BRAINWAVES REPORT BW/022

VALIDITY OF THE STERN REVIEW

Disclaimer

The author wishes to make it plain that while he possesses degrees in classics (MA, Oxon), mathematics (BSc, Open) and New Testament History (PhD, Wales, Lampeter), he boasts no qualifications whatever in either science (beyond 'A' level physics) or economics. He does however have extensive experience in mathematical modelling and operational research in scientific fields, with several classified reports produced under MoD defence contracts, mostly in avionics.

ABSTRACT

In his groundbreaking study *Stern Review on the Economics of Climate Change* (2006), Sir Nicholas Stern employed as his model for discounting the future a well-known equation first published by F.P. Ramsey in 1928. This equation makes use of two constants representing ethical choices whose values need to be determined for each application. Those used by Stern have been challenged by critics in terms of the ethical assumptions on which they were based, and subsequently defended by him, his team and others. It would appear that *in terms of his application of Ramsey's discounting equation Lord Stern wins his case*. However, it may be questioned whether the equation is itself adequate for the task for which it is being used. What is required is a wholesale transformation of our contemporary approach to technology. The international action strongly urged by the *Review* requires a firmer metaphysical foundation for this, such as that offered by Plato.

INTRODUCTION

In 2005 Sir Nicholas Stern was asked by Chancellor Gordon Brown to conduct a major review of the economics of climate change as a guide to developing government policy. Sir Nicholas, now Professor Lord Stern, was a well-respected, established economist who has been the chief economist at the World Bank, the second permanent secretary of HM Treasury, and the head of the (UK) Government Economic Service. His *Review*, released in late 2006, expressed alarm at the impending climate damages that would result from 'business as usual', and presented novel economic arguments endorsing 'strong, immediate action in the form of about 1 per cent of GDP in order to thwart the possibility of damages amounting to as much as "20 per cent of GDP"…under business as usual.'[1] It was soon criticised by a number of other economists, alarmed by the striking difference between Stern and the majority of preceding economic analyses, which tended to recommend much smaller and

[1] Dasgupta 2007, 4.

slower responses. Central to the argument lay the *discount rate* adopted by Stern and his team. Ackerman puts it as clearly as any:

> For economists, calculation of future costs and benefits routinely involves a discount rate. The logic of discounting starts from the fact that money today is worth more than the same amount of money next year, or farther into the future (even if there is no inflation). No financial institution makes zero-interest loans, in which you pay back, in the future, exactly what you borrowed in the past. If you could borrow money at a 3% interest rate, getting £100 today would cost you £103 a year from now. To express current and future costs and benefits on a comparable basis, economists *discount* future amounts, converting them to the equivalent *present value*. At a 3% discount rate, £103 a year from now has a present value of £100. (Ackerman 2007, 4)

> Because the climate impacts of today's decisions span such long periods of time, the choice of a discount rate is one of the most important factors in the economic analysis of climate change. Stern's preferred discount rate, 1.4%..., is much lower than the rates used in traditional climate economic models. For William Nordhaus, "the *Review*'s radical revision arises because of an extreme assumption about discounting…this magnifies enormously impacts in the distant future and rationalizes deep cuts in emissions, and indeed in all consumption, today."[2] As Nordhaus suggests, a lower discount rate makes the far future look more important today, and supports greater future-oriented investment.

> In selecting the appropriate discount rate for long-term public policy decisions, economic theory often distinguishes between two components. The *rate of pure time preference* is the discount rate that would apply if all present and future generations had equal resources and opportunities….In addition, there is a *wealth-based component* of the discount rate, reflecting the assumption that if future generations will be richer than we are, then there is less need for us to invest today in order to help them protect themselves. In the notation of the *Stern Review*, the *discount rate*, *r*, is the sum of these two parts:

$$r = \delta + \eta g$$

> Here δ (delta) is the *rate of pure time preference*, and *g* is the *growth rate of per capita consumption*. If per capita consumption is constant, implying that $g = 0$, then the discount rate $r = \delta$. The second parameter, η (eta), determines how strongly economic growth affects the discount rate. A larger value of η implies a larger discount rate, and hence less need to provide today for future generations (as long as per capita consumption is growing). (Ackerman, 2007, 4)

This equation for *discount rate of consumption r* – that is, the *rate of fall of the discount factor* – reflects the ethical framework, standard in modern economics, known as *Classical Utilitarianism,* and was first published in 1928 by F.P. Ramsey, Professor of Mathematics at King's College, Cambridge (brother of the Archbishop). It was in use before Stern, and is prescribed for government use today in the Treasury *Green Book* (2011).[3]

In the *Review* δ has two components, *catastrophe risk* and *pure time preference,* or pure time discount rate, which today are commonly separated, as in the Treasury *Green Book* (2011):

> The first component, *catastrophe risk*, is the likelihood that there will be some event so devastating that all returns from policies, programmes or projects are eliminated, or at least radically and unpredictably altered. Examples are

[2] Nordhaus (2007, 289)

[3] A "tractable workhorse", as Beckerman and Hepburn describe it (2007, 191).

technological advancements that lead to premature obsolescence, or natural disasters, major wars etc. The scale of this risk is, by its nature, hard to quantify.

