

Risk-Benefit Analysis: who wants it? who needs it?¹

“No practitioner [of cost-benefit analysis] should pretend that all the problems are resolved.”

From the introduction to “Cost-benefit analysis and environmental policy”, by Pearce²

After more than three decades of debate between practitioners and critics of cost-benefit analysis, in which the participants have been trading the same arguments and insults³, it is perhaps time to ask if the unresolved problems are resolvable.

David Pearce, Britain’s foremost proponent of CBA, helpfully sets out the main unresolved problems:

1. “the distributional issue” and “the issue of how to define the relevant population for non-use values”,
2. “the issue of incommensurables”, and the facts that “the science of economic evaluation has evolved and is still evolving” and “the science of benefit estimation changes very rapidly”
3. “the issue of how best to accommodate multiple objectives”
4. “the issue of whether we have anything better as a decision aid.”

There is now a large, and to me convincing, literature that explains why these “issues” can never be resolved in a way that will make CBA an acceptable method for settling arguments about projects or policies⁴. I shall try to give a brief summary.

With respect to issue 1 Pearce says “the distributional issue was perhaps never fully resolved.” Perhaps! But in any event he observes that there has been a retreat from attempts to deal with it because distributional issues are not “best addressed through project investments.” He thus walks away from the problem that CBA favours projects, such as roads and airports, that save rich people (who value time highly) a lot of time, at the expense of poor people who can afford to pay little to defend their environments. He also notes and walks away from the unresolved problem of whose

¹ This paper draws heavily on earlier publications by the author: *Cost-benefit analysis: part of the problem, not the solution*, Green College Centre for Environmental Policy and Understanding, Oxford, March 1995; chapter 6 of *Risk*, UCL Press (1995), London; and “Cars, Cholera and Cows: the management of risk and uncertainty”, *Policy Analysis* No 335, March 4, 1999, published by the Cato Institute, Washington; republished with a new preface as *Risky Business* by the Adam Smith Institute, London 1999.

² David Pearce (1998) Cost-benefit analysis and environmental policy, *Oxford Review of Economic Policy* vol. 14, No. 4. In this article Pearce reviews the chequered history of CBA and attempts a rebuttal of its critics. The article is helpfully concise and, for anyone new to the debate, is recommended as a good introduction to the other side.

³ My most cherished insult is “Adams is not an economist”.

⁴ A far from complete list of my favourites includes: Downs, A. (1965) contribution to discussion in *Measuring Benefits of Government Investment*. R. Dorfman (ed), Brookings Inst. Washington DC. (first recorded reference to CBA as “horse and rabbit stew”); Fischhoff, B. (1991) Value elicitation: is there anything in there? *American Psychologist*, vol 46, no 8, 835-847; Jacobs, M. (1991) *The Green Economy: environment, sustainable development and the politics of the future*, Pluto Press, London; O’Neil, J. (1993) *Ecology, Policy and Politics: human well-being and the natural world*, Routledge, London; O’Neil, J. (1996) Cost-benefit analysis, rationality and the plurality of values, *The Ecologist*, vol 26, no 3, 1996.

“non-use values”⁵ should be included in a CBA. Everyone in the world, if informed about the existence of some threatened species or landscape, is capable of forming a view about the amount of money that would be needed to compensate them for its loss. As Pearce himself demonstrates⁶ – the outcome of a CBA will be hugely and arbitrarily influenced by the fraction of this global population that is actually included in the analysis. Distributional issues are at the core of almost all disputes about projects and policies. A decision-making methodology that cannot deal with them is unlikely to arrive at fair decisions.

With respect to issue 2 he notes, without offering a solution, that there remain after decades of intellectual struggle unresolved problems associated with measuring environmental costs and benefits. The most intractable of these is the cash valuation of environmental losses suffered by poor people. He pretends that rules of CBA permit the valuation of such losses either in terms of willingness to accept compensation for the loss (WTA), or willingness to pay to prevent the loss (WTP). This is not the case. Both the logic and morality of CBA require that losses be valued in terms of what the losers would be willing to accept as fair compensation. Willingness-to-pay measures are constrained by ability to pay and, for the very poor, render their environment worthless. In practice willingness-to-pay values are almost always used by cost-benefit analysts because they present fewer obvious measurement problems.⁷ The rapid evolution of the “science of economic valuation” to which Pearce refers might be better described as high-speed wriggling in an attempt to evade an unpalatable truth - if their science cannot capture incommensurables, it has nothing useful to say.

With respect to issue 3 Pearce offers no remedy other than the claim that “it is far from clear that other approaches fare any better than CBA.” Controversial projects and policies usually pit “developers” against “environmentalists” (see appendix 1). The former commonly place high values on the benefits of their projects and low/negligible values on the environmental losses. Conversely the latter value nature highly and are often dismissive of the developmental benefits. Attempting to convert these contending values into cash is likely to yield averages that completely obscure the underlying dispute about the nature of “development” and “environment”. It will settle no arguments, but is likely to antagonise both sides by its irrelevance.⁸

With respect to issue 4 Pearce concludes that “CBA still seems the ‘best game in town’.” This is the cost-benefit analyst’s last ditch defence: whatever flaws CBA’s critics might find in his methods they cannot do as well. This is not a claim he feels moved to substantiate by detailed comparisons with other “games”.

Everything that the proponents and critics of CBA now have to say about these four issues could have been written 30 years ago (see appendix 1). Although the monetary

⁵ These include “existence values” – e.g. values that people might attach to rare endangered species that they might never see but whose extinction they would never the less regret.

⁶ He cites an example in which the conclusions of a CBA were reversed by a decision to reduce the “affected non-use population” from 7.5 million to 100,000 (Pearce 1998, p 95).

⁷ Because WTP measures are constrained by ability to pay they permit the cost-benefit analyst to dismiss as implausible very large or infinite values. With WTA measures it is possible for someone to say, and mean, that no amount of money could compensate them for a loss. It takes only one infinity to blow up a CBA.

⁸ Wendy Nelson Espeland provides an excellent example in her discussion of the propensity of the “average aesthetic” to produce ugly art.

values incorporated in cost-benefit analyses have risen with inflation nothing of significance in the intellectual disagreement between the proponents and opponents of CBA has changed. Why?

