Impacts from restoration strategies: assessment through valuation workshops

Begoña Álvarez-Farizo*
Economics Unit
C.I.T.A. – Gobierno de Aragón
Ctra. Montañana, 930 - 50059- Zaragoza - SPAIN

José M. Gil
CREDA-UPC-IRTA
Parc Mediterrani de la Tecnologia
08860-Castelldefels (Barcelona) - SPAIN

&

B.J. Howard
Centre for Ecology and Hydrology
Lancaster Environment Centre
Library Avenue - Bailrigg
Lancaster LA1 4AP - UK

*corresponding author:
e-mail: balvarezf@aragon.es; phone: ++ 34 976 71 63 54; fax num: ++ 34 976 71 63 35

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Abstract

Recent decades have seen a wide range of pollutant spills affecting natural, industrial, urban and rural areas (Exxon Valdez, Amoco Cadiz, Erika, Prestige, the Chernobyl nuclear power plant , and the Aznalcóllar mines in Spain, to name a few). The extent of damage covers both time and space. Therefore, in order to mitigate the effects of pollution, it is necessary to adopt integrated management of both productive and natural areas. However, to be effective it is necessary to consider not only the health or biophysical effects of the countermeasures, but also the response of individuals to these changes. The purpose of this study is to assess the potential social and environmental impacts derived from the implementation of restoration strategies resulting from spills. Our approach is based on a choice experiment applied within the context of a citizens' valuation workshop or market stall in Cumbria (UK) and Zaragoza (Spain). The results highlight the advantages of this participatory technique versus traditional surveys.

Keywords: Choice experiments, market stall, valuation workshop, impact assessment, community preferences.

1. Introduction

Recent decades have seen disasters[1] caused by well-known oil spills and other disastrous events that have affected not only natural spaces but urban, industrial, and rural areas (examples include the Exxon Valdez, Amoco Cadiz, Erika or Prestige tankers or the accidents at the Chernobyl nuclear power plant and the Aznalcóllar mines in Spain). The extent of damage is both on time and space, thereby resulting in the need to have integrated management of the areas dedicated to living, producing and supporting natural ecosystems in order to mitigate the impact of the pollutant.

The application of restoration strategies have an immediate effect on the environment, which is generally recognized through changes in the surrounding landscapes. However, the implementation of similar strategies can lead to divergent results under differing conditions and environments. In order to effectively manage these situations, not only the health and the biophysical effects on humans and nature should be considered, but also the human response to these changes in the surrounding environment (Cropper and Sussman, 1990). Thus, even though a measure may have beneficial effects — such as decreasing toxic doses for humans — certain associated implications can reduce the quality of life of those affected. These effects, while considered secondary and not necessarily negative, are not intended when the countermeasures for environmental recovery are applied. Including these prospective impacts in a remediation plan can help to extend the scope of decision-making models (Cox et al., 2005).

[1] Bonnieux et al.(1980), Bonnieux and Rainelli (1991, 1993, and 2001), Carson et al. (1992), Carson and Hanemann (1992), NOAA (1983) and White and Nichols (1982), among others, provide an economic perspective of disasters caused by pollutants.

Furthermore, it will always be difficult to justify the implementation of all available countermeasures, regardless of the cost, in order to mitigate the effects of contamination. Yet it is equally difficult to justify that remediation countermeasures should only be applied based on their effectiveness in reducing the doses. Considering these conflicting interests, how should a restoration plan be designed? How do we choose between the external effect to pursue and the one to avoid? How can we compare the secondary effects of the different measures that can be applied? There must be guides and methods for assessing the outcomes in order to avoid *ad hoc* decision making[2]. Usually this information is obtained by applying methods based on the use of both revealed and stated preferences, as well as utilizing a vast amount of literature that is available on the assessment of external effects (Álvarez-Farizo and Hanley, 2006; Hanley et al, 2001; Bennett and Blamey, 2001; Hanley et al, 1997; NOAA, 1997, 1983; among others). However, there has been limited research focused on the effects derived from the application of remediation strategies[3].