The second component, *pure time preference*, reflects individuals preference for consumption now, rather than later, with an unchanging level of consumption per capita over time. (Green Book, 2011)

In this latter sense δ describes a lower weight on the future, simply because it is in the future. Cole explains:

Virtually everyone would rather receive a dollar today than a dollar tomorrow or five years from now. A dollar in hand today can be invested at some positive rate of interest so that it will be worth more than a dollar tomorrow and worth much more than a dollar five years from now. The "*pure rate of time preference*" or "*utility discount rate*" is an estimate of the interest rate at which individuals discount the value of money over time.

The *Review* proposes a *catastrophe risk* – the possibility of extinction of the human race – of 0.1%. At this rate Stern computes that the human race has a probability of 0.095 of not surviving 100 years. At the same time he sets the *pure rate of time preference* to zero. This gives a total δ = 0.1%. (*Review* 2A.1, 47)

Defining *c* as *the marginal utility of consumption* gives *c*'/*c* as the *growth rate of consumption*, denoted nowadays by *g*. Then η as the *elasticity of the marginal utility of consumption*, of which Stern writes:

In this context [η] is essentially a value judgement. If, for example η=1, then we would value an increment in consumption occurring when utility was 2c as half as valuable as if it along the path: this is a specification of the path itself or the scenario or forecast of the path of consumption as we look to the future. (*Review*, 2A.1,.46)

Then the *Review* opts for

$$\eta = 1\%,\ g = 1.3,\ \delta = 0.1\%, \text{ giving } r = 1.4\%^{4}$$

These low values of η and δ are what give us the low *r*. On this basis,

Stem calculates that by investing one percent of annual global GDP starting now and continuing potentially forever, the world could avert costs to annual global GDP of ten percent "forever." In the "worst case," climate change mitigation would yield net costs amounting to 3.4 percent of annual global GDP. In the "best case," climate change mitigation would add 3.9 percent net to annual global GDP. (Cole 2008, 62)

[4] Compare the *Green Book* (2011) where in different notation the Social Time Preference Rate *r,* valid for up to 30 years, is computed using δ = 1.5%, η = 1.0, *g* = 2%, giving *r* = 1.5% + 1.0*2% = 3.5%. For longer periods the recommended Declining Long Term Discount Rate is specified in a table whose entry for 201-300 years is given as 1.5%, beyond which 1.0% is to be used.

THE CRITICS

By any standards the *Review* is a monumental achievement, encompassing as it does so much scientific data together with economic analysis and strategic proposals. However, he has received some merciless treatment at the hands of critical fellow-economists, who include Dasgupta (2007), Nordhaus (2007) and Weitzman (2007). As Ackerman puts it,

> In the opinion of a number of economists who have discussed the *Stern Review*, these criticisms invalidate Stern's conclusion that the costs of climate mitigation are much smaller than the benefits. (Ackerman 2007, 3)

The problem is confused by the fact that the exact interpretation of δ and η varies between commentators. Dasgupta, for instance,

> interprets δ as the measure of the trade-off between present and future, independent of wealth differences, and η as the measure of the trade-off between rich and poor, independent of time differences. In this framework,
>
> - $\eta = 0$ implies that ***every pound is of equal value*** regardless of who receives it;
> - $\eta = 1$ implies that ***every 1% increase in a person's income is of equal value*** regardless of the wealth of the person who receives it; and
> - $\eta > 1$ implies that ***a 1% increase in income is of greater value*** to a poorer person.
>
> Dasgupta endorses Stern's argument that δ is close to zero, but maintains that equity requires much more concern for the poor, reflected in a larger η; Dasgupta suggests a range of 2 to 4. (Ackerman 2007, 6, summarising Dasgupta, 2007, 3-7)

Daniel H. Cole (2008) gives a sustained and measured evaluation consideration of the state of play between Stern and his critics, in terms of conformity by the *Review* to "best practice" of BCAs (Benefit Cost Analyses). He asks,

> Is $\delta = 0.1$ too low?, and
> $\eta = 1$ too low?

On the first of these he cites on p.66 the view of William Nordhaus, who

> concludes that the *Stern Review's* choice of a very low δ, more than any other factor, explains why the *Stern Review's* results differ so dramatically from those of other climate change BCAs, including his own:
>
> > The *Review* proposes ethical assumptions that produce very low discount rates. Combined with other assumptions, this magnifies impacts in the distant future and rationalizes deep cuts in emissions, and indeed in all consumption, today. If we substitute more conventional discount rates used in other global-warming analyses by governments, by consumers, or by businesses, the *Review's* dramatic results disappear.... (Nordhaus 2007, 689)

Cole defends Stern's choice of $\eta = 1$ by pointing out that

> [t]he η actually combines three distinct valuations within a single number: (1) a measure of risk aversion, (2) a judgment about the extent of static income inequality among different people, and (3) a judgment about the extent of dynamic income inequality for individuals over time. (Cole, 2008, 71)

Because of this it is hard to fault Stern's choice of value, since

> the temptation to assign inconsistent values to η is understandable given the variety of potentially inconsistent judgments that η incorporates. (Ibid.)