Risk Benefit Analysis

In attempting to answer this question I propose to focus on a relatively neglected aspect of the debate – the treatment of risk in CBA. In addition to the uncertainties tacitly acknowledged by the term “incommensurable”, cost-benefit analysts occasionally incorporate risk explicitly in their analyses.

In *Blueprint for a Green Economy* Pearce *et al* argue that “by trying to value environmental services we are forced into a rational decision-making frame of mind.” In a later paper with Fankhauser on the greenhouse effect Pearce again insists upon the reduction of all elements of the problem to cash as a necessary condition for rational decision-making.

“A monetary assessment is crucial to design the optimal policy response. A comparison between the costs of greenhouse prevention and the benefits of avoided warming, which forms the backbone of an economically rational greenhouse response, is only feasible if damage can be expressed in monetary terms.”⁹

In *Blueprint for a Green Economy* we find the following illustration of what this means when applied to risks.

“Suppose that a particular programme involves a significant probability of a major catastrophe through soil contamination in a hundred years time. The cost of this contamination is estimated, in today's prices, to be £100 million and the probability that it would occur is 0.5. Then the expected cost in 2089 is £50 million. Discounted at 10 per cent per annum this amounts to £36, at 5 per cent it amounts to £3802, and at 2 per cent it amounts to £69,016.”¹⁰

This is a straightforward application of the definition of risk most commonly found in the risk literature; probability is multiplied by magnitude and, because the risk being discussed lies far in the future, the product is discounted to its present value¹¹. In this example we find the Kelvinist view of risk carried to its logical conclusion - if a risk exists, it must exist in some quantity and can therefore be measured - and the only practicable measure, say the economists, is money.

There is reason to suppose that such numbers are meaningless abstractions - even for economists who have a professional interest in them being meaningful. The discounted values given in this example are wrong by two orders of magnitude? They should be multiplied by 100, giving present values of £3600, £380,200 and £6,901,600. It is

⁹ Note the inverted “rationality” in this framing of the problem. The assumed cause of the “greenhouse problem” is increasing atmospheric CO₂ caused by increasing emissions resulting from increasing traffic and other forms of economic activity. Avoiding the damage caused by increasing CO₂ is called a “benefit”, and the “cost” is the bill for the avoidance measures. If the damage caused by global warming were to be treated (as it should be) as the cost, and valued using willingness-to-accept-compensation measures then the “project” of economic growth would never pass a CBA test.

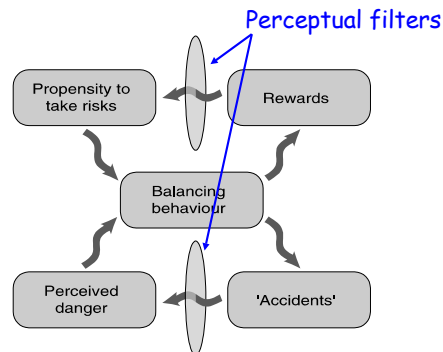
¹⁰ Pearce, D., Markandya, A. & Barbier, E. 1989. **Blueprint for a Green Economy**, London: Earthscan, p 136.

¹¹ The ‘present value’ of some future loss is the sum that would have to be invested now at the going interest rate in order to produce a sum of money equal to the loss in the year in which it occurs.

possible that this is simply a series of typographical errors. Such an error, however, is not a trivial problem in quantitative treatments of risk; there are numerous cases in which people conjuring with complex models and large numbers have managed to misplace their decimal points.

But given the importance attached to human error in the literature on risk and safety let us consider for a moment the possible significance of this particular 'accident'. It occurs in a section of the Pearce Report that is explicitly devoted to comment on the power of compound interest to reduce large values in the future to insignificance in the present. This suggests that it might have been an accident in calculation rather than typing. But let us be charitable and assume that it is the result of mere slips of the keyboard that got past the proof reader. The ability of such large errors to escape detection through all the processes of checking raises questions about the *meaning* of the numbers. The calculation and interpretation of such numbers are, supposedly, part of the process by which *society* should perform its risk balancing act. The calculation of such numbers should become, it is proposed by the cost-benefit analysts, the means by which government policy makers articulate perceptions of danger. The numbers are intended to be compared with future benefits, also uncertain, also monetized and also discounted, to guide the making of decisions about environmental risks.

Let us consider the adequacy of this way of dealing with uncertainty with the help of the simple *conceptual* model of risk management described by Figure 1. It characterises risk management as a non-monetized form of cost-benefit analysis. The rewards of a contemplated action – which are uncertain – are balanced against adverse outcomes – which are also uncertain.



The model postulates that

- everyone has a propensity to take risks
- this propensity varies from one individual to another
- this propensity is influenced by the potential rewards of risk taking
- perceptions of risk are influenced by experience of accident losses - one's own and others'
- individual risk taking decisions represent a balancing act in which perceptions of risk are weighed against propensity to take risk
- accident losses are, by definition, a consequence of taking risks; the more risks an individual takes, the greater, on average, will be both the rewards and losses he or she incurs.

Perceptual filters

The model is equipped with “perceptual filters”. There has been a long-running and sometimes acrimonious debate between “hard” scientists - who treat risk as something that can be objectively measured - and social scientists - who argue that risk is culturally constructed. Much of this debate has been caused by the failure of the participants to distinguish between different kinds of risk. It is helpful, when considering how the balancing act in Figure 1 is performed, to be clear about the sort of risk one is dealing with. There are

- *directly perceptible risks*: e.g. climbing a tree, riding a bicycle, driving a car,
- *risks perceptible with the help of science*: e.g. cholera and other infectious diseases,
- *virtual risks* – risks about which scientists do not or cannot agree: e.g. the connection between bovine spongiform encephalopathy, (BSE or “Mad Cow Disease”) and Creutzfeldt-Jakob Disease (CJD) in humans, global warming, numerous suspected carcinogens, etc., etc..

In Figure 2 these categories are represented by three overlapping circles to indicate that the boundaries between them are indistinct, and also to indicate the potential complementarity of approaches to risk management that have previously been seen as adversaries in the debate between the “hard” scientists and the cultural constructionists.

