10 Climate change: life and death

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Ethics and danger

The United Nations Framework Convention on Climate Change (UNFCCC) is the treaty in which nations agreed to try and control climate change. It has been signed by virtually every nation on Earth. It declares in Article 2 that:

> The ultimate objective of this Convention . . . is to achieve . . . stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

This article of the UNFCCC has set the agenda for subsequent political discussion and negotiations. To speak very roughly, the international process under the UNFCCC has three stages. First of all, the negotiators and their advisers try to work out what would be dangerous anthropogenic interference with the climate system. Then they try to work out how much greenhouse gas can be emitted without reaching this dangerous level they have fixed on. Finally, they try to reach an agreement about how to divide up those permissible emissions among the nations.

It is widely recognised that the last stage raises ethical issues. The allocation of emissions permits raises some difficult ethical questions. How far are the present members of a nation responsible for the harm that is done by their ancestors' emissions? How far are they responsible for the harm done by their own emissions made before they knew they were harmful? How far should the distribution of emission permits take into account the present maldistribution of so many of the Earth's other resources? Should it try to correct for this maldistribution? Should nations whose population grows be awarded increased emissions as a result? And so on.

It is widely recognised that there is a role for moral and political philosophers in answering questions like these. They are mostly questions of fairness or justice. Most philosophers of climate change are political philosophers, and political philosophy is these days very much focused on justice. So many philosophers of climate change are content to concentrate on this third stage of the political process.

A consequence is that the other two stages have been left mostly to scientists and economists. The question of what concentration of greenhouse gas would be dangerous is left mostly to them. Stemming from their work, a consensus has emerged in the political process around the ill-founded idea that it would be dangerous to let temperatures get higher than two degrees above the pre-industrial level.[1] In 2013, Working Group 1 of the Intergovernmental Panel on Climate Change (IPCC), which contains no philosophers, implicitly endorsed a target of keeping cumulative emissions below one trillion tonnes of carbon dioxide.[2] Their grounds are that this would give us a two-thirds chance of holding warming below the two degree level.

These are weak grounds. There is evidently an important role for moral philosophers in answering the question of what is dangerous. It will be the subject of this chapter. The notion of dangerousness is plainly an evaluative one. To work out what interference with the climate system is dangerous, we need to know, not only what effects would result from different degrees of interference, but also how good or bad those effects would be. Ethics, and specifically value theory, is the discipline that assesses goodness and badness. So we need ethics.

It seems not to be clearly understood by all the protagonists that there is an academic discipline that deals with values. The *Synthesis Report* of the Third Assessment Report of the IPCC – again written without a contribution from philosophy – declares that:

> Natural, technical, and social sciences can provide essential information and evidence needed for decisions on what constitutes 'dangerous anthropogenic interference with the climate system'. At the same time, such decisions are value judgements determined through socio-political processes, taking into account considerations such as development, equity and sustainability, as well as uncertainties and risk.[3]

Here the authors recognise that dangerousness is not a matter for science alone, because it involves values. But they seem to assume that judgements about value have to be 'determined through socio-political processes'. They seem not to recognise that values can be investigated by philosophy.

True, in some cases the ethical aspects of dangerousness are so easy to understand that they raise no questions for philosophy. These are cases where

[1] The history of this consensus in described in C. Jaeger and J. Jaeger, 'Three views of two degrees', *Regional Environmental Change*, 11 (2011), 815–26. An example of target-setting by scientists is J. Hansen *et al*., 'Target atmospheric CO_2: where should humanity aim?', *Open Atmospheric Science Journal*, 2 (2008), 217–31.

[2] The IPCC is officially 'policy-neutral'. However, the two-degree target and the trillion-tonne target are given prominence in Working Group III's *Summary for Policymakers*, 25. The trillion-tonne target was also evidently made prominent in the press conference that launched Working Group III's report, since it was widely reported in the press.

[3] IPCC, *Climate Change 2001: Synthesis Report,* question 1, section 1.1.

the physical conditions are like a cliff. It is not difficult to work out that you should not walk over a cliff, even if it is hard work or very costly to avoid doing so. The consequences of doing so are so obviously dire that you do not have to think about precisely how bad they are. All you need to know is where the cliff is. A map of the physical geography will tell you that. You need no advice about value.

