

Saved by Disaster?¹
Abrupt Climate Change, Political Inertia and the Possibility of an Intergenerational Arms Race

Stephen M. Gardiner
Department of Philosophy and Program on Values in Society
University of Washington, Seattle

DRAFT
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"We are all used to talking about these impacts coming in the lifetimes of our children and grandchildren. Now we know that it's us."²

In recent years, scientific discussion of climate change has taken a turn for the worse. Traditional concern for the gradual, incremental effects of global warming remains; but now greater attention is being paid to the possibility of encountering major threshold phenomena in the climate system, where breaching such thresholds may have catastrophic consequences. As recently as the 2001 report of the *Intergovernmental Panel on Climate Change* (IPCC), such events were treated as unlikely, at least during the current century.³ But the work of the last six years tends to suggest that these projections are shaky at best. As the United States' National Research Council warns us, climate surprises are 'inevitable'.⁴

In this paper, I want to explore some ways in which this paradigm shift may make a difference to how we understand the moral and political challenges posed by climate change, and in particular the current problem of political inertia. I will examine two suggestions. The first is that abrupt climate change undermines political inertia, in part through undermining three common explanations for it, based in economic, psychological, and intergenerational factors. The second suggestion is that this shift is in one respect beneficial: the focus on abrupt, as opposed to gradual, climate change actually helps us to act. On the one hand, it supplies strong motives to the current generation to do what is necessary to tackle the climate problem on behalf of both itself and future generations; on the other hand, failing this, it acts as a kind of fail-safe device, which at least limits how bad the problem can, ultimately, become.

¹ Earlier versions of this paper were presented at workshops on *Global Justice and Climate Change* at San Diego State University and the University of Reading, and also at the University of Delaware and the University of Leeds. I am grateful to those audiences, and also to Neil Adger, Peter Atterton, Cecilia Bitz, Simon Caney, Paula Casal, Dale Jamieson, Willett Kempton, Catriona MacKinnon, Andrew McGonigal, Darrel Moellendorf, Henry Shue, and two anonymous reviewers. I am especially grateful to Lije Millgram for initially discussing the topic with me back in 2004, and to Michael Oppenheimer for inviting me to attend the Princeton workshop on climate change and the psychology of long-term risk in late 2005 that persuaded me to write it up.

² Martin Parry, co-chair of Working Group II of the IPCC, quoted in David Adam, Peter Walker and Alison Benjamin, 'Grim Outlook for Poor Countries in Climate Report', *Manchester Guardian*, September 18, 2007.

³ At the time of writing, it is not yet clear what overall line the IPCC will take in its 2007 Synthesis Report, especially on sea level rise. When released in February 2007, the Summary for Policy Makers of Working Group I tried to avoid the topic of rapid ice sheet collapse, and was criticized by some scientists for doing so; but Working Group II did assert that the chances of such collapse were considerable. See Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: The Scientific Basis* (Cambridge: Cambridge University Press, 2007); Cornelia Dean, 'Even Before Its Release, World Climate Report is Criticized as Too Optimistic', *New York Times*, February 2, 2007; IPCC, *Climate Change 2007: Impacts, Adaptation and Vulnerability* (Cambridge: Cambridge University Press, 2007); and David Adam, 'Scientists Warn It May Be Too Late To Save the Ice Caps', *Manchester Guardian*, February 19, 2007.

⁴ US National Research Council, Committee on Abrupt Climate Change, *Abrupt Climate Change: Inevitable Surprises* (Washington DC: National Academies Press, 2002).

My thesis is that these suggestions are largely mistaken, for two reasons. First, the possibility of abrupt change tends only to reshape, rather than undermine, the usual concerns; hence, the root causes of moral corruption remain. Second, the possibility may make appropriate action more, rather than less, difficult, and exacerbate, rather than limit, the severity of the problem. Worst of all, if the abrupt change is severe, it may provoke the equivalent of an intergenerational arms race.

I. Abrupt Climate Change

"The debate on global change has largely failed to factor in the inherently chaotic, sensitively balanced, and threshold-laden nature of Earth's climate system and the increased likelihood of abrupt climate change."⁵

Until recently, scientific discussion of climate change has been dominated by what I shall call 'the gradualist paradigm'. Researchers tended to assume⁶ that the response of natural phenomena to increases in greenhouse gas concentrations would be mainly linear and incremental; and this assumption tended to result in analogous claims about likely impacts on human and non-human systems. Hence, for example, the original IPCC report projected a rise in global temperature at an average of 0.3C per decade in the twenty-first century⁷, and typical estimates of the economic costs of impacts ran at around 1.5-2% of global world product.⁸

Such results are hardly to be taken lightly, and much of the first three IPCC reports was taken up with showing how and why they are matters of serious concern. But recent research suggests that they may underestimate the problem. This is because there is increasing evidence that the climate system is much less regular than the gradualist paradigm suggests. In particular, there may be major threshold phenomena, and crossing the relevant thresholds may have catastrophic consequences. Scientists have been aware of the possibility of such thresholds for some time. But recent work suggests that the mechanisms governing them are much less robust, and the thresholds themselves much closer to where we are now, than previously thought. This suggests that we need an additional way of understanding the threat posed by climate change. Let us call this, 'the abrupt paradigm'.⁹

⁵ Robert Gagosian, "Abrupt Climate Change: Should We Be Worried?" (Woods Hole Oceanographic Institute, 2003), 12. Available at http://www.whoi.edu/institutes/occi/hottopics_climate_change.html.

⁶ One scientist suggested to me that they were right to do this, since standard methodology says that we should consider the null hypothesis before exploring "more exotic" possibilities. This claim suggests that the paradigm shift may have *procedural* roots; and it naturally raises questions about whether the said procedures are desirable. Presumably under some circumstances – such as the threat of catastrophe – it might be sensible to put some priority on investigating nonlinear possibilities.

⁷ IPCC, *Climate Change 1990: The Scientific Basis* (Cambridge: Cambridge University Press, 1990); cf. Donald Brown, *American Heat: Ethical Problems with the United States' Response to Global Warming* (Lanham, Md.: Rowman & Littlefield, 2002), 18-19.

⁸ John Houghton, *Climate Change: The Complete Briefing* (Cambridge: Cambridge University Press, 3rd ed, 2004), 184.

⁹ For explicit mention of 'a new paradigm', see US National Research Council, *op. cit.*, 1. The Council offers the following scientific definition of an abrupt change: "Technically, an abrupt climate change occurs when the climate system is forced to cross some threshold, triggering a transition to a new state at a rate determined by the climate system itself and faster than the cause". But, recognizing that what is important from the point of view of policy is the societal and ecological impacts, it also suggests that an abrupt change is "one that takes place so rapidly and unexpectedly that human or natural systems have difficulty adapting to it" (*Op. cit.*, 14). I have two concerns with these definitions. First, it is not clear that being unexpected ought to be essential to the second: if we could reliably predict that we were just about to cross a major climate threshold, this would not lessen the policy concern. (More

Where might this paradigm be instantiated? Three possibilities are especially well-known. The first is ice sheet disintegration, accompanied by a major rise in sea level. In the past, such change has occurred very abruptly - as much as "an average of 1m of sea level rise every 20 years" for four hundred years.¹⁰ Furthermore, the current potential for change is substantial. Melting the mountain glaciers and Greenland alone would lead to a sea level rise of around seven meters, and adding the West Antarctic ice sheet would boost the total to fifteen meters.¹¹ Moreover, it is easy to see why such melting could be catastrophic. Even a total rise of over two meters "would be sufficient to flood large portions of Bangladesh, the Nile Delta, Florida, and many island nations, causing forced migration of tens to hundreds of millions of people."¹² Indeed, since "a large portion of the world's people live within a few meters of sea level, with trillions of dollars of infrastructure"¹³, James Hansen believes that such a rise would "wreak havoc with civilization"¹⁴, making the issue of sea level "the dominant issue in global warming" and one which "sets a low ceiling on the level of global arming that would constitute dangerous anthropogenic interference."¹⁵ Given this, it is clearly a matter of concern that the Greenland ice sheet is "currently thought to be shrinking by 50 cubic kilometers per year", and that this might prime the ice sheets for a sudden, "explosive", and irreversible disintegration.¹⁶

The second possibility is a weakening of the ocean conveyor of the North Atlantic, which, among other things, supports the Gulf Stream to Western Europe. Again, paleoclimatic evidence suggests that the system is vulnerable to abrupt change. Furthermore, substantial effects on ocean circulation are projected by climate models, and

on this later.) Second, and more importantly, there is some tension between the definitions: since the policy definition makes no mention of thresholds and new states, it seems that a perfectly regular but high magnitude change might count as abrupt on the second definition but not the first.