Three kinds of Risk

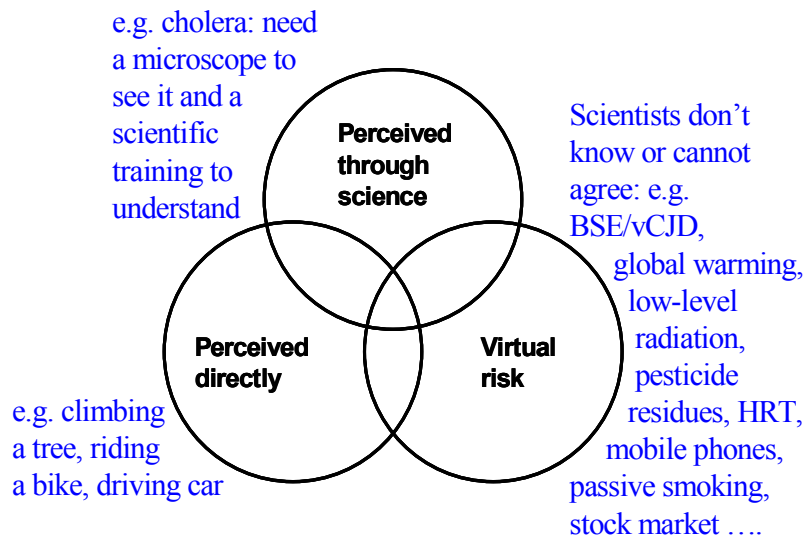


Figure 2

With the exception of gambling and other financial risks, *directly perceptible risks* are managed instinctively and intuitively – we do not undertake a formal probabilistic risk assessment before we cross the street. The risk thermostat model has at its centre a box labelled *balancing behaviour*. The *reward* of, say, getting to the church on time might induce a prospective bridegroom to drive faster and more recklessly than normally. In the terminology of our model this behaviour is accounted for by the driver balancing a higher than normal *propensity to take risks* with a higher than normal *perceived danger*. This propensity and perception are states of mind that are

Comment: Page: 2

I'm not certain what you mean by the last part of the sentence, and I expect the average reader will have problems as well. Can you add a sentence or two in explanation? OK now?

not directly measurable and are assumed to be responses to external conditions that have passed through perceptual filters. The mental mechanisms by which such balancing acts are performed are but dimly understood, but behaviour is assumed to seek an 'optimal' trade-off between the benefits of risk taking and the costs.

Any attempt to measure the costs and benefits associated with this behaviour would reveal that they are various, multifaceted and incommensurable. No one knows how the balancing trick is done, but certainly there is no evidence to suggest that the speed at which the bridegroom takes a corner is the result of a calculation in which either the benefits of getting to the church on time or the potential costs of a road accident are translated into cash.

Science illuminates many of the connections between behaviour and consequence, sometimes so successfully that previously invisible risks become directly perceptible. Cholera is now detectable and contaminated water supplies can be treated or labelled. One would have to very thirsty indeed to risk drinking from a well labelled 'cholera'. Although the lack of clean water in many poor countries still leads many to take this risk, there is no evidence that those who take it decide to do so after converting into money the reward of slaking their thirst and the suffering they might endure from potential diseases.

Sometimes the illumination by science is partial. The prospective outcomes of medical treatments, for example, are frequently expressed as probabilities, with respect to both the likelihood of cure and the likelihood of adverse side-effects. Here cost-benefit analysts have spotted an opportunity. If uncertainty can be expressed as a probability then, as noted above in Pearce's contaminated soil example its treatment is considered straightforward – simply multiply estimated cost and benefit values by the probability of their occurrence.

However estimates of such probabilities are usually of limited value to those seeking guidance about what to do in the face of uncertainty. There are at least as many problems attaching to the probability estimates as there are to the value estimates by which they are multiplied. A debate currently running in the British press about the use of surgeons' 'success'¹² rates as indicators of probable future outcomes illustrates one intractable problem. The best surgeons are likely to be given the most difficult cases, thereby reducing their success rate. Conversely, to the extent that success rates are likely to affect funding and job prospects there will be attempts to fob difficult cases off onto others, perhaps the most junior surgeons least able to object. This might be described as "the Heisenberg problem" – as in small particle physics, the act of measurement alters that which is being measured.

Another problem occurs when accident statistics are used to estimate the probability of future fatal road accidents; such probabilities commonly appear in comparative risk tables. The probability of a Briton dying in a road accident this year is currently entered in such tables as about 1 in 16000 – a figure arrived at by dividing the number of road accident fatalities last year by the population. But a trawl through the road safety literature turns up claims that a young man is 100 times more likely than a middle-aged woman to be involved in a serious road accident, that one is 134 times more likely to die if on the road a 3am Sunday than at 10am Sunday, that one is 10

¹² There are also many problems with defining and measuring success. Does merely surviving the operation for a specified time count as a success?

times more likely to die if one suffers from a personality disorder, and that one is 20 times more likely to die if more than two and half times over the legal blood alcohol limit. If these variables were independent it would mean that a disturbed drunken young man on the road at 3am Sunday would be about two and a half million times more likely to die than a normal, sober, middle-aged woman driving to church 7 hours later.

This exaggerates the case; the variables are not, of course, independent. There are almost certainly more disturbed drunken young men on the road at 3am Sunday than 10am. But by how much does it exaggerate? The above example lists only 4 variables out of vastly larger set that might influence accident outcomes. Was the driver calm or angry? sleepy? on drugs? insured? Was the car old or new? fitted with ABS brakes, bald tyres, airbags? Was the road well-lit? icy? straight? well-maintained? ... The list is long.

Such difficulties have not deterred the cost-benefit analysts of Britain's Department of Transport from multiplying their estimates of lives that will be saved by building new roads by their estimates of the cash value of a life¹³ in order to calculate one of the major "benefits" of their road building proposals. The multiplication of funny numbers by funny numbers has produced life saving "benefits" that have been used to justify the construction of billions of pounds worth of roads schemes in Britain.

Even worse, the construction of these schemes has almost certainly made Britain's road network more dangerous. The spurious life saving "benefits" were always calculated for a small part of the road network containing the new scheme and immediately surrounding roads. Since the new schemes almost always relieved traffic jams, they have had the effect of liberating suppressed demand for road space and increasing the flow of traffic on many miles of road upstream and downstream of this new capacity, thereby increasing traffic danger over a wide area. The issue discussed above of how to define the relevant population for non-use values is equally important for "use values", such as the values of the lives and limbs of people who will be directly affected by projects.

