

Behavioural Economics and Current Environmental Valuations: Findings, Lessons, and An Alternative*

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Economic assessment of environmental values has attracted considerable attention in keeping with growing demands to take the importance of environmental amenities and resource productivity into account in public and private decisions. The call, particularly from economists, is usually for more such accountings and valuations. However, currently, as in the past, the demands for environmental valuations and our means to supply them are not in a particularly happy balance.

Early on in the era of environmental valuations – in the 1960s and extending into the next decade – there was considerable confidence in our ability to use travel-cost methods (Clawson, 1959), hedonic price models (Knetsch, 1964), and contingent valuations (Davis, 1964), to handle what were assumed to be the assessment problems of the day. These problems were largely taken to be estimating the monetary value of recreation visits to parks and water bodies, and the benefits of a limited set of similar amenity improvements. Most of us working in the area at the time thought that we had produced a good supply of methods and measures.

But there was little demand for these measures. It was rare that any application of any of these newly developed methods had any influence on any real decision or policy. Few asked for results of such studies, and even fewer used them in the cases where they were available.

There were, however, continuing refinements of the methods and growing stores of applications. These were housed largely in the theses and dissertations of graduate students, and the papers of academics – groups who found this a novel and interesting area of applied economics, and one where individuals could usefully differentiate their expertise. Partly as a result of this and of the many opportunities to present such novel

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and interesting work at professional meetings and other gatherings, there was a large recreational component to the construction of recreation demand and valuation models.

Later there was a marked shift in the balance between the demand for environmental valuations and their supply. Environmental problems and opportunities, for which values were important, became far more comprehensive. They now included issues such as preservation of habitat and cultural amenities, air and water quality, global climate change, natural resource productivity, land use, and biodiversity. The values centred on those of environmental losses, mitigation of losses, and reductions in losses, and prompted legislative and judicial requirements to recognize such values – especially in the U. S., where responsible parties are often made financially liable for the damages from oil spills and other causes of natural resource degradation.

The newer controls requiring greater accounting and compensation for environmental losses led to more urgent demands for valuations – people needed a basis for determining damage payments or deciding on the extent of remedial actions that were justified by the harm. While this has been the focus of much environmental valuation activity in the past decade or so, the growing demands for economic assessments has not been limited to this. There have also been increasing calls for such information to better rationalize trade-offs between environmental and other community values, to justify environmental regulatory controls, and generally to align incentives and restraints in accord with community preferences.

However, nearly concurrent with the increasingly stronger demand for environmental valuation, there has been growing and serious questioning of the numbers that can be supplied. Despite their inclusion in the increasingly redundant reviews of available methods, the travel cost method and the hedonic price method, have been seen to be far too limited in their applicability to current environmental worries to be of much real use. And the numbers provided by the contingent valuation method, which is now the method of choice throughout the world, have increasingly been seen to provide less than the economic measures needed. Further, there is also growing awareness that not only are the answers to contingent valuation questions often likely to be misleading, but the wrong question is being asked. We seem now to be experiencing large demands and severe constraints on supply.

This is not to suggest that there is a shortage of suppliers quite willing to provide requisite numbers in response to calls from public and private officials intent on justifying a position, and from potential litigants anxious to claim greater or lesser scales of environmental disruption. A sizable cottage industry has risen to the task and seems to be expanding to meet most requests. This, however, does not really alter the innate worries over the nature of the supply.

These concerns with economic assessments of environmental values are among the many more general insights and critiques coming from the emerging field of behavioural economics.¹ Many of the findings from this work of psychologists, decision analysts, and a growing number of economists, suggest that some important behavioural assumptions that form the basis of much current economic analysis often provide neither a very good description of people's preferences nor very useful predictions of their reactions to real choices (Rabin, 1998; Jolls, Sunstein, and Thaler, 1998). This work also demonstrates that analyses might be materially improved with what now seem to be better readings of people's preferences. Little use is, however, yet being made of these findings.

There are several areas in which results from behavioural research have implications for environmental valuations. The following is a review of some examples illustrating the importance and range of environmental valuation issues potentially affected, along with a brief mention of an alternative strategy that may offer an improvement over current approaches.

The Disparity Between Valuations of Gains and Losses

The economic value of an environmental good or a change in access to an amenity is, like the economic value of any entitlement, measured by what people are willing to sacrifice to obtain it or to reject its loss. In evaluation terms: "benefits are measured by the total number of dollars which prospective gainers would be willing to pay to secure adoption, and losses are measured by the total number of dollars which prospective losers would insist on as the price of agreeing to adoption" (Michelman, 1967, p. 1214). This is the

¹ Much of this area is also often referred to as economic psychology. Experimental economics is also used, but as the fields have developed this may be more accurately describe overlapping but yet distinct interests and objectives.

source of little controversy. The maximum sum people are willing to pay (WTP) and the minimum compensation they are willing to accept (WTA) remain the standard definitions of the monetary measures of, respectively, gains and losses.

The usual working assumption of economic valuations has been that the two measures, the maximum WTP and the minimum WTA, are for all practical purposes² equivalent: "...we shall normally expect the results to be so close together that it would not matter which we choose" (Henderson, 1941, p. 121). This remains the presumption of choice, as again confirmed, for example, in the widely discussed review of environmental damage assessment methods: "This [WTP] is the conservative choice because willingness to accept compensation should exceed willingness to pay, *if only trivially*" (US NOAA Panel, 1993, p.4603, emphasis added).

Evidence of a Disparity

The empirical evidence is sharply at variance with the conventional assertion of equivalence between the WTP and WTA valuations. The findings that people instead commonly value losses more than commensurate gains have been widely reported in the professional literature for more than two decades, and come from a wide array of survey studies, real exchange experiments, and recordings of the choices made by individuals in their daily lives. The earliest reports of these endowment effect disparities were based on survey studies and appeared in the early 1970s. For example, duck hunters said they would be willing to pay, on average, \$247 to preserve a marsh area important to propagation of bird life but would demand \$1044 to agree to its demise (Hammack and Brown, 1974). Results of studies in the years since have become more wide ranging in terms of the nature of entitlements valued, investigators and research methods used, populations studied, and realism of exchanges.