These two points help to bring out my reason for using the language of "paradigms". Since our primary policy concern is with the impacts of climate change, the relevant difference between gradual and abrupt change appears to be one of degree, rather than kind. Suppose, for example, that on the Gradualist Paradigm the climate system turned out to be very sensitive to even quite small alterations, so that the increments of uniform and regular climate change were large. Then, the linear change envisioned by gradualism might turn out to have results that mirror severe abrupt change in their phenomenology and impacts. Conversely, if a sudden and irregular change were only of modest magnitude, then it might resemble the typical gradualist changes in its effects. Under such scenarios, the issue of whether the underlying change was scientifically regular or abrupt is unlikely to be of fundamental interest to policy makers, since it does not bear directly on the nature of the impacts. It is only if the impacts of gradual and abrupt change diverge substantially that the distinction becomes important from the point of view of policy.

This consideration suggests that we need terms that will help us to focus in on the most salient impact scenarios. With this in mind, I have characterized the irregular change in the abrupt *paradigm* in terms of catastrophic outcomes, thresholds, and proximity. Clearly, we might encounter catastrophic outcomes quickly even under linear change (e.g., if the magnitude of such change were considerable), and if that were the case, much of what is said about the abrupt paradigm below would apply equally to this kind of gradual change. Still, given prevailing gradualist views, it seems safe to say that the usual gradualist *paradigm* is not of this form. My claim then is that the abrupt and gradualist paradigms are good focal points for discussion. This can be the case even if both are a little caricatured.

¹⁰ James Hansen, "A Slippery Slope: How Much Global Warming Constitutes "Dangerous Anthropogenic Interference?", *Climatic Change* 68, (2005): 269-279; 269.

¹¹ USGS Professional Paper 1386A. Williams and Ferrigno, eds. 1999.

¹² Hansen, op. cit, 274.

¹³ James Hansen, "Defusing the Global Warming Time Bomb", *Scientific American* 290 (2004): 68-77; at 73.

¹⁴ Hansen 2005, 275.

¹⁵ Hansen 2004, 73.

¹⁶ Quirin Schiermeier, "A Sea Change", *Nature* 439 (2006), January 19: 256-260; at 258; James Hansen, "Can We Still Avoid Dangerous Human-made Climate Change?", Talk presented at the New School University (2006).

there is little reason to doubt that such change could be catastrophic, at least to some countries.¹⁷ Given this, it is sobering to see some scientists reporting that the Conveyor may already be showing some signs of disruption.¹⁸

A third, less understood, possibility is that “vast stores of methane hydrate – a super-greenhouse gas – that are currently frozen under the oceans will, when global warming has reached some point, rise to the surface and dissipate themselves into the atmosphere”. Again, there is precedent. Such a release is said to have caused the biggest extinction of all time, the end of the Permian era 251 million years ago, when ninety percent of species were suddenly lost.¹⁹ Clearly, a change of this kind would be catastrophic. A *New York Times* columnist aptly referred to it as “the Big Burp Theory of the Apocalypse”.²⁰

Now, the three prominent examples are of serious interest in their own right. However, it may be that the most important thing about them is the support they lend to the abrupt paradigm. This is because perhaps our greatest uncertainty at the moment concerns how good we are at identifying catastrophic risks. In short, it is reasonable to think that our current grasp of the possibilities is seriously incomplete²¹; and this may be the most crucial fact from the point of view of policy.

If there are abrupt thresholds, where might they be? Recent work suggests that some are in the area of projected emissions, and of these, some may be close by. According to the IPCC, the preindustrial atmospheric concentration of carbon dioxide was around 280 parts per million (ppm), and the current concentration is around 380 ppm. Based on a range of model scenarios, making different assumptions about rates of technological change and economic and population growth, the IPCC projects atmospheric concentrations of carbon dioxide of 535-983 ppm, and an increase in surface temperature of 1.1-6.4° Celsius (best estimate, 1.8-4.0°C) by the end of the century.²² Recent estimates of where the relevant thresholds might be include: 1°C for the disintegration of the Greenland ice sheet; 2°C, 450 ppm CO₂ or 2-4°C, <550 ppm for the West Antarctic ice sheet; and 3°C in 100 years, 700 ppm CO₂ for a shutdown of the thermohaline circulation.²³ Clearly, we are in dangerous territory.

II. Some Causes of Political Inertia

Still perhaps the news is not all, grim. For it has been suggested that the possibility of abrupt change may help us out of our current problem of political inertia. Let me first

¹⁷ Gagosian, op. cit.; Richard Alley, “Abrupt Climate Change”, *Scientific American* (2004), 68; R.J. Stouffer et al., “Investigating the Causes of the Response of the Thermohaline Circulation to Past and Future Climate Changes”, *Journal of Climate* 19 (2006), 1365-1387; Michael Vellinga and Richard A. Wood, “Global Impacts of A Collapse of the Atlantic Thermohaline Circulation”, *Climatic Change* 51 (2002): 251-267.

¹⁸ See, for example, Harry L. Bryden, Hannah R. Longworth, and Stuart A. Cunningham, “Slowing of the Atlantic Meridional Overturning Circulation at 25 Degrees North”, *Nature* 438 (2005), December 1: 655-657. Still, many facets of such work remain controversial. Though most agree that the past events occurred and were accompanied by a slowdown, there is disagreement about the extent of the climatic impacts, how they might be relevant to predicting future climate change, and whether we are indeed seeing signs of such change already. Still, much of this controversy concerns *when* we might expect a change, not whether there will be one if global warming continues well into the future. Models predict a point “beyond which the thermohaline circulation cannot be maintained”, but also that this requires warming of 4-5 degrees Celsius. Most scientists apparently believe that we will not experience that this century (Schiermeier, 257); but it is worth pointing out both that this hardly lessens the intergenerational issue, and that even a small probability of collapse this century is a matter for concern.

¹⁹ Brian Barry, *Why Social Justice Matters* (Cambridge: Polity, 2005), 260.

²⁰ Nicholas Kristof, “The Big Burp Theory of the Apocalypse”, *New York Times* (2006), April 16.

²¹ Alley op. cit., 69. Consider, for example, the recent emergence of ocean acidification as a serious concern.

²² IPCC 2007, *Physical Science*.

²³ For a summary, see Michael Oppenheimer and Annie Petsonk, “Article 2 of the UNFCCC: Historical Origins, Recent Interpretations”, *Climatic Change* 73 (2004), 195-226.

sketch this problem and then suggest why it might be thought that the threat of abrupt change might help.