Cole then disarms all of Stern's critics who attack him for his choice on individual values of δ, η or *g,* since Ramsey's equation makes *r* a function of all three. The same value for *r* could result from any number of different combinations of δ, η and *g.* Nevertheless this does suggest a number of weaknesses in the present day application of BCA analyses generally, noted particularly by Weitzman, who

> also doubts the ability of Stem or any other economic analyst to perform such calculations given the current state of economic science. (Cole, 2008, 76)

In Weitzman's own words:

> trying to forecast costs and benefits of climate change scenarios a hundred years or so from now is more the art of inspired guesstimating by analogy than a science (imagine forecasting today's world a century ago). (Weitzman, 2007, 715)

Cole continues:

> Is Weitzman suggesting that "state of the art" economic analysis is not yet up to the task of dealing with a problem as potentially large and long-term as climate change? The last three sections of Weitzman's review of the *Stern Review* suggest that the answer to this question is a qualified yes.
>
> The problem, in a nutshell, is the wide range of possible temperature increases under the IPCC's most current climate change models, including a five-percent possibility that temperature increases will equal or exceed 6°C and a two-percent probability of increases equal to or greater than 8°C within the next 100 to 200 years. Weitzman notes that "any honest economic modeler would have to admit" to complete uncertainty about the social, economic, and environmental effects of such a temperature increase because "such high temperatures have not existed for some tens of millions of years." (Cole, 2008, 75)

Moreover, Stern and his team have provided robust defences of their own methodology (Dietz and Stern, 2008; Dietz, Hope Stern, Zenghelis, 2008), justifying their choices of δ and η in terms of their ethical stance.

VERDICT

Ackerman summarises the discounting debate as follows:

> On discounting, the choices of both δ and η affect the discount rate. The choice of pure time preference (δ) is an ethical question, involving the value placed on the intrinsic wellbeing of future generations, independent of income. Stern favors a much lower value than most (not all) other economists, but the choice is not a matter of technical analysis. Rather, as the *Review* puts it, "if you care little about future generations you will care little about climate change. As we have argued that is not a position which has much foundation in ethics…[It is a position] which many would find unacceptable." [5] To quantify an ethical perspective that respects and validates the future, it is essential to set pure time preference close to zero.
>
> Regarding the choice of the second parameter, η, involving the value placed on changes in wealth, the arguments are less clear. Sensitivity analyses show that the exact *Stern Review* value of η is not crucial to the general conclusions, i.e. that the benefits of active, immediate mitigation outweigh the costs. (In this context, recall Arrow's conclusion that the benefits exceed the costs, even with $\eta = 2$ and a much higher rate of pure time preference.)…
>
> *In short, whenever there are data sufficiently precise to justify discounting…, Stern's general arguments for a low discount rate are persuasive*. As Weitzman and others have noted, this alone could be sufficient to flip the outcome of cost-benefit analysis: the high discount rates favored by many economists seem to justify doing very little for now; Stern's low discount rate, applied to the same data, endorses doing much more, much sooner. (Ackerman 2008, 16; emphasis added.)

Cole likewise writes positively on the discounting issue:

> Perhaps the most obvious lesson from the *Stern Review* and its critics…is that the choice of parameter values [including δ, η and *g*] can decisively influence the outcome of BCAs. Unfortunately, the *Stern Review* and its critics also remind us *of just how far away we remain from being able to specify a consensus "best practice" for selecting parameter values*. Many (though by no means all) reviewers complain that the *Stern Review's* choice of a 0.1 percent pure rate of time preference is too low. This assessment is supported by two reasons: (a) such a low discount rate ignores how people actually behave in markets and (b) it deviates significantly from a "conventional range" of discount rates in the BCA literature. These assertions are both true, and yet *they do not warrant a conclusion that Stem's choice of discount rate was "wrong" or violated some "best practice" of BCA.* (Cole 2008, 81, emphasis added).

Also:

> Sir Nicholas Stem, as lead author of the *Stem Review,* has also made himself available for conferences and meetings devoted to criticizing his *Review*. For example, on February 15, 2007, Sir Nicholas participated in a conference at Yale, where he confronted some of his staunchest critics, including William Nordhaus and Robert Mendelsohn. Not every author of every BCA would have been so brave or open to disputation. (Ibid, 89)

And finally:

> At the same time, the *Stern Review* seems to have influenced how other economists, including some of the *Stern Review's* staunchest critics, approach the economics of climate change. After slamming the *Review* when it was first

[5] *Stern Review*, Appendix to Chapter 2, p.48.

