

A normative account of dangerous climate change

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1 I

The central objective of the United Nations Framework Convention on Climate Change (UNFCCC) “is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system... ”¹ Unless global energy policy is to pursue the evidently impossible, namely the avoidance of all climate change, we must distinguish climate change that is dangerous from that which is not. Climate scientists concerned that international policy be intelligently guided have sought to assess the dangers of climate change, most often by discussing the risks associated with different warming scenarios. In this paper I argue that such efforts are important for a proper account of dangerous climate change but ultimately insufficient.

In the next section I defend a provisional understanding of *dangerous* as too risky and I argue that the judgment that an action or policy is too risky involves more than an empirical estimation of the risks involved. It rests on normative considerations. In the third section I distinguish the present account from relativism to which the account in Section 2 bears a superficial resemblance. The fourth section argues that the identification of climate change as dangerous involves both procedural and substantive considerations. In Section 5 I consider and reject alternative normative accounts of dangerous climate change. The sixth section amends the provisional understanding of *dangerous* to incorporate uncertainty and discusses the necessary role of precautionary thinking in the identification of climate change as dangerous. I conclude in Section 7 with very brief remarks on the practical upshot of this account of dangerous climate change.

¹United Nations Framework Convention on Climate Change, 1992. Available on line at http://unfccc.int/essential_background/convention/background/items/2853.php. (Accessed 23 Dec. 2008).

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2 II

In trying to understand the nature of dangerous climate change it would be folly not to incorporate the findings of climate science. We need to understand what CO₂ does in the atmosphere, how long it stays there, what its likely climatic effects are, and the variety of positive feedbacks that warming produces. Many climate scientists have carefully studied these matters for decades. If policy makers don't pay attention to what the climate scientists are saying, the policy makers certainly won't understand the dangers. Not paying attention to scientists in this case would be like not listening to a doctor's assessment prior to arduous mountain climbing. If you want to know whether mountain climbing is especially dangerous for you, given your medical condition, it makes good sense to listen to what your doctor says about the risks you would assume were your to engage in it.

Still, it will not do to identify dangerous climate change with risky climate change. If dangerous climate change just is risky climate change then the central objective of the UNFCCC is impractical since the avoidance of risk altogether is not possible in climate change policy. If we take the UNFCCC as relevant to constraining climate change, we do well to provide a construction of the central objective that is practical. I suggest provisionally that it makes better sense to understand dangerous climate change as climate change that is too risky. Although, as we shall see in Section 6, this understanding of dangerous climate change requires amendment to account for uncertainty, it has the virtue of preserving the practical value of the central objective of the UNFCCC. Moreover, taking *dangerous* as too risky establishes the appropriate conceptual connection between a judgment of danger and an attitude of avoidance; it makes it clear why dangerous climate change should be avoided.

Returning to the mountain climbing example, your doctor's assessment will take you only so far. The judgment that mountain climbing would be too risky is not ultimately determined by the medical facts and projections alone. The judgment involves the attitude that the action *should be* avoided. This is an action-guiding attitude, not merely a report about your condition. Your doctor can offer expert knowledge on your state of health. She can tell you what might happen if you decide to climb. But neither her report nor her prediction decides the question of whether climbing is something you should pursue or avoid. The heed paid to respect for patient autonomy in bioethics and good clinical practice is evidence of the broad acceptance of this view. To the extent that whether you should climb is decided by your interests in, say, adventure and good health, the normative judgment about whether or not climbing is dangerous—or too risky—is a prudential one. You consider the expert opinion regarding the risks; you assess your values; and you determine whether the risks are worth it to you. Discussions of the nature, content, and justification of normative judgments are the stock and trade of philosophy—and when the norms are moral, moral philosophy in particular.

Climate scientists have approached the assessment of danger in two main ways. One involves a projection of the risks associated with climate change. In an effort to bring science to bear on the assessment of dangerous climate change, former UK Prime Minister Tony Blair hosted a major international conference on climate change in 2005 at the Hadley Centre in Exeter. Prime Minister Blair set before the attendees of the conference the task of establishing the threshold of danger: "What level of greenhouse gases in the atmosphere is self-evidently too much?"