The fact that climate change poses a serious threat has been known for some time. In 1988, the United Nations Environment Program and the World Meteorological created the Intergovernmental Panel on Climate Change, and charged it with the task of providing member governments with state of the art assessments of “the science, the impacts, and the economics of – and the options for mitigating and/or adapting to – climate change”.²⁴ In 1995, the IPCC claimed that “the balance of evidence suggests a discernible influence on climate”.²⁵ In 2001, it went still further, asserting that “most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations”²⁶, and in its most recent report, in 2007, it upgraded this assessment to “very likely” (meaning a probability of 90% or more).²⁷ The IPCC’s main conclusions have been endorsed by all major scientific bodies, including the National Academy of Sciences, the American Meteorological Society, the American Geophysical Union, and the American Association for the Advancement of Science. This consensus appears to be remarkably robust.²⁸

Despite this, progress on solving the problem has been minimal. First, as a matter of substance, humanities emissions of the main greenhouse gas, carbon dioxide, have grown by more than 12% since the early 1990s.²⁹ Moreover, there is no sign of serious, sustained reductions either globally or in particular nations: indeed, the rate of growth has increased recently to around 2% per year.³⁰ Estimates of future trends vary considerably.³¹ But under a scenario usually taken to be representative of “business as usual”, annual carbon dioxide emissions will increase over the century from around 8 gigatonnes of carbon (Gt C) in 2000 to around 20 Gt C in 2100, an increase of 250% (to >700 ppm CO₂).³² Under a more extreme scenario of rapid, fossil-fuel intensive growth, the figure rises to around 29 Gt C per annum in 2100, an increase of more than 350% (to around 1000 ppm CO₂). Second, at the political level, despite some notable efforts, overall progress has been less than impressive. In the global arena, several weak agreements have been made, but then broken. At national levels, even those nations who express the strongest commitment to tackling climate change publicly – such as the European Union, United Kingdom and New Zealand – have had difficulties in restricting their emissions.³³

Plainly, there is a mismatch between the apparent seriousness of the problem and our collective institutional response. What accounts for this? No doubt there are many possible explanations, more than one of which may play a contributing role. Here I shall discuss three particularly prominent suggestions, to see how far they might be undermined by the emergence of the Abrupt Paradigm.³⁴

²⁴ IPCC 2001, *Scientific*, p. vii.

²⁵ IPCC, *Climate Change 1995* (Cambridge: Cambridge University Press, 1995), cited by Houghton 2004, 105.

²⁶ IPCC 2001, cited by Houghton 2004, 106.

²⁷ IPCC 2007, *Physical*, 8.

²⁸ Naomi Oreskes, “The Scientific Consensus on Climate Change”, *Science* (2005), 3 December, 1686.

²⁹ IPCC 2007, *Physical*, 2-3.

³⁰ Hansen 2006.

³¹ This is mainly because they must be based on different projections of factors such as consumption behavior, population, and economic growth.

³² Houghton 2004, 116.

³³ SELF-REFERENCE; European Environment Agency. *The European Environment: State and Outlook 2005*.

³⁴ Important suggestions not considered here include scientific uncertainty, media bias, misinformation campaigns, and cultural barriers to change. I do not wish to deny the importance of such considerations, nor that of a more general account of political inertia. I do assume, however, that the three considerations I do consider are important enough to deserve separate treatment (SELF-REFERENCE; Bjorn Lomborg, *The Sceptical Environmentalist*

1. Economics

One explanation for political inertia is, of course, that people believe that action is not justified. Such arguments are often couched in economic terms.³⁵ So, for example, Bjorn Lomborg asserts that “economic analyses clearly show that it will be far more expensive to cut CO2 emissions radically than to pay the costs of adaptation to the increased temperatures.”³⁶ Now, in my view, such arguments are dubious even under the gradualist paradigm. Nevertheless, it is worth discussing the impact of the Abrupt Paradigm on them, since it appears to undercut these economic arguments even more decisively.

Let us begin with the usual objections. First, interpreted as a general claim about economic analysis, Lomborg’s assertion appears to be false. In fact, the results of economic analyses vary widely, and are inconclusive. Hence, for example, the economist Clive Spash asserts:

“... [E]conomic assessment fails to provide an answer as to what should be done. The costs of reducing CO2 emissions may be quite high or there may be net gains depending on the options chosen by the analyst. The benefits of reducing emissions are beyond economists’ ability to estimate so the extent to which control options should be adopted, on efficiency grounds alone, is unknown.”³⁷

However, second, interpreted more narrowly, Lomborg may be correct. If he means to refer only to standard economic approaches – in particular those relying on current market prices and employing substantial discount rates (of the order of 5% or more) – then it may be true that there is wide agreement in the results of such analyses in the direction he suggests. However, unfortunately, this claim does not have the implication that Lomborg intends – that inaction on climate change is justified – since it is precisely these features of standard economic approaches that many people argue makes them inappropriate tools for assessing long-term impacts. For one thing, over the long term, prices change in response to such things as technological advances and changes in supply and demand, driven in part by wider social changes. Such changes are, by their nature, very difficult to predict. Moreover, the associated uncertainties are significant enough to undermine the use of fine-grained cost-benefit analysis over the very long term. Commenting on the problem, John Broome goes so far as to say: “Cost-benefit analysis, when faced with uncertainties as big as these, would simply be self-deception.”³⁸ For another thing, there are serious theoretical and practical issues surrounding the use of positive discount rates for the long-term future. Some object that such rates should not be used at all, while others claim that the rate employed should at least be substantially lower than the standard rates.³⁹

(Cambridge: Cambridge University Press, 2001); Michael Oppenheimer, ed., *Climatic Change 77: Special Issue on Climate Change and the Psychology of Long-Term Risk* (2006).

³⁵ Some, of course, argue that the science is not compelling. Others add that there is some kind of conspiracy afoot. For current purposes, I will set such views aside. For some discussion see Brown 2002, SELF-REFERENCE and Elizabeth Desombre, “Global Warming: More Common Than Tragic”, *Ethics and International Affairs* (2004), 41-46.

³⁶ Lomborg 2001, 318.

³⁷ Clive L. Spash, *Greenhouse Economics: Value and Ethics* (London: Routledge, 2002), 178.

³⁸ John Broome, *Counting the Cost of Global Warming* (Isle of Harris, UK: White Horse Press, 2002), 19.

³⁹ Tyler Cowen, Tyler and Parfit, Derek Parfit, “Against the Social Discount Rate”, in Peter Laslett and James Fishkin, eds., *Justice Between Age Groups and Generations*. (New Haven: Yale University Press, 1992), 144-161; Martin Weitzman, “Why the Far Distant Future Should Be Discounted at its Lowest Possible Rate”, *Journal of Environmental Economics and Management* 36 (1998), 201–208; Nicholas Stern, *The Economics of Climate Change* (Cambridge: Cambridge University Press, 2006).

In short, the standard economic approach looks extremely problematic for long-term impacts of climate change. But perhaps there is a rejoinder. Enthusiasts for the standard approach may want to argue that we need not be too concerned about future uncertainty so long as climate change itself has only a minor impact on factor prices; and perhaps they will claim that the worry about discount rates can be overcome if we make sure that we reinvest productive gains and save for the future. Even as it stands, this rejoinder has limited appeal.⁴⁰ Still, the abrupt paradigm may undermine even this. For one thing, a severe abrupt change, such as a substantial temperature drop in Europe caused by a major change in ocean circulation in the North Atlantic, would presumably have a large impact on global society, and so on relative prices.⁴¹ Indeed, a report commissioned by the Pentagon speculated that the regional impacts of a shutdown in the thermohaline circulation would be “a world where Europe will be struggling internally, large numbers of refugees washing up on its shores, and Asia in serious crisis over food and water”, such that “disruption and conflict” would be “endemic features of life.” For another, such a change would probably affect both the productivity of investment, and the possibility of intergenerational saving. If there is a severe abrupt change, we might predict that the current generation would dissave whatever had been set aside for the future in order to address more immediate hardships. (More on this later.)⁴² Again, consider the Pentagon report: “In the event of abrupt climate change, it’s likely that food, water, and energy resource constraints will first be managed through economic, political, and diplomatic means such as treaties and trade embargoes. Over time though, conflicts over land and water use are likely to become more severe – and more violent. As states become increasingly desperate, the pressure for action will grow.”