In an early study involving real exchanges, as opposed to hypothetical ones, participants demanded a minimum of four times as much money to give up a lottery ticket than the maximum sum they were willing to pay to acquire a ticket (Knetsch and Sinden, 1984). A group of individuals in another real exchange experiment were willing

² Except for an income or wealth effect, which is normally demonstrably very small and correctly taken to be of little or no consequence.

to pay, on average, \$5.60 for a 50 percent chance to win \$20, but these same individuals demanded an average of \$10.87 to give up the identical entitlement (Kachelmeier and Shehata, 1992).³ In another example, participants were willing to pay \$0.96 to acquire a widely available lottery ticket selling for \$1.00, but these same individuals demanded an average of \$2.42 to give up exactly the same entitlement (Borges and Knetsch, 1998).⁴

A similar larger value being ascribed to losses relative to gains is also evident in common non-experimental decisions (Kahneman, Knetsch, and Thaler, 1991). Frey and Pommerehne (1987), for instance, note that the disparity clearly motivates the asymmetric treatment accorded to the acquisition and the retention of national art treasures. The greater sensitivity of investors to losses than to gains has been found to be associated with the historical profit premium they give up to invest in bonds rather than more volatile equities (Thaler, Tversky, Kahneman, and Schwartz, 1997). The strong reluctance to give up a default automobile insurance option when an otherwise more attractive choice is readily available (Johnson et al., 1993), the hesitation to realize a loss by selling which leads to the observed smaller volume of sales of securities that have declined in price relative to those for which prices have increased (Shefrin and Statman, 1985), the typically greater demands for regulation of new environmental risks than of equivalent old risks (Sunstein, 1993), the greater sensitivity to losses in judgments of fairness (Kahneman, Knetsch and Thaler, 1986), and the stronger legal protection accorded to losses over foregone gains in judicial choices (Cohen and Knetsch, 1992), are further examples of the difference in valuations of gains and losses. The commonplace nature of the greater valuation of losses is also evident in most editions of daily newspapers; the anguish of job losses and disruptions to people's lives command far more attention than the gains others receive, and people made to give up what they perceive as their entitlements for the benefit of others is the stuff of newsworthy conflicts.

³ There is a curious result of a low correlation (of about 0.30) between the WTP and WTA bids and offers of the participants in this experiment, which also appears in the results of other within subject disparity studies (Borges and Knetsch, 1998). These low correlations suggest that individuals' WTP valuations may not be very closely related to their WTA valuations – a result which should be investigated further.

⁴ The results of some studies have indicated the disparity may decrease, or even disappear, over repeated trials (for example, Shogren, Shin, Hayes, and Kliebenstein, 1994). However, it now appears on the basis

Other studies have demonstrated that the valuation disparity is pervasive, usually large, and not a result of income effects, wealth constraints, or transaction costs (for example, Kahneman, Knetsch, and Thaler, 1990). The empirical evidence indicates that rather than being valued in terms of end points, as assumed by standard economic principles, the valuation of a change – the gain or loss of a good, or benefiting or losing from a policy – is instead typically made from the standpoint of changes from a reference position. Most people, for example, weigh changes to their income or wealth as gains or losses to their current income or wealth, not as smaller or larger positive sums. And as in the case of income or wealth, gains from the reference state are valued less and losses from the reference state of these entitlements are valued more – in keeping with a value function that is kinked at the reference state and much steeper in the domain of losses than in the domain of gains (Kahneman and Tversky, 1979). Consequently, a good, or an environmental change, does not have a single value. It will have one value to a person in terms of how much this individual is willing to sacrifice in order to obtain it. The identical entitlement will have a different value in terms of how much this same person would sacrifice to avoid its loss.⁵

The different valuations of an entitlement will depend on the gain and loss domains of both the good being valued and the money or other numeraire being used to measure the value. These can be illustrated as comparisons among the four quadrants formed by a vertical axis indicating a gain or loss of the entitlement or good being valued, and a horizontal axis indicating a gain or loss of money (or another good or outcome used as the value numeraire).⁶

The expected pattern of valuations of entitlements is indicated by the results of a real exchange experiment involving three groups of participants who were all asked to value a coffee mug, but to do so in three ways. The valuations of one group were expressed in

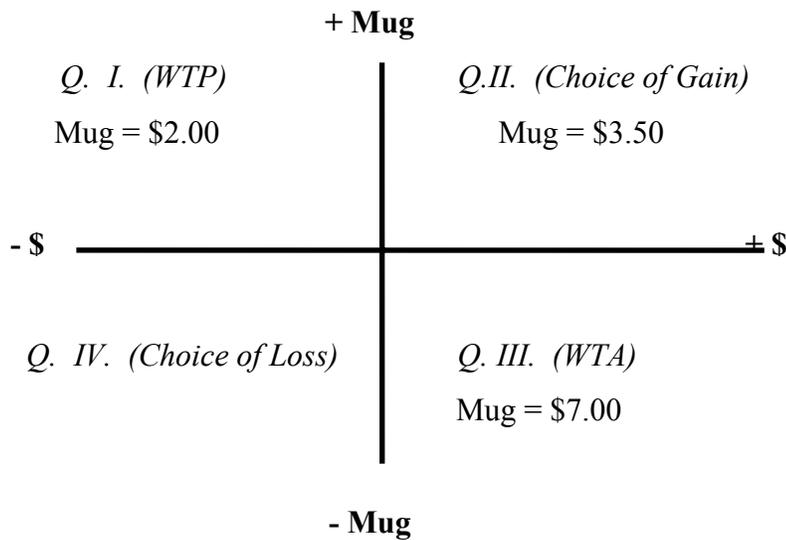
of further tests, that such results are attributable to the failure of the Vickrey auction used in these studies to accurately reveal people's valuations (Knetsch, Tang, and Thaler, 1998).

⁵ In instances where the same individual is observed to be willing to pay a relatively low sum for an entitlement and then almost immediately demand a high amount to give it or – or to display the same behaviour in reverse order – it is very unlikely that the individual is not aware of the real worth of the entitlement. It is instead simply that the entitlement is worth one value when acquiring it and a greater value when giving it up.

⁶ Daniel Kahneman suggested this illustrative scheme in joint work on preliminary analyses of early endowment effect findings.

terms of how much they would pay to gain a mug, those of a second group by how much money they would demand to give up a mug, and the third group by how much money they would need to receive rather than receive a mug – a choice between two gains (Kahneman, Knetsch, and Thaler, 1990). The results for these three of the four possible quadrants are presented in Figure 1.