Climate change could be like a cliff. It could be that the consequences of climate change will be only moderately bad so long as the concentration of greenhouse gas stays below some threshold, but disastrous if it goes beyond the threshold. For example, it might be that, if we pass some threshold, all the methane buried under the Arctic Ocean will bubble up and cause runaway global warming. This threshold would be like a cliff. If there is a cliff, and if scientists could work out where it is, there would be no need for moral philosophy. We would need only scientists to tell us where the cliff is. Scientists could determine the point where our interference with the climate system would become dangerous.

But even if there is a cliff, scientists have not been able to work out where it is. We do not know what concentration of greenhouse gas, if any, will take us over a cliff. One thing we do know is that the greater the concentration of greenhouse gas, the greater our risk of falling over a cliff. Suppose we assume that falling over a cliff would lead to some extremely large amount of harm. What is the expectation of that harm? I mean the mathematical expectation, which is the amount of harm multiplied by the probability of its happening. For a low concentration, the probability that we fall over a cliff is small, and so is the expectation of harm, therefore. With increasing concentration, the probability of falling over a cliff increases, and so does the expectation of harm. So, even if there is a cliff in terms of actual harm, because we do not know where it is, in terms of expectation we have a downward slope rather than a cliff.

There are also actual harms that increase with concentration in a way that is not cliff-like. For example, as temperatures and sea levels rise, farmland and people's homes vanish underwater, and farming becomes harder. These harms steepen the downward slope of expectations that is created by the risk of a cliff. Just as there is uncertainty about the cliff, there is a great deal of uncertainty about these harms too. We do not know how quickly temperatures and sea levels will rise. So expectations of harm are all we have to go on, and we face a downward slope of expectations as concentrations of greenhouse gas rise.

Given that, what concentration leads to dangerous interference with the climate system? This question needs to be framed more precisely. Some dangers are worth accepting for the sake of the benefits that can be gained by accepting them. For example, some dangerous surgery is worth the risk it poses. Evidently, the UNFCCC does not mean to refer to acceptable danger, but to danger so great that it ought to be avoided. Our question should therefore

be: what concentration of greenhouse gas is so dangerous that we ought to keep below it?

Indeed, dangerousness is not really the issue. A situation is dangerous when there is a risk of a great harm – a risk of going over a cliff as I put it. Climate change poses that risk. But it also creates harms that increase steadily with the concentration of greenhouse gas. These are bad but not exactly dangerous. Nevertheless, they are an important part of the problem. So what we really need to know is simply what concentration we should keep below.

The 'should' in this question is a moral one. Science and economics can provide data to help answer it, but they cannot provide the whole answer. That also demands judgements of value. We can act more or less strongly to reduce emissions of greenhouse gas. Stronger action has the benefit of reducing concentrations, which reduces the expectation of harm. But stronger action has costs. For example, we could ban all air travel, and the eating of meat, and that would damage the interests of many people. It is not obvious whether or not the benefit gained would be worth this cost.

To know what actions are worthwhile, we have to balance costs against benefits. That requires setting a value on them. We have to assess how good and bad are the various different effects. Science can tell us what these effects might be, and how likely each one is, but it cannot tell us how good or bad they are. The necessary judgements of value ultimately have to be founded on ethics.

In practice, the detailed calculations of value will have to be done by applying the quantitative methods of economics, using data derived from science. This is just because climate change is a hugely complicated problem on a huge scale, involving the balancing and aggregating of different values across the whole globe and across centuries of time. But the foundations of these economic methods must be ethical. The economics of climate change is at heart an application of ethics.[4]

Expected value

Why do I say it is expectations of costs and benefits that we should care about? This claim is already a conclusion of ethical theory. It is by no means obviously true, although the idea of basing decisions on expectations is intuitively attractive once you see it. Since it will be important later, I shall introduce it by means of an example.

[4] As is well recognised in *The Stern Review*: N. Stern, *The Economics of Climate Change: the Stern Review* (Cambridge University Press, 2007), particularly 23–4. On the other hand, many economists deny that their discipline rests on foundations of ethics. Examples are the two reviews of *The Stern Review* published in the *Journal of Economic Literature*, 45 (2007), by W. Nordhaus (686–702) and M. Weitzman (703–24).

When the results of your acts are uncertain, on what basis should you decide what to do? You might at first think you should do what is most likely to have the best results. But that would be a bad mistake. You can see why by thinking about whether or not you should buy a fire-extinguisher. Your house is unlikely to catch fire. A fire-extinguisher costs money, and if you do not buy one but your house does not catch fire – as is most likely – that money will be saved. So if you base your decision on what is most likely to happen, you will not buy a fire-extinguisher.

