of their definition of skepticism, and I recommend that all skeptics should be aware of it.

Now, the types of process I have described above are not paranormal, nor are they pseudoscientific. All are well established by research. In addition, linking them together in models to understand the Earth is a perfectly logical – indeed inevitable – next step. It is completely scientific: how could we possibly understand the Earth's climate if we didn't create huge theoretical models of how it all works? Of course, the models may be wrong in their predictions, but that is a necessary feature of science.

It follows that, since climate modelling is not paranormal, and is not pseudoscientific; it does not fall within the purview of skepticism. It is a genuinely scientific debate. However, the reason why everyone should be concerned about the debate's outcome is obvious: if the climate change theorists are right, we have a major problem heading our way and we ought to do something about it. If not, then the AGW ideas must be firmly discarded. It is an important topic, and needs to be argued out.

My first step was to look at a few simple books and papers on the topic. The enormity and complexity of the issues rapidly became clear. To work my way to a point where I could understand and critique the various arguments about climate change would, I estimated, take between three and five years of study. I could not devote all my time to climate change research, as I have a family and academic responsibilities. In addition all, this work would not make me a fully-fledged climate scientist; it would simply put me in a position where I could make reasoned judgements on the claims of the real scientists. Since I am 62 now, and most projects take longer than I expect, I might be aged 70 or more before I finally achieve my goal. Could there be another way?

“ People we dislike can sometimes be right, and people we like can be resoundingly wrong.”

SOME BAD WAYS OF THINKING

I noticed that some people – skeptics and others – sometimes make decisions about the question of global warming on badly-considered grounds. They may take a stance on the issue because they disapprove of the people on one side of the debate. For example, they dislike tree-hugging bleeding-heart leftish environmentalists, or they hate rapacious corporations who will say or do anything to make a profit. A moment's reflection should show that this is not a very intelligent way of proceeding. In the real world, people we dislike can sometimes be right, and people we like can be resoundingly wrong. Our skepticism should lead us in the direction of wanting to look at evidence.

A second ill-considered approach is to take a single argument and use that to make a decision. For example, I was talking to a well-known Australian skeptic a while ago, and he told me that he did not believe in climate change. His reason was that if the air near the Earth warmed up, it would rise through convection, and be replaced by cooler air, and so global warming would not take place.

The argument struck me as flawed at the time, but even if it is correct it is inadequate. Equally, a glib argument to the effect that "Humans are putting out more and more carbon dioxide, and that's why the climate is changing" simply does not stand up to any sort of critical consideration. The logical gaps in those arguments, and their total inadequacy, should be clear to anyone. As we have seen, a proper understanding of climate involves a massive assembly of processes and interactions: no one consideration decides the outcome completely.

Finally, I was struck by a comment from a Canberra skeptic when I presented my ideas on this topic. He said that he accepted that humans were causing global warming, but he was angered by abuse from some pro-AGW people. I mentioned at the time that I had come across some recent, rather nasty abuse going the other way (eg Evans 2010). My own view is that abuse in any important issue is inappropriate, and that the best reproof we can offer is simply to concentrate upon evidence and argument: that is, we should regard abuse as beneath serious consideration. Closely linked to these arguments are those attacking the motives of one side or the other. I have seen suggestions that pro-AGW scientists are simply after research money, and that anti-AGW people are funded by energy corporations. These may, or may not, be true, but our key focus should be on evidence and reasoning: who is right, and why?

EXPERT SCIENTIFIC OPINION

The dilemma I face should now be clear. Normal skeptical methods do not

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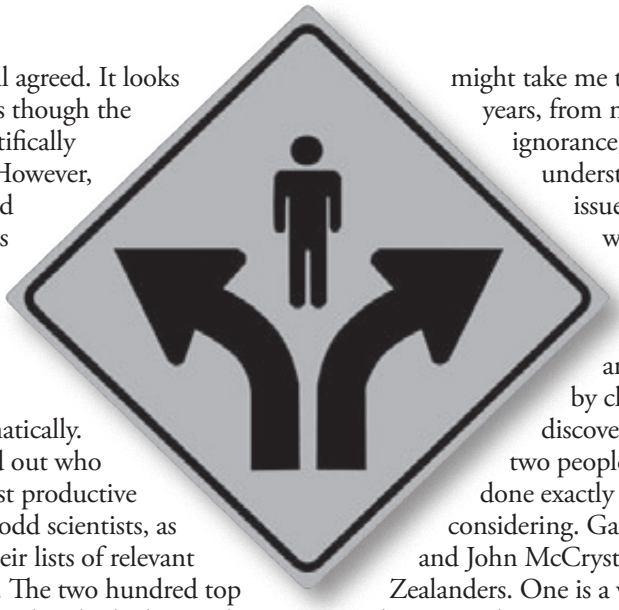
apply to the climate change controversy, because it is a genuine scientific debate. In essence it centres on whether the vast, complex models used to simulate the climate of the Earth can be trusted to any extent, or whether they are grossly misleading.