(Schellnhuber et al. 2006) The record of the conference contains papers that focus on the effects of warming on vulnerable areas of the Earth's climate system and geography, and the impact of change in these areas on humans and ecosystems. This procedure for assessing danger involves laying out the various possible bad and catastrophic effects, and discussing the probabilities that can be attached to them. The reports of conferences such as these are exceedingly valuable for an understanding of the risks that climate change policy should respond to.²

A second approach to the assessment of danger has drawn on the findings of the social and behavioral sciences. This involves analyzing people's reactions to the possibilities of bad and catastrophic effects. The idea is to understand the psychological and cultural factors that go into a person's assessment of danger. The natural science and social-behavioral science approaches are sometimes distinguished as "external" and "internal" approaches to danger assessment.³

An identificatory account of dangerous climate change—where *dangerous* is understood as too risky—is inadequate unless it can provide reasons that the climate change should be avoided. The problem for the external approach is that highlighting the bad effects and their probabilities—although an essential exercise for a rational assessment of risk—does not necessarily establish that these effects should all-things-considered be avoided. Two people can be presented with the same set of facts and probabilities about a hazardous line of employment—high-rise construction for example—and one is willing to accept the risks, given the pay rewards and her available employment alternatives and the other is not. The person accepting the job has not *necessarily* failed to appreciate the facts and risks; but I hope that we would all agree that appreciating them is very important in order for her decision to be rational. The question of whether the person accepting the job should accept it is not then fully answered by the assessment of the facts and risks. The problem for the internal approach is that coming to understand which psychological mechanisms or cultural norms influenced the two people might help to predict their decision but it does not tell us whether they *should* accept or reject the job. Prediction and normative evaluation are two distinct enterprises. A normative assessment of which changes to the climate should be avoided is not then captured by either the natural or social-behavioral scientific accounts of danger.

I have been arguing that there is a distinction between what science can tell us about the world and what we have reason to do in light of what science tells us. Determining whether one should avoid or pursue a course action involves a scientific appreciation of the risks, but it also involves a normative evaluation, which science cannot provide. Is this too sharp a distinction between science and normative assessment? John Dewey holds that, "When physics, chemistry, biology, medicine, contribute to the detection of concrete human woes and the development of plans for remedying them and relieving the human estate, they become moral; they become part of the apparatus of moral inquiry." (Dewey 1957) According to Dewey, this humanization of science enriches not only science, but morality as well, which "loses

²See Schneider (2001). See also Stephen H. Schneider and Janica Lane, "An Overview of 'Dangerous' Climate Change," in Schellnhuber, *Avoiding Dangerous Climate Change*, 7–24. See also O'Neill and Oppenheimer (2002).

³Cf. Dessai et al. (2004).

its peculiar flavor of the didactic and pedantic; its ultra-moralistic and hortatory tone.”⁴ There are, of course, scientists—including climate scientists—who would be inclined to disagree. Some scientists maintain that responsible science requires policy neutrality. The Intergovernmental Panel on Climate Change (IPCC), for example, carefully avoids making policy prescriptions preferring to maintain a neutral stance on what should be done about climate change. Perhaps this lends broader credibility to the science that the IPCC reports. But even so, it is not necessarily a rejection of Dewey’s main claim, which might be interpreted as taking the measure of the importance of scientific inquiry to be the extent to which it results in socially relevant knowledge. Scientists themselves need not be the ones pressing the social relevance of their projects. To ensure broader credibility perhaps they sometimes should not.

Whatever the intellectual or social merits of Dewey’s view, there is no reason to think that it contradicts the argument that I have been making about the insufficiency of scientific understanding to the normative assessment of dangerous climate change. I’m not trying to reject the view that science should pursue morally appropriate goals. And I believe emphatically that in the case of climate change the work of climate scientists is of the utmost value to social policy. The view that I want to endorse about how to identify dangerous climate change involves both a scientifically informed understanding of the likely consequences of climate change and a role for moral deliberation in assessing these.

I shall call the above example of the people deliberating about risky employment *the personal analogy*. The point of the discussion of the personal analogy is to illustrate the limits—but certainly not the irrelevance—of science in an assessment of danger. The assessment of danger is not settled by any physical measurement or inference of the probability of outcomes, unless one thinks that the person taking the high-rise construction job is necessarily choosing irrationally—is necessarily pursuing what she should avoid. This can be captured by saying that the normative judgment of danger is underdetermined by the empirical judgment of the risks. The discussion, of course, also shows the importance of the scientific assessment of the facts and risks. A person would not be choosing wisely if he ignored the facts and risks.

3 III

Because the lesson of the personal analogy is that the identification of the risks of an activity does not establish whether it is too risky, some people might wrongly be led to believe that the assessment of danger is always relative to whoever is making it: Danger is in the eye of the beholder. If this were so, there would be no possibility for an international determination of danger. Prime Minister Blair’s well-intentioned efforts would be completely misguided. People led to this view embrace a version of relativism, the family of doctrines that hold that there are no objective standards for judgments. To some relativists, the personal analogy may be a piece of evidence that undergirds their relativism. Their inference would be that because two people can reach different normative judgments—one avoiding risky employment and the other pursuing it—it is the case that the validity of norms generally simply varies from person to person or culture to culture.