In brief, all the problems encountered by cost-benefit analysts when they are dealing with outcomes that they consider certain, are hugely increased in the presence of uncertainty framed as probability. But these problems are trivial compared to those encountered when the risks are virtual.

Virtual Risk

Virtual risks are products of the imagination which work upon the imagination. The less conclusive the science relating to a particular risk, the more liberated are people's imaginations. BSE/CJD, genetically modified foods and mobile phones are topical examples of virtual risks. In the absence of clear and convincing scientific evidence, judgements about these risks will be influenced by people's predispositions to view the evidence in particular ways.

We all, scientists included, perceive virtual risks through different *perceptual filters*.¹⁴ The discovery of the Antarctic ozone hole was delayed by such a filter. U.S.

¹³ A critique of this number can be found in J. Adams (1974) "... and how much for your grandmother?", *Environment and Planning A*, vol. 6.

¹⁴ See *Risk* chapter 3, Patterns in uncertainty.

satellites failed to pick it up. Their computers had been programmed to reject as errors, the data identifying the hole that their instruments collected because the values lay beyond the range that the programmers had considered credible.¹⁵

When scientists do not know or cannot agree about the “reality” of risks people are liberated to argue from belief and conviction. Figure 3 presents a typology of four “myths of nature” that encapsulates various preconceptions about nature that guide decisions made in the face of uncertainty.¹⁶ Each of the four myths is illustrated by the behaviour of ball in a landscape; and each myth is associated with a distinctive risk-management style.

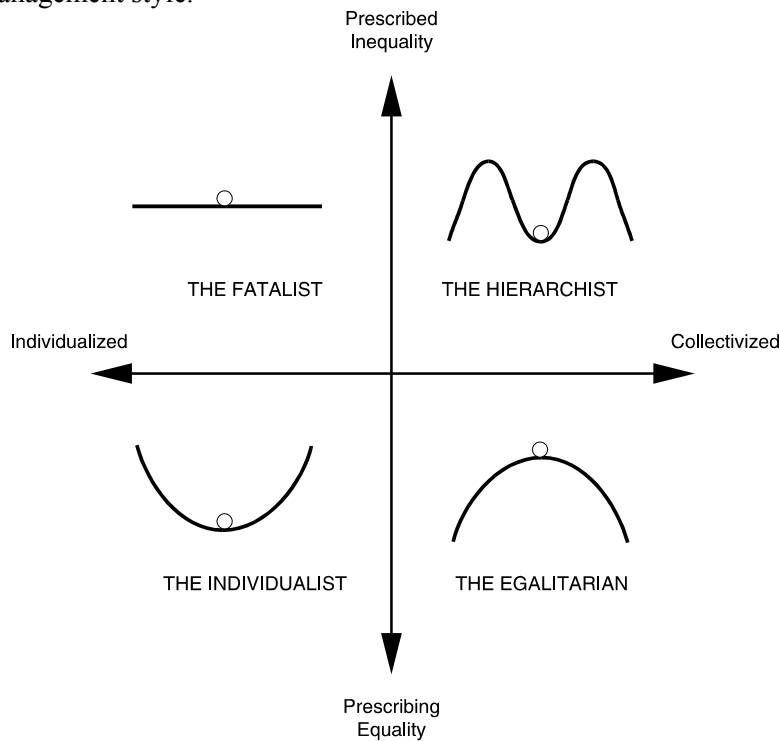


Figure 3. Four rationalities: a typology of bias

- *Nature benign* is represented by a ball in a cup: nature, according to this myth, is predictable, bountiful, robust, stable, and forgiving of any insults humankind might inflict upon it; however violently it might be shaken the ball comes safely to rest in the bottom of the cup. Nature is the benign context of human activity, not something that needs to be managed. The management style associated with this myth is relaxed, exploitative, laissez-faire.
- *Nature ephemeral* is represented by a ball balanced precariously on an over-turned cup: here nature is fragile, precarious and unforgiving. It is in danger of being provoked by human greed or carelessness into catastrophic collapse. The objective of management is the protection of nature from Man. People, the myth insists, must tread lightly on the earth. The guiding management rule is the precautionary principle

¹⁵ R.E. Benedick (1991) *Ozone Diplomacy*, Harvard U.P.

¹⁶ Wendy Nelson Espeland provides an illuminating discussion of what happens when CBA encounters opposing world views.

- *Nature perverse/tolerant*: this is a combination of modified versions of the first two myths. Within limits nature can be relied upon to behave predictably. It is forgiving of modest shocks to the system, but care must be taken not to knock the ball over the rim. Regulation is required to prevent major excesses, while leaving the system to look after itself in minor matters. This is the ecologist's equivalent of a mixed economy model. The manager's style is interventionist.
- *Nature capricious*: nature is unpredictable. The appropriate management strategy is again laissez-faire, in the sense that there is no point to management. Where adherents to the myth of nature benign trust nature to be kind and generous the believer in nature capricious is agnostic; the future may turn out well or badly, but in any event, it is beyond his control. The non-managers motto is *que sera sera*.

Plural Rationalities

The myths of nature presented in Figure 3 represent partial truths; nature, depending on time, place and circumstances is capable of behaving in any of these ways. Thompson, Ellis and Wildavsky¹⁷ associated these myths with distinctive perceptual biases or “rationalities”.