> published, Tol and Yohe more recently have suggested that Stem and his co-authors "may be right" (albeit "for the wrong reasons"). Weitzman always suspected that might be the case." While critical of the *Stern Review's* choice of parameter values, Weitzman thought Stem was right to focus more attention on the potential for climate change catastrophes. Since the *Stern Review* was published, Weitzman has been working to improve the treatment of low-probability catastrophes in climate change IAMs.[6] Nordhaus, meanwhile, has amended his own DICE IAM to reduce the pure rate of time preference (δ) in half from 3 to 1.5, although it is not clear whether the *Stern Review* played any role in this decision….
>
> To his credit, Stem never claimed that his conclusions and recommendations were the final word on the economics of climate change. He claimed only to be making "a contribution to the discussion." Judged as such, the *Stern Review* may be the most important contribution so far to the economics of climate change. (Ibid, 90)

I have not found any more recent writer who disputes this. So this outsider concludes that, on balance, *in terms of his application of Ramsey's discounting equation Lord Stern wins his case*. It seems appropriate therefore to reproduce it. In Ackerman's summary,

> [D]elays in mitigation will only make costs rise, foreclosing the opportunity to reach lower stabilization targets at acceptable costs. Since greenhouse gases remain in the atmosphere for decades or centuries after they are emitted, the cost of reaching any particular stabilization target depends on how much is already up there, as well as how much is emitted in the future. The longer we wait, the higher the atmospheric concentration will be, and the more drastic the cutbacks in emissions that will be required to stabilize at reasonable levels. In terms of the graph, the cost curve will move steadily upward if we delay – raising both the achievable concentration, and the costs of getting there. (Ackerman 2007, 19)

IMPLICATIONS

Reflecting on the above, there seem to be three related issues which need disentangling:

(1) *The Chancellor and politicians* want to know, how much, if any, of GDP will it be cost effective to commit towards climate change mitigation?

(2) *The economists* want to know, how best can they design a cost benefit analysis so as to answer (1)?

(3) *The world* wants to know, how do we mitigate (or even prevent) climate change as an end in itself, whatever the cost?

There is a suggestion in (1) here which concerns us. It is that *Chancellors and politicians will only pay for mitigation if it is cost effective to do so*. A Chancellor whose business is to balance his budget will naturally want to spend as little as possible, and to make as much profit as possible on what he does spend. But there is a moral problem here which transcends economics. We are treating the earth as though we owned it. But we do not own it. Having received it from our ancestors, we merely hold it in trust for all of our subsequent descendants. We and our immediate predecessors since,

[6] IAM: Integrated Assessment Model.

perhaps, the industrial revolution, have breached that trust. It is therefore incumbent upon us, having now realised the extent of the damage and the urgency of action, *as a moral duty*, to do whatever we can to rectify this, regardless of our own personal discomfort, political or electoral considerations.

Issues of how we assess the rights of future generations in comparison with our own which are implicit in the choice of η are beside the point. We are already their debtors.

Stern's wrestling with these issues is deeply impressive:

> [T]he current generation does not have the right to consume or damage the environment and the planet in a way that gives its successor worse life chances than it itself enjoyed. (*Stern Review*, 2A.1, 42)
>
> The notion of 'stewardship' can be seen as a special form of sustainability. It points to particular aspects of the world, which should themselves be passed on in a state at least as good as that inherited from the previous generation….
>
> Essentially, in this approach each generation has the responsibility of stewardship. Some would see the climate in this way, since it shapes so much of all the natural environment and is not straightforwardly substitutable with other capital. Others might ask still more basic questions as to how we ought to live, particularly in relation to nature. (*Stern Review*, 2A.1, 43)

Lord Stern is quite evidently deeply concerned to do all he can to preserve the planet as in (3) above, and to that end his *Review* stands as a wake up call to us all. He is wholly aware of issues of moral responsibility. But his brief is to examine (1), for which he needs a cost benefit analysis whose bottom line is GDP. Without this the politicians of today might take no action at all. But cost benefit is not an issue in relation to (3).

There *is* a role for cost benefit analysis, not to compute the *financial* outcome in terms of GDP, but in terms of the *effectiveness* of proposed scientific strategies in minimising greenhouse gases. This is a measurable scientific issue which does not rest on endless disputes about unquantifiable ethical issues. It has nothing whatever to do with anyone's '*right* to consume or damage the environment.' We have no human *right* to damage anything. But we do have an unquantifiable responsibility to generations yet unborn whose lives will already have been blighted by our own polluting lifestyles. And for forcing us to recognise this we have every reason to be grateful to Lord Stern whose *Review* stands as a towering contribution to the battle against climate change.

CONCLUSION: LIFE BEYOND RAMSEY

However, we may question whether Ramsey's equation is itself fit for purpose. What concept for instance does it entertain of *people*? People appear in it, indirectly, as *consumers*. For Beckerman and Hepburn (2007, 196) this utilitarianism is too impersonal:

> Thus the recipients of utility are regarded simply as vessels into which one puts a certain amount of utility.

Is this adequate? People can *think*. They can *make choices*. And they can *change*. And this has a very considerable impact on our problem. For the only ways of mitigating climate change that this model envisages are *monetary*: those whose financial value forms a significant element of GDP. Annex A illustrates how a comparable environmental problem, that of waste and litter, can be substantially combated by thinking people *at minimal public expense*.