Along this line, the main objective of this paper is to assess some of the unintentional and intangible consequences (externalities), both environmental and social, derived from the application of remediation strategies that can be perceived through changes in the urban and natural landscapes. Specifically, we analyse the consequences of implementing strategies for the elimination or

[2] For a review of the social and ethical aspects of decision making on selecting countermeasures, see Oughton et al (2002)

[3] It is worthwhile here to highlight the controversy on the need to assess externalities and, if so, how to do the assessment (Mazzotta et al., 1994; Unsworth and Bishop, 1994; Jones and Pease, 1997; Bonnieux and Le Goffe, 1997; Brans and Uilhoorn, 1997; Holl and Howarth, 2000; Bonano et al 2000; Navrud, 2003; Álvarez-Farizo and Gil, 2003). These studies suggest other approaches of environmental assessment. They propose measures other than economic valuation for compensating restoration, including measures that compensate economically when the damage cannot be repaired.

reduction of radioactive contamination to viable (or non-hazardous) levels for humans. These externalities were identified within the context of the STRATEGY[4] project, and they affect individuals, through both the direct and indirect use of their nearby environment, by just knowing about the damage.

The methodological objective of this study has been to explore the possibilities of overcoming some of the criticisms of non-market valuation methods. These criticisms are based on the problem of providing information; on the ability of respondents to process the information and fully understand what they are trying to assess (Fishkin, 2003; Luskin et al, 2002); on the complexity of the valuation tasks (Swait and Adamowicz, 1996; Mazzotta and Opaluch, 1995); on the notion that people have or do not have certain, pre-formed preferences for environmental goods (Payne and Bettman, 1999); and on the notion of community rather than self-interested values (Sagoff, 1988).

In recent studies, participatory approaches have been incorporated into valuation exercises to minimise these difficulties (Kenyon et al., 2001; Kenyon et al., 2003; MacMillan et al., 2003; Álvarez-Farizo and Hanley, 2006). This line of research seeks to use deliberative methods in which the public actively participates (Spash, 2000; O'Connor, 2000a and b; Kontoleon et al., 2001; Fishkin, 2003)[5] and are supported institutionally. For example, the Aarhus declaration of 1998 states that better access to information regarding

[4] Strategy: Sustainable restoration and long-term management of contaminated rural, urban and industrial ecosystems; Contract number: FIKR-CT-2000-00018.

[5] These studies include aspects that were highlighted during the concerted actions, "EVE" (Environmental Valuation in Europe), the purpose of which was to seek valuation methods of environmental goods and services, and VALSE (Valuation for Sustainable Environments), which endeavoured to demonstrate effective social processes for the valuation of environmental goods and natural capital for conservation purposes and for designing sustainable policies.

environmental issues and public participation in the decision-making processes improve both the quality and implementation of the decisions.

We hereby attempt to explore the possibilities of applying stated preference methods in a deliberative and participatory environment. In the same exercise, we have combined a valuation method called choice experiments (CE) with a citizens' workshop (CW) participatory technique, that is, we pretend to take the advantages of both techniques, aimed at different objectives: the citizens' workshops are aimed at forming and developing the preferences while the valuation technique (CE) is to register and calibrate the changes and measure the values in monetary terms. More explicitly, the citizens' workshop is intended to circulate information and force individuals to deliberate as responsible citizens who have no particular or relevant self-interest and may represent their own community in making decisions on an issue of general interest (Sagoff, 1988). Their opinions and decisions are collected in a questionnaire after deliberation, which also contains a choice experiment. This experiment is intended to inform us about the subject's (i) preferences for restoration, (ii) willingness for trade-off on restoration impacts, and (iii) the relative importance of possible consequences from each measure.