⁴*Ibid.*

It is unclear, however, how a relativist would proceed in assessing the danger of global change. If his relativism is personal, then there is danger when, but only when, he believes there is danger. The discussion of the assessment of danger is then a monologue. If his relativism is cultural, the discussion extends to his cultural cohort, but it is limited to the matter of interpreting and applying culturally bound values to facts and risks. Neither of these forms of relativism would support an international effort to identify and avoid dangerous climate change since in both cases the assessment of danger is severely limited and the communication of the reasons for believing that there is danger is tightly constrained. Of course, the more powerful could simply impose their standard on the less powerful. And if the powerful believed this the correct thing to do, the relativist might be hard pressed to find a reason for disputing it. But this is an unpromising model of international cooperation. Whatever the intellectual merits of relativism then—and this is not the place to discuss its general merits—it is not a doctrine particularly well-suited for solving the practical problems global climate change.

Returning to the personal analogy, relativism is not the only lesson that might be drawn from the underdetermination of the normative judgment to avoid or pursue risky employment by the empirical judgment of the risks. One can accept that society should grant the person choosing the risky job full discretion to do so, without affirming relativism. It is reasonable, for example, to believe that there are a range of cases in which competent adults are called upon to make decisions, and in which the decision is entirely at the discretion of these adults, without accepting that the standard of the decision is merely relative to the person.

The thinking might go something like this. There are decisions that affect only the well-being of the person deciding. All other things being equal—unless, for example, the person has done something to deserve otherwise—we assume it is a good thing for the person's well-being to be advanced, for her goal to be achieved, her desire satisfied, and so on. Now suppose that a person's well-being consists in whether certain distinctively human capabilities have been actualized.⁵ These could include capabilities such as the capability to provide for one's nutritional, medical, and shelter needs, or to pursue one's intellectual curiosity and spiritual longings. It is reasonable to believe that the individual person is best suited to weigh the risks of a choice when the consequences fall only on her because that person is in the best position to understand the complexities of the situation and to act on her interests in fulfilling her capabilities given all the factors. This view is attractive because it renders individual autonomy consistent with objective standards about how well a person's life is going. A person who holds this view can think it perfectly appropriate that society allows competent adults to decide for themselves whether to take what many people believe to be dangerous jobs, such as in high-rise construction.

Now there are limits to the applicability of the personal analogy. The reasoning above might support laws that allow adults to smoke cigarettes, cigars, and pipes. But it does not support allowing them to smoke in enclosed public places, in which the smoke can be harmful to others. (And it does not rule out taxing tobacco if public funds are to be used to treat smokers who develop cancer.) Individual discretion does

⁵The capabilities approach is championed in welfare economics by Amartya K. Sen and in philosophy by Sen and Martha C. There is a rich literature on this. For representative examples see Sen (1979, 1985), Nussbaum (2000), and Nussbaum and Sen (1993).

not extend to harming others. John Stuart Mill argues that even if it is inappropriate to protect adults from their own choices, society still has good reasons to protect *other* people from their choices. “As soon as any part of a person’s conduct affects prejudicially the interests of others, society has jurisdiction over it.”⁶ For that reason the personal analogy breaks down in the case of climate change. In the case of climate change there is no parallel to the scope for individual discretion that exists in choosing a job in high-rise construction. It would not be appropriate, for example, to permit the person choosing high-rise construction the discretion to decide whether she may toss down her tools from up high into crowded spaces below. Nor is it appropriate to let a polluter decide what level of pollution is dangerous for others.

The personal analogy has helped us to see that judgments of danger are normative. Perhaps we better understand the peculiar action-guiding character of judgments of danger. Still analogies are tools for understanding and persuasion. And as with all tools, the use-value of the personal analogy is limited. It does not help us to understand what in particular counts as dangerous in the case of climate change. It would lead us astray, if it led us to believe that the assessment of danger could be left to the particular state formulating its energy policy. The energy policy of every state—some much more than others—affects the well-being of people around the globe. Insofar as climate change is a global problem, the standard of danger cannot be left simply to individual states to decide in their own way and by their own lights.

CO₂ emissions are changing the Earth’s climate, thereby affecting all life on the planet. In contrast to those seeking risky employment, emitters of CO₂ are not merely assuming risks for themselves; and those setting climate change policy are not merely choosing the rules to govern their own conduct. The Conference of the Parties (COP) of the UNFCCC, which is assigned the power to approve climate change treaties under the UNFCCC, is a collective body meant to represent the interests of citizens of various states. Now nearly half of the world’s population lives on less daily income than equivalent (in their local currencies) of what \$2 buys in the United States of America (This is called *purchasing power parity*.) These are not people who are usually involved in assessing the risks and benefits of climate policy; many of them are simply eking out a living as subsistence farmers in very poor countries. Too often their representatives are not well-equipped to negotiate in international forums that set policy. More importantly, the overwhelming majority of those who will experience the negative effects of increased atmospheric concentrations of CO₂ have not yet been born. These are the persons who will experience climactic disruptions such as droughts, severe storms, and rising sea-level for centuries to come. These are the truly vulnerable since it is not merely that their representatives are not well positioned at the negotiating table; they have no representatives at the table at all. We cannot simply assume, then, that whatever the COP chooses is likely to be correct because it is in a privileged position to know its interests and realize its well-being. Here the personal analogy fails us.