Further, by far the most powerful thing we can do towards our ends is to *change attitudes* – which may cost little, if anything at all. *We must begin thinking the unthinkable*. One attitude we could profitably address immediately is the widely prevalent view that all new technology promotes human wellbeing; that 'Because we CAN, we MUST.' Sometimes traditional technology is to be preferred. For instance who benefits from petrol-driven leaf blowers, whose manufacture requires non-negligible quantities of the earth's resources, and whose operation generates greenhouse gases while inflicting noise pollution on the neighbours? If they are imported they reduce GDP as well. What do they achieve that cannot be done by a traditional broom, which is more likely to improve the physical wellbeing of the user at the same time?

Each new device should prompt us to ask, *Does this enable us to do something worthwhile that we could never do before*, as did refrigerators and televisions? Does it genuinely save labour, like washing machines, or does it simply make us lazy – as some would say of dishwashers? Does it justify the expense of resources and electricity use which increases the national requirement for power? Such devices also tend to speed up the pace of life, which also carries implications for our health and overall happiness. There are virtues in *simplicity*.

Similar questions might well be asked of the planned HS2 programme.

In the same vein *we should beware also of the notion that automation for its own sake is an unqualified good*. Each new application of wireless or internet technology brings with it the possibility of malicious interference from hackers, cybercriminals and other undesirables. As we approach the age of driverless cars we will need to be aware that any such vehicle carries with it the risk of online hijack by superior technology, thus initiating a perpetually escalating digital war such as that with which banks, industry, the defence establishments and even private individuals are already familiar. Another example is the newly introduced 'contactless' debit cards whose advantages are unclear. Apart from the obvious point that any such card dropped in the high street enables the finder to make a series of fraudulent purchases unchallenged, it now transpires that there are already devices available cheaply on the internet which enable the user to scan such a card from a distance while it is still within the wallet or handbag. *This is a high price to pay for negligible convenience*. And while contactless cards obviously do not directly cause global warming, they nevertheless form part of the culture of 'Because we CAN, we MUST' which must be eradicated if greenhouse gases are to be minimised. At the very least we shall need as a matter of course to provide lower technology

alternatives as fallback facilities wherever possible, just as high rise buildings require staircases as well as lifts. 'Yesterday's technology has a great deal to be said for it.'[7]

What is plain is that the *transformation of our thinking*, values and practices required to tackle climate change is not something that can be confined to a single ministry as can, say, the Health Service or the armed forces. The necessary revolution needs to be universal, affecting all areas of national life, if it is to succeed at all. For this we will need to rest upon a broadly acceptable foundation – a metaphysics – of proven worth, such as is proposed in Annex B. Given leadership, at a time of deep political divisions following the two recent referendums on Scottish independence and 'Brexit', such a transformation could prove a healing and unifying experience for the UK as a whole. Beyond that, at the time of writing (immediately after the September 2016 G20 summit), when it is reported that our stock in the world is lower than for many years,[8] successful innovations in combating climate change could become a positive example for the UK to offer to the world. This is after all the very scope and intention of the *Stern Review*. At the same time it could give us a fresh sense of purpose and national identity. Is it not worth a try?

Martin Mosse,
September 2016.

[7] Sometimes referred to as *Mosse's Third Law*. I have in mind Dr E.F. Schumacher's brilliant concept of Intermediate Technology brought to public notice in 1973 by his prophetic book *Small is Beautiful: A Study of Economics as if People Mattered*. It is to be regretted that when he wrote the dangers of fossil fuels had not been fully appreciated, which occasionally colours his argument.

[8] 'Britain's reputation as a force for stability in the world has been shaken' (Rachel Sylvester, 'May hit by whirlwind of political emotion', *The Times*, 6 September 2016.)

ANNEX A

LOW COST REPAIR OF THE ENVIRONMENT

It is characteristic of the *Stern Review* and similar analyses of cost effectiveness that they focus mainly on approaches to climate change mitigation which involve substantive *monetary* outlay, and that mainly dependent on government expenditure. They tend to ignore low technology approaches which cost very little, or very little public money, but which are strong in human imagination and creativity, or alternatively require changes in human thinking, life patterns or behaviour. But even within living memory attitudes and behaviour have been significantly changed by government-sponsored advertising campaigns which by comparison with technological solutions are relatively cheap to run and of limited duration. Such have been the 1960s campaign to make normal the wearing of seat belts in cars; the Road Safety Act of 1967 which introduced the breathalyzer, recent legislation to prevent smoking in public places and so forth. Such campaigns tend to involve single non-recurring expenses, unlike for instance ongoing measures to reduce greenhouse gas emissions by changing energy sources, where the initial hardware expense may be followed by indefinite cost increases. The proposed new Hinkley Point C power station provides an example.

Let us consider by example the comparable problem of litter and waste disposal. Imagine a council whose domain has a major problem with litter, especially besides roads and in lay-bys. A high-tech solution might be to buy a new pickup truck to travel round and clean up each lay-by on a rotating basis. This would mean employing a driver and other staff, as well as regular maintenance, and would in addition have the side effect of burning diesel fuel, with consequent emission of greenhouse gases.