The rest of the paper is structured as follows. Section 2 broaches and justifies the methodological aspects of the approach herein proposed. Our approach combines the participatory method, the citizens' workshop, with the valuation method, and the Choice Experiment. The next section outlines the exercise and scenario designs, followed by the discussion of the main results obtained. Finally, we conclude by acknowledging the limitations of the study and by proposing possible lines for future research.

2. Choice experiments and citizens' workshop

There is a wide variety of instruments that are used to incorporate public views in decision making (including surveys, referendum, citizen panels and juries). Each can be of use, depending on the objectives and circumstances of the study.

However, most studies on environmental assessment collect information from surveys sent to the general public. The values obtained are based on individual preferences, revealed or stated, and they emulate studies made on market goods. However, Sagoff (1998) indicates that society decides on issues such as health, security, environment, and ethics based on community preferences (rather than on individual preferences). When individuals are surveyed, do their answers reflect the community objectives as responsible members of the society or, conversely, do they reflect their personal objectives as self-interested individuals? Moreover, during a traditional valuation exercise of non-market goods, we wonder what individuals are being forced to show: consumer preferences or citizen preferences.

The citizens' workshop approach (CW) (Jefferson Centre, 2004) or the market stall approach (MacMillan et al., 2002) can help to clarify and identify roles in decision making. CWs gather the opinions of participants as lay individuals who have no relevant, particular interests, and are a balanced combination between deliberation, independence of opinion, access to information, use of available time and scrutiny of the process (Coote and Lenaghan, 1997). Participants (between 10 to 15) must be representative of their community, receive information from experts and stakeholders, and have the opportunity to pose questions and present views in order to be included in the analysis. The main advantage of this technique is the "participatory" process, which is

receptive to feedback and allows for information to be added or the focus of the study to be changed, if necessary. Some versions of CWs form subgroups in order to design courses of action (see Coote and Lenaghan, 1997, for designing health policies; Aldred and Jacobs, 2000, for wetlands land use; and Kenyon et al, 2001, for alternatives for traffic reduction). Despite the fact that Brown et al. (1995) suggest that CWs can be used to estimate environmental damage, only a few studies have effectively applied it to impact assessment (MacMillan et al., 2002; Álvarez-Farizo and Hanley, 2006; Álvarez-Farizo et al, 2007). We have opted to use CWs for this study[6], since it allows for eliciting a social valuation of remediation measures after decontamination and, furthermore, considers the motivations and different perspectives of damage assessment. Moreover, this combined technique allows us to learn about the process of preference formation. The selection of a "representative" group of citizens is crucial since all strata should be included unless properly justified. It is very important to avoid someone leading the arguments, avoiding or impeding the access to express an opinion or even to defend it. In environmental issues, it is easy to find passionate defenders of opposite positions in the same group, who "monopolize" the flow of ideas and opinions. It is very important to rely on an expert moderator to control the room without biasing the natural flow of ideas.

With respect to the instrument for obtaining information about preferences, the choice experiments technique is probably the most widely applied today in environmental valuation (Hanley et al., 2005; Rodríguez and León, 2004; Hanley et al., 2001; Bennet and Blamey, 2001, among many others). Choice experiments are included among conjoint analysis techniques (Green and

[6] In section 3 we explain how all the "rules" for selecting a representative group, and having a productive

Srinavasan, 1978; Hair et al., 1995; Blamey et al., 1996, 1997). They all obtain non-market based values by measuring the willingness to pay or accept compensation in order to improve the environment, to avoid damage, or to avoid a secondary effect as a result of removing a pollutant. This method is based on stated preferences, given that individuals are required to *declare* their preferences regarding a hypothetical situation.

Choice experiments contain elements from the theory of value (Lancaster, 1966) and consumer behaviour, which fundamentally include rational choice and preference theory. Following the theory of value, individuals get utility from the characteristics of goods, services, and ideas... more than from the good as a whole. Lancaster's theory states that the relevant features must be defined not in terms of the individual reactions towards the good but in terms of objective measures — the intrinsic proprieties of the good. With respect to our research objective, the external effects derived from remediation measures, we endeavour to break down these effects into relevant aspects based on objective measures and not based on individual reactions to a countermeasure. Our interest, therefore, focuses on reactions to the objective consequences, both individually and considered as a whole.