A morally appropriate decision of the COP would have to be informed by the right sorts of considerations for the well-being of the vulnerable. Otherwise, it would be morally dubious. Unlike the normative assessment of danger involved in deliberating about whether to climb mountains or to take risky jobs, the assessment of danger in

⁶John Stuart Mill, *On Liberty*, chp. IV. Available on line at <http://www.bartleby.com/130/4.html>. (Accessed 21 April 2009).

the case of climate change necessarily involves deliberation about the risks to other people. The norm involved then is not prudential, but moral. It guides our action not merely in pursuit of our own well-being but also in pursuit of what we owe others.

4 IV

We are seeking a normative account of danger that could guide policy with respect to the aspects of climate change that it is appropriate to avoid. This is distinct from a judgment of the risks of bad outcomes of CO₂ emissions since we accept that we can rationally forge ahead in the face of risks. But we cannot accept that the COP should have full discretion in determining whether and how to forge ahead since the interests of persons are imperfectly represented by that body. We need a clearer understanding of the nature of the norm of danger in this case.

A moral standard might be substantive, or procedural, or some combination of these. A substantive moral standard may state a threshold: For example, the limit of acceptable climate changes in light of the interests of persons affected or the impact on ecosystems. If the COP were constrained by a substantive standard, it would not have the moral license to agree on a treaty that was likely to contravene the standard. A procedural moral standard, in contrast, places constraints only on deliberation about acceptable climate change policy. It might, for example, state both whose interests must be represented in deliberation and what sort of bargaining moves were permissible in establishing a standard, but beyond that it places no constraints on the outcome of the deliberation. If the COP met an appropriate deliberative standard, it would have full discretion over the outcome.

Parents who have deliberated about how to handle quarreling siblings know this substantive-procedural distinction even if they have not named it. Some parents take the substantive approach of trying to understand what all the fuss is about and then of looking for a solution that seems fair and equitable. Other parents rely on a procedural approach. They tell the kids to sort it out themselves and report back in a few minutes when it is resolved or the toy, game, or whatever, will be taken away. This approach does not rely on a standard for the outcome of the dispute. Rather, the requirement to report back with a solution or lose the privilege is a procedural constraint.

The appeal of proceduralism is that it seems to model part of what is at work in the personal analogy. Proceduralism permits sensitivity to the variety of considerations relevant to the judgment that climate change is dangerous. If an assessment of what is too risky depends in part on the available alternatives, then proceduralism allows affected states to determine a standard in light of the alternatives that confront them. A procedural account of danger would allow poor countries to reject a proposed treaty as dangerous that would result in restrictions on economic growth and thereby threaten human development. CO₂ emissions are the result of activities that confer vital benefits, especially to the poor. Electricity production traditionally emits CO₂. And electricity generation by means of coal-fired plants is still cheaper than by means of solar technology. Poor people in per capita poor states cannot be expected to assume the costs of cleaner electricity generation since that would significantly retard electrification. And electricity can hardly be characterized as a frivolous luxury. Indoor pollution caused by the burning of wood and animal dung—because of a

lack of electricity—results in 1.5 million deaths per year, mostly children under the age of 5. This exceeds the number of deaths from malaria and rivals those from tuberculosis.⁷ Providing Electrification, even when produced by coal plants, confers life-saving benefits to the desperately poor. Whether or not this is dangerous and should be avoided, depends in part on what sorts of alternatives are available. Such considerations seem most appropriately determined in international deliberations in which other options are on the table for representatives of developing countries to consider. This recalls the main lesson of the personal analogy, namely that a judgment of danger with respect to an action or policy is sensitive to the alternatives available.

Proceduralism then has two virtues. First, it might ensure that the negotiations that establish the threshold of danger are informed by the kind of information that developing countries and developmental and environmental advocacy organizations can bring to the table regarding the risks of both climate change and treaties that could constrain human development. This makes for more intelligent deliberation about policy. Second, proceduralism helps to ensure that the costs of avoiding risks are not so high as to make accepting the climate change related risks more appealing than avoiding them. Human development requires economic growth. But it comprises more than that. The United Nations Development Programme (UNDP) uses a human development index that includes average per capita income, longevity, and school attainment to measure human development. If development is taken to include health and education outcomes in addition to wealth creation, responsible representatives of developing countries are understandably loathe to restrict development. Just as it might be rational for a person in need of work to take a risky job, so responsible representatives from developing states might reject a climate change mitigation treaty that constrains the human development of their societies. A particular treaty might be more dangerous than no treaty.