A cheaper way could be to generate local enthusiasm for getting the litter picked up by volunteers. In March this year a small army of adults and children all over the country united in a hugely successful campaign to *Clean For The Queen*[9] in order to clear up the worst trouble spots all over the country, unpaid, in order to celebrate Her Majesty's ninetieth birthday, at minimal public expense.

Some villages have a strong ethos of clearing litter either for its own sake or for participation in a 'Tidiest village' type of competition.[10]

But best of all, people can be educated *not to drop litter at all.* For a small effort in schools, in the home and elsewhere, an entire culture can be turned around. Initial outlay may be minimal but the

[9] See http://www.cleanforthequeen.co.uk/resources/2466 . Accessed 2 September 2016.

[10] As reported sometimes on the Isle of Wight, as http://www.iwcp.co.uk/news/tidiest-villages-clean-up-awards-9661.aspx . Accessed 2 September 2016.

effect indefinite. Germany is famous for its national culture of tidiness.[11] In Switzerland the tidiness and cleanliness culture extends even into the home.[12]

As for waste disposal, perhaps the most striking voluntary enterprise is the worldwide Freecycle network whose webpage[13] reads:

> Welcome! The Freecycle Network™ is made up of 5,287 groups with 9,115,487 members around the world. It's a grassroots and entirely nonprofit movement of people who are giving (and getting) stuff for free in their own towns. It's all about reuse and keeping good stuff out of landfills. Each local group is moderated by local volunteers (them's good people). Membership is free.

A small government investment to support or replicate such a scheme in areas where it is not currently represented would be hugely cost effective.

Again, the *Guardian* website reports that in the first six months since the introduction of a 5p charge in 2015, the number of single-use carrier bags handed out by retailers dropped to 500 million, compared with 7 billion the previous year.[14] This required no more than an act of Parliament but has a huge effect on the environment.

All this suggests that in matters of the environment an enormous amount can be achieved for minimal government outlay, if any at all, by the use of the imagination in changing the way people *think*, and so the way they *behave*. In time entire cultures can be turned round. Such possibilities cannot be captured by a cost benefit analysis such as the *Review* which considers only the expenditure in terms of GDP as the driver of change.

---

[11] http://blogs.transparent.com/german/the-german-culture-of-cleanliness-putzfimmel-and-kehrwoche/ . Accessed 2 September 2016.

[12] http://news.bbc.co.uk/1/hi/programmes/from_our_own_correspondent/4318029.stm . Accessed 2 September 2016.

[13] https://www.freecycle.org/ . Accessed 2 September 2016.

[14] https://www.theguardian.com/environment/2016/jul/30/england-plastic-bag-usage-drops-85-per-cent-since-5p-charged-introduced . Accessed 2 September 2016.

ANNEX B

METAPHYSICAL BASIS FOR CLIMATE CHANGE MITIGATION

Stern is evidently extremely aware of the ethical dimension of climate change mitigation and deliberates on this at length at the start of his *Review*. He is rightly suspicious of arguments about the 'right to emit' at certain levels. There is no 'human right' to pollute the planet.

He has a strong sense of stewardship, which

> points to particular aspects of the world, which should themselves be passed on in a state at least as good as that inherited from the previous generation. (*Review*, 2A.1, 43)

The need to produce quantifiable answers leads him to adopt a *Classical Utilitarian* approach to ethics embodied in Ramsey's equation as a means of achieving intergenerational justice. For this his *Review* has been roundly castigated by Beckerman and Hepburn (2007) on account of its "impersonal, or cosmopolitan, consequentialism" (p.188), which treats people of all generations as of equal value. Against this they prefer *agent-relative ethics*, deriving from David Hume, which attach more importance to people alive today than to distant generations. Rejecting also the 'revealed ethics' of the marketplace, they dismiss (Plato's, unattributed) philosopher kings with a single swipe of the name of Isaiah Berlin (205-6).

So how do we begin in our postmodern, materialist age to judge between competing ethical schemes? Is there anywhere or anyone to whom we can turn for some kind of ethical guidance? Are we really doomed by the near-universal relativism of our age? For if we are incapable of finding any common basis for agreement on climate change with any chance of international acceptance, our efforts to protect the planet are likely to be in vain. As is not uncommon in cases of truly intractable issues, there may be something to be said for delving back into the past for an understanding of how the present mess came about.

It was in response to this very environmental crisis that the Islamic (Sufi) Professor Seyyed Hossein Nasr, wrote his penetrating, prophetic book *Man and Nature: The Spiritual Crisis of Modern Man*. In this he argues that the ecological and environmental problems of today have a spiritual origin, stemming ultimately from the rejection by Western civilisation of its own metaphysical roots at the time of the Renaissance.