Figure 1. Combinations of Gains and Losses and the Median Value of Mugs.



The valuation in Quadrant I (QI) is in the domain of gains for the good (+Mug) and losses for money (-\$). This produced the lowest valuation of the mug, a median buy price of \$2, because in this exchange money is given up and therefore it is valued more and the mug is a gain and therefore valued less. The highest valuation of the mug, \$7, was found in Quadrant III which is in the domains of gains for money and losses for the good. As a consequence of the value disparity, individuals would likely demand a larger sum of money, which they value less for being gains, to compensate for giving up a good.

The monetary valuation in Quadrant II is in terms of both money and the good being in the domains of gains. This valuation is in terms of the money gain that is given up in order to gain the good and is, therefore, an opportunity cost measure of the value of the good and would be expected to be intermediate between those of Quadrants I and III. This too was evident in the \$3.50 valuation of the mug when individuals were presented with a choice between gaining money or gaining a mug. A valuation in Quadrant IV, not

carried out in the mug experiment, would be in terms of what loss of money would be weighed as being equivalent to a loss of a good.⁷ Such a choice between two losses yields, similar to the choice in Quadrant II, provides an opportunity cost measure of the mug's value.

The measures in Quadrants I and III are direct measures of sacrifice – WTP for gains and WTA for losses – and therefore are appropriate monetary measures of gains and losses. While the choices between two gains (QII) or two losses (QIV) might be of some interest as indications of preferences between alternatives, they remain opportunity cost measures. And as opportunity costs are weighed less than out-of-pocket costs, due to the endowment effect, neither of these measures will adequately reflect a correct measure of sacrifice. The inappropriateness of the opportunity cost measure stemming from a choice frame is clear in the case of the \$3.50 valuation of a mug which was a result of individuals choosing between receiving money or a mug (Quadrant II of Figure 1). This sum does not represent either the value of the loss of a mug, which was correctly measured by the WTA of \$7, or the value of gaining a mug, which was correctly measured by the WTP of \$2.

In sum, there is often not a single value of an entitlement, but different values depending on whether the entitlement is being gained or lost. The negative value to a community of losing a park will be greater than the value of gaining the same amenity; and losing jobs will be more aversive than the benefits of gaining like numbers of jobs.

The Reference State

The economic value of a change will in most cases differ not only depending on whether it is a positive or negative move, but also on whether it is in the domain of gains or the in the domain of losses. Positive changes will often be seen as a gain, but given the nature of the change relative to the reference state, individuals may see some positive changes as being a reduction in a loss. Similarly, negative changes can be either losses or, if in the domain of gains, may be viewed as foregone gains.

⁷ While this valuation was not included in the mug experiment, a reasonable prediction based on the ratios of the QII to the QI values and the QIII to the QII values would be around \$4.

The distinction is important because a positive change that results in reducing a loss will normally be more valuable than one that provides a gain, and a negative change which imposes a loss will be far more aversive than one that results in just foregoing a gain. Reducing pollution levels, for example, is likely valued more, and is more likely to be economically justified, if viewed by people as reducing the harm of pollution than if considered by them to be a gain in environmental quality. This makes it important to distinguish between gains and reductions of losses, and between losses and foregone gains, and to use the correct measure to assess them. Losses and reductions of losses are both most appropriately assessed with the WTA measure, and both gains and foregone gains with the WTP measure (Knetsch, 1997).

This discrimination between gains and reduction of losses and between losses and foregone gains turns on the reference state from which changes are judged. Reference levels appear to be mostly a matter of what people regard as the expected or normal state (Kahneman and Miller, 1986). This may often be the status quo, but not always.

The reference states also appear largely not to be a matter of legal entitlement (Knetsch, 1997). Legal rights determine what claims receive recognition by the state and support a cause of action (usually injunctive relief or damage payments) of an injured party against a neighbour. They presumably reflect not only efficiency, but also equity, fairness, and other justice goals of the community, and take account of asymmetries in avoidance costs and costs of enforcement and compliance – the entitlement to impose minor nuisances on neighbours is usually given to construction people, for example, largely because of a belief that making the opposite assignment of rights for neighbours to be free of such nuisance would result in greater costs of monitoring and enforcement, and the community benefits of encouraging building improvements. The choice of economic measure is about another issue, one of choosing a metric that best reflects actual changes in welfare in particular cases. The extent of welfare loss associated with various injuries may well be influenced by the assignment of specific legal entitlements – as rules presumably evolve to provide greater protection against more important losses. To this extent, and largely in accord with this direction of causality, property rights are related to losses.

The dependency of the reference on what is regarded as normal or expected is indicated by Leowenstein's (1988) perceptible example of biological references sometimes being a function of time, whereby the positive change of acquiring food may be perceived as a gain under normal circumstances but would be viewed as a reduction of a loss after long periods of deprivation. Similarly, the finding that people believe restoration of environmental quality and human health to historic levels to be more valuable and worth doing than making equivalent changes from the status quo, suggests that the reference condition may also be a function of past deterioration (Gregory, Lichtenstein, and MacGregor, 1993). Further evidence of the variability of the reference depending on people's expectations of normal is provided by the findings that people expect increasing wages over their working life and therefore regard an interruption of these increases in earnings as a loss, but consider decreases in health with age as the expected course and consequently do not regard such normal deterioration as a loss (Chapman, 1996).

Current practice is overwhelmingly to treat any positive change as an improvement for which the WTP is used as the measure of its value. This is legitimate for gains, but not for changes which people regard as a reduction of a loss. Containing the oil from a spill might be considered to be an improvement, for example, but it seems more likely that most people would regard this as more realistically an action to reduce the loss caused by the spill, for which the minimum compensation they would accept not to have the oil contained would measure the value of the action. Similarly, framing a contingent valuation question asking about the value of saving lives by reducing discharges of noxious pollutants as an improvement, implies the strong empirical assertion that people would consider, for example, "exposure to a pollutant, often a cancer-causing one" (Cropper, Aydede, and Portney, 1994, p. 243) as a neutral reference state and therefore regard an intervention that reduces the number of people dying from this cause as an improvement. People might instead regard being exposed to a cancer-causing pollutant as not the normal state, but one of having been put in the domain of losses, and an action to reduce the exposure would then be taken as reducing a loss rather than providing an improvement. As the differences are almost certain to be large, and would be reflected by

the appropriate WTP and WTA measures, the distinction has substantial practical importance in terms of assessing the economic justification for stopping the pollution.