Interviewees tend to apply a variety of choice strategies[7]. The most common and direct one is optimization: individuals are required to choose the option that maximizes their own welfare. This means that individuals must compare the options in terms of expected costs and gains and then choose the option that is the most satisfying. In this case, a certain restoration strategy (or countermeasure) will be preferred over another if the utility derived from the positive consequences or if the (negative) impacts derived from the preferred

workshop where followed.

strategy are greater (less) than those derived from the one not chosen. This assumes additive utility models. However, if we assume that there are certain lexicographic elements in the preferences for environmental goods, additive utility models will not be valid, since in this case utility is derived from each consequence-level and will be independent from the utility derived from the rest.

The basis of behaviour in choice experiments, regardless of the decision strategy, is random utility theory (RUT). Under RUT, the choice can be broken down into a deterministic part (a function of the observable characteristics of the goods and individuals) and another unobservable part — the error term.

We therefore start with the expression of an individual's indirect utility function (U),

$$U_{ij} = V_{ij}\left(X_{ij}\right) + e_{ij} \qquad (1)$$

where V_{ij} is a deterministic function of X_{ij}, which are vectors containing both individuals' characteristics (socio-economic and demographic) and characteristics describing the relevant aspects of the object under study; and e_{ij}, is the unobservable, stochastic term of utility. The assumptions made on this error term determine the model to be estimated (logit, mother logit, probit, mixed logit, etc.). The general practice is to consider that this error term follows a Gumbel or Weibull distribution, which leads to the multinomial (MNL) or conditional logit (CL) model[8], which is the most widely used decision model. Therefore, according to equation (1), the probability of choosing a certain combination of impacts or consequences will depend not only on the

[7] See Blamey et al. (1997) regarding choice strategies.

[8] MNL models require the propriety IID to be fulfilled, which means that each error term is distributed identically and independently from the rest. The consequences of this

characteristics of the impacts themselves, but also on an individual's personal characteristics. Thus, certain combinations will have higher probabilities of being selected as the beneficial consequences increase and/or the negative impacts and costs decrease. This probability will offer an indicator of the relative satisfaction derived from the restoration strategy (Louviere et al., 2000). Thus, option *m* will be preferred from the choice set *j*, if the probability that the utility produced by the mentioned option is higher than that generated by any other alternative *j*. Therefore,

$$P\left[\left(U_{im} \rangle U_{ij}\right) \forall j \neq m\right] = P\left[\left(V_{im} - V_{ij}\right) > \left(e_{ij} - e_{im}\right)\right] \quad (2)$$

where subscript *i* refers to the i-th individual. Assuming the usual Weibull distribution error term (IID), the probability of choosing any alternative *m* can be expressed as (McFadden, 1974):

$$P\left(U_{im} > U_{ij}, \forall j \neq m\right) = \frac{\exp\left(\mu V_{im}\right)}{\sum_{j} \exp \mu V_{ij}} \quad (3)$$

where μ represents the scale parameter, which can not be estimated independently from the other parameters. This is the simplest model that can be applied to estimating parameters for choice experiments. The willingness to pay for a marginal improvement in the impacts considered can be obtained from the ratio between the estimated parameter of the corresponding attribute and the cost parameter:

$$-\beta_m / \beta_j \quad (4).$$

This willingness to pay elicited on the workshops will differ from what is obtained in a conventional survey, since preferences have had the time and opportunity

restriction as well as the implications of alternative models are shown in Louviere et al. (2000).

to be formed and matured. Maturation is derived from a process in which the combination of deliberation and enough time to think will allow doubts and thoughts to emerge, which can be incorporated into the analysis (Whittington et al 1992). In particular, if there were relevant characteristics or relevant impacts that may have been overlooked in the initial analysis, there would be no way to amend the problem in a conventional valuation exercise with choice experiments. Moreover, deliberation allows for a multidirectional flow of ideas, provided that all important matters reach all participants, thereby feeding back to the discussion and enriching the perspectives.