However, that is not what you ought to do. If your house does catch fire and you have no fire-extinguisher, the result will be dire. This unlikely but possible consequence is so bad that (for most of us at least) it makes it worth buying a fire-extinguisher to prevent it. The lesson is that, when you are uncertain of the results of what you decide, your decision should not be based on what is most likely to happen.

This is an important lesson for climate change. When deciding what to do about climate change, the important thing may not be what is likely to happen. The important thing may be what is unlikely to happen, but may. The most likely result of increasing greenhouse gas is two or three degrees of further warming. But the unlikely possibility of eight or ten or twelve degrees might be a more important consideration, since its consequences would be catastrophic. I am not saying this is so; only that it may be so. We need at least to think about whether it is so. Is climate change a fire-extinguisher case?

The lesson so far is that we should not base our decision on what is most likely to happen. What is the correct criterion, then? It is expectation. More exactly, it is expectations of benefits and costs. This is the conclusion of our standard theory of right action in the face of uncertainty, which is known as 'expected value theory'. I shall not here try to demonstrate the truth of this theory; that requires some difficult theoretical work.[5] Nevertheless, I shall take its truth for granted.

The fire-extinguisher example does not demonstrate its truth, but it does illustrate how expected value theory delivers a correct result. Suppose you do not have a fire-extinguisher, so that if your house catches fire it will burn down. Your expectation of harm – given that you have no extinguisher – is the badness

[5] The main argument was first propounded by F. Ramsey, 'Truth and probability', in D. H. Mellor (ed.), *Foundations: Essays in Philosophy, Logic, Mathematics and Economics* (London: Routledge and Kegan Paul, 1978), pp. 58–100. It was developed by J. von Neumann and O. Morgenstern in *Theory of Games and Economic Behavior* (Princeton University Press, 1944), by L. Savage in *The Foundations of Statistics* (NY: John Wiley and Sons, 1954) and by R. Jeffrey in *The Logic of Decision*, 2nd edition (University of Chicago Press, 1983). These authors demonstrate that you should maximise the expectation of something generally called 'utility'. It takes a further argument to show that utility is a measure of value, so that you should maximise the expectation of value. This argument appears in J. Broome, *Weighing Goods* (Oxford: Blackwell, 1991).

of the house burning down multiplied by the small probability of its doing so. The badness is so great that, even multiplied by the small probability, it outweighs the cost of a fire-extinguisher. So according to expected value theory you should buy a fire-extinguisher. That is the correct conclusion.

Killing

We need to judge the value of the benefits and costs of different responses to climate change, and compare them together. This valuation must ultimately be based on ethical considerations. I shall next describe some of the ethical issues climate change raises. There are many. Some are easy to deal with and some hard. I shall mention some of the harder ones. These are issues of life and death.

Climate change will kill many people. It has various means of killing. The most obvious is the direct effect of heat. Because of climate change, heat waves are becoming more frequent, and heat waves are killers. A decrease in the number of cold waves is also expected, but cold waves do not kill people in such numbers as heat waves do.[6] There are also other lethal direct effects of weather, such as floods and storms. But direct effects kill comparatively few people in comparison with the effects of climate change that work less directly through disease and malnutrition. Climate change makes people more vulnerable to tropical diseases including malaria and diarrhoea. It also disrupts farming, which increases poverty and malnutrition, through either famines or chronic lack of food.

We need some idea of numbers. These are hard to come by, and estimates can only be extremely rough. It is not even easy to know how many deaths are already being caused by climate change, and predicting the number of future killings is harder. A few figures have been published. The World Health Organization (WHO) has estimated that in 2004 about 141,000 deaths were caused by climate change.[7] The Global Humanitarian Forum extended the WHO's methods more recently and reached the figure of 300,000 deaths caused by climate change in 2010.[8] They say this is a conservative figure. At the moment we have had less than one degree of global warming, and we are almost sure to get twice that much in the next few decades. I doubt we would be overestimating if we assumed that, from a few decades from now onwards, climate change will kill around half a million people a year. There is no clear

[6] IPCC, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Summary for Policymakers*, A Special Report of Working Groups I and II of the IPCC, C. B. Field *et al*. (eds.), (Cambridge, UK and New York, USA: Cambridge University Press, 2012), pp. 1–19, p. 11.