Implications of the Disparity Between Measures

The implications of the valuation disparity range widely over many areas of economics, finance, law, negotiation and conflict resolution, management, and decision sciences.⁸

They certainly include assessing environmental values.

Economic Analysis and Practice

Some of the consequences of the disparity between gain and loss values are ones related to standard assumptions of economic principles and economic analyses, which are of at least indirect relevance to environmental evaluations.

To the extent that people demand more to give up an entitlement than they are willing to pay to acquire it, the common preference order assumptions such as transitivity, completeness, dominance, and independence will be violated. For example people will commonly value the loss of a good A more than the gain of a good B, the loss of a B more than gain of C, but also loss of C more than gain of A, thereby contravening the transitivity axiom which assumes that if A is preferred to B, B is preferred to C, then A must be preferred to C (Knetsch, 1995).

In much the same way individuals will commonly demand more of a good A to give up another good B, then they are willing to pay of A to obtain B. Therefore, contrary to standard assumptions, indifference curves will not be independent of initial reference positions and the direction of exchange offers and such curves will have a discontinuity, or kink, at the reference point (Knetsch, 1989, 1992).

The usual Coase Theorem prediction of final entitlements resulting from costless exchanges being independent of initial allocations, is often used in the analysis and design of policy reforms, prominently including those related to environmental issues. However, this prediction is critically based on the assumption of gains and losses being valued the same. As this now appears generally not to be the case, the result will be quite

the opposite – final allocations will usually depend on initial distributions (Kahneman, Knetsch, and Thaler, 1990).

Another consequence of sell prices (WTA) being higher than buy prices (WTP), is that the possible gains from trade realizable from even costless voluntary exchanges will be much smaller than those that would be available with the standard assumption of gain/loss equivalence. Thus, not only will final market outcomes depend on initial distributions of entitlements, but the smaller available gains will result in fewer Pareto efficient trades, and exchanges will fail to shift entitlements to those willing to pay the most for them (Borges and Knetsch, 1998). This suggests that markets may be “sticky” even in the absence of transaction costs. It should also give further pause to assertions of the irrelevance of initial distributions of exchangeable entitlements, such as pollution permits, water rights, and fishing quotas, and to predictions of the numbers of expected trades and the likely gains from their exchange.

Environmental Values

In the case of environmental valuations, the implications of the valuation disparity are even more direct. Given the near universal use of the WTP measure to assess losses and reductions in losses, perhaps the most important is that the continuing practice of using the WTP measure of economic value to assess losses, for which it is not the agreed measure, on such dubious advice as “the willingness to pay format should be used instead of the compensation required because the former is the conservative choice” (US NOAA Panel, 1993, p. 4608), has little justification – the reported differences of WTA values being from two to five or more times WTP measures are too large to defend this practice on grounds of prudence – and is likely to seriously mislead.

The current practice of using the WTP measure, rather than the appropriate WTA measure, for losses and for reductions of losses will in most cases give rise to systematic understatements of their value. This will lead to undue encouragement of activities with negative impacts, such as pollution and risks to health and safety, as such losses will be

⁸ The early and well-known Kahneman and Tversky paper (1979) calling attention to the effect is reputed to be the most often cited paper ever published in *Econometrica* (Laibson and Zeckhauser, 1998), a testament to both the importance of the finding and the range of applications.

under-weighted. Similarly, compensation and damage awards may be too small to provide proper restitution and deterrence, and inappropriately lax standards of protection against injuries will be set as assessments of added costs of further harm will be heavily biased. Too few resources will be devoted to avoiding environmental and other forms of community deterioration as the efficiency of alternative allocations will be biased against avoiding losses, and full accounting and appropriate pricing of resources with non-pecuniary value, such as environmental amenities, will be frustrated (Knetsch, 1990).

Among the most transparent, and as a practical matter most important, instances of the misuse of WTP measures for assessing losses and reductions in losses occurs with the current widespread use of contingent valuation studies. The reason that essentially all contingent valuation assessments elicit WTP, rather than WTA, responses is not because of widespread belief that WTP is the correct measure of losses, but is instead simply a response to the inability to elicit meaningful WTA values from respondents:

Respondents will be far less familiar with the notion of receiving compensation for losing something... This is likely to cause far greater uncertainty and variability in answers to WTA questions than occurs with WTP questions. Therefore, the former are to avoided in favour of the latter (Turner, Pearce, and Bateman, 1993, p. 123).

This heavy weighting of convenience at the expense of even a good approximation is likely to lead to considerable misguidance. It is a case of asking the wrong question. Nor is the cause much helped by the widespread practice of defining a loss as a gain by asking people how much they would pay to not experience a loss and using the answers to measure an existing loss.⁹

Time Preferences

The accounting of intertemporal preferences is another area in which behavioural findings are at considerable variance with common assumptions guiding environmental valuations. The major valuation issue involves the appropriate discounting of the value of future outcomes.

⁹ An example was the use of valuations from the question: “what is the most your household would be willing to pay in total over the next five years in higher prices for programs that prevent oil spills, like those described above, along the West Coast over the next five years?”, to provide a “measure of the damage of the Nestucca oil spill” – a spill that had already occurred (RCG/Hagler, Bailly, Inc. 1991, p. 6.3).

The standard economics textbook model assumes that people adjust their varying intertemporal preferences for present and future outcomes to a market interest rate, through borrowing and saving. Consequently the rate of time preference between the present and future will be the same for all individuals at the margin, and in the absence of transaction costs, risks, and other such considerations, the tradeoff between a guider of present consumption and a guider of future consumption will be given by the risk-free market interest rate. This leads to the well-known standard practice of weighing all future costs and benefits with the same positive discount rate – even though the specific rate is the subject of continuing debate, the convention is not.