> The disappearance of a real cosmology in the West is due in general to the neglect of metaphysics, and more particularly to a failure to remember the hierarchies of being and of knowledge. (Nasr 1997, 23)

> The Middle Ages thus drew to a close in a climate in which the symbolic and contemplative view of nature had been for the most part been replaced by a rationalistic view. (Ibid, 63-64)

This has led to a disregard for what we once saw as our nurturing 'Mother Earth', of which the ultimate consequence has been the present climate change crisis.

> One of the chief causes for this lack of acceptance of the spiritual dimension of the ecological crisis is the survival of a scientism which continues to present modern science not as a particular way of knowing nature, but as a complete and totalitarian philosophy which reduces reality to the physical domain and does not wish under any condition to accept the possibility of the existence of non-scientific world views. (Ibid, .4)

> Modern man, faced with the unprecedented crisis of his own making which now threatens the life of the whole planet, still refuses to see where the real causes of the problem lie. He turns his gaze to the Book of Genesis and the rest of the Bible as the source of the crisis rather than looking upon the gradual de-sacralization of the cosmos which took place in the West and especially the rationalism and humanism of the Renaissance which made possible the Scientific Revolution and the creation of a science whose function, according to Francis Bacon, one of its leading proponents, was to gain power over nature, dominate her and force her to reveal her secrets not for the glory of God but for the sake of gaining worldly power and wealth. (Ibid, 6)

> Having devastated nature through the application of a science of a purely material order combined with greed, modern man now wishes to put the blame at the door of the whole Western religious tradition. But because the reality of the Spirit is such that it cannot be denied by any form of sophism or limited science of the material order, the ecological crisis cannot be solved without paying particular attention to the spiritual dimension of the problem. (Ibid, 7)

We have lost the art of *thinking* and urgently need to rediscover it. In this writer's judgement, we need look no further than Plato, of whom wrote Alfred North Whitehead,

> The safest general characterisation of the European philosophical tradition is that it consists of series of footnotes to Plato.[15]

Plato's *Republic* offers us as fine a manual on learning to *think* as has originated anywhere in Western culture, to which it provided a generous foundation. He offers us a metaphysics – a structure for our thinking – which supplies a firmer basis than the almost universal, one-dimensional materialism of our present destructive age of which Nasr complains, and finds support in the paradoxical and mysterious nature of mathematics, which is commonly overlooked by contemporary scientism.[16]

As to the philosopher kings for which the *Republic* is famous – the *thinkers,* so scorned by Beckerman and Hepburn, whom Plato wanted to put in charge of his ideal state – we may yet see their day. Our present heir to the throne is after all no mean thinker. As such, His Royal Highness may be said with few rivals such as Al Gore to have done more to combat climate change than any other single individual. The Prince's Rainforest Project,[17] inaugurated in October 2007, just a year after the first release of the *Stern Review*, has won recognition within the international community of

---

[15] A.N. Whitehead, *Process and Reality* (1929), part 2, chapter 1

[16] This writer's website www.brainwaves.org.uk is dedicated to the business of rediscovering the lost art of thinking. On the *mystery* of mathematics see in particular BRAINWAVES Report BW/018, 'The Lion, the Cage and the Peashooter', in Section II of the website. For numerous renowned mathematicians such as G.H. Hardy and Sir Roger Penrose, 'mathematical reality' exists objectively in its own right outside us, equally real as the physical reality of the everyday world of our senses. If so then there is precedent for the genuine objective existence of abstracts in which Plato believed but which lies outside the credo of modern scientism.

[17] http://www.princeofwales.gov.uk/the-prince-of-wales/initiatives/princes-rainforests-project

scientists and others dedicated to taming the climate change monster by a constructive proposal to preserve the rainforest. In the Prince's own words,

> If deforestation can be stopped in its tracks, then we will be able to buy ourselves some much-needed time to build the low carbon economies on which our futures depend. I have endeavoured to create a global public, private and NGO partnership to discover an innovative means of halting tropical deforestation. Success would literally transform the situation for our children and grandchildren and for every species on the planet.[18]

For over forty years of endeavour to promote environmental awareness and sustainability His Royal Highness was in October 2012 honoured with The International Green Awards' Lifetime Achievement Award. In his acceptance speech, delivered *in absentia*, he said

> If we are really going to meet the needs of 9 billion people by 2050 and keep nature's capital intact we have to bring about a substantial transformation in the way we do things.[19]

'He that hath ears to hear, let him hear.' This transformation will most certainly be required if the recommendations of the *Stern Review* are ever to be implemented on an international scale. It begins with our *thinking*.

18 https://en.wikipedia.org/wiki/Prince%27s_Rainforests_Project

19 http://ethicalteam.com/myportfolio/specific-video/

BIBLIOGRAPHY

For clarity a broadly chronological sequence has been followed.

FOUNDATION

Ramsey, F. P. (1928), "A mathematical theory of saving", *Economic Journal* Vol. 38, Iss. 152 (December 1928), (543-559).

http://darp.lse.ac.uk/papersdb/Ramsey_(EJ_28).pdf Accessed 23 August 2016..