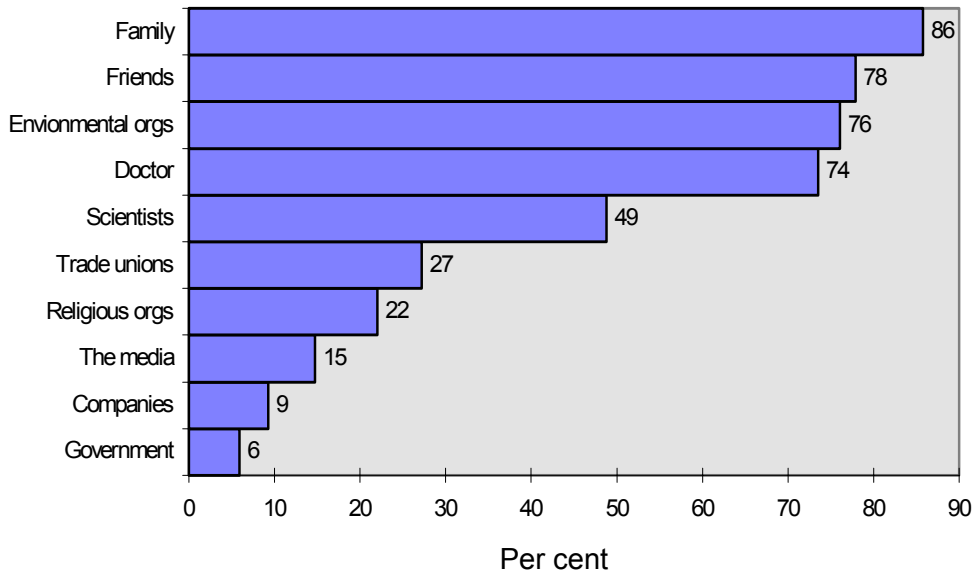
- Individualists are enterprising “self-made” people, relatively free from control by others, and who strive to exert control over their environment and the people in it. Their success is often measured by their wealth and the number of followers they can command. The self-made Victorian mill owner or present-day venture capitalist would make good representatives of this category. They oppose regulation and favour free markets. Nature, according to this perspective, is to be *commanded* for human benefit.
 - Egalitarians have strong group loyalties but little respect for externally imposed rules, other than those imposed by nature. Group decisions are arrived at democratically and leaders rule by force of personality and persuasion. Members of religious sects, communards, and environmental pressure groups all belong to this category. Nature is to be respected and *obeyed*.
 - Hierarchists inhabit a world with strong group boundaries and binding prescriptions. Social relationships in this world are hierarchical with everyone knowing his or her place. Members of caste-bound Hindu society, soldiers of all ranks, civil servants and employees of the World Bank¹⁸ are exemplars of this category. Nature is to be *managed*.
 - Fatalists have minimal control over their own lives. They belong to no groups responsible for the decisions that rule their lives. They are non-unionised employees, outcasts, refugees, untouchables. They are resigned to their fate and see no point in attempting to change it. Nature, they expect, will throw things at them, and the best they can do is *duck if they see something coming*.
- These predispositions are deeply entrenched and highly resistant to incompatible information, and when there is no trustworthy information they tend to be the

¹⁷ Thompson, M, Ellis, R & Wildavsky, A (1990) Cultural Theory, Boulder Colorado, Westview.

¹⁸ Michael Goldman's paper for this conference about the World Bank provides an excellent description of hierarchist mind set.

principal determinants of what people believe about hypothesised threats (see appendix 2 for applications of this typology to the debates about BSE/CJD and GM plants and foods). What people believe about virtual risks depends on whom they believe, and whom they believe depends on whom they trust. Recent surveys of trust by both Mori and academics have produced rather disturbing results. Responses to the question “would you trust institution X to tell you the truth about threats to the environment” are displayed in Figure 4. X referred to the Government, Companies, the media etc.¹⁹

Figure 4. Whom do you trust?



Least trusted (by less than 10% of those sampled) were government and big business; most trusted (by over 80% of the sample) were friends and family. Thus the generators and regulators of most big risks, and those with access to the best information about them, are trusted least, and those with access to the least reliable information are trusted most. This provides fertile soil for the hysteria and paranoia that are routinely exploited by the media whenever they discover a new virtual risk.

With such risks the balancing act still involves judgements about rewards and potential adverse outcomes, and these judgements will be strongly influenced by whether the risk is seen as voluntary or imposed. In terms of the above typology the opposition to genetically modified foods can be viewed as an *egalitarian* crusade; its success, in the absence of any uncontested evidence that GM foods have done any harm, can perhaps be explained by the fact that a) few consumers at present, of any predisposition, see any benefit in eating them, and b) the producers' resistance to labelling, thereby denying the consumer choice, has resulted in GM foods being seen as imposed risks – imposed for the benefit of the producer. If a risk, however small or remote, is accompanied by no perceptible rewards a rational risk manager will have no reason to take it. By contrast, the – slightly more convincing, though still

¹⁹ C. Marris, I. Langford, T. O'Riordan (1996) *Integrating sociological and psychological approaches to public perceptions of environmental risks: detailed results from questionnaire survey*, CSERGE Working Paper GEC 96-07, University of East Anglia.

inconclusive – evidence of potential harm caused by mobile phones has not perceptibly impeded the impressive growth rate of this form of communication. Here the risks are largely seen as voluntary and for most people the rewards associated with their use appear to justify the risk.

So who wants to monetize risk?

From the perspective of cultural theory cost-benefit analysis is a collectivist's tool. The perceived need to monetize risk arises from the pursuit of 'Pareto improvements' - measures that will improve collective welfare. But it is, more specifically, a hierarchist's tool. Nature, according to the hierarchist's myth, requires managing. In *Blueprint for a Green Economy* Pearce et al assert that

'Preserving and improving the environment is never a free option; it costs money and uses up real resources.'²⁰

But this is true only if preserving and improving the environment are seen as activities requiring active management. Clearly it would be wasteful management to spend money on preserving or improving something if the costs of doing so were to be greater than the benefits; rational decision-making about the environment requires, therefore, that *all* the relevant costs and benefits be priced.

However nature, according to the egalitarian's paradigm, is not to be commanded, but obeyed; preserving and improving the environment require not more human interference with nature, but less. From this perspective global scale environmental degradation is the result of careless and excessive consumption. There are two ways a fat person can lose weight. The hierarchist's way - health farms, exercise machines, liposuction - uses up real resources. The egalitarian's way - walking or cycling to work and eating less - *saves* real resources. The egalitarian's method of losing weight does not require cost-benefit analysis; he does not need to calculate the cash value of being slimmer and then work out whether or not he can afford it. The cost-benefit analysts insistence that "monetary assessment is crucial to the design of the optimal policy response" (see page 3) rests upon the false premise that there is prior agreement about what is optimal and a single metric by which the constituent elements of an optimal state might be measured.

