Ockham's Razor 1

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Some twenty years ago the Western world began to worry about a phenomenon called 'global warming'. Scientists had become aware that temperatures were rising, and they believed that the warming was due to increased levels of carbon dioxide in the air. What had produced this change? Well, the scientific view was that we human beings had brought about the change ourselves, through our need for petrol to run our cars and planes, and for coal to produce electricity, actions which give off carbon dioxide. Our modern civilisation depended on both these fossil fuels, and the developing countries were keen to follow our example. But, said the Intergovernmental Panel on Climate Change (the IPCC), the scientific peak body with a deep interest in this issue, to increase the concentration of carbon dioxide in the atmosphere would be to increase air temperature, and ever-increased air temperature would change the earth's climate patterns, melt polar ice, rise sea levels and cause deserts to form. We would have to stop these emissions. Some deeply worried people have since told us that we had only two years to turn around our behaviour. One or two have said that it was already too late.

So the world's governments met in forum after forum, and agreed that they should do something about it. In Kyoto, in 1997, most of them agreed to a planned reduction in carbon use that would have the effect of reducing the emission of carbon dioxide. Quite how this would be done no one was sure, and the United States of America and indeed our own country, Australia, did not sign up to these targets. In time the term 'global warming' was replaced by 'climate change', and this had the effect of bringing a wider range of climatic behaviours to public attention. In 2006 the film 'An Inconvenient Truth', presented by former US Vice-President Al Gore, drew large audiences and much public attention, and led in time to the award of the Nobel Peace Prize to Gore and the IPCC itself. As the Australian electorate prepared in 2007 for the coming federal elections, the importance of global warming in the public mind was made clear when the Howard Government suddenly switched its position on Kyoto. The then Leader of the Opposition, Kevin Rudd, had already declared that if his party were elected Australian would sign the Kyoto Protocol. His party was indeed elected, and Mr Rudd did sign Australia up.

In this broadcast I want to delve into the question of global warning to see what is at the heart of it, and then, in the one that follows, I want to explore why the issue is such a difficult one — why, for example, we don't already have a tax on carbon or on carbon dioxide emissions, if the future is so bleak. I need to say at once that I have not been trained in the natural sciences, but then, nor has the Federal cabinet, which will have to decide on what measures to adopt, nor has the great majority of the Australian public service which advises it, and nor have most of the listeners to this program, I should imagine, let alone the twelve million or so in the Australian electorate. There is nothing especially unusual about this state of affairs, because the extent of human knowledge is now vast, and experts are only authoritative in very small domains. But since new taxes are proposed in order to deal with the increasing concentrations of carbon dioxide, and since we are all affected by taxes, we are all entitled to find out as much as we can.

In fact, the central questions in this issue are quite straightforward. There are three of them, and they lead naturally to others. I need to warn you that though the questions are straightforward the answers, at least in my opinion, are less so. The questions are these: first, is the earth warming? Second, if it is warming up, is this warming unprecedented? Third, to what extent are humans and their use of fossil fuels the cause of any warming that has occurred? You will see at once that all these questions are about measurement, and you might guess that we only have really good data for the last hundred years or so — or, in the case of satellite measurements, the last twenty years. Outside the recent past everyone has to rely on what are called 'proxies', some of them most ingenious. One other preliminary is the comment that although what we are dealing with is now conventionally called 'climate science', people who work in the area come from many different disciplines, partly because climate science is a new field, and partly because it so far relies on the techniques of other fields, like physics, chemistry, geology, marine science, statistics and so on. You might not be surprised to learn that scientists from several disciplines all working in the same field can sometimes disagree with one another about what they have found and what it means.

Well, is the earth warming? It depends on the period you are talking about. If we take the last ten thousand years, no — the temperature seems to have cooled ever so slightly. Too far away for you? If we look at the last century, then it warmed from about 1910 to 1940, when it stopped warming, It warmed again from 1975 to 1998, and then it stopped warming again. The IPCC has made an estimate of the warming over the 20th century, which it puts at 0.6ºC ± 0.2ºC. The second warming period, from 1975 to 1998, coincided with a steady increase in the atmospheric concentration of carbon dioxide, and it is just this coincidence that alarmed scientists in the 1980s. I should say that not everyone agrees that you can derive a meaningful average temperature for the earth's atmosphere, and I have my own doubts about the validity and reliability of the measurements themselves. But most of the doubting Thomases will accept the IPCC's estimate, if only because it doesn't seem very large to them. It is also consistent with the retreat of most glaciers, and other observable phenomena.