In conclusion, a severe abrupt change would surely undermine the reliability of existing cost-benefit analyses of climate change. Hence, there is at least one respect in which the possibility of a catastrophic abrupt climate change does seem to help with the problem of political inertia: it appears to undermine (what was left of) the appeal of the economic arguments.

2. Psychology

A second prominent explanation for political inertia is psychological. For example, Elke Weber claims that political inertia is not surprising, since neither peoples nor their governments have (yet) become alarmed about climate change, and this has meant that they have not (yet) become motivated enough to act.⁴³

Why aren’t people alarmed? A full explanation would no doubt be very complex. But Weber’s account suggests that the outline is accessible enough. In short, human beings have two processing systems – the affective and the analytical⁴⁴ – and these two systems are influenced in different ways, and by different kinds of inputs. Moreover, in cases involving risk and uncertainty – such as climate change – the affective system is dominant.⁴⁵ This

⁴⁰ First, Broome’s fundamental point is about historical uncertainty in general, not the effects of climate change in particular. Second, there are major concerns about whether we *will* actually reinvest in long-term projects.

⁴¹ Peter Schwartz and Doug Randall, “An Abrupt Climate Change Scenario and Its Implications for United States National Security” (2003), 14. Available at: www.grist.org/pdf/AbruptClimateChange2003

⁴² Schwartz and Randall, 22.

⁴³ Elke Weber, “Experienced-based and Description-Based Perceptions of Long-Term Risk: Why Global Warming Does Not Scare Us (Yet)” *Climatic Change* 77 (2006): 103-120; 103. See also Anthony Leiserowitz, “American Risk Perceptions: Is Climate Change Dangerous?”, *Risk Analysis* 25.6 (2005): 1433-1442; at 1438 & 1440; and “Before and After the Day After Tomorrow”, *Environment* 46.6 (2004), 23-37; at 27. Broader psychological, institutional and political explanations are canvassed in Oppenheimer 2006 in the papers by Baron, Bazerman, Leiserowitz and Sunstein. I focus on Weber’s account because it has the most direct relevance to the distinction between the abrupt and gradual Paradigms.

⁴⁴ Weber, 104.

⁴⁵ Weber, 104.

gives rise to a number of general problems. First, the two systems can, and often do, offer different judgments for the same cases.⁴⁶ Second, the reasons for these differences seem shallow. In particular, the two systems acquire information in different ways - the affective tends to rely on personal experience, whereas the analytical favors statistical descriptions - with the result that "ostensibly same information can lead to different choices depending on how the information is acquired".⁴⁷ Third, for reasons we shall see in a moment, the interplay of the two mechanisms gives rise to a systematic bias in decision-making: "low-probability events generate less concern than their probability warrants on average, but more concern than they deserve in those rare instances when they do occur".⁴⁸

To make matters worse, these problems interact badly with some related psychological phenomenon surrounding risk. For one thing, Weber claims that there is a "finite pool of worry": people have a limited capacity for the kind of worry that motivates action, so that an increase in concern about one risk tends to reduce concern about others.⁴⁹ For another, there is an analogous limitation in people's responses to problems even when they are motivated to act. Decision makers have a "single action bias", such that they are "very likely to take one action to reduce a risk that they encounter and worry about, but are much less likely to take additional steps that would provide incremental protection or risk reduction". Moreover, this bias persists even if the single action taken is neither the most effective, nor suitably coordinated with other actors, since a single action alone is enough to reduce worry.⁵⁰

These two tendencies have a number of implications. First, the presence of a finite pool of worry suggests that we can expect political inertia even when people appreciate that a particular problem exists, if concern for that problem is "crowded out" by other issues that seem more pressing. Second, given its dominance, failure to engage the affective mechanism is likely to result in a particular problem's being marginalized by other - perhaps objectively less important - concerns that do so engage.⁵¹ Third, even successful engagement is not enough, given the "single action bias". Hence, in cases where piecemeal, incremental policy-making is unlikely to work, it is vital not only to take major action when an issue has succeeded in grabbing the political spotlight, but also then to take all (or most) of the action necessary.

The relevance of these general claims to climate change problem seems clear. First, most of the information available about climate change comes from science and is both abstract and statistical. Hence, it engages the analytical system. However, given the dominance of the affective system, such engagement is liable to be ineffective by itself. Second, it is difficult to engage the affective system in the case of climate change because within that system "recent personal experience strongly influences the evaluation of a risky option"⁵² and "personal experience with noticeable and serious consequences of global warming is still rare in many regions of the world."⁵³ Third, given this, we should expect a communication problem. Weber claims that statistical information has a different impact on those who are used to employing their analytical systems and those who are not. Hence, she claims, there is likely to be a mismatch between the reactions of scientists and

⁴⁶ Weber, 104.

⁴⁷ Weber, 106.

⁴⁸ Weber, 102.

⁴⁹ Hence, for example, "increases in the concern of the U.S. public about terrorism post 9/11 seem to have resulted in decreased concern about other issues such as environmental degradation or restrictions of civil liberties". Weber, 115.

⁵⁰ Weber, 115.

⁵¹ Weber, 105.

⁵² Weber, 103.

⁵³ Weber, 108.

laypeople to the same information.⁵⁴ Finally, concerns about the psychological limits of attention and action seem pressing.⁵⁵ For one thing, empirical work suggests that many people see climate change as a real problem, but also rank it below many other concerns, particularly when it comes to voting behavior.⁵⁶ For another, many political communities do seem to have suffered from a kind of attention-deficit disorder when it comes to climate change. Moreover, those efforts that have been made tend to be predominantly piecemeal and incremental. Even the current Kyoto agreement is routinely defended as “merely a necessary first step”. But these may be dangerous tendencies given the single action bias.

What are the implications of all this psychology? Weber suggests that we must find a way of engaging the affective system, “perhaps by simulations of [global warming’s] concrete future consequences for people’s home or other regions they visit or value.”⁵⁷ But then she adds that invoking the gradualist paradigm is unlikely to work:

“To the extent that people conceive of climate change as a simple and gradual change ... the risks posed by climate change would appear to be well-known and, at least in principle, controllable (“move from Miami to Vancouver when things get too hot or dangerous in Florida”). While some of the perceived control may be illusory, the ability or inability to take corrective action is an important component of vulnerability.”⁵⁸

Instead:

“It is only the potentially catastrophic nature of (rapid) climate change (of the kind graphically depicted in the movie “The Day after Tomorrow”) and the global dimension of adverse effects ... that have the potential for raising a visceral reaction to the risk.”⁵⁹

In short, Weber claims that the abrupt paradigm has the capacity to engage the affective system in a way sufficient to motivate action. Given this, the growing scientific support for that paradigm is indeed good news in one respect. For it offers a potential way out of psychologically-induced political inertia.⁶⁰ Of course, Weber herself wants to go even further than this. For she asserts that it is abrupt climate change alone – and only truly global and catastrophic instances of it at that – which *can* help.⁶¹

⁵⁴ Weber, 108.

⁵⁵ James Hansen and Makiko Sato, “Greenhouse Gas Growth Rates”, *Proceedings of the National Academy of Sciences* 101, 46 (2004): 16109–14.