The findings from numerous empirical studies of people's intertemporal choices, however, fail to support the conventional model and the standard discounting practice. Instead of invariance, the reported results indicate that individuals have widely varying rates of time preferences. Two empirically well supported patterns of divergent rates are: (1) people commonly discount future losses at a lower rate than futures gains (e.g., Thaler 1981; Loewenstein, 1988), and (2) people use higher rates to discount outcomes in the near term relative to those accruing at more distant times (e.g., Benzion, Rapoport, and Yagil, 1989; Cropper, Aydede, and Portney, 1994; Kirby and Marakovic, 1995).

The disparity between people's valuations of gains and losses appears to be a major contributing factor to the observed patterns of time preferences. An individual's rate of discount for the same change in future entitlement can be expected to differ depending on the nature of the change relative to the reference state – a difference evident, for example, in the finding that a group of high school students required compensation of \$1.09 to delay use of a \$7 gift certificate by 7 weeks but were willing to pay only \$0.52 to speed-up its use by the same length of time (Loewenstein, 1988).

Just as the value of an immediate gain is the maximum amount a person would pay now to receive it, the present value of a gain accruing in the future is appropriately measured by the maximum sum the individual would sacrifice now to receive an entitlement to the future benefit – represented as a Quadrant I “purchase” WTP value in Figure 1. As people are willing to pay relatively less for gains, this means that a future gain would be equivalent to a relatively smaller present sum. This implies a relatively higher discount rate for future gains.

In the same way, just as the value of a current loss is correctly measured by the minimum compensation demanded to accept it, the present value of a future loss is the compensation received now that would leave the individual as well off as without the future change – a Quadrant III “sell” WTA value. And as losses are weighed relatively more this means that the present compensation would need to be relatively larger, implying a relatively lower discount rate for future losses.¹⁰

The different frames for a future outcome, using the appropriately different measures, are likely to reveal quite different rates of time preference. This was evident, for example, in results of a recent survey of a group of undergraduate students. One half were asked for “the largest sum of money you would pay today to receive \$20 a year from now?”, and the other half were asked for “the smallest sum of money you would accept today to give up receiving \$20 a year from now?”. The rate used to discount the future gain was, on average, about three times higher than the rate used to discount the future loss.

An important implication of the expected differences in time preference rates is the likely need to depart from the conventional practice of using a single rate to discount all future outcomes attributable to a program or project. It may well be reasonable and efficient instead to assess future gains using a likely higher rate resulting from a WTP measure, which itself may vary with the length of delay and other characteristics of the gain, and assess future losses or costs using a likely lower rate yielded by a WTA measure (Harvey, 1994).

To the extent that varying rates of discount better reflect people’s time preferences this can have a major impact on the valuation of environmental changes and on the rationalization of environmental policies and actions. The apparent lack of easy economic justification of efforts to deal with global climate change, long-term storage of hazardous materials, and unsustainable resource use, may well be a function of a failure to account for varied rates, particularly ones that are lower for future losses and declining for longer periods in the future.

¹⁰ Many time preference studies are based on people’s choice between two gains or between two losses, generally of the form of “receive S now or W+Y in the future”. This, however, is a Quadrant II (or IV in the case of two losses) opportunity cost measure. And just as the \$3.50 value determined on the bases of a choice between two gains did not measure the value of either gaining a mug or losing a mug (Fig. 1), the

Although some patterns of time preferences are becoming more firmly established as a result of recent behavioural research, many characteristics remain uncertain. And while invariant discount rates remain the conclusion of texts and manuals, their intuition is becoming less compelling for many. This seemed to be sensed by Weitzman in his recent review of the standard discount model:

Few are the economists who have not sensed in their heart of hearts that something is amiss about treating a distant future event as just another term to be discounted away at the same constant exponential rate gotten from extrapolating past rates of return to capital (1998, p. 202).

Valuations and the Stability of Preferences

Environmental valuations, like much of economic analysis, presumes that people have stable, usually well-defined, preferences, and reveal them by their actions. In the case of contingent valuation, or similar stated preference techniques, it is assumed that these preferences can be elicited with carefully crafted questions.

The conventional view of individuals holding stable preferences that are revealed by behaviour or by skillful probing, seems increasingly to be at odds with the evidence. Many recent findings suggest that people's preferences depend on context or means of elicitation, or on other factors which nominally should have no impact on them.

This violation is illustrated, for example, in the case of simple gambles for which it is quite obvious that the payoff and the probability of winning are equally important in determining their expected value. Even though nominally equivalent, people's judgments of the relative attractiveness of a series of gambles were found to be much more sensitive to differences in the probabilities of winning than to the size of the payoffs (Slovic and Lichtenstein, 1968). These individuals, quite characteristically, distinguished between the two attributes of the gambles in a way inconsistent with usual notions of valuations. In this case differences in the probability dimension are very salient as there is a ready understanding of the bounds of probabilities and where any given chance lies within this range, whereas the payoff is an unbounded dimension and individuals are less sensitive to knowing whether any sum is particularly good or not.

rate resulting from such choices does not give either the discount rate for a future gain or the discount rate

A similar valuation phenomenon occurs with the many reported cases of preference reversals in which one object is preferred to another when preferences are elicited in one way and the other object is preferred when preferences are elicited in a different way. For example, 83 percent of subjects in one experimental study chose to receive \$2500 in 5 years rather than receive \$3550 in 10 years; but only 29 percent expressed the same preference when asked in separate questions how much compensation they would require to give each of them up (Tversky, Slovic and Kahneman, 1990). This, and the many similar reported preference reversals, raises questions about the nature of preferences and about the assumption of stable preferences in particular (Bazerman, Moore, Tenbrunsel, Wade-Bensoni, and Blount, in press).

Similar changes, or instabilities, in preferences can take place when goods or outcomes vary in what may be thought of as their evaluability. This was demonstrated when a group of music students were asked how much they would pay for a music dictionary. A large dictionary with a torn cover was given a lower valuation when the lack of a comparative dictionary focused their attention on the defective cover. However, its large number of entries was brought to prominence and resulted in a higher valuation when an alternative smaller dictionary was also offered (Hsee, 1996). In this case, as in many others, people's preferences and valuations were influenced by what is conventionally assumed to be an irrelevant comparison.