Despite the appeal of proceduralism a purely proceduralist account of dangerous climate change contains grave deficiencies. Any account of dangerous climate change that rests solely on the outcome of deliberation by representatives of states leaves the norm vulnerable to two kinds of procedural bias. First, in reality the representatives of states might not well-represent the interests of vulnerable persons because the representatives are beholden to elite interests. Second, the representatives might have little reason to take into account the interests of persons beyond the present and next generation.⁸ Even if present citizens have access to institutions that hold their representatives reasonably accountable, future citizens do not. An account of dangerous climate change that surrenders to real-life procedures the complete critical determination of the threshold beyond which change is dangerous is therefore deficient.

A substantive account has the significant advantage of being able to incorporate appropriate regard for the interests of persons not necessarily well-represented in actual deliberations. It is possible in principle to combine substantive and procedural considerations into a unified account. For example, certain substantive constraints

⁷United Nations Development Program, *Human Development Report 2007–2008*, 45. Available on line at <http://hdr.undp.org/en/reports/global/hdr2007-2008/>. (Accessed 15 Dec. 2008).

⁸Stephen M. Gardiner has exposed the dangers of intergenerational bias in several important papers. See, for example, his (2001) and (2004).

could be placed on the outcome of real-life deliberation. A climate treaty that was accepted by all parties in deliberations that were internally fair might nonetheless be unsatisfactory if its implementation seemed likely to place unreasonable burdens on vulnerable population groups alive now or in the future. Clearly much could be said about what constitutes unreasonable burdens. This is a major object of discussion in contemporary political and moral philosophy and this is not the place to try to advance that discussion. I think that it is enough to note for the subject matter of this paper that there are good reasons to object to the view that parties engaged in real-life deliberation will necessarily ensure that the burdens placed on the vulnerable will be reasonable. And especially in the case of future generations, it seems necessary to evaluate what deliberators actually agree upon by considerations of what they should agree upon if they are being appropriately impartial with respect to generations.⁹

5 V

The normative approach to identifying dangerous climate change that I have been outlining is not the only one on offer. We will better appreciate the merits the approach that I have defended if we compare it to others. One focuses on human rights. Another employs a cost–benefit analysis. Consideration of these alternative proposals will, I believe, find them wanting in comparison to the combination of the substantive and procedural elements that I outlined above.

Some moral assessments of climate change argue that it poses the threat of massive human rights violations.¹⁰ We need only note that a UNDP report forecasts an *additional* 600 million people suffering from malnutrition by 2080 to get a sense of the scale of possible human rights violations.¹¹ Article 22 of the Universal Declaration of Human Rights recognizes that, “Everyone, as a member of society, has the right to social security...” And Article 25 asserts that, “Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food...”¹² It is hard for most people to imagine human rights violations on the immense scale suggested by the UNDP warnings; and we might be reticent to consider that the energy policies of various states—our states—are resulting in human rights violations on such a scale. But weakness of the imagination and reticence to consider our own possible culpability should not stand in the way of serious moral assessment. Could a better way to identify dangerous climate be to take massive climate-change-related human rights violations as the mark of danger?

One response to this alternative approach can be gleaned from the arguments of some philosophers who argue that appealing to human rights in the case of the future effects of climate change is absurd because we are discussing future people, that is people who don’t yet exist. We can have no duties based upon the rights of such

⁹For one account of intergenerational impartiality and its demands see Moellendorf (2009).

¹⁰See for example Caney (2006).

¹¹UNDP 2007–2008, 27–30.

¹²Universal Declaration of Human Rights, 1948. Available on line at <http://www.un.org/Overview/rights.html>. (Accessed 15 Dec. 2008).

people, these philosophers claim, because persons cannot have rights if they don't exist.¹³ To these critics, appealing to the human rights of future persons is absurd.

It can seem very puzzling to think about climate change's effects 100 or more years in the future when everyone who then will exist does not yet exist. So, to respond to the critics who charge that human rights in principal cannot be the source of present duties to future persons let's start with a more familiar example. Imagine you are considering buying a house. You haven't yet taken out a mortgage. Do you owe a payment to a future lender? Clearly not. If you take out a loan, you do; but then the lender is not a future lender anymore. So, do you have any moral duties to your merely future lender before you take out the loan? You might think not. This sort of reasoning seems to be at work in the minds of philosophers who deny duties based upon the rights to future persons. These future persons are like the future lenders who have no right to demand payment from you. But, if you were to take out a loan, knowing that you could not pay the bank back, you would be acting wrongly by knowingly bringing about a state of affairs in which you cannot perform as the bank has a right to expect of you. This suggests that generally we have a duty now not to take on duties that we know we cannot fulfill in the future. Contrary to those philosophers who assert that talk of the rights of future persons is absurd, it is not absurd to claim that we have a present duty not to act in ways that will bring about future situations in which the rights of persons will not be respected.¹⁴ This is no more mysterious than claiming that a would-be borrower has a duty to a potential lender not to apply for a loan that the borrower knows that he could not pay back. So, there is no reason to think that human rights talk is necessarily absurd in the case of the future effects of climate change.