⁵⁶ See references in Dale Jamieson, “An American Paradox”, *Climatic Change* 77: 97-102; 101-2, note 1.

⁵⁷ Weber, 103.

⁵⁸ Weber, 112.

⁵⁹ Weber, 113-4. (More on the full version of this passage later.)

⁶⁰ Weber does point out that there is some concern that abrupt climate change may “crowd out” other legitimate policy concerns. (See my later remarks about the intergenerational arms race.)

⁶¹ This view is far from universal. For example, a recent report argues that emphasis on abrupt change is actually counter-productive: “... the scale of the problem as it is shown excludes the possibility of real action or agency by the reader or viewer. It contains an implicit counsel of despair – ‘the problem is just too big for us to take on’. Its sensationalism and connection with the unreality of Hollywood films also distances people from the issue. In this awesome form, alarmism might even become secretly thrilling – effectively a form of ‘climate porn’. It also positions climate change as yet another apocalyptic construction that is perhaps a figment of our cultural imaginations, further undermining its ability to help bring about action”. See Gill Ereaut and Nat. Segnit, *Warm Words: How Are We Telling the Climate Story and How Can We Tell it Better?* (London: Institute for Public Policy Research, 2006), 7.

3. The Intergenerational Analysis

The third explanation of political inertia is, I confess, my own. This suggests that one root of the problem lies in its intergenerational structure. The basic idea can be illustrated (in a simplistic way) as follows.⁶² Imagine a sequence of groups occupying the same territory at different times. Suppose, for the sake of simplicity, that each group is temporally distinct: no member of one group exists at the same time as any member of another group (i.e., there is no “overlap” between the groups). Call each group so conceived a “generation”.⁶³ Suppose then that the preferences of the members of each group are “generation-relative”: they concern only things that happen within the timeframe of that group’s existence. Finally, suppose that there are such things as temporally extended goods: goods that have benefits and costs that accrue in more than one generation. For current purposes, let us distinguish two kinds of such goods: those that have benefits in one generation and costs in later generations can be called “front-loaded goods”; those that have costs in one generation and benefits in later generations can be called “back-loaded goods”.⁶⁴

Other things being equal, in such a situation we would expect that if each group does exactly as it pleases it will consume as many front-loaded goods as possible, and eschew all back-loaded goods. But this observation appears to raise a basic problem of intergenerational fairness. Surely, the thought goes, there are situations in which a given group ought to forgo at least some front-loaded goods and invest in at least some back-loaded goods; presumably there are at least some constraints (of fairness, or justice, or some other such notion) on legitimate intergenerational behavior. If this thought is correct, then we might expect that groups that are unaware of, or do not recognize, such constraints will tend to *overconsume* front-loaded goods, and *underconsume* back-loaded goods. In other words, each such generation will take advantage of its temporal position by *illegitimately passing on costs* to later generations for the sake of securing benefits for itself, and *illegitimately forgoing opportunities to benefit* later generations for the sake of avoiding costs to itself.⁶⁵ Moreover, this problem will be iterated over time - since the incentives that generate the basic behavior arise anew for each generation as it comes into existence - with the result that such buck passing is likely to produce cumulative effects on generations further along the temporal sequence. Hence, one can expect a systematic bias in overall decision-making across generations. Let us call this, ‘the problem of intergenerational buck passing’ (PIBP).⁶⁶

⁶² The next two paragraphs are adapted from SELF-REFERENCE.

⁶³ I do not intend this as a general definition of a generation. This is just a helpful way to talk within the example.

⁶⁴ Obviously, these are extreme cases and in the real world most intergenerational goods will have a more complex profile than this. We might say that the goods distinguished are “pure” versions of the relevant goods. But, of course, similar concerns will arise for goods with more complex profiles whose net costs and benefits are distributed in the same general way. Talking in terms of pure front-loaded and back-loaded goods merely simplifies the exposition of the problem.

⁶⁵ Note that the PIBP does not assume that there ought to be no consumption of temporally diffuse goods. Moreover, any application of the PIBP will need to be understood against the background of some theory of what would constitute legitimate consumption of such goods. However, this is not to say that the existence of the PIBP is contingent on some particular theory of legitimate intergenerational consumption. Instead, the PIBP arises for any such theory that does not assume that the then-current generation may do completely as it pleases. Hence, the PIBP assumes only that there is a genuine question about legitimate intergenerational consumption, and that the right answer is not that one.

⁶⁶ For an earlier analysis of the problem, see SELF-REFERENCE 2003.

Elsewhere, I have argued that the PIBP is manifest in the case of climate change.⁶⁷ On the gradualist paradigm, this looks especially likely. But might the abrupt paradigm help? Initially, it appears so, since the potential proximity of the relevant thresholds appears to undercut the intergenerational aspect of climate change. Consider, for example, the following statement by the (now former) British Prime Minister Tony Blair:

“What is now plain is that the emission of greenhouse gases, associated with industrialisation and strong economic growth from a world population that has increased sixfold in 200 years, is causing global warming at a rate that began as significant, has become alarming and is simply unsustainable in the long-term. And by long-term I do not mean centuries ahead. I mean within the lifetime of my children certainly; and possibly within my own. And by unsustainable, I do not mean a phenomenon causing problems of adjustment. I mean a challenge so far-reaching in its impact and irreversible in its destructive power, that it alters radically human existence.”⁶⁸

Blair’s main claim appears to be that the impacts of climate change are both extremely serious, and coming relatively soon. (He does not mention abrupt climate change explicitly, but it is reasonable to assume that this is what he has in mind.) If this is right, it seems to give current people powerful reasons to act. Again, the abrupt paradigm appears to extinguish a major source of political inertia.

III. Against Undermining

At first glance, then, it appears, that the abrupt paradigm does undercuts all three of the major explanations for political inertia we’ve considered. But I shall now argue that in the case of the last two explanations, this appearance is deceptive. Instead, it is plausible to think that the possibility of abrupt climate change will actually make the intergenerational problem worse, rather than better, and that the psychological problem will add to this sad state of affairs.

Let us begin with the intergenerational problem. Blair suggests that some impacts of climate change are serious enough to “[alter] radically human existence”, “within the lifetime of my children certainly; and possibly within my own”. A rough calculation suggests that this means possibly within the next 26 years, and certainly within the next 75 (or 58).⁶⁹ At first glance, such claims do seem to undermine the usual intergenerational analysis. But this is too hasty. For the notion of proximity is made complicated in the climate change case by the considerable time lags involved – the same lags that give rise to the PIBP.

Consider the following. First, the atmospheric lifetime of a typical molecule of the main anthropogenic greenhouse gas, carbon dioxide, is often said to be around 200-300 years. This introduces a significant lagging effect in itself, but obscures the fact that around 25% remains for more than a thousand years.⁷⁰ Moreover, many of the basic processes set

⁶⁷ See Gardiner 2004a. Obviously, the application of the PIBP to the real world is complicated by several factors, and especially the existence of generational overlap. But I do not think this undermines such an application in this case. For some general reasons for skepticism about overlap, see Gardiner 2003.

⁶⁸ Tony Blair, Climate Change Speech (2004). Available at: <http://www.number-10.gov.uk/output/page6333.asp>

⁶⁹ Blair’s four children were born in 1984, 1986, 1988, and 2000. If we assume an average lifespan of 80 years, then he is claiming with certainty that there will be radical impacts no later than 2080 (if he means to pick out only the youngest of his children), or perhaps 2064 (if he means to pick out all of his children). Since Blair himself was born in 1953, he is also claiming that radical impacts could come before 2033. Moreover, on the reasonable assumption that he intends to suggest that abrupt climate change would have profound effects on the course each of their lives (rather than simply being observed by them right at the end of their lives), Blair presumably envisages timeframes notably closer than these outlying dates.