A further example of the importance of context is given by the results of a study in which individuals were asked how much they would pay for a cup of ice cream (Hsee, 1998). When valued separately, they were willing to pay more for a smaller amount of ice cream that overflowed a small cup than they would pay for a larger serving of ice cream that only partly filled a large cup. When both cups were offered together, participants in the study could readily see that the larger cup contained more ice cream and were willing to pay more for it than the smaller serving. This preference reversal appears to occur because when the ice cream servings are offered one at a time, there is little basis for comparison and individuals then give undue prominence to a nominally irrelevant feature of how much of the cup is filled with ice cream.

Slovic further illustrated the role of a basis for comparison in people's valuations of an object in a recent study that involved rating the attractiveness of an offer (1998). Individuals in one group were asked to rate an offer of a particular probability of winning \$9. Other individuals were asked to rate the same chance to win \$9, but with the remaining probability resulting in a loss of 5 cents. Even though the offer to the second group was slightly inferior to the offer made to the first, because of the possibility of losing 5 cents, these individuals gave it a higher attractiveness rating. The \$9 win had little basis for comparison for the first group so they had less reason to think it was an attractive offer, but the introduction of the small loss made this \$9 win appear to be a very good deal to the second group and they rated it accordingly.

Another example illustrates how different attributes of an outcome can have unexpected impacts. One group of medical patients ascribed greater discomfort to a shorter unpleasant medical procedure than another group did to a longer one which included all of the shorter procedure plus an added final segment at a reduced level of discomfort. The seeming preference for more pain over less appeared to be due to the lack of sensitivity to the length of the procedure and the importance of a relatively less unpleasant ending of the procedure in individuals' rating of the overall experience (Kahneman, Wakker, and Sarin, 1997).

All of these examples, and the many others that have been reported in recent years, are inconsistent with the usual view of what is meant by stable and well-defined preferences that guide people's choices and decisions. They demonstrate instead that many preferences, "...are remarkably labile, sensitive to the way a choice problem is described or 'framed' and to the mode of response used to express the preference", (Slovic, 1995, p. 365). It seems people, in many cases, focus on immediately salient attributes of an object which both increases the weight of that characteristic in the final choice or judgment, and inhibits the processing of further information about other attributes thereby decreasing the importance of these other factors.

The demonstrations that many judgments and valuations vary widely with differing contexts suggest that it may be more useful to think of them as being "constructed" or "assembled" during the decision process, rather than being revealed by it (Payne, Bettman, and Johnson, 1992; Slovic, 1995). One important consequence of people's

preferences being less well defined is that they may be more malleable to context, description, transaction procedure, and means of assessment. Although direct evidence is scanty, this lack of well-defined and stable preferences might well be less the case with common routinely purchased goods and more so with unpriced public goods (Payne, Bettman, and Schkade, in press) – however, the studies reported by Hsee and others using common market goods like ice cream and dinnerware suggests that this characterization of preferences may be more general.

The evidence that many judgments appear to be made on the basis of attitudes or valuations that are sensitive to the salience of particular attributes, and not sensitive to others, has important implications for attempts to elicit monetary values by some form of stated preference technique. The difficulty stems largely from the strong tendency of the varying sensitivity to different attributes not to correspond to the traditional view of the contribution of these characteristics to their monetary value. For example, the size or quantity dimension of an entitlement plays an important role in determining its economic value – more of a good is worth more than less of a good. Yet in many cases people's attitude about a change of entitlements, which motivates their response, are fairly insensitive to this characteristic (Kahneman, Ritov, and Schkade, in press).

This has been demonstrated most extensively in the particular cases of jury deliberations over the setting of punitive damage awards, and contingent valuation methods of assessing environmental values.

Punitive damages are payments, over and above compensation for injuries to the plaintiff, that are imposed to punish the defendant, to deter others from imposing similar harms, and to mark the community sense of outrage of the action of the wrongdoer. Determining compensation for actual injuries suffered by plaintiffs is relatively straightforward, and while often subject to dispute, the guidelines are fairly clear and tribunals reach quite predictable outcomes. Punitive damages, however, have little or no boundary guidelines which leads to erratic and unpredictable awards. This is a cause of serious concern in many of the jurisdictions that allow such awards; their unpredictability undermines the deterrence function they are intended to serve and violates a sense of fairness as defendants causing similar harms may be subjected to vastly differing payment demands.

The results of an extensive study of the causes of the arbitrariness and unpredictability of punitive damage awards indicated that different individuals shared very similar feelings about the relative outrage of different harmful actions, “but that people have a great deal of difficulty in mapping such judgments onto an unbounded scale of dollars” (Sunstein, Kahneman, and Schkade, 1998, p. 2074). The basic cause of the erratic awards was found to be that juries are asked to nominate a damage figure on the basis of an unbounded scale – and the findings from a great deal of decision research suggest that people have difficulty coming up with similar numbers when this is the case. Consistent with results of constructed preference studies, jurors focus on irrelevant attributes, are subject to anchoring, use the opportunity to exploit “deep pockets”, or pursue objectives other than a reasonable attempt to promote efficient deterrence and express a proper sense of outrage. When individuals are allowed to express their sense of relative outrage on rating scales, or on nearly any other form of bounded scale, there is wide agreement among them. However, the unbounded nature of a monetary scale largely destroys this agreement. The result is the observed erratic and unpredictable awards.

Contingent valuation studies of environmental values largely fail for similar reasons. However carefully the questions are crafted, the quantitative attribute has little weight in the valuation that respondents convey in their answers. Instead, they tend to respond in ways reflecting the prototype of the object which the subject of the question prompts – a question concerning provision of habitat for an endangered species will likely bring to mind the saving of endangered species generally and respondents will answer accordingly (Kahneman, Ritov, and Schkade, in press). Or, a program that saves smaller areas of wildlife habitat, for example, may be considered nearly the equal of one that saves much larger areas – people’s focus of attention being on the benefit of saving habitat to the near exclusion of how much is being saved.

Further, respondents will tend to use the only means given to them, the monetary scale of willingness to pay, to express their satisfaction over doing something about whatever they have interpreted the question to be about. This can lead to the commonly observed embedding in contingent valuation responses, in which people indicate different values for an object depending on how it is initially included with other objects or valued by

itself (Kahneman and Knetsch, 1992). This also seems to be one cause of the observed neglect of the quantity dimension in valuation responses.