[7] WHO, *Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks* (Geneva: WHO Press, 2009), p. 50.

[8] Global Humanitarian Forum, *The Anatomy of a Silent Crisis: Climate Change Human Impact Report* (2009), www.ghf-ge.org/human-impact-report.pdf, last accessed 10 October 2014, p. 1.

end to all this killing. If it goes on for decades, it amounts to tens of millions of deaths attributable to climate change.

This is an important part of the harm that climate change will do. One of the benefits of controlling climate change will be to reduce the scale of this harm. In order to decide what we should do about climate change, we need to evaluate the benefits of acting and compare them with the costs. The costs are the efforts we have to put in: the sacrifices we bear to reduce emissions. These are things like travelling less, eating less meat, insulating buildings and diverting some of our consumption towards reducing emissions. The benefits include saving lives. How can we possibly compare that benefit against our more mundane sacrifices?

Economists are well used to making comparisons of this sort. For example, governments spend money on making roads safer. In doing so they are guided by just this sort of comparison. It is a routine of transport economists. They have a value for human life, measured in terms of money, and they compare the value of the lives saved with the cost of saving them. Health services make similar comparisons. For example the UK's National Institute for Clinical Excellence values a person's life at between £20,000 and £30,000 per year.

There is a lot to criticise in the way economists arrive at these numbers in practice, but I am not going to discuss their methods. Instead I shall discuss the principle – the whole idea of setting a value on life in terms of money. Many people find this idea horrifying. Life is sacred, they think, and we should not assign a money value to it.

What could we do instead? One possibility would be to treat lives as infinitely valuable. But that would be wrong. It would clearly be wrong to preserve lives at all costs. If a health service did this, it would not use any of its resources to improve lives in any other way than by extending them. It would do no hip replacements, for example, because hip replacements do not extend lives; they only save people from great pain. But clearly it is sometimes worth improving people's lives in this way.

Our lives are not infinitely valuable. You might nevertheless think it wrong to assign them a finite value in terms of money. Your view might be that not all good things are commensurable in value; their values cannot all be measured on the same scale. Climate change will destroy some of the beauty of nature, and this is a great loss. It will destroy many species of plants and animals. It will destroy the cultures of Arctic peoples. It would be a misunderstanding of these losses to assign them a monetary value that puts them on the same scale as not having foreign holidays and eating less meat. These goods are not all commensurable with each other, you might think.

There are indeed genuine incommensurabilities of value. Intuitively, we encounter them within our lives; we face them in many of the decisions we

make for ourselves. Take a teenager who is choosing between a career in medicine and one in music. These two ways of life realise values that are very different from each other. It seems implausible that their values can be precisely weighed against each other. You might think that human life is similarly incommensurable in value with the mundane goods whose value can be measured in money.

But that would be a mistake. What is this value of life we are considering? It is the value of having a longer life rather than a shorter life. If your life is saved, you are not given some completely new thing; you are given more of what you have already. And what is the good of that? Well, living is good because good things come to you while you live. You get to have fun with people, visit beautiful places, paint pictures or look at them, go on holidays, eat nice food and all the other worthwhile things you do. These are just the mundane good things of life. The harm death does is to take these goods away from you; missing a foreign holiday is the same loss to you whether it happens because you are saving carbon dioxide emissions or because you die before you travel. Conversely, the good of life saving is to give people more of these mundane goods. Since the good of life saving is made up of mundane goods, it cannot be incommensurable with them. True, there may be incommensurabilities among the mundane goods themselves, but the value of life is not separately incommensurable with them.

The upshot of this is that, when we come to assessing what we should do about climate change, we shall not encounter ultimately intractable ethical questions surrounding the saving of people's lives. To be sure, there are difficult questions, but in principle they are ones we can handle with the methods of ethics we have.

Ethics of population

The real difficulty arises at the other end of life. There are two ways to add more life to the world. One is to extend the lives of already living people; the other to create more people. I now turn to the second way. Creating more people adds to the Earth's population, so I am turning to the ethics of population. Here there really are difficult problems.

They cannot justifiably be ignored when we think about how to respond to climate change. The growth of the Earth's population is one of the major causes of climate change. Reciprocally, climate change will influence the Earth's population. It follows that any action we take to limit climate change will also influence the population. This is the elephant in the room of climate change ethics. It is a huge ethical problem for climate change, but it is generally ignored.