Clearly, some elements may be positive for some individuals, but negative for others. An example would be an industrial landscape or a natural landscape with integrated industrial elements, such as a wind farm. While for some people wind turbines degrade the scenery, for others they represent technological modernity and the path to sustainability. Among the former, this degradation may not leave any possible room for negotiation, but others could be willing to accept some degradation of beauty when it guarantees the substitution of a polluting energy source for a green one (for example). Under a traditional survey format, these connotations and (reasoned) trade-offs would be unknown, given that there are interrelated elements that are being examined simultaneously, even if they do not form part of the study.

Another aspect we would like to highlight here is the different evaluation perspective resulting in a different orientation of the willingness to pay. In a traditional approach, we obtain just the individual and self-interested value, but when the valuation exercise is implemented during a citizens' workshop, we assume it is possible to get the responsible and committed value of a citizen (Sagoff, 1998; MacMillan et al, 2003; Brown, et al 1995 ; Álvarez-Farizo and

Hanley, 2006; Álvarez-Farizo, et al, 2007). Thus, the willingness to pay will contain elements of the discussions held among different members of society, while private interests will be inhibited by the surrounding environment[9].

In traditional surveys, an individual is required to state what amount of money he or she would contribute or accept, but only considering what they can afford. In the citizens' workshop context, participation will elicit relevant collective aspects that may not directly affect private individuals, but they will affect them indirectly as a member of a local society. Thus, the willingness to pay will not only include those things that favour individuals, but also those that favour the community.

Finally, as previously stated, there is an absence of clearly defined preferences for most non-market goods, and in the case of traditional surveys, preferences are constructed *ad hoc* during a short interview, while there is no opportunity to review choices, among other things. Choice experiments during jury sessions are completed after a number of tasks, such as deliberation on certain issues. Thus, based on the generic preferences[10], participants will build their own preferences based on a process of maturation and based on their personal principles relating to the subject of study. Throughout this process, and before making the final choices, participants' attitudes, thoughts, feelings, experiences, etc., will come out during the exercise, thereby allowing them to take the role of spokespersons for their relatives and friends.

At the end of the process, the participants will have a clear, overall view of the problem, they will know the implications of various options, and they can

[9] In an environment where the common good and welfare are discussed, private interests do not come out easily, since they will be considered inappropriate. However, collective interests, such as those of farmers, business associations, etc., are backed up by the common interests of the group itself, and this will be elicited during a citizens jury.

weight the pertinence of adopting a certain attitude when making decisions, given that their preferences will have been clearly defined during the valuation exercise.

We hereby endeavour to test if there are indeed changes caused by the elicitation method, or CWs. More specifically, we endeavour to test if the CWs allow for a change from individual to collective values and if they help to build well-defined preferences. Therefore, rather than using an MNL, we have applied a Random Parameters Model (RPL) or mixed logit choice model. This model overcomes some limitations of the MNL by allowing for taste variation, unrestricted substitution patterns and correlation in unobserved factors over time (Train, 2003), which is more conformable with our objectives.

We continue to assume that individual *i* will consider all the offered alternatives in each choice situation *t*. The utility of each alternative *j*, as evaluated by each individual *i* in choice situation *t*, will be represented as

$$U_{ijt} = \sum_{k=1}^{K} \beta_{ik} x_{ijtk} + \varepsilon_{ijt} = \beta_i^{'} x_{ijt} + \varepsilon_{ijt} \qquad (5)$$

where x_{ijt} is the vector of the explanatory variables which include those observed by the analyst, such as the individual socioeconomic characteristics, as in the previous model, those describing both the decision context and the choice task itself in the choice situation *t*. Again, the β's and ε's are not observed by the analyst and are treated as stochastic influences, but unlike the previous model, the β's are assumed to vary across individuals. If the IID assumption holds, errors of different alternatives cannot be correlated. However, in the case of environmental attributes, these are very likely to be correlated (Black et al., 2006), since it is easy to expect that individuals who