⁷⁰ David Archer, “Fate of Fossil Fuel CO₂ in Geologic Time”, *Journal of Geophysical Research* 110 (2005), 5.

in motion by the greenhouse effect continue to play out over thousands of years. Second, these facts have implications for the shape of the climate change problem. For one thing, the problem is *resilient*: once the emissions necessary to cause serious climate change have been released it is difficult – and perhaps impossible – to reverse the process. For another, the problem is *seriously backloaded*: at any given time the current impacts of anthropogenic climate change do not reflect the full consequences of emissions made up to that point. Finally, this implies that the full effects of current emissions are *substantially deferred*. Even if we are to reap some of what we sow, we will not reap all of it.⁷¹

These points suggest that it is worth distinguishing two kinds of proximity: temporal and causal. When Blair claims that the impacts of climate change are coming soon, he means to speak of temporal proximity: the impacts are near to us in time. However, the presence of resilience, serious backloading and substantial deferral implies that temporal proximity does not always imply causal proximity, and *vice versa*. Moreover, this fact has important implications, as we shall now see.

1. Domino Effect

Consider first a scenario we are in a position to cause a catastrophic abrupt impact, but won't suffer that impact because it will be visited on future generations. In other words, there is causal, but not temporal proximity. (Call this scenario, 'Domino Effect'.) Several of the most worrying impacts currently envisioned seem to fit this scenario. For example, even very rapid ice sheet disintegration is presumed to take place over centuries, such that its impacts are intergenerational⁷²; similarly, the limited work that has been done on deposits of methane hydrate in the oceans suggest that the associated impacts would not arise for several centuries, if not millennia.⁷³ Hence, the real concern in these cases is with causal proximity: the worry is that by our actions we may commit future generations to catastrophic climate changes.⁷⁴ However, such a scenario clearly raises, rather than undermines, the intergenerational analysis. So, we will have to look elsewhere for a challenge to the PIBP.⁷⁵

2. On the Cards

A second kind of scenario would involve temporal but not causal proximity. Suppose, for example, that we are already only a few years from crossing a major climate threshold, and that at this point we are already committed to doing so. The most obvious reason why this might be the case would be because, given the time lags, our past emissions make breaching the threshold literally inevitable. But it might also be that we are already committed because there are emissions that we are morally no longer going to be able to avoid, for example, because avoiding them would impose intolerable costs on current people and their immediate descendents. (Call this scenario, 'On the Cards'.)

If it turned out that *On the Cards* characterized our situation, and if we knew that it did so, then the implications of the abrupt paradigm for political inertia would be more mixed than the basic objection to the intergenerational analysis suggests. First, and most

⁷¹ See Gardiner 2006.

⁷² Hansen 2004.

⁷³ David Archer and Bruce Buffett, "Time-dependent Response of the Global Ocean Clathrate Reservoir to Climatic and Anthropogenic Forcing", *Geochemistry. Geophysics. Geosystems* 6 (2005), Q03002, doi:10.1029/2004GC000854; Danny Harvey and Zhen Huang, "Evaluation of the Potential Impact of Methane Clathrate Destabilization on Future Global Warming", *Journal of Geophysical Research* 100 (1995): 2905-2926.

⁷⁴ For this reason, Hansen describes the ice sheets as a "ticking time bomb" (Hansen 2005, 275). I prefer the analogy of a *Domino Effect*, since the central issue is that one generation is in a position to initiate a chain of events that will be very difficult (though not impossible) to stop.

⁷⁵ Blair's himself mentions both a mismatch in timing between cause and effect, and the intergenerational dimension, suggesting a sensitivity to the PIBP.

obviously, *On the Cards* might simply reinforce inertia. Suppose, for example, that a given generation knew that it would be hit with a catastrophic abrupt change no matter what it did. Might it not be inclined to fatalism? If so, then the temporal proximity of abrupt change would actually enhance political inertia, rather than undercut it. (Why bother?)

Second, and less obviously, *On the Cards* may provoke action of the *wrong kind*. For example, assume, for simplicity, that the two main policy responses for climate change are *mitigation* of future impacts through reducing the emissions that cause them and *adaptation* to minimize the adverse effects of those impacts that can or will not be avoided. Then, the following may turn out to be true of *On the Cards*. On the one hand, the incentives for the current generation to engage in mitigation may at least be weakened, and might disappear altogether. This is because, if a given abrupt change is, practically-speaking, inevitable, then *it* appears to provide no incentive to a current generation with purely generation-relative motivations for limiting its emissions. Perhaps the current generation will still have reasons to engage in some mitigation, since this might help it to avoid further impacts (including abrupt impacts) after the given abrupt change. But the given abrupt change does no motivational work of its own. Hence, its presence does not help future generations. On the other hand, the incentives for the current generation to engage in adaptation might be substantially improved. If big changes are coming, then it makes sense to prepare for them.⁷⁶ In itself, this appears to be good news for both current and future people. But there are complications. For it remains possible that the current generation's adaptation efforts may be unfair to the future. This point is important, so it is worth spending some time on it.

Let us consider three ways in which the improved motivation for adaptation provided by *On the Cards* may come into conflict with intergenerational concerns. First, considering only its generation-relative preferences, a current generation aware of an impending abrupt change will have an incentive to overinvest in adaptation *relative* to mitigation (and other intergenerational projects). That is, given the opportunity, such a generation will prefer to put resources into adaptation (from which it expects benefits), rather than mitigation (which tends to benefit the future).⁷⁷ Moreover, even within the category of adaptation, the current generation will have an incentive to prioritize projects and strategies that are more beneficial to it (e.g., temporary "quick fixes") over those that seem best from an intergenerational point of view.

Second, this problem is likely to be exacerbated by psychological effects. For example, Weber claims that proximity which brings with it engagement of the affective mechanism often leads to an overreaction – "low-probability events generate ... more concern than they deserve in those rare instances when they do occur".⁷⁸ Hence, those in the grip of an abrupt change are likely to overinvest in their adaptive responses.

Third, and most importantly, the proximity of the abrupt change may actually provide an incentive for *increasing* current emissions above the amount that *even a completely self-interested generation* would normally choose. What I have in mind is this. Suppose that a generation could increase its own ability to cope with an impending abrupt change by increasing its emissions beyond their existing level. (For example, suppose that it could boost economic output to enhance adaptation efforts by relaxing existing emissions standards.) Then, it would have a generation-relative reason to do so, and it would have this *even if* the net costs of the additional emissions to future generations far exceed the short-term benefits. Given this, it is conceivable that the impending presence of a given

⁷⁶ Alley 2004; US National 2002.

⁷⁷ This incentive is likely to be augmented by the possibility of greater opportunities for "double counting" and "no regrets" policies within adaptation, as opposed to mitigation, projects. For example, suppose that one adaptation strategy involved building up emergency response capabilities. Such a strategy would presumably bring with it benefits for dealing with non-climate as well as climate-related disasters.

⁷⁸ Weber, 103.

abrupt change may actually *exacerbate* the PIBP, leaving future generations worse off than under the gradualist paradigm (or than they would be if the earlier generation had not discovered the falsity of that paradigm). Furthermore, just like the original PIBP, this problem can become iterated. That is, if the increased indulgence in emissions by earlier generations intent on adapting to a specific abrupt climate change worsens the situation for a subsequent generation (e.g., by causing a further threshold to be breached), then the later generation may also be motivated to engage in extra emissions, and so on. In short, under the *On the Cards* scenario, we may see the structural equivalent of an *Intergenerational Arms Race* surrounding greenhouse gas emissions. Abrupt climate change may make life for a particular generation hard enough that it is motivated to increase its emissions substantially in order to cope. This may then increase the impact on a subsequent generation, with the same result. And so it goes on.