Although I don't think there is any kind of logical absurdity in appealing to human rights in the case of the future effects of climate change, I think that doing so in an effort to distinguish dangerous from non-dangerous climate change is not particularly helpful.¹⁵ Any rational moral assessment of policy has to be based upon weighing the alternatives. And we must also face up to the possibility of massive human suffering if in order to mitigate climate change we were to drastically curtail the use of fossil fuels around the globe, and as a result prohibitively raise the costs of development projects such as electrification in impoverished rural areas. Our climate change policy would be implicated in that suffering as well. And if the suffering caused by emissions constitutes human rights abuses on a wide scale, then so would the suffering caused by a public policy induced rise in energy prices that prevents human development. Human rights violations then are not necessarily distinctive of dangerous climate change. Observing that climate change policy might bring about human rights violations does not secure an identification of the policy as productive of dangerous climate change.

Another approach to climate change, prominent in most standard economic analyses of the matter, involves weighing the expected utilities of alternative policies

¹³An argument to this effect is made in Beckerman and Pasek (2001).

¹⁴This idea is developed by Woodward (1986).

¹⁵Rajendra Pachauri invokes the importance of rights as part of the assessment of danger. Cf. Rajendra Pachauri, "Avoiding Dangerous Climate Change," in Schellnhuber, *Avoiding Dangerous Climate Change*, 3–5. See Schellnhuber et al. (2006).

in order to find the optimal one.¹⁶ Expected utility is the value or disvalue of an outcome multiplied by its probability of occurrence. Utility in the standard economics of climate change is taken to be consumption, or GDP, and disutility loss of consumption. One idea is to use this sort of approach to identify dangerous climate change by establishing a substantive threshold below which expected disutility would be considered dangerous.

There might be all kinds of good uses for cost–benefit analysis in public policy. For example, in deciding whether to purchase snow plowing equipment it might be rational for a city to weigh the costs of the equipment against the economic loss associated with street closures. Simply because a city has to endure street and business closures every once and a while, as was the case in London during the winter of 2009, does not necessarily make it rational to spend money on snow removal equipment. Cost–benefit analyses gain their credibility in general from the fact that for much of what we value, whether it is an economic good or not, there is an economic cost associated with providing or maintaining it. For example, it would be wrong to think of education as merely an economic good since not only does it train people to be productive members of the economy; it is also necessary for becoming an autonomous adult and a good citizen. Even so, it is not necessarily wrong to employ a cost–benefit analysis as part of the deliberative process of deciding whether to build a school or to keep one open.

This procedure is put under strain in cases, such as climate change, in which a major share of the costs are foreseeable human deaths. Economists have developed a procedure for assigning costs to non-economic goods that involves an assessment of how much people are willing to pay to be provided a good or to avoid a loss, or must be paid to be willing to accept a loss. But serious problems arise in the case of foreseeable human deaths. The willingness-to-pay-to-avoid-death approach has the problem of valuing lives differently depending upon the resources available to the persons threatened. The lives of those who can pay little to avoid death are valued less than those who can pay more. And the willingness-to-be-paid-to-accept-a-loss approach has no credible way to assign a cost to a human death since rational persons will not expect payment after death.¹⁷

Even if the alternatives were less grim, and death did not feature in our climate change projections, the method of calculating estimated utilities would still not work for determining when climate change has passed a threshold of danger. The current state of climate science allows at best only forecasts within very broad ranges of confidence and probability. For example, the IPCC's *Fourth Assessment Report* (AR4) predicts with high confidence, meaning it believes that the chance of the prediction being correct is about eight in 10, the following outcomes for particular warming levels: A 1°C temperature increase would put up to 30% of existing animal and plant life at increased risk of extinction and would increase coral bleaching; 2°C increase would result in increased damage from floods and storms and in most coral being bleached; 3°C increase would expose hundreds of millions of people to increased water stress; a 3.25°C increase would bring about increased morbidity and mortality from heat waves, floods and droughts; and a 3.75°C would cause a 30%

¹⁶A well-developed version of this approach can be found in Nordhaus (2008). For an economic critique of seeking an optimal approach, along the lines of Nordhaus's, see Weitzman (2007).

¹⁷For a good discussion see also Broome (1999).

loss of coastlines and the suffering of millions of people due to flooding.¹⁸ Recent assessments of observed change suggest that the AR4's projections are conservative (Rahmstorf et al. 2007).