[10] By this term, we are referring to the sum total of attitudes, beliefs and experiences

want an improvement in an environmental attribute will also want an improvement in a related attribute. One way to deal with heteroskedastic and correlated errors is to estimate the following regression (Hensher et al., 2005), thus

$$\beta_{ik} = \beta + \delta_k' z_i + \Gamma v_i = \beta + \delta_k' z_i + \eta_{ik} \qquad (6)$$

where: η_{ik} is a random term whose distribution over individuals depends, in general, on the underlying parameters; z_i is the observed data; and v_i is a vector of uncorrelated random variables. β_i may contain alternative-specific constants; δ and Γ are parameters to be estimated. Thus, η_{ik} may also vary across choices and may induce correlation across choices (Hensher et al 2005)[11].

3. Design of the exercise

This study was performed during April and May of 2003 at two locations[12], the county of Cumbria in the UK and the province of Zaragoza in Spain. The possible consequences of a nuclear accident were simulated for each scenario. For each of these two locations, deposition schemes where defined. A database was created with aspects such as soil characteristics, the size of towns, land use, farming practices, food production patterns, habits, population characteristics, etc. (Cox et al., 2005). Restoration strategies were designed by taking into account both the deposition scenario and the characteristics and expected effectiveness of the measures. Likewise, countermeasure effects on the landscape were simulated. At this point, we organised a group (the citizen jury, CJ) at each location. During recruitment,

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that are the basis for the preferences of all goods.

[11] For a detailed reference on mixed logit models see (Hensher et al., 2005, and Train, 2003).

participants were told that they were selected in order to assess the consequences of damage restoration and that their decisions would be binding, such that a standard remediation protocol[13] would be prepared from the results of the sessions. They were also instructed that the reports on the CWs would be open to everybody. This was done in order to make the exercise as true to life as possible.

The design of the questionnaire was similar for both locations, except for the part referring to the participants' knowledge and attitudes towards their own reality. In the case of Cumbria, for example, participants had already had experience with a radioactive pollutant (there are still restricted areas resulting from the Chernobyl deposition) and with an epidemic (foot and mouth disease), which required very drastic measures in certain areas.

The central part of the questionnaire, the choice experiment itself, was common except for the currency. Individuals were shown different sets of alternatives from which they had to choose the preferred one, if any.

The CJ participants met on two occasions, five to seven days apart, and meetings lasted for around three hours including a break for relaxation. There was a balanced representation of the population, with a final group of 25 participants in Cumbria and 17 in Zaragoza[14].

During the sessions, various experts were available for consultation to explain the measures and their expected consequences. Furthermore, there was

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[12] The locations were selected based on the researchers' residences. However, Cumbria, the research coordinator's residence, was affected by the accident at the Chernobyl nuclear power plant.

[13] At this point, we placed considerable emphasis on this point in order to make the situation as credible as possible and to avoid any free-rider position.

[14] The recruitment process was similar in both cases. After contact and pre-selection according personal characteristics, a random process was used to select the final members. The size of the groups was determined by budget restrictions and the possibility of equal participation.

sufficient material available, such as manipulated images and real photographs for illustrating the consequences of applying selected countermeasures of pollution removal. The questionnaire included socio-economic-demographic information in order to establish choices and behaviour patterns, together with environmental and social attitudes, and to inform about the decision process.