At first, the possibility of an intergenerational arms race may seem outlandish, in at least two ways. For one thing, it may seem to envisage an impossible, or at least very remote possibility: that the proximity of abrupt climate change could motivate even more greenhouse gas emissions than are currently being generated. For another, it may seem to attribute to a generation a hopelessly immoral (and therefore utterly unrealistic) outlook.

The first objection seems to me implausible. Consider, for example, a substantial change in the ocean conveyor brought on by climate change. If the physical impacts in Europe were anything like the magnitude of the past events mentioned by oceanographers, then the social and economic impacts would likely be very large, and negative.⁷⁹ Is it implausible to think that such impacts would cause a sharp change in energy and industrial policies in Europe? Is it unlikely that a Europe facing shortages of food, water and fuel (as the Pentagon report predicted) would abandon high energy taxes and clean burning technologies, seeking whatever aid additional energy could give it in fighting such problems?⁸⁰ Moreover, is it likely that the rest of the world, witnessing such impacts, would stand by and stoically refuse to aid those in distress? Would they not relax their own standards, burning their own oil and coal in whatever ways might be helpful in alleviating such a tragedy? Such actions seem entirely natural. Moreover, they are likely to be exacerbated by the psychology of risk. If Weber is right that there is a finite pool of worry, and a single action bias, one would expect a current generation to be consumed with the immediate tragedies of a severe abrupt change at the expense of other, more long-term worries.

This brings us to the second objection. However likely people might be to act in these ways, wouldn't they have to be grossly immoral to do so? I'm not so sure. As the above scenario suggests, there may be something admirable about the actions of such a generation, even if there is also something tragic, in that such actions predictably harm future people. Indeed, such a generation may be *morally justified* in its actions. Considering a similar situation, Martino Traxler likens the case to one of self-defense:

“Where the present harm from not emitting is conspicuous enough, we would be unrealistic, unreasonable, and maybe even irrational to expect present people to allow present harm and suffering to visit them or their kith and kin in order that they might avoid harm to future people. In these cases, we may with good reason speak of having so strong or so rationally compelling a reason to emit that, in spite of the

⁷⁹ Some people may regard the possibility of such impacts as itself outlandish. But that will not help here. For here we are considering arguments that use such possibilities in their main premises. The question is, *if* such impacts are possible and likely close by, does this undermine the intergenerational problem? My answer is that it does not.

⁸⁰ Note that California's widely-lauded recent climate change legislation includes an explicit “safety valve” clause, such that the Governor may delay or suspend regulations “in the event of extraordinary circumstances, catastrophic events, or threat of significant economic harm”. See California Assembly Bill 32 (2006), section 38599.

harm these emissions will cause to (future) others, we are excused for our maleficence."⁸¹

We seem then to have uncovered a way in which abrupt climate change may lead to a form of the PIBP that is actually worse in several respects than the one suggested by the Gradualist Paradigm. First, abrupt climate change might increase the *magnitude* of intergenerational buck passing, by increasing the presence of front-loaded goods. If a current generation can protect itself more effectively against an abrupt change through extra emissions that harm the future, then it has a reason to do so.⁸² Second, a severe abrupt change may make taking advantage of such goods not simply a matter of self- or generation-relative interest (which might be morally criticized), but morally justifiable in a very serious way. Hence, abrupt change may make buck passing even harder to overcome.⁸³

3. Open Window: Causal and Temporal

On the Cards shows that it is possible for abrupt change to make matters worse. But perhaps that scenario is too pessimistic. Hopefully, even though there is a sense in which the climate thresholds are close, it is not true that we are already committed to crossing one.⁸⁴ Interestingly, this thought reveals a tension in the proximity claim that is supposed to undermine the intergenerational problem: to be successful, the threatened abrupt change must be temporally close enough to motivate the current generation, but distant enough so as not yet to be "on the cards". This tension suggests that the argument against the intergenerational analysis presupposes a very specific scenario: that there is an abrupt change that would affect the current generation, to which the planet is not yet committed, but to which it will become committed unless the current generation take evasive action very soon. (Call this scenario, 'Open Window'.)

Several issues arise about *Open Window*. The first, obviously enough, is whether there is such a window, and, if so, how big it is. These are empirical questions on which our information is sketchy. Still, the preliminary estimates are not particularly encouraging. First, two parameters loom large. At the present time, scientists often say that there is a further temperature rise beyond that which the Earth has yet experienced but which is "already in the system". Estimates of this commitment typically range from 0.5-1.0°C, suggesting that a fair amount of climate change is already literally "on the cards". The vital issue then becomes how much more is *in effect* on the cards, since we cannot stop the world economy (and so the current trajectory and level of global emissions) on a dime. Barring a sudden technological miracle, the answer to this question would also seem to be "a substantial amount". These facts suggest that we are already committed to any abrupt changes likely to arise in the short- to medium-term. Thus, *On the Cards* has substantial relevance.

Second, preliminary calculations suggest that our ability to avoid a more substantial commitment is limited. Consider, for example, the European Union's call for limiting the

⁸¹ Martino Traxler, "Fair Chore Division for Climate Change", *Social Theory and Practice* 28 (2002):101–34; 107. I say more about such possibilities in SELF-REFERENCE.

⁸² Of course, such a scenario may arise under gradual change as well, even given the modest rate of change posited by the gradualist paradigm. It is simply more likely to arise, to arise quickly, and to swamp intergenerational concerns under the abrupt paradigm.

⁸³ It is worth noting that the presence of an "intergenerational arms race" with a bias toward adaptation might easily result in an economic argument for inaction predicated on the premise that unfettered economic growth is the best adaptive strategy. In many cases – though not always – this may manifest a form of what I elsewhere call "moral corruption". See Gardiner 2006.

⁸⁴ More weakly, perhaps we are committed only to crossing some thresholds and not others, and the abrupt climate change to which we are not yet committed is, on balance, worth avoiding, even for our own sakes.

global temperature rise to 2°C in order to avoid “dangerous climate change”. The origins of this target are a little unclear⁸⁵; but according to one recent analysis, its policy implications are sobering. At the very least, strong action appears to be needed very quickly:

“... to have a high probability of keeping the temperature increase below 2C, the total global 21st century carbon budget must be limited to about 400 Gigatonnes ... A budget of 400 GtC is very small. To stay within this budget, global emissions would almost certainly have to peak before 2020 and decline fairly rapidly thereafter. If emissions were to continue to grow past 2020, so much of the 400 GtC budget would be rapidly used up that holding the 2C line would ultimately require extraordinary rates of emission reduction, rates corresponding to such large and historically unprecedented rates of accelerated capital-stock turnover that, frankly, it’s difficult to imagine them occurring by virtue of any normal, orderly economic process. Time, in other words, is running out.”⁸⁶

But given the current, substantial growth in global emissions, stabilization in less than 15 years is a very ambitious target. According to the authors of the analysis, the 400 Gt budget is so tight that even if the developed nations were to reduce their emissions to zero by 2028, it would require serious reductions by developing countries starting in 2030. Obviously, absent some technological miracle, the antecedent of this claim is politically (and morally) impossible. But the consequent is almost as *implausible*, given that projections indicate that in 2030, the developing nations will still be quite poor.⁸⁷

It is thus unclear whether the 2°C target is feasible. Hence, if meeting that target is really necessary for avoiding any catastrophic abrupt impacts for the current people - and, some, of course, believe that 2°C is too high⁸⁸ - then the prospects for motivating action on those grounds appear slim. Much would then depend on how many other impacts that are still causally proximate are temporally close enough to have notable effects on the current generation. This remains an empirical question. But the projections suggest that we are now dealing with a very limited subset of the impacts of climate change. In short, for a generation interested only with impacts that affect its own concerns, the window may be closed, or at best, only slightly ajar.