The threats of severe and abrupt climate change are, however, more a matter of uncertainty than risk. To risks we can assign probabilities with varying degrees of confidence; to uncertainties we cannot. So, when confronted with uncertainty expected utility analysis is useless. Although some economic accounts assign uncertain events a low probability, this is bad methodology and appropriately criticized in economic discussions of climate change.¹⁹

Consider the uncertainty surrounding the threat of massive inundation from sea-level rise. The projected range of sea-level rise in the AR4 is 0.4 to 3.7 m. That is a very wide range of uncertainty, but even that range does not include the possible contribution to sea-level that would be made by the rapid melting of the Greenland and Antarctic ice sheets. Because the dynamics of ice sheet melting are not well-understood, the IPCC could not assign probabilities to sea-level rise that took into account massive ice sheet disintegration. This does not mean, however, that such disintegration is of low probability. There have been credible warnings of a possible sea-level rise in excess of 5 m this century in the event of significant ice sheet melting.²⁰ To put that in perspective, 10% of the world's population lives at the altitude of 10 m above sea level or lower. This includes metropolitan centers such as New York City at 10 m, Miami at 2 m, Shanghai at 4 m, Dhaka at 4 m, Bangkok at 2 m, and Mumbai at 10–15 m. Adaptation over the course of this century to extensive ice sheet collapse could require the relocation of tens of millions of people.

The uncertainty surrounding inundation from rising seas should reasonably affect our confidence in the costs that we attribute to climate change scenarios.²¹ The threat of massive inundation is obviously important and should inform our assessment of dangerous climate change. But as of now there can be no precise statement about large-scale rapid ice sheet collapse and consequent sea-level rise. So, it's just not possible to calculate the estimated disutility of such events. Our inability to employ cost–benefit analyses in climate change policy is disappointing in part because responding to future threats such as sea-level rise, tropical storms, droughts, and flooding has its costs. Resources are finite and important projects going on now might suffer if funds are diverted to prevent future costs. Cost–benefit analyses can help us think through these trade-offs. Imagine being confronted with the news that you faced the threat of a very bad medical prognosis, a severe reduction of quality of life, perhaps even death, due to a rare medical condition. Imagine further that you could make it less likely that the bad health outcomes would come about, but doing so would require drastic changes of lifestyle including ceasing many enjoyable activities.

¹⁸Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report summary for Policy Makers*, 10. Available on line at <http://www.ipcc.ch/ipccreports/ar4-syr.htm>. (Accessed 15 Dec. 2008).

¹⁹See Weitzman's (2007).

²⁰James Hansen, "Huge sea level rises are coming—unless we act now," *New Scientist* 2614, (25 July 2007). Available on line at <http://www.newscientist.com/article/mg19526141.600-huge-sea-level-rises-are-coming-unless-we-act-now.html?full=true>. (Accessed 21 April 2009).

²¹See Weitzman's, "A Review of *The Stern Review* " 715–723 and Partha Dasgupta (2008): 141– 16, esp. secs. 5–6.

When confronted with this news, it would seem perfectly reasonable for you to want to know what the risks of the bad outcome were. You would want to do something like an informal cost–benefit analysis of the lifestyle change. It would be distressing if the doctor told you that she could not provide you with the any probabilities for the bad outcome, either with or without the lifestyle change.

6 VI

Part of the point of the previous section is that the identification of climate change as dangerous must be made not only in light of the risks of climate change. It must pay attention to the uncertainties as well. The implications of this extend also to the understanding of *dangerous* as too risky. Not only can we not reasonably rely only on a cost–benefit analysis employing the estimated utility of various projections to establish a threshold for dangerous climate change, we also cannot simply take *dangerous* to be too risky. The dangers of climate change involve not merely the risks; they also involve the uncertainties.

Climate change is dangerous not merely when we have reasons to avoid its risks, but also when we have sufficiently good reasons to avoid outcomes that are uncertain. The issue is how to assess whether reasons for avoiding uncertain outcomes are sufficiently good. Article 3 of the UNFCCC invokes the precautionary approach to uncertainty: “The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures. . . .”²² The precautionary principle is often offered as a guide to our action in the face of uncertainty. The principle expresses a norm of rational or reasonable decision-making under conditions of uncertainty. There is, however, controversy about the principle.²³ Much of this has to do with whether there is a version of the principle that can escape the charge that it is too conservative. Scientific advances in the development of pharmacological therapies often have uncertain side-effects. Would a public policy that takes precautionary measures rule out all such advances?

In a paper in which the focus is not the precautionary principle I cannot attempt to survey and respond to the important debates that surround its application. So, what I have to say here will necessarily be provisional. Any account of dangerous climate change that includes not only the identification of changes that are too risky but also the uncertain outcomes that are to be avoided is adequate only to the extent that the debates concerning the employment of the precautionary principle can be settled in a way that renders it a substantive normative principle.

The appeal of the precautionary principle involves an appreciation of the non-negligible (but uncertain) likelihood of something very bad happening, something much worse than merely assuming the costs of action to avoid that outcome. A person might rationally accept an indeterminate, but probably small, risk of getting a parking ticket from parking illegally to quickly drop off a book due at the library.