Short of spending all those years studying the science of climate change, how can I arrive at a reasoned conclusion on this matter? I have devised a method which allows me to tentatively come to some conclusions. If my method is reasonable, then it may be applied to other scientific controversies. If it is wrong, then I need to understand why.

My method begins with a suggestion by Bertrand Russell (1961). He argued that in an expert controversy, there is no certainty at all that the experts are right. However, he went on: if the experts are agreed that a particular proposition is true, then we cannot state with certainty that it is not. I would modify this a little, and say that we should take the considered opinions of scientific experts seriously. If they generally agree that something is so, we would require extremely good evidence – and a high degree of expertise – to say that it is not.

On the face of it, this looks almost as arduous as becoming a climate expert. How do we decide who is an 'expert' in a scientific area, and how do we examine what their opinions are? Luckily, this has already been done. William Anderegg and some colleagues (2010) compiled an enormous list of climate scientists who had published a report, or signed statements regarding whether or not climate change was due to human activity. Anderegg and his colleagues divided this list of 1372 scientists into those who were convinced by the evidence that humans were causing climate change, and those who were unconvinced. Roughly two-thirds of the scientists were convinced by the evidence.

Now a two-thirds majority among relevant scientists is nowhere near enough for us to conclude that the experts are all agreed. It looks very much as though the issue is scientifically undecided. However, Anderegg and his colleagues went further with their research, and this changed the picture dramatically. They worked out who were the most productive of the 1300-odd scientists, as judged by their lists of relevant publications. The two hundred top scientists were then looked at, and a rather different pattern emerged. Of the top two hundred climate scientists in the world, 97.5 per cent were convinced by the evidence that humans were influencing climate change. This is quite startling, as it means that out of those 200 scientists, fully 195 were convinced by the evidence.



The picture becomes even more extreme when the top 50 scientists were investigated. Out of the top 50, Anderegg and his colleagues found, fully 98 per cent were convinced by the evidence that humans were playing a part in changing the climate. Turn that into real people, and only one out of the top fifty scientists in the relevant area is not convinced. Given the cross-grained nature of humans, I would judge that to be as near to a consensus as any real group of people can ever reach. My tentative conclusion is that despite many claims to the contrary, it really does look as if there is an effective consensus on climate change among top scientists in the area, and the consensus appears to be that humans are playing a part. Since I take scientific opinion seriously, this suggests to me that there is a good case for accepting AGW.

The Anderegg research is one piece of evidence which, to the non-specialist, might suggest that there is an appreciable human input into climate change: a huge majority of the top scientists think that this is so. Obviously, more evidence would also be welcome. Earlier, I estimated that it might take me three to five years, from my current ignorance, to be able to understand all the issues concerned with climate change. To my amazement, and quite by chance, I discovered that two people have done exactly what I was considering. Gareth Morgan and John McCrystal are New Zealanders. One is a writer, the other an academic in a school of business. Between them, they decided to investigate the problem of climate change and decide who, behind all the shouting, was actually right.

When they began, Morgan and McCrystal (2009) were 'agnostic' on the climate change topic. They didn't know who, if anyone, was actually right. They read the relevant literature, corresponded with leading proponents and opponents, and also invited people on both sides to comment on the main arguments of their opposition. The entire exercise took them 18 months, which is conspicuously faster than I could have managed.

In their book, they review the evidence and come to a considered conclusion: "On the balance of evidence, observations of the natural world would support a coherent theory of why increased concentrations of greenhouse gases due to human activity will produce significant global warming, in which case policy initiatives to address global warming and its consequences are worth evaluating ... It has to be said that only a few of the Sceptics are actually sceptics: too many are mere gadflies and deniers." (Morgan and McCrystal, 2009: 248)

This is a pretty clear-cut verdict. Let me stress that it does not come out of the blue. Morgan and McCrystal spend a couple of hundred pages reviewing and evaluating the evidence. Indeed, their book is one of the best primers I have come across on the key issues. In addition, they have a website with

supplementary information, including pro and anti-AGW arguments. (Morgan and McCrystal 2010)