How is population treated by people who think about climate change? Take William Nordhaus as an example. Nordhaus is an economist who has been working on climate change as long as anybody; he is one of the most important figures in the field. He created an 'integrated assessment model' called DICE, which he uses for comparing alternative approaches we might take to managing climate change. He uses this model in order to evaluate each of the different programmes we might follow.

Each programme involves putting a particular amount of effort into reducing greenhouse gas emissions, and distributes this effort over time in a particular way. For example, one programme puts a lot of effort into reducing emissions very soon. Another gradually increased the amount of effort over time. Nordhaus uses the DICE model to predict the effects of each programme and to set a value on each. His aim is to identify the best. He aims to 'optimise', that is to say.

This is a project within ethics. When Nordhaus sets a value on different programmes, he engages in ethical judgement. It requires the mathematical methods of economics to apply ethics to the extraordinarily complex problem of climate change, but these methods must be built on ethical foundations. Nordhaus himself is reluctant to recognise the ethical basis of what he does.[9] But in fact the 'objective function' he uses to evaluate alternative programmes within the DICE model embodies Nordhaus's own ethical theory. It reveals his ethics of population.

The function is:[10]

$$W = \sum_{t=1}^{T\,max} u[c(t), L(t)]R(t)$$

where

$$R(t) = (1+\rho)^{-1}$$

and

$$u[c(t), L(t)] = L(t)[c(t)^{1-\alpha}/(1-\alpha)]$$

The notation is as follows. W is the objective that is to be maximised – overall value, we may say. t is time, which is divided into discrete moments that are indexed from one up to *Tmax*. $c(t)$ is consumption per capita at time t. $L(t)$ is population at time t. $U[c(t), L(t)]$ represents the overall value of the world at time t. $R(t)$ is a discount factor that gives less weight to value at later times than

[9] W. Nordhaus, 'A review of the *Stern Review* on the economics of climate change', *Journal of Economic Literature*, 45 (2007), 686–702. See especially pp. 691–2.

[10] W. Nordhaus, *A Question of Balance: Weighing Options on Global Warming Policies* (Yale University Press, 2008), p. 205.

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to value at earlier times. ρ is the discount rate. α is a parameter known as the 'elasticity of marginal utility of consumption'.

The formula

$$c(t)^{1-\alpha}/(1-\alpha)$$

stands for per capita well-being (Nordhaus would call it 'utility') at time t. Per capita well-being at a time is assumed to be a function of per capita consumption at that time, and the parameter α fixes the precise form of the function. The form does not matter here. The function determines *temporal* well-being: how well a person's life goes at the time. Temporal well-being must be distinguished from *lifetime* well-being, which is how well a person's life goes as a whole.

In Nordhaus's objective function, per capita temporal well-being at a time is multiplied by the population at that time. The resulting product is the total of temporal well-being at the time. This total is then multiplied by the discount factor, and added up across time to give the overall value that constitutes Nordhaus's objective. The resulting formula represents the ethical theory that Nordhaus assumes.

It shows that, in the ethics of population, Nordhaus adheres to a discounted version of 'total utilitarianism'. Total utilitarianism is the theory that the value of a world is the total of the lifetime well-beings of the people who live. Had Nordhaus set his discount rate at zero, the theory implied by his objective function would have been exactly total utilitarianism, with the added assumption that a person's lifetime well-being is simply the total of the temporal well-being she enjoys in her life. Actually Nordhaus assumes a positive discount rate, which is a complication. It implies that a person's lifetime well-being is a discounted total of her temporal well-beings – discounted in a way that gives less weight to later times in her life than to earlier times. It also implies that the lifetime well-beings of people who live later in time are less valuable than the lifetime well-beings of those who live earlier. Nevertheless, it is fair to treat Nordhaus's implicit theory as a version of total utilitarianism.

Nordhaus did well to multiply per capita temporal well-being at each time by the population. Had he not done so, his implied ethical theory would have been that the value of the world is the discounted total of per capita temporal well-being at each time. This theory is absurd. It implies it would be better if everyone whose temporal well-being is below the average were to die.

What difference does Nordhaus's ethical theory make to his conclusions about climate change? Since Nordhaus multiplies well-being per capita by the number of people, the effect is to give more weight in his valuations to the quality of life at times where there are more people in the world. That is to say, it gives more weight to the future. This makes a significant difference to his conclusions. Most of the action in the economics of climate change revolves around balancing the interests of the future against the interests of the present.