SUBJECT DOCUMENT

Stern, Nicholas (2006), *Stern Review on the Economics of Climate Change*, 30 October 2006 (original edition without postscript).

http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf Accessed 23 August 2016.

Postcript January 2007:
http://webarchive.nationalarchives.gov.uk/20130129110402/http://www.hm-treasury.gov.uk/media/A/6/Postscript.pdf Accessed 23 August 2016.

Combined January 2007:
http://webarchive.nationalarchives.gov.uk/20080910140413/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm Accessed 6 September 2016.

Stern, Nicholas (2007), *The Economics of Climate Change* (Cambridge: Cambridge University Press) (includes postscript).

https://www.amazon.co.uk/Economics-Climate-Change-Stern-Review/dp/0521700809/ref=sr_1_2?s=books&ie=UTF8&qid=1471946689&sr=1-2&keywords=stern+climate++change Accessed 22 August 2016.

OVERVIEW

https://en.wikipedia.org/wiki/Stern_Review Accessed 22 August 2016.

CRITICS

Dasgupta, Partha (2007), 'Commentary: The Stern Review's Economics of Climate Change', *National Institute Economic Review.* London: Sage Publications. 199 January 2007, 4–7.

http://qed.econ.queensu.ca/pub/faculty/garvie/econ443/debate/dasgupta%20commentary%20stern%20review.pdf Accessed 23 August 2016.

Beckerman, Wilfred and Cameron Hepburn (2007), 'Ethics of the Discount Rate in the Stern Review on the Economics of Climate Change', *World Economics* Vol. 8, No. 1, January–March 2007, 187-210.

http://qed.econ.queensu.ca/pub/faculty/garvie/econ443/debate/beckerman%20and%20hepburn.pdf Accessed 22 August 2016.

Nordhaus, William D. (2007), 'A Review of the Stern Review on the Economics of Climate Change', *Journal of Economic Literature,* Vol. XLV (September 2007), 686–702.

http://piketty.pse.ens.fr/fichiers/Nordhaus2007b.pdf Accessed 22 August 2016.

Weitzman, Martin L. (2007), 'A Review of the Stern Review on the Economics of Climate Change', J*ournal of Economic Literature* Vol. XLV (September 2007), 703–724.

http://scholar.harvard.edu/files/weitzman/files/review_of_stern_review_jel.45.3.pdf Accessed 22 August 2016

RESPONSES TO CRITICS

Dietz, Simon, Chris Hope, Nicholas Stern & Dimitri Zenghelis (2007), 'Reflections on the Stern Review (1) A Robust Case for Strong Action to Reduce the Risks of Climate Change', *World Economics* Vol. 8, No. 1, January–March 2007, 121-168.

http://qed.econ.queensu.ca/pub/faculty/garvie/econ443/debate/stern%20et%20al%20reflections%20I.pdf Accessed 22 August 2016.

Ackerman, Frank (2007), 'Debating Climate Economics: The Stern Review vs. Its Critics', Report to Friends of the Earth-UK, July 2007.

https://www.foe.co.uk/sites/default/files/downloads/debate_climate_econs.pdf Accessed 22 August 2016.

Evans, David (2008), 'Climate Change - the Stern Review and Discounting the Future', *Royal Economic Society Newsletter* 141, April 2008.

http://www.res.org.uk/view/art3Apr08Features.html Accessed 22 August 2016.

Dietz, Simon and Nicholas Stern (2008), 'Why Economic Analysis Supports Strong Action on Climate Change: A Response to the *Stern Review*'s Critics', *Review of Environmental Economics and Policy*, 23 April 2008, Volume 2, Issue 1, 94-113.

http://reep.oxfordjournals.org/content/2/1/94 Accessed 22 August 2016.

Dietz, Simon (2008), 'A long-run target for climate policy: the *Stern Review* and its critics', part of a consultancy project for the Committee on Climate Change Secretariat to provide analytical support on the long-term review, 2 May 2008.

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.318.2867&rep=rep1&type=pdf Accessed 23 August 2016.

Cole, Daniel (2008), 'The *Stern Review* and Its Critics: Implications for the Theory and Practice of Benefit-Cost Analysis', *Natural Resources Journal* Vol. 74, Winter 2008, 53-90.

http://lawschool.unm.edu/nrj/volumes/48/1/04_cole_stern.pdf Accessed 22 August 2016.

MISCELLANEOUS

Plato (2003), *Republic*, tr. H.D.P. Lee, second edition (revised) with Further Reading by Rachana Kamtekar, London: Penguin Classics.

Schumacher, E.F. (1974), *Small is Beautiful: A Study if Economics as if People Mattered,* London: Abacus.

Nasr, Sayeed Hossein (1997), *Man and Nature: The Spiritual Crisis of Modern Man,* Chicago, IL: ABC International Group.

HM Treasury (2011) *The Green Book: Appraisal and Evaluation in Central Government.*

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf Accessed 3 September 2016.

Mosse, Martin (2014), ‘The Lion, the Cage and the Peashooter’, BRAINWAVES Report BW/018, www.brainwaves.org.uk, Section II.