Returning to the main issues with which we began it is apparent that

1. distributional issues are central to environmental controversies – whether global warming, GMOs or local road schemes – and CBA has nothing helpful to say about them;
2. some incommensurables exist because they ought to – most moral codes dictate that some things, *the most important things*, are beyond price; others exist because of disagreements about whether they are costs or benefits – does a golf course, or a Capability Brown landscape, improve upon nature or damage it?
3. the main reason why CBA has no solutions to issues 1 and 2 is that it cannot cope with multiple objectives; its "single-metric rationality" is helpless in the face of the plural rationalities encountered in environmental debates.
4. The cost-benefit analysts' assertion that despite all these failings CBA remains "the best game in town" is whistling in the dark; it is an assertion made in apparent wilful ignorance of ongoing experiments in consensus building – experiments that acknowledge the existence and importance of multiple objectives and plural rationalities, experiments that accept that workable solutions to problems that are, at

²⁰ Pearce, D., Markandya, A. and Barbier, E. (1989) **Blueprint for a green economy**. Earthscan, London.

root, value conflicts, can only result from deliberative processes that lead to a convergence on common values²¹.

Cost-benefit analysis is the embodiment of the Hierarchist rationality. Cost-benefit analysts assume that the problems they are analysing – even global warming – are manageable; otherwise what would be the point; they are assigned the role, or commonly assign to themselves the role, of consultant to the manager.

They *assume* that scientists and other data collectors can provide them with meaningful measures of all the significant consequences of a range of possible courses of action, and then *assume* that they can divine cash valuations of all these consequences that command sufficient agreement to justify aggregating them and attaching \$/£ signs to the results. If these are not valid assumptions the cost-benefit analyst has nothing useful to say. This perhaps accounts for the cost-benefit analyst's willingness to work with highly speculative scientific data and cash valuations that strike other people as ludicrous. He *needs* these numbers; his professional life depends upon them.

A major part of the explanation for the longevity and inconclusiveness of the debate about CBA is that the participants have been, and still are, arguing from different premises.²² COBA, the “own brand” version of cost-benefit analysis employed by Britain's Department of Transport over many decades to justify building billions of pounds worth of roads appeared to persuade few people beyond economists and those in the Government who commissioned their studies; it became a term of abuse amongst objectors to these road schemes.

Who wants it? The hierarchy. They are in charge. They have complex problems to manage. They are easily seduced by those who offer simple “rational” solutions. *Who needs it?* The seducers. Their jobs depend on it. Figure 4 suggests that the cost-benefit analyst's principal client – Government – has a credibility problem. It is a problem that the further application of cost-benefit analysis is likely to exacerbate.

²¹ See *Consensus Building for Sustainable Development*, Environment Agency, SD 12, March 1998, London.

²² Sydney Smith, an early 19th century clergyman and famous wit was once being given a guided tour of an Edinburgh slum. Down a narrow alleyway between tall tenements the group came upon a spectacular argument overhead between two women shouting abuse at each other across the alleyway. Sydney Smith stopped, looked up and listened for a while, then shook his head and walked on saying “they'll never agree; they're arguing from different premises.” Not a bad metaphor for the CBA debate.

Appendix 1

A return visit to Roskill: 1

The cost-benefit analysis by the Roskill Commission in 1970-71 of London's Third Airport was, at the time, the largest ever undertaken anywhere. It has featured prominently in discussions about the merits of CBA in Britain ever since. Looking back on the troubled history of CBA, Pearce complains that it has been, and continues to be, damagingly misrepresented. The work of the Roskill Commission was, he asserts, "subject to some ridicule for allegedly placing a fire insurance value on an historic Norman church at one site. In fact, this was only a suggestion at one stage and never appeared in the final report, despite continuing erroneous comment that it did. ... None the less the damage was done."

This was more than a mere "suggestion". Insurance values for historic churches were included in the cost-benefit analysis published by the Commission in 1970²³ accompanied by the following defence.

"It could be claimed that the valuation does not fully reflect the value of churches as monuments to visitors and non-participants. The willingness of local church communities to insure their churches at considerable cost, at least on a 'per capita' basis, is almost certainly due in part to the value of the churches as historic monuments. While accepting that this method of valuation does not fully take into account the latter benefits, it could be argued that such benefits are unlikely to be much greater than the insurance values." (p. 417)

Pearce is right when he notes that it did not appear in the final report, but it was removed *because* of the ridicule to which it was subjected (see section 2 of this appendix for an example). The reasons given by the Commission for removing it from the final report²⁴ provide no comfort for those who believe that rationality requires the monetization of all factors significant to a decision.

"We decided that no attempt should be made to value explicitly in money terms such contentious items as the loss of wild life or churches which would have to be demolished. (p. 120)

They explain why

"Much of the criticism of the techniques of quantified analysis has stressed that however much those techniques may mould some complex problems into a less intractable form, they can do little to help in placing a just value upon an important and possibly unique example of post Norman-conquest church architecture, the bird life of the Essex coast line, the benefits to be derived from further advances in radio-astronomy at the Lord's Bridge Observatory or on the research work carried out at the Royal Aircraft Establishment at Bedford. ... Each generation is faced with the problem of deciding what use should be made of its heritage in countryside, in buildings and other works of man which it has received from previous generations. ... As William Morris said in 1877: 'It has been most truly said that these old buildings do not belong to us only: that they belonged to our forefathers and they will belong to our descendants unless we play false. They are not in any sense our property to do as we like with them. We are only trustees for those that come after us.' We

²³ Commission on the Third London Airport, *Papers and Proceedings: volume VII*, HMSO 1970.

²⁴ Commission on the Third London Airport, *Report*, HMSO 1971.

cannot know whether our descendants would commend our judgment the more for preserving Stewkley Church or for preserving the Essex coastline and for preventing the extinction of the dark bellied Brent Goose. ... The lover of the open countryside and of historic churches will unhesitatingly say that less environmental damage is done by an airport at Foulness than at any of the inland sites. ... The naturalist and the bird lover will find no comfort in these arguments. He regards the preservation of wildlife- especially the unique wildlife of Foulness as of as great if not greater importance than the preservation of the countryside and its communities. ...