You may think that the last sentence of the quote is rather unpleasant to those who do not accept human influence on climate change. However, Morgan and McCrystal are at least equally tough on the other side. The scientists of the International Panel for Climate Change – the chief proponents of human-induced global warming – are characterised as arrogant, as being atrocious communicators and as having lost the public debate over the issue. In addition, scientists on this side are heavily criticised for the 'hockey stick' fiasco, in which a statistical curve was unjustifiably fitted to a range of data. On the other hand, Morgan and McCrystal's conclusion about the 'anti' case is pretty tough: "Scientifically meritorious argument against the theory of anthropogenic global warming tends to be thin on the ground." (Morgan and McCrystal 2009: 244)

It is worth noting that Morgan and McCrystal also add that much is uncertain about the future of climate change. Because of the uncertainty in the scientific models, neither the degree of warming nor its timing can be clearly established. I might also add that once we have accepted that we are causing climate change, there still remains the issue of how grave a problem it will be, and what we should do about it. These are separate issues, even more fraught by uncertainty.

I now have two different reasons for regarding human-influenced climate change as being probably a justified theory. I know that among top scientists in the relevant field there is a near-consensus, and that Morgan and McCrystal, starting from agnosticism, have ended up endorsing that position after much research. Of course, they could be wrong. On balance, though, I have to weigh up the probabilities, and these point in a pro-AGW direction.

TWO OTHER POINTS

Two other considerations do weigh fairly heavily with me. I mention both of them with a good deal of caution, but they influence my view and they may influence those of other skeptics. First, many prominent scientific bodies have come out in support of the theory of human-induced climate change. After my presentation at the Australian National University, leading Canberra skeptic Nick Ware gave me a booklet published by the Australian Academy of Sciences (2010), titled *The Science of Climate Change.*

At the end, after reviewing the arguments and evidence, the Academy concludes: "We are very confident of several fundamental conclusions about climate change: that human activities since the industrial revolution have sharply increased greenhouse gas concentrations, that these added gases have a warming effect; and that the Earth's surface has indeed warmed since the Industrial revolution. Therefore, we are very confident that human-induced global warming is a real phenomenon." (Australian Academy of Sciences 2010: 16)

Other major scientific bodies have also made similar pronouncements. I find the statement by the Geological Society of America (2010) to be especially telling, since geologists are often among the most outspoken critics of human-induced climate change. This statement takes the view that: "... global climate has warmed and that human activities (mainly greenhouse-gas emissions) account for most of the warming since the middle 1900s. If current trends continue, the projected increase in global temperature by the end of the twenty first century will result in large impacts on humans and other species." (Geological Society of America 2010)

"How do we decide who is an expert in a scientific area, and how do we examine what their opinions are?"

Why am I influenced by statements like these? Am I deferring to people with important-sounding positions and titles? That is not my reason. In principle, it could be possible that the climate science community has got things wrong. Perhaps it is dominated by a few fanatics, or has been corrupted. These statements from major scientific bodies resemble references. They are saying, in effect, "The science here is good, and the people are trustworthy." To me, that is another point in favour of AGW.

I am influenced in my judgment by one further consideration. I will state it as carefully as I can, and request any readers to make sure that they understand exactly what I am saying, as it is very easy to misinterpret this point. Back in the 1980s, I first became involved with the Australian Skeptics over opposition to creation science in Queensland. Creation science, as we all know, is a pernicious doctrine based upon Christian fundamentalism. Its core is the view that the book of Genesis, literally interpreted, is a valid scientific theory, and can be treated as a scientific explanation of how the Earth and all its living organisms came to be. (Bridgstock 1986a)

The creationists were extremely skilful at creating organisations which looked, to the uninformed observer, exactly like scientific ones. There were research organisations such as the Institute for Creation Research and the Creation Research Society. There were 'scientific' journals, such as the *Ex Nihilo Technical Journal.* There were PhDs who would speak eloquently and with conviction about the value of the 'creation paradigm'. And there poured forth a mass of books, films and leaflets in support of creationist claims. The book co-authored by Ken Smith and myself (Bridgstock and Smith 1986) is largely a critique of this propaganda assault.

And yet it was all fake. It was, quite literally, a pseudoscience. The creationists did almost no research, and relied on misrepresentations of genuine science for their 'evidence' (Bridgstock 1986b). For a long time, though, a huge section of the population accepted that creation science was in fact scientific. In the United States, many still do.

What I learned from this was that it is possible, given sufficient resources and determination, to create a

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pseudoscience, a fake science. It will boast PhD researchers, will publish books and professional-looking journals, and will present a superficially convincing case for the most outlandish propositions.