Climate change policy, looked at from this point of view, is a matter of the current generation's sacrificing its own well-being for the sake of promoting the well-being of future generations. By adopting total utilitarianism, Nordhaus is giving some more weight to the future. As a separate matter, Nordhaus applies a discount factor to well-being, which is to give less weight to the future. His total utilitarianism counteracts his discounting to some extent.

This is a significant consequence. But the full importance of population ethics in climate change does not emerge in Nordhaus's work, because Nordhaus treats the growth of population as exogenous. He does not consider the effects of climate change, and of policies that respond to climate change, on the Earth's population. If he did allow for endogenous population, he would be inclined to favour policies that add people to the world. This is a natural consequence of total utilitarianism. Total utilitarianism implies that, for any given level of well-being (provided it is counted as a positive rather than negative level), the more people who enjoy well-being at that level the better the world is.

Most people find total utilitarianism, whether discounted or not, unattractive. Most of us care about how things go for the people there are. We want to make life better for them. We do not attach value to the number of people. We think that adding new people to the world is not in itself a good thing, even if those people will be well off. If well-being is added to the world by making a person who already exists better off, that is a good thing. But if well-being is added to the world by creating a new person to enjoy it, that is not in itself a good thing. Prolonging the life of an existing person is normally a good thing because it normally adds to the goodness of the person's life as a whole, but creating a new life is not a good thing, even though both these actions bring it about that more good life is lived. In the words of Jan Narveson, 'we are in favour of making people happy, but neutral about making happy people'.[11]

What was the Chinese government thinking of when it introduced its one-child policy, in an attempt to reduce the growth of the Chinese population? It was thinking of improving the standard of living of Chinese people. It believed it could promote their standard of living by holding back the population, so as to reduce the pressure on resources. I am sure it did not think it a consideration against its policy that it would reduce the total amount of well-being enjoyed by Chinese people, because there would be fewer people to enjoy it. In this respect, many of us think like the Chinese government.

When we see a couple who decide not to have a child, although they could have a happy child if they chose, we mostly do not think they are giving up an opportunity to make the world a better place. If they were, their decision would

[11] J. Narveson, 'Moral problems of population', *The Monist*, 57 (1973), 62–86.

be morally dubious: normally we are morally required to improve the world if we can. But we mostly think there is nothing wrong with their decision.

In sum, I think most of us are gripped by the intuition that adding a person to the world is morally neutral. It makes the world neither better nor worse. I call this the 'intuition of neutrality'.

So not only does Nordhaus's value function embody an ethical theory, it embodies one that does not accord with common intuition. I am not saying that common intuition is right and Nordhaus wrong. Indeed, it will emerge that I am more on Nordhaus's side than against it. I am simply emphasising that the ethical theory of population implicit in Nordhaus's work is significant. It cannot be taken for granted.

Climate change, population and the chance of catastrophe

How does our population ethics – whether total utilitarianism or the intuition of neutrality or something else – affect the judgements we should make about climate change? It depends on how climate change will affect the world's population, and that is not yet clear for climate change at the level that is thought likely: a few degrees. I do not know of any predictions of the demographic effects of climate change. I do not even know whether likely climate change can be expected to increase or decrease the Earth's population. We do not know how to make population endogenous to our models, and we cannot tell how doing so would affect our conclusions about climate change.

But for severe climate change, which is far beyond the likely level, things are different. Severe climate change will be catastrophic. It will drown our coastlines under the sea; it will wipe out many of our fresh-water supplies; it will make it much harder to grow crops; it will cause conflicts over our diminished resources. It will make the world much less habitable for human beings. It will inevitably cause a collapse of our population. It may even cause our extinction. What should we think of that?

This is an important practical question. Severe climate change is unlikely. However, I explained in the section 'Expected value' that unlikely possibilities are not necessarily unimportant. Indeed, they may be the most important consideration for some decisions, as they are for buying a fire-extinguisher. It depends how bad the unlikely event is. If it is extremely bad, its badness may outweigh the small chance of its occurrence. We need to know whether the chance of severe climate change is like the chance of your house burning down. We therefore need to think about how bad its results would be.