For us to claim to judge absolutely between these views is to claim gifts of wisdom and prophecy which no man can possess. All we can do is respect both points of view.” (pp 52,55)

So what should the cost-benefit analyst do? The Roskill Commission “respected” views about these “contentious items” by dropping them from their quantitative analysis – effectively giving them a zero value. But these “items” are representative of the issues that are central to the sorts of environmental controversies which CBA purports to be able to settle. Pearce may be entitled to be cross with someone who has failed to notice that insurance values for Norman churches were dropped from the final report (*after* much ridicule), but he does not provide an alternative valuation for this contentious item – and his form of “rationality” requires one.

There was an even larger contentious issue which the Roskill Commission ducked. It is an issue that remains at the core of environmental debates today.

“The logical result of pressing both views to the extreme [i.e. the views of the defenders of wildlife and coast line, and the views of the defenders of countryside and community] is that there can be no airport at all. We refuse to accept this conclusion for it is clear to us that the nation requires a third London airport.” (p. 133)

The requirement of land to accommodate more traffic - of people and goods, by surface and air - is a concomitant of the process of economic development: projected GDP levels are the main drivers of almost all traffic forecasting models. Whether the benefits of development are worth the costs was not a question asked by Roskill; the benefits were simply *assumed* to outweigh the costs.

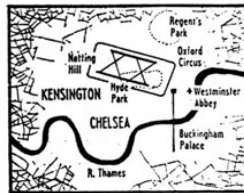
Recent attempts by economists to subject this assumption to the rigours of cost-benefit analysis in the case of global climate change have produced more valuations that have received, and deserve, ridicule for the same reasons that led the Roskill Commission to retreat from insurance values. The most notorious of these is the valuation of the lives of the richest people in world at fifteen times more than the lives of the poorest.²⁵

²⁵ This number is almost certainly an embarrassed compromise. It hugely understates the difference between the sums that the richest and poorest are willing (able) to pay for measures that save lives.

A return visit to Roskill: 2

My first encounter with CBA was in 1970 when I published a critical review of the Roskill cost-benefit analysis complaining that the high values it assigned to passenger convenience and the low values that it assigned to environmental damage would justify building an airport in Hyde Park in the centre of London. The article was my first venture in satire. It was the subject of an article in *The Sunday Times* which reproduced my map showing the southern runway pointing at Buckingham Palace.

SUNDAY TIMES JULY 12 1970



Site for third airport?

How about an airport in Hyde Park?

By Tony Dawe

THE CITY of Westminster is a logical site for the new London

The cost-benefit analysis that Cublington, the cheapest site at a cost of £2.385 million and Foulness report has made a decision on Mr Justice Roper's members of his court observers at the public hearing—now fourth month—say London is emerging favourite. A decision at the turn of the Mr Adams says: "The team has taken a materialistic view of cost every affected by an airport many things which indirectly. But you mustn't lose sight of the disruption of life of thousands this way."

Mr Adams cites the report on recreational facilities as the cost replacing them and time and travel cost reaching a new site. The report assesses on their insurance

The following week the editor published a letter from retired Air Vice-Marshal Don "Pathfinder" Bennett congratulating me on the idea – while pointing out modestly that he had recommended the same thing in 1946. Ever since this exchange I have tried and failed to imagine a kit of analytical tools that could settle the disagreement between the Air Vice-Marshal and me about the most appropriate site for a new London airport.

SUNDAY TIMES JULY 19 1970

Yes to Hyde Park Airport

- "congratulate those who have had the courage to recommend an airport in Hyde Park"
- "London needs at least 6 airports of this size"
- "recommended Hyde Park in 1946"

Don Bennet (Air Vice-Marshal, ret)

Blackbushe Airport, Camberley

Appendix 2 Figure A2.1 BSE/CJD: a typology of bias





<p> Fatalist</p> <ul style="list-style-type: none"> • “They should shoot the scientists, not cull the calves. Nobody seems to know what is going on.” Dairy Farmer quoted in <i>The Times</i> (2.8.96) • “Charles won’t pay for Diana’s briefs” Main headline in <i>The Sun</i> on 21.3.96, the day every other paper led with the BSE story. 	<p> Hierarchist</p> <ul style="list-style-type: none"> • “We require public policy to be in the hands of elected politicians. Passing responsibility to scientists can only undermine confidence in politics and science.” John Durant, <i>The Times Higher</i> 5.4.1996 • “As much as possible, scientific advice to consumers should be delivered by scientists, not politicians.” <i>The Economist</i>, 21 March 1996 • “I believe that British beef is safe. I think it is good for you.” (Agriculture Minister Douglas Hogg 6.12.95) • “I believe that lamb throughout Europe is wholly safe.” (Douglas Hogg, 23.7.96) • “I felt the need to reassure parents.” Derbyshire Education chief quoted in <i>The Sun</i>, 21.3.96 • “I have not got a scientific opinion worth listening to. My job is simply to make certain that the evidence is drawn to the attention of the public and the Government does what we are told is necessary.” Health Secretary Stephen Dorrel, <i>Daily Telegraph</i>, 22.3.96 • “We felt it was a no-goer. MAFF already thought our proposals were pretty radical.” Richard Southwood explaining why he had not recommended a ban on cattle offal in human food in 1988, quoted by B Wynne, <i>Times Higher</i> 12.4.96
<p> Individualist</p> <ul style="list-style-type: none"> • “The precautionary principle is favoured by environmental extremists and health fanatics. They feed off the lack of scientific evidence and use it to promote fear of the unknown.” T. Corcoran, <i>The Toronto Globe and Mail</i> • “I want to know, from those more knowledgeable than I, where a steak stands alongside an oyster, a North Sea mackerel, a boiled egg and running for the bus. Is it a chance in a million of catching CJD or a chance in ten million? I am grown up. I can take it on the chin.” Simon Jenkins, <i>The Times</i>, quoted by J. Durant in <i>Times Higher</i>, 5.4.96 • “ ‘Possible’ should not be changed to ‘probable’ as has happened in the past.” S.H.U. Bowies, FRS, <i>The Times</i> 12.8.96 • “It is clear to all of us who believe in the invisible hand of the market place that interference by the calamity-promoting pushers of the precautionary principle is not only hurtful but unnecessary. Cost-conscious non-governmental institutions are to be trusted with the protection of the public interest.” P. Sandor, <i>Toronto Globe and Mail</i> 27.3.1996 • “I shall continue to eat beef. Yum, yum.” Boris Johnson, <i>Weekly Telegraph</i>, no 245. 	<p> Egalitarian</p> <ul style="list-style-type: none"> • Feeding dead sheep to cattle, or dead cattle to sheep, is “unnatural” and “perverted”. “The present methods of the agricultural industry are fundamentally unsustainable.” “Risk is not actually about probabilities at all. It’s all about the trustworthiness of the institutions which are telling us what the risk is.” (Michael Jacobs, <i>The Guardian</i>, 24.7.96) • “The Government ... choose to take advice from a small group of hand-picked experts, particularly from those who think there is no problem.” Lucy Hodges, <i>Times Higher</i> (5.4.96) • “It is the full story of the beginnings of an apocalyptic phenomenon: a deadly disease that has already devastated the national cattle herd ... could in time prove to be the most insidious and lethal contagion since the Black Death.” “The British Government has at all stages concealed facts and corrupted evidence on mad cow disease.” “Great epidemics are warning signs, symptoms of disease in society itself.” G. Cannon in the foreword to <i>Mad Cow Disease</i> by Richard Lacey • “My view is that if, and I stress if, it turns out that BSE can be transmitted to man and cause a CJD-like illness, then it would be far better to have been wise and taken precautions than to have not.” Richard Lacey <i>ibid</i>.