Is such a level of warming unprecedented and/or worrying? Here there is considerable disagreement. It will be plain to you that the IPCC is worried, and in one of its four major reports it went to some trouble to argue that the warming of the late twentieth century had no counterpart in the last thousand years. This claim was hard to accept, since there is abundant evidence both of a mediaeval warm period, when the monasteries in England grew grapes and made wine, and of a later 'little ice age', when the Thames froze and a frost fair was held for a few months in 1683 and 1684 on the frozen river in central London. The little ice age only came to an end in the late 18th century, and when temperatures began to rise, as they did in the 19th, the glaciers started to melt and retreat. It may be that the warming that has occurred is largely a return from a cold period. In any case, the paper on which the IPCC's claim relied was subject to intense scholarly criticism, and was dropped from and not referred to in the IPCC's most recent report.

Much of the argument about temperatures in the past has been based on ice-cores from Greenland and Antarctica (where the ice can be kilometres thick) and the information that is contained within them. Obtaining, storing and analysing these ice-cores is expensive and time-consuming. But they seem to show that the last ten

thousand years, a period that geologists call the Holocene, has been a time of relatively even temperatures, with warmer and cooler periods that do not depart very much from the average. Our present average temperature is not yet at the level of the peak in the medieval warm period. On all the evidence I think we are entitled to say that if there is warming it is not yet either alarming or unprecedented.

To what extent has human activity caused the warming? Here disagreement is central, and abundant. The IPCC argues that basic physics shows that carbon dioxide is an important greenhouse gas, and that increased amounts of carbon dioxide must raise the temperature. There is no doubt that the concentration of carbon dioxide in the atmosphere is increasing, at between 1 and 2 parts per million each year. It is at least likely that human activity is responsible for some of that increase. The correlation between the increase in carbon dioxide and the increase in temperature over the past century, however, is not strong, and over the last ten years is nil. Moreover, the contribution of carbon dioxide in raising temperature is logarithmic and diminishing. This means that increasing amounts of carbon dioxide produce smaller heating effects. To give an example, the doubling of the argued pre-industrial level of carbon dioxide, which is said to be 280 parts per million to 560 parts per million (today's level is 385 ppp) will have the same effect on temperature as the next doubling, from 560 ppm to 1160 ppm. What is more, we do not know a great deal about the interaction between carbon dioxide, water vapour and clouds, so that estimates of the effect of increased concentrations of carbon dioxide will have a wide range of possibilities. Most of us know about greenhouse gases, and that it is the greenhouse effect that makes life possible for us. It is possible that increasing temperatures could also lead to more cloud, which might lead to a cooler or a hotter climate. It depends. On the evidence it is not obvious that an increase in the earth's atmospheric temperature would be a bad thing. A substantially cooler temperature, however, would reduce the growing season for food crops. It is worth remembering that the little ice age was a time of food shortages, and was also the time where, in the search for explanation, witches were burned to expiate the evil thought to have caused God's wrath.

There are echoes of that sentiment today, and because carbon dioxide currently has a bad press, it is worth remembering that all animals depend upon it because it is the chief plant food, and all of us eat plants and/or the animals that eat plants. For my part, I am as yet unpersuaded that there is good evidence to support the claim that the increase in carbon dioxide concentrations is alarming, and the IPCC has not provided it. What it has done is to model climate, and to provide forecasts of the kinds of climate we might have if various futures were to take place. Some of those forecasts are dire. But models are models; they are not the real thing, and they don't prove anything.

To sum it up, the earth may be warming, but if so it may well have been warming slowly for the past century and a half, after a long cool period. There have been other warm periods in the past, just as there have been other cool periods. Yes, carbon dioxide concentrations are increasing, but it is not plain that they are causing temperatures to rise, and they are not harmful to us, at least yet..

You are entitled to ask how all this can be, given our government's agreement to Kyoto, and the near unanimity of public discussion on climate change, where

greenhouse gas emissions are said to be the central problem. It is a puzzle, and in my next talk I will set out to provide an explanation.

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