Context does matter, particularly for contingent valuation questions proposing unfamiliar exchanges of money for a non-market environmental value, just as it mattered for the music students who focused on the torn cover of the dictionary when there was little other basis for valuing, but then focused on the large number of entries when a smaller dictionary was provided for comparison. Numbers are invariably produced by contingent valuation surveys, but they are not likely to have many of the characteristics of economic values.

The growing evidence appears to suggest that not only might the weaknesses of jury conclusions and contingent valuations be more explicable with some relaxation of the conventional stable preference assumption, but that well known anomalies, preference reversals, and varying sensitivities to characteristics of an outcome might be as well (Sunstein, Kahneman, and Schkade, 1998). A better understanding of preferences, and preference formation, could also contribute to more productive policy analysis and design.

An Alternative: Damage Schedules Based on Scales of Importance

Problems with supplying monetary measures of environmental values does little to diminish the demands for some accounting of their importance. Damage awards are being set and allocations made, and there is an ever greater demand to have such decisions made in better accord with community preferences.

One means of accomplishing much of this desired outcome is to base damage assessments and allocation guides on a pre-established fixed schedule that reflects the relative importance of environmental assets or changes in environmental resources. While not without problems, such an alternative to current valuation efforts appears to avoid many of their weaknesses and could provide better guidance for improving the even handedness and efficiency of environmental resource management (Rutherford, Knetsch, and Brown, 1998).

Judgments of the relative importance of different environmental changes, which are all that is required to derive useful damage schedules of sanctions and allocation guides,

might be determined in various ways, but a relatively simple means which at present seems most promising and provides a high degree of transparency, is by means of paired comparison surveys. In this well-established method for ordering preferences among objects, each individual in a representative sample is presented with all possible pairs of the elements of a set of, say, environmental losses. For each pair, one is selected which the respondent feels is the most valuable or important of the two. As each object is paired an equal number of times, all have the same probability of being selected as being more important than the others. Its scale value is simply the proportion of times that an object is actually chosen relative to the maximum number of times it is possible to be chosen by all individuals in the sample. The scale values for each object can be arrayed to provide an interval scale of preferences reflecting the collective judgment of the relative importance of the different objects being compared (Peterson and Brown, 1998).

While people appear to be unable to assign consistent monetary measures to environmental losses, they do seem able to provide less demanding assessments of relative values in a paired comparison format. Unlike other methods, such as contingent valuation surveys which demand monetary expressions that people find more difficult, only judgments that people can do well are needed to provide empirical support for damage schedules.

The mapping of damage awards and other sanctions to scales of relative importance is, like workers' compensation award schedules with which they have much in common, not an automatic translation nor without the need for somewhat arbitrary assignments – though in practice this might well be less so than with current resolutions in which the correspondence between value estimates and sanction is hardly direct. A damage schedule based on an importance scale would prescribe more severe sanctions for what are widely judged to be more serious harms and lesser sanction for less important losses. Preliminary tests confirm that this level of discernment and the guidance this provides should be quite readily attainable (Chuenpagdee, Knetsch, and Brown, in process). Further, in much the same way as workers' compensation schedules are developed, more extensive schedules can be developed over time by establishing the relative importance of subsequent changes as they are encountered by interpolation and extrapolation from scale values of those previously assessed.

Damage schedules do not provide, nor are they intended to provide, monetary measures of loss. As such the goal of completely optimal allocations and perfectly efficient deterrence cannot be fully met by their use. For example, if the true economic value of wildlife habitat were known then policies and sanctions could be designed to protect the socially optimum area of such resources by the most efficient level of precaution and care. However attractive in principle, this level of certain guidance is not a realistic alternative.

Current methods are incapable of providing accurate (or even very consistent) estimates. Each approach has limitations of its own that preclude any such expectation, but beyond these all current techniques are at best used to provide willingness to pay measures of loss rather than the more appropriate willingness to accept measure (Rutherford, Knetsch and Brown, 1998). This inherent disadvantage of using the more modest guidance of damage schedules may, therefore, be more illusory than real. As Epstein suggests,

The relevant comparison between simple and complex rules should be conducted not in the language of aspiration, but in the language of realizable achievement. It is that more humble task which simple rules best discharge, for their relative cost-effectiveness and certainty forestall the vast amounts of intrigue brought into the legal system by the relentless, if naïve, pursuit of perfection (1995, p.39).

And the remaining errors that arise with use of the simpler rule can be expected to be smaller to the extent that schedules are based on better readings of community preferences.

A further reason for tolerance of the lack of valuation precision of a damage schedule is that other important social purposes of loss assessments and compensation payments, aside from ones of directing resources to more efficient uses, are even more undemanding of complete accuracy. One such purpose, for example, is to provide some form of social or corrective justice for a loss. For this it is more important that people see that environmental resources are not taken to be without value and to be disregarded accordingly, but instead have real worth that is recognized by some form of protection and sanctions that attend their degradation – and the more automatic the attendance, the better. Or, analogous to cases of pain and suffering to individuals, it is often important to provide a means of redress. And as suggested by Rabin:

Requiring payment is a way both to bring the wrongdoer to recognize that she has done wrong and to make redress to the victim. Redress is not restitution or rectification. Redress instead means showing the victim that her rights are taken seriously (1993, p.60).

Importantly, goals of corrective justice and redress, and ones of providing solace to victims, can largely be met by sanctions and damage awards that need only to be widely seen to be correlated with the severity of the transgression; they do not require an accurate assessment of the monetary value of each loss.

Among their further advantages, damage schedules provide predictability by specifying remedies in advance rather than after an event or change has taken place. This advance knowledge provides more effective and efficient deterrence incentives as those responsible for potential losses would be more fully aware of the consequences of their actions.

Similarly, enforcement of sanctions would likely be easier as once liability is established in any particular case, the consequence is foretold from the pre-existing schedule rather than being the uncertain result of self-serving data collection, attempts to discredit methods, and contentious adjudication. For many of these same reasons, the costs of using damage schedules should be much lower than those encountered with present practices. Once a schedule is implemented, improvements can be made as new information is brought forward, but there is then no need for new assessments and challenges for each incident or activity as it occurs.

Pre-existing schedules of sanctions should also better serve horizontal equity goals as greater similarity of treatment of similar losses will likely result (Sunstein, Kahneman, and Schkade, in press). Present after the fact valuations often lead to widely erratic assessments of similar losses, the product of unreliable methods, differences in protocol, and often in the case of contingent valuations the arbitrary decisions of how many people's loss over what geographic area are to be "counted" in any particular assessment.