Figure A2.2 Ecological risks and prospects of transgenic plants: a typology of bias

<p>☹ Fatalist</p> <ul style="list-style-type: none"> • <i>The whole world is powerless to countermand the actions of powerful, profit-driven corporations: “[GMOs are] being inflicted on unwilling people like myself by Monsanto’s unwelcome inclusion of GMOs in the world’s food supply.... There are no benefits for the consumer by the inclusion of GMOs, only greater profits for Monsanto.”ⁱⁱ</i> <p>Austin, <i>The Guardian</i>, 16 December 1997.</p> <ul style="list-style-type: none"> • Gallows humour is a common fatalist response to perceived powerlessness. 	<p>☹ Hierarchist</p> <ul style="list-style-type: none"> • <i>genetically modified organisms constitute a management problem, soluble by science and regulation</i> • “We conduct a full scientific risk evaluation . Once we are satisfied, we recommend to Ministers, who have always accepted our advice and who then issue Government approval.” Derek Burke, Chairman of the Advisory Committee on Novel Foods and Processes, explaining how genetically modified foods gain approval in Britain.ⁱⁱ • “We had no safety concerns [about genetically modified soya] and the Food Advisory Committee did not require labelling.” <i>ibid</i> • <i>Government and the scientists it employs know best - but there is a risk communication problem.</i> “We used to think that all we had to do was to decide whether a novel food or process was safe or not, and a grateful public would accept what we said. We should have known better! Food irradiation, a process I and many others, believe to be safe is unusable because of fears connected with the word ‘irradiation’, which go back to the atomic bomb and are fed by concerns about nuclear power stations.” <i>Ibid</i>
<p>☺ Individualist</p> <ul style="list-style-type: none"> • “The new technologies are environmentally friendly and will lead to health benefits, an end to world hunger and reduced use of pesticides. ‘There’s no crop or person that cannot benefit. There’s a tide of history turning. You can look back, or ask how you’re going to feed the world,’ Monsanto said.”ⁱⁱⁱ • “Biotechnology is, and has always been, used to make bread, bacon, beer, wine, cheese, yoghurt, pickles and sauces. Humans have been manipulating plant and animal genes for about 8000 years, by breeding and cross-breeding. The difference is that, since Crick and Watson worked out the structure of the genetic code in 1953, it is now possible to work out exactly what is going on when an animal or plant grows faster, taller, or straighter, or withstands rust or blight or brucellosis.”^{iv} • <i>if you can’t prove its dangerous assume it’s safe:</i> “Do you cease to approve all new technologies until everything you could conceivably imagine as a risk has been evaluated to the nth degree? ... I am confident it is safe. It is not possible to prove that it is entirely safe.” Monsanto^v 	<p>☹ Egalitarian</p> <ul style="list-style-type: none"> • <i>abhors “unnatural” practices; is averse to unpredictability; fears technology dependence, and the polarising socio-economic consequences of the concentration of the ownership of the new technology in a small number of hands</i> • “Robert Shapiro [CEO of Monsanto] ... has to find a market for the products his company has spent billions developing ... The wants and needs of ordinary humans are incidental. This ‘growth at any costs’ attitude on the part of the world’s corporate giants is destroying not just our physical environment but the social environment that nurtures human community. ... The biotech industry [seeks] to prohibit labelling of genetically modified foods. ... The premium now is clearly on ignorance. ... Whatever the multi-million dollar spin merchants care to tell us, the scientists cannot guarantee their results. ... man’s tampering with nature in this way is a recipe for disaster straight out of a horror movie. And you know what comes next. Nature fights back.”^{vi} • <i>if you can’t prove its safe assume it’s dangerous:</i> “We cannot just release these things into the environment and hope for the best” Greenpeace^{vii}

ⁱ Lynette Anderson, *Food Magazine*, November 1997. A true fatalist would not trouble to write to a magazine because there is no point, but this quotation exemplifies what might be termed an informed-fatalist perspective. A recent study of public attitudes in Britain to genetically modified foods discovered that fewer than half the people recruited for focus group discussions of GMOs had even heard of biotechnology in the context of food (R. Grove-White, P. Macnaghten, S. Meyer & B. Wynne (1997) *An uncertain World: genetically modified organisms, food and public attitudes in Britain*, Centre for the Study of Environmental Change, Lancaster University). Thus fatalists can be assumed to outnumber by a wide margin all the active participants in debates about GMOs.

ⁱⁱ Derek Burke (1997) The regulatory process and risk: a practitioner's view, in *Science, Policy and Risk*, The Royal Society, London.

ⁱⁱⁱ *The Guardian*, 15.12.97.

^{iv} Bernard Dixon, editor of *Medical Science Research*, in *The Guardian*, 18 December 1997

^v *The Guardian*, 17.12.1997

^{vi} Anita Roddick, Body Shop International in letter to *The Guardian*, 19 December 1997

^{vii} *The Guardian*, 17.12.1997