²²UNFCCC, 1992. See footnote 1.

²³For examples of recent criticisms of the precautionary principle see Sunstein (2005) and Lomborg (2008), 158. A recent defense in light of various criticisms can be found in Gardiner (2006).

But he would be foolish to risk his career to do so. In fact, we are likely to agree if he says that it would be far too dangerous for him to do so; better to pay the overdue fine even if the risk is small (but indeterminate). Invoking the precautionary principle then typically involves consideration of costs and benefits, but without the precision of cost–benefits analyses since the probability of outcomes is not known. Such ignorance is in fact a fairly typical feature of daily life. Rather than mourn the loss of precision associated with cost–benefit analyses, we would do well to recall the injunction of Aristotle that we should seek only that degree of precision that the subject matter allows.²⁴

The lack of precision raises the question of whether the precautionary principle can offer any substantive practical guidance since nearly all public policy involves the indeterminate but non-negligible possibility of harm to people. Recall that Article 3 invokes “serious” and “irreversible” threats to the climate system; these include threats of massive human suffering and damage to ecosystems. I suggest four guidelines for the application of precautionary thinking that capture the spirit of Article 3. The case for precaution is strong to the extent that (1) that which is under threat provides systematic or fundamental support to the well-being of items whose well-being we have reason to value greatly, (2) the nature of the harm is such that accommodation to it will be very difficult to a great many of these items, (3) the probability of harm to these items, although indeterminate, is non-negligible, and (4) the moral losses associated with the pursuit of the precautionary approach are significantly lower than those that would be incurred if the harms were to be suffered.

Even though these rules of application do not establish a bright line rule, they are not practically useless. For example, they would not support precaution in most cases in which highway construction would lead to foreseeable deaths since, although persons will die who would not die in the absence of the highways, the threat is episodic, not a feature of a compromised system of support for persons. Moreover persons can take reasonable precautions to reduce the threat of the harms, defensive driving, looking before crossing, and so on. In contrast, many of the major threats of climate change are very different. The climate system provides systematic and vital benefits, such as reasonably predictable weather patterns, stable coastlines, and stable aquifers. Once these benefits are compromised, individuals typically have few opportunities at modest costs to seek improved benefits elsewhere.

A precautionary approach is relevant procedurally to parties considering whether the threats of climate change are severe enough to incur costs. But the precautionary principle can also be used substantively in assessing whether the outcome of a deliberation among parties tasked with reaching an agreement about how to avoid danger recklessly endangers the lives of vulnerable persons living now or in the future. In order to be sensitive to the uncertainties as well as the risks, the identification of dangerous climate change, then, involves not only procedural and substantive determinations of whether policies are too risky, but also whether the uncertain outcomes should be avoided.

²⁴Aristotle, *Nicomachean Ethics*, bk. 1, sec. 3. Available on line at <http://classics.mit.edu/Aristotle/nicomachaen.1.i.html>. (Accessed 23 Dec. 2008).

7 VII

I have been arguing that no amount of scientific understanding alone can prescribe the attitude of avoidance of risk since given their circumstances people might have very good reasons for taking on a risk. This does not entail relativism since there might be objective moral constraints on the risks that persons may impose on others. Assessing whether climate change is dangerous requires a normative account that includes both procedural and substantive considerations. The former requires broad participation from developing countries in assessing the risks and uncertainties of climate change and the threats to development of various kinds of responses. This procedural element is, however, insufficient because we cannot be confident that real-life deliberation about climate change will adequately protect the vulnerable living now and in the future. Any real-life deliberation, as important as it is for distinguishing the threats that are reasonable to assume from those that are not, is in principle subject to critical evaluation on behalf of the vulnerable living now and in the future. Moreover, I have given reasons to believe that this identificatory account is superior those that centrally employ human rights or expected utility. The former fails because human rights violations are not only a threat posed by dangerous climate change. The latter fails because it cannot adequately account for uncertainty. To do this a precautionary approach must added to the assessment of the possible outcomes of climate change.

The identificatory account of this paper does not issue in a distinct temperature goal for the avoidance of dangerous climate change. Instead it gives both some reason to be solicitous of the decisions of parties engaged in climate negotiations, if these deliberations are based on good science and fair procedures, and the basis upon which to criticize these decisions if they fail properly to regard the vulnerable living now and in the future. Much attention internationally is currently directed towards the 2°C warming limit. Insofar as the 2°C limit is on the conservative end of the spectrum of risks and uncertainties that are acceptable to impose on future generations, the substantive elements of the present account of dangerous climate change would tend to endorse it. The procedural element awaits an answer to the question of whether policies that would be likely to constrain warming within 2°C will be endorsed by developing and underdeveloped countries in light both of the effects of such policies on human development and of the alternatives available.

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