The use of damage schedules based on people's judgments of the relative importance of environmental changes is not likely to lead to optimal deterrence and maximum efficiency in the allocation of environmental resources. But there is no present alternative that provides this. Schedules appear, on present evidence, to provide at least a reasonable potential for significant improvement over current practices.

Concluding Observations

The results from what is now a vast array of tests have provided consistent evidence that some of the common behavioural assumptions that guide the ways in which environmental values are taken into account, are very often wrong. On current readings, the implications for environmental assessments, and damage awards and allocations based on them, appear substantial.

The implications of behavioural findings, such as the difference in people's valuations of gains and losses, extend far beyond just formal analyses of costs and benefits, present values of future outcomes, and the like. Importantly, they also include the way in which issues and problems are thought about and discussed – the habit of mind that can so greatly influence social judgments and policy proposals. Contemplating the negative consequences of a proposed action or policy not in terms of how much individuals would pay to avoid them, but in terms of how much compensation would be required for them to accept the losses is likely to evoke quite different and more accurate feelings and responses.

There is also evidence, it seems to me, of a lax observance of another common behavioural assumption having to do with the application of accepted evidence. The common presumption we are led to believe is that credible research findings that pass the tests of peer review would be used, especially if there is a likely social gain from doing so. This appears not to be the case with respect to environmental valuations. In spite of these behavioural results being reported in *all* of the leading economics journals, as well as those of other related fields, for the past two decades, there is an almost total absence of any accounting, or even acknowledgment, of these findings in debates over environmental values, in valuation exercises, or in the design of environmental policies.

The standard explanation offered for this incongruity is that it takes time for new results to be applied. This, however, seems to be more the question not the answer -- why, one might better ask, does it take so much time.

One explanation for analysts continuing to be tethered to old assertions and dismissive of the new evidence, is consistency with the major behavioural finding that people resist

giving up present holdings, whether they are mugs, access to clean air, or, it seems, ideas. As Oliver Wendell Holmes, the American jurist put it over a century ago:

It is in the nature of man's mind. A thing which you have enjoyed and used as your own for a long time, whether property or *an opinion*, takes root in your being and cannot be torn away without your resenting the act and trying to defend yourself, however you came by it" (1897, p. 477, emphasis added).

We also are now more aware that people, presumably including environmental economists and policy analysts, are often subject to confirmation bias. Individuals tend to seek out and accept evidence that confirms their prior belief and to limit the search for and discount disconfirming information (Bazerman, 1998).¹¹

The matter of incentives seems, however, to be a more general explanation for the observed lack of enthusiasm in applying or discussing the behavioural findings – individuals do not see it as being in their interest to do so. Nearly all textbooks, for example, continue to exclude any discussion of the evidence and issues raised by these findings. A major explanation for this omission was offered by a successful economics text author, in exclaiming, “If I put this in, no one would adopt my books”. He was no doubt correct – but he does not use this disincentive and his reaction to illustrate his text discussion of market failures.

A variant of such incentives seems to operate in encouraging the continuing use of the WTP measure of environmental losses, rather than what is agreed to be the more appropriate WTA measure, in litigation over assessments of damage awards. The choice of the WTP measure is often justified, or rationalized, on the expedient grounds noted earlier that respondents find a compensation question difficult to answer. However, the continuing practice of using the inappropriate and biased measure is greatly encouraged by a compatible alignment of self-interests of the parties directly involved. Plaintiffs recognize that the usual contingent valuation study will not provide consistent WTA responses and so desire to establish at least the smaller WTP quantum of damages which tribunals will accept, contractors hired to provide damage estimates can only conveniently produce WTP numbers so claim their legitimacy, and defendants are only to

¹¹ The lengths to which some economists and other analysts go in attempts to “explain” away the behavioural findings often attain near comical proportions. Less amusing, however, is the extent to which a

pleased to endorse a measure that will yield lower estimates over one that would give rise to liability for far larger assessments.¹²

The asymmetry in the incentives and restraints facing individuals appears to carry through to organizational and professional structures as well. Continuing to use long accepted conventional methods and approaches seldom carries risk of censure, regardless of the outcome. Departures, however, usually yield few benefits but carry high risks to career prospects – employment, promotion, research grants, and professional recognition, and the lack thereof, provide non-trivial motives for most people. The not surprising consequence is a bias to follow the tried if not necessarily the true.

These incentives to conform to accepted convention often give rise to what has become known as “groupthink”, and they appear to operate within professions with no less impact than on more closely knit groups in organizations. Social pressures, desires to avoid conflicts, censure of dissenters, apprehension about evaluations of others, and desires to preserve friendly relations with members of the group, almost invariably lead to varying degrees of self-censorship, inhibitions of criticism and suppression of contradictory opinions, not taking alternatives seriously, bias in collecting and processing information, illusion of unanimity (and invulnerability), and, consequently, poorer judgments and decisions (Bazerman, 1998). Richard Shumway provided an illustration of the pressures on dissent in his recent Presidential Address to the American Agricultural Economics Association, in which he describes consequences of his forsaking more conventional views on management of research enterprises:

I was frequently the guest of state, federal, and international research administrators. I worked directly with several research managers, consulted with a number of public and private research organizations, and gave seminars and presentations at high-level administrative conferences. After my first paper as a skeptic was published, invitations to my experiment station director’s office ceased. After the second skeptical paper appeared, all invitations to consult or even interact with other research administrators stopped (1998, p. 894).

This experience is not exceptional. And the consequences are predictable.

disinterest in these findings seems to be a condition of employment by some research and public policy institutions, and these organization’s seeming insistence on a similar “tameness” in their collaborators.

¹² Such pragmatic responses seem to influence some parts of academic life as well, as illustrated by the only partly factitious remark, “Yes I know the usual contingent valuation studies are a bit dubious, but I

The demand for change in taking greater account of behavioural findings in environmental valuations, and the supply of such change, seems to be in no better balance than the demand for environmental valuations and their supply. And as yet few signs of much convergence have appeared, even though the current intransigence may be imposing appreciable social costs of less efficient and equitable choices.

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can get money to do them, they are easier to get published, and I am up for promotion in a couple of years."

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