How do you recruit PhDs for this kind of enterprise? I think there are two ways. No matter how weird your views, it is likely that somewhere in the research world there will be a few people with perfectly genuine PhDs who believe as you do. They can be hired and put to work. Then, other people friendly to your cause can gain PhDs through 'degree mills' which exist in the USA and, from time to time, in the UK. One prominent creation scientist, apparently, gained his PhD through a 'university' situated in a Florida motel! (Bridgstock 1986b). In short, given sufficient resources and determination, it is possible for someone with any belief – no matter how weird – to create a pseudoscience which supports his ideas. Obviously, we should be very wary of accepting the claims of any such pseudoscience. The problem remains, though, of how non-specialists tell the real from the fake.

There seem to be only two ways of working out whether a given body of dissenting knowledge is a genuinely scientific movement, or whether it is a constructed pseudoscience. One way is to acquire expertise. As I have already indicated, it could take several years to progress from being an ignoramus on a specialised topic to the point where one can make sense of it. The other way is to look at key indicators of scientific status. For example, have the proponents of the scientific dissent published papers in major scientific journals? Are an appreciable number of them widely acknowledged by their scientific peers as being first-rate authorities in the discipline?

Although the pseudoscience of creationism marshalled a fair array of PhDs, it turns out that many of them were not in relevant specialties, and some were actually bogus. What is more, creation scientists made very little contribution to the scientific literature. Therefore, this strongly suggests that they were, in fact, pseudoscientists.

I am not suggesting that people who dissent from climate change are pseudo-scientists. However, it does seem uncomfortably true that the dissenters have contributed relatively little to the top work in climate change, which again rather resembles the contribution of creation scientists. Therefore, a handful of major papers in top journals would go a long way to dispel the question mark which hangs, in my mind, over climate change dissent.

CONCLUSION

In this paper, I have tried to show how a non-scientist like myself can arrive at a reasoned conclusion about a complex scientific issue. I first noted that an overwhelming majority of top climate scientists do appear to accept that human activity is contributing towards global warming. Second, two non-scientists have already done what I was considering doing, and analysed the arguments and evidence pro and con, to come to a qualified conclusion that AGW is indeed happening. Third, major scientific associations, including the Australian Academy of Science and the Geological Society of America, have come out strongly in support of AGW. Finally, I am a little uneasy at the apparent similarity between some aspects of climate change dissent and the creation science movement: I would like to be convinced that the resemblance is only a passing one. Taken together, these points suggest to me that the case for AGW is probably strong enough to accept.

All of my reasoning and conclusions could be wrong. In that case, it should be possible to point out my errors and make an even better case for another conclusion. In the meantime, I am going to read relevant work by Lord Nicholas Stern and the International Panel on Climate Change. The question of what is to be done about climate change is at least as tricky as the question of whether it is happening. ■

References

1. Anderegg, W. R. L., James W. Prall, Jacob Harold and Stephen H.Schneider (2010) "Expert credibility in climate change". *Proceedings of the National Academy of Science 107*, 27, July 6: 12107-12109
2. Australian Academy of Science (2010) *The Science of Climate Change*. Canberra, ACT. Australian Academy of Science. (A fully-referenced version is available online at www.science.org.au/policy/climate change 2010.html)
3. Australian Skeptics (2010) Our Aims (http://www.skeptics.com.au/about/our-aims) Accessed November 9, 2010
4. Bridgstock, Martin (1986a) "What is the Creation Science Foundation Ltd?" In Bridgstock and Smith (eds) *Creationism: An Australian perspective.* 81-85.
5. Bridgstock Martin (1986b): "But lots of creationists are scientists, and with so many brilliant people on both sides shouldn't it be taught?" in Bridgstock and Smith (eds) *Creationism: an Australian perspective.*12-13.
6. Bridgstock, Martin and Smith, Ken (eds) (1986) *Creationism: an Australian perspective*. Melbourne, Australian Skeptics.
7. Evans, Ray (2010) "Laputans in Retreat". *Quadrant*, 54, 7-8, July-August; 19-21
8. Geological Society of America (2010) Climate Change (http://www.geosociety.org/positions/position10.htm) Accessed September 5, 2010.
9. International Panel on Climate Change (2010) Publications and Data (http://www.ipcc.ch/publications-and-data/publicatons-and-data.htm). Accessed September 10, 2010.
10. Morgan, Gareth and McCrystal, John (2009) *Poles Apart. Beyond the shouting, who's right about climate change?* Melbourne: Scribe.
11. Morgan, Gareth and McCrystal, John (2010) *Poles Apart. Website.* http://www.polesapart.com/
12. Russell, Bertrand (1961) *Sceptical Essays*. London, Allen & Unwin

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