It would be very bad in one obvious way. If severe climate change causes our population to collapse, it will not do so in a nice way. The collapse will happen through horrific events: starvation, drought, disease and war. Huge numbers of

people will suffer, and many will die before their time. These are terribly bad consequences that will result from severe climate change. Their badness is independent of population ethics. Suffering and killing is bad on any theory.

However, surprisingly perhaps, all this dreadful badness is not enough to make severe climate change like the case of the fire-extinguisher. The numbers show why. Suppose, say, there is a one-in-a-hundred chance that severe climate change will kill billions. I do not think we should put the chance at more than this. Then the expected number of deaths is billions divided by one hundred, which comes to tens of millions. But I explained earlier that tens of millions of people are going to be killed even by the degree of climate change that is likely. So this small chance of killing billions does not dominate the calculations in the way that the chance of a fire dominates the calculations about a fire-extinguisher. It is a dreadful harm, but because of its small probability its expectation of badness is of the same order as the badness of killing we must expect from likely climate change. To dominate, it would have to be much greater.

Besides killing all those people, severe climate change will have another effect. It will prevent the existence of other people. Since the population will collapse, many people who would otherwise have existed will actually not exist. If we become extinct there will be no more people again, ever. Whether or not there is complete extinction, we may say that there will be many 'absences'.

The number of absences severe climate change will cause is likely to be much larger than the number of people it will kill. To take the most extreme case, suppose humanity becomes extinct. Had this not happened, humanity might plausibly otherwise have survived with a population of billions for a hundred thousand more years, renewing its population every hundred years or so. This puts the number of absences in the trillions. If absences are bad, the sheer number of them might well be a harm that makes severe climate change like the case of a fire-extinguisher.

That depends on how bad the absence of a person is, which is a question for the ethics of population. What you think about it will depend on your theory about the value of existence. I said that most of us intuitively do not value the existence of people for its own sake. We should therefore not disvalue the absence of people. Those of us who are gripped by this intuition of neutrality should not think that a collapse of population or even the extinction of people is in itself a bad thing. Many of us are not pleased by the fact that population is growing; we should therefore not be displeased if it shrinks. So from our point of view, the catastrophe caused by extreme climate change will be the huge amount of killing it will cause, not the subsequent absence of people. I have explained that the killing is not enough to make climate change like the case of the fire-extinguisher.

I think many people will find this thought a challenge to the intuition of neutrality. When we are gripped by the intuition of neutrality, we are not normally thinking about such extreme consequences of it. Thinking about a collapse of our population, or our extinction, may incline us to change our minds. Many of us also have a conflicting intuition that the extinction of humanity would be a dreadfully bad thing. This should make us think again about the intuition of neutrality.

This does not mean we have to reject it. There are separate considerations that could explain why the extinction of humanity would be a dreadfully bad thing. It may be that humanity has a value over and above the value of the people who make it up. We often think this about other species of life, and humanity has qualities that plausibly make it a particularly valuable species. We have great achievements to our credit: language, science, art, rationality, morality, civilisation. These may have a value of their own, which makes them worth preserving and developing.

To take this view, we do not necessarily have to think hubristically that they have a value from the point of view of the universe. We might think alternatively that they have a value from the point of view of humanity, viewed as a species or a collective. In the same way, a person's continuing life has a value for the person herself. Her continuing life is a good thing for her: better for her than dying. Similarly, continuing the human species may be a good thing from the point of view of humanity itself, better for us than extinction.

Rejecting the intuition of neutrality

So we are not forced to give up the intuition of neutrality by the contrary intuition that the extinction of humanity would be a bad thing. However, we should give up this intuition anyway. I do not say this on grounds of any contrary intuition, but on grounds of argument. I cannot present the full argument here, but to illustrate the way it goes I shall describe the beginning of it.[12]

The intuition of neutrality is the intuition that adding to the world's population makes the world neither better nor worse. To take a particularly simple case, compare two possible worlds. One is the actual world. The other is exactly the same, except that there is an extra person added to the population. Everyone else in the other world is exactly as well off as she actually is. In practice, some people would undoubtedly be affected by the existence of the extra person – her parents for instance. But imagine that anyone who is affected for good or ill by

[12] See Broome, *Weighing Lives*, chs. 11 and 12.

the extra person's existence has her well-being improved or damaged in some exactly balancing way, so that the net effect on her well-being is nothing. The intuition of neutrality implies that the world where an extra person exists is neither better nor worse than the actual world where she does not exist.