Hopefully, the projections just cited will turn out to be unduly pessimistic.⁸⁹ Hence, it is worth making some observations about the importance of the PIBP even if there is an *Open Window* for the current generation. Our second issue then is whether, if the window is open, this undermines the relevance of the PIBP. One concern is that generations might care less about the end-of-life abrupt climate change than earlier-in-life ones. Another is that even an open window severely restricts the relevance of future people’s concerns. For *Open Window* to be effective, there have to be enough effects of present emissions that accrue within the window to justify the current generation’s action on a generation-relative basis. But this ignores all the other effects of present emissions - i.e, all those that accrue to other generations. So, the PIBP remains. Moreover, in light of the PIBP, there is a realistic concern that solutions that avoid a particular abrupt climate change will be judged purely on how they enable a present generation to avoid that change arising during their lifetime, not on their wider ramifications. In other words, each generation will be motivated simply to *delay* any given abrupt climate change until after it is dead. So, it may endorse

⁸⁵ Barry 2005, 265; Oppenheimer and Petsonk 2004.

⁸⁶ Sivan Kartha, Tom Athanasiou, Paul Baer and Deborah Cornland, “Cutting the Knot: Climate Protection, Political Realism and Equity as Requirements of a Post-Kyoto Regime” (2005), 4. Emphasis in original.

⁸⁷ Kartha et al., 10.

⁸⁸ E.g., Barry, 267.

⁸⁹ Notice, however, that even if that is the case, they may enter into the present reasoning of the current generation, and so corrupt its decision-making.

policies that merely postpone such a change, making it inevitable for a future generation. Finally, sequential concerns may arise even under the open window scenario. Considering the PIBP, it would be predictable that earlier generations tend to use up most of any safety margin left to them. Given this, it may turn out that some later generation cannot help pushing over a given threshold, and using up most of the safety margin for the next.

4. The Self-Corrective Argument

If all of this is the case, the potential for the abrupt paradigm to undermine the intergenerational problem appears to be slim. But before closing, it is worth addressing one final argument. Weber suggests that the psychological problems she identifies may eventually take care of themselves:

“Failing these efforts, the problem discussed in this paper is ultimately self-corrective. Increasing personal evidence of global warming and its potentially devastating consequences can be counted on to be an extremely effective teacher and motivator.”⁹⁰

The basic idea seems to be that, once realized, the impacts brought on by inaction on climate change are of a sort to engage the affective mechanism. Of course, as Weber recognizes, this may only happen once a substantial amount of damage is already done, and the planet is committed to significantly more.⁹¹ Still, the claim is that at least there is some kind of limit to inertia provided by the phenomena of climate change themselves.

Does the abrupt paradigm impose some limit on how bad climate change can get? Perhaps. But again the intergenerational problem rears its ugly head. If climate change is resilient and seriously backloaded, the effects on a present generation that experiences an abrupt change and knows these facts are unclear. If further bad impacts are already on the cards, or if the open window is only slightly ajar, then, if the present generation is guided by its generation-relative preferences, we may still expect substantial intergenerational buck-passing, and so more climate change. Experience of abrupt impacts may not teach and motivate, precisely because for such a generation the time for teaching and motivating has already passed – at least as far as its own concerns are implicated. Moreover, we should expect other factors to intervene. If a generation experiences a severe abrupt change, we might expect long-term concerns (such as with mitigation) to be crowded out in the finite pool of worry by more immediate concerns. We might also expect such a generation to be morally justified in ignoring those concerns, to at least some extent. In short, we might expect something akin to the beginnings of an intergenerational arms race.⁹²

IV. Concluding Remarks

This paper has considered three theses: that the possibility of abrupt change undermines the usual economic, psychological and intergenerational causes of political inertia; that it provides the current generation with positive motivation to act; and that it implies that there is some kind of fail-safe system that will limit humanity’s on-going infliction of climate change on itself and other species.⁹³ Against these claims, I suggested

⁹⁰ Weber, 116.

⁹¹ In the sentence immediately following the quoted passage, she says “unfortunately, such lessons may arrive too late for corrective action”. On the face of it, this remark appears to contradict the ‘self-corrective’ claim. But this is an uncharitable reading. I provide a better one immediately below in the main text.

⁹² These remarks are not criticisms of Weber herself, since she envisions that the motivation will be intergenerational. See next section.

⁹³ Taken together, these claims are comforting in at least two ways. First, they suggest that the way to overcome political inertia is simply to make current people aware of the possibility of abrupt climate change, through personal experience or relevant simulations of that experience. Awareness ought to be enough – the thought goes - because

that although the real possibility of abrupt change does tend to undermine economic explanations for inertia (which were, however, not very strong anyway), it does not undercut either its psychological, or intergenerational roots. Instead, the abrupt paradigm threatens to make climate change an even worse problem than the gradualist model it is supposed to augment or replace, since abrupt climate change may actually increase each generation's incentive to consume dangerous greenhouse gas emissions, and may even cause at least some generations to have a moral license to do so.

I conclude that we should not look to the disasters of abrupt change – either the actual experience of them, or increasing scientific evidence that they are coming – to save us. One implication of this is that we should not waste precious time waiting for that to happen. If severe abrupt climate change is a real threat, the time for action is now, when many actions are likely to be prudentially and morally easier than in the future. Still, how effectively to motivate such action remains a very large practical problem, about which the psychologists have much to teach us. In my view, if we are to solve this problem, we will need to look beyond people's generation-relative preferences. Moreover, the prevalence of the intergenerational problem suggests that one set of motivations that we need to think hard about engaging is those connected to moral beliefs about our obligations to those only recently, or not yet, born.⁹⁴ This leaves us with one final question. Can the abrupt paradigm help us with this last task? Perhaps so: for one intriguing possibility is that abrupt change will help us to engage intergenerational motivations. Indeed, Weber explicitly suggests as much in the full version of a passage quoted earlier:

“It is only the potentially catastrophic nature of (rapid) climate change (of the kind graphically depicted in the movie “The Day after Tomorrow”) and the global dimension of adverse effects *which may create hardships for future generations* that have the potential for raising a visceral reaction to the risk.”⁹⁵

If Weber is right that the potential effects of abrupt change on future people can cause the needed psychological effects⁹⁶, then the psychology of abrupt climate change might turn out to be of profound importance after all, even taking the PIBP into account. Still, this would now be because such change helps to underwrite a solution to the intergenerational problem, not because it undermines its application. Hence, such a result would fit well with the main aim of this paper, which has been to show that a solution to the intergenerational problem is still required, and that, given this, these are the relevant psychological and philosophical questions to be asking.

the current generation does appear to be vulnerable to such change, and the magnitude of it is sufficient to engage the right affective mechanisms. Second, the three claims imply that if, for some reason, this does not work, at least there is a limit to how bad it can get before the problem of political inertia finally goes away.

⁹⁴ We need also to think about duties to nonhuman nature. But since this is, at best, a far more difficult case to make, let alone to motivate people from, I leave it aside here. For a few remarks, see SELF-REFERENCE.

⁹⁵ Weber, 113-4; emphasis added.

⁹⁶ Leiserowitz may disagree with this. He says “climate change is unlikely to become a high-priority national issue until Americans consider themselves personally at risk” and though he may be taking a broad view of the “personal” in this passage – probably intending to refer to “impacts on themselves, their family or their local community” – this is still likely to be too narrow to capture the kind of intergenerational concern needed. See Leiserowitz 2005, 1437-8.