The intuition splits at this point into two versions. According to the strong intuition of neutrality, as I shall call it, the two worlds in this example are equally good. According to the weak intuition on neutrality, they may be incommensurate in value. I shall show that the strong version is false.

The strong version claims that the two worlds I have described are equally good. Now take a third world. It is exactly like the second one, containing the same people including the same extra person. But in this third world, the extra person is better off than she is in the second world. Everyone else is exactly as well off as she is in both the first world and the second. Think about the relative goodness of the second and third worlds. These worlds contain exactly the same people, and all but one of the people they contain is equally well off in each. That one person is better off in the third world. So the third world is obviously better overall than the second: it is better for one person and equally good for all the rest.

Now think about the relative goodness of the first and the third world. The only difference between these worlds is that the third contains a person who does not exist in the first. Everyone else's well-being is the same in the two worlds. The strong intuition of neutrality implies these two worlds are therefore equally good.

We know already that the strong intuition implies that the first and second worlds are equally good. So the second world and the third world are both equally as good as the first, according to the intuition. This means they are equally as good as each other. But that is not so; we know already that the third is better than the second. So the strong intuition of neutrality implies something false. It is therefore false itself.

That is a conclusive argument against the strong intuition of neutrality. My argument against the weak intuition is more complicated, and I shall not present it here.[13] I have to admit that it is less conclusive than the one I have given against the strong intuition.

We mostly have the intuition of neutrality. But thinking about the possibility of extinction gave us one reason to doubt it. And there is also the good argument against it that I have just described. We should give up this intuition.

[13] See Broome, *Weighing Lives*, ch. 12.

What to do?

What alternative account of the value of population do we have? I have mentioned total utilitarianism, which values the total of all people's well-being. Total utilitarianism implies that a collapse of population would be an enormously bad disaster. It would cause the loss of all the well-being of all those trillions of future people who would be absent. But most people find total utilitarianism implausible too. Some other ethical views about the value of population are also in circulation. But all of them are subject to strong objections of one sort or another.[14] At present the state of population ethics is confused. It is much debated in the philosophical literature, but nothing close to a consensus has emerged.

This presents a serious problem for policy making about climate change. Severe climate change is a real possibility. If it would be truly catastrophic, this possibility will make climate change like the case of a fire-extinguisher. Though unlikely, it would be so bad that it should dominate our planning. This is the view that the economist Martin Weitzman has been propagating for some years.[15] But if it should really dominate our planning, that will only be because it causes a collapse of population, or even extinction. So we cannot judge the badness of a catastrophe without judging how bad a collapse of population would be. Yet we have no secure basis for doing so.

We mostly have the intuition of neutrality. I suspect this explains why people have thought so little about the effects on population when they assess climate change policies. But the intuition of neutrality is false. And at present we have no secure ethics of population to put in its place.

What can be done about this problem for policy making? At a theoretical level the problem is particularly intractable. All the theories we can come up with about the value of population are subject to strong objections. But at a practical level it is not so far different from many problems of policy. Because population ethics is so intractable, philosophers disagree deeply about it, but disagreement is ordinary. We are used to disagreements over many issues, among experts and among the public. Yet decisions have to be made, and they get made despite the disagreements.

A society cannot hope to arrive at agreement about everything before it acts. We therefore have a way of making decisions that does not require agreement. One purpose of a democratic political system is to mediate between people's different opinions. However the moral philosophy of climate change progresses, it will actually be the political system that determines what we shall

[14] G. Arrhenius, *Population Ethics* (Oxford University Press, forthcoming) explains the profound difficulties that all theories face.

[15] M. Weitzman, 'On modeling and interpreting the economics of catastrophic climate change', *Review of Economics and Statistics*, 91/1 (2009), 1–19.

do about climate change. Provided the system works well, we should welcome that fact.

To work well, a democratic system requires people to be well-informed participants. This gives a role to moral philosophy in the democratic process. Philosophers need to participate in the public debate and provide guidance to people in making up their minds. When, as philosophers, we think we know the answer to a question, our job is to put our answer into the public domain, and defend it with arguments as well as we can. When we are unsure of an answer, we should explain what we see as the alternatives, and what merits they have. When we disagree about an answer, we should argue the question out. We can at least offer the public ways of thinking about the questions.

As a contribution to the debate about climate change, one thing I have been trying to do is point to the elephant in the room. In making our judgements, we need to recognise the importance of population, and think about its value.