The central part of the questionnaire was the choice experiment itself. Alternatives were constructed as sets of environmental and social impacts derived, as a side effect, from the implementation of anti-pollution measures with two possible levels: minimum/none and existing[15]. Each option included five possible consequences, apart from the pursued removal of contamination, from applying the remediation strategy. Table 1 shows the impacts and levels considered in this exercise, which results in 160 possible combinations. Given the difficulty in evaluating all the combinations (Louviere et al., 2000; Montgomery, 2001) and given the instrument used to collect the choices (CWs), we opted for a main effects design with two-way interactions (for the two extreme values of the cost attribute), thereby reducing the number of option sets containing the choices to 16 (with a fractional factorial design[16]). Each option set included two alternatives with a different combination of impacts as well as the possibility of choosing no option; meaning that the participant wanted no corrective measures after the pollutant was removed. From the exercise, we determined

[15] Remediation strategies may simultaneously affect biodiversity (most of the measures apply treatments to the soil, vegetation, or crops) or animal welfare (with changes to both livestock management and longevity). In order to estimate these values, the implicated measures and the implied change must be described. This is why the collaboration of experts on the affected systems is needed; they help to provide an understanding of how these effects can be perceived by the non-expert public.

the trade-offs that the participants were willing to make; or, in other words, what they were willing to sacrifice in order to guarantee more (or less) of an attribute. For instance, they may have been willing to pay more in order to ensure that no animal suffered or for the restoration of unique buildings, or they may have been willing to sacrifice the beauty of the landscape to have a safer environment. By including cost as an attribute, it was possible to measure how individuals *valued* the impacts. It would thus be possible to infer the value of the change from the status quo (the situation in which the damage is not corrected) to a situation in which the damage is corrected; in other words, the willingness to pay to correct specific damage[17].

>>>>>>>>>>>> Table 1 about here <<<<<<<<<<<<<<<<<<<<<<<<

The monetary cost was focused differently at each location. In the case of Cumbria, it was designed as an increase in local taxes, while for Zaragoza, due to the risk of the exercise being rejected, we opted for an annual increase in the daily cost of living. This cost was explained it should be spread on the long term, such as 25 or 30 years time.

4. Participants' motivations and general attitudes

A battery of questions was posed in order to ascertain the participants' priorities and attitudes and thus to have a better understanding of their motivations. The appendix contains the phrases and results regarding attitudes.

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[16] Regarding fractional factorial design, see Louviere et al., 2000, pp 90 and ff; Montgomery, 2001, pp 303 and ff; and the papers by Street et al., 2005, and Burgess and Street, 2004.

[17] The implicit prices were estimated in order to satisfy the information required for the STRATEGY project. They are not included here, since this paper is more concerned with the methodological aspects of combining techniques rather than specific assessment. The results are available at http://www.strategy-ec.org.uk/output/reports/D7_Valuation%20of%20cms.pdf.

For priorities, participants were given a list of environmental and social issues. In general, the priorities seemed to be the same at both locations, with the exception of employment. In Zaragoza, employment was second in importance, and in Cumbria it was the least important. There are three possible explanations for this exception: (i) the priorities, in general, are different in each country (for the Spanish team, the priorities were in line with the results of sociological testing [CIS, 1999]); (ii) differences in group composition (the jury in Cumbria was, in average, ten years older than in Zaragoza; or (iii) the lower unemployment rate in the UK.

The participants' opinions about the effects of radioactive pollution were, in general, very similar. Results indicated that, from the participants' perspective, future generations would be more affected than the present; aquatic animals would be more sensitive than land animals; while landscape would be the least affected. Cumbria's group highlighted the effects on the local economy, while for the Spanish group, in the event of contamination, the local economy was ranked as the least important.

A five-point Likert scale was applied to questions regarding attitudes towards both nuclear energy and other general issues, where 5 represented the highest degree of agreement and 1 represented fully disagreement. Statements varied by country, given that some issues, such as those referring to nuclear accidents, were unfamiliar to the Zaragoza group.

In general, Cumbria's participants were unanimous in rejecting products exposed to any source of pollution, even if harmlessness was guaranteed. They demanded better information regarding all aspects relating to the consequences of a spill, and they did not initially show any pre-established attitudes about paying for damage remediation.

Despite the differences regarding some of the questions, both groups showed similarities. Examples include the demand for better information, the rejection of any product when safety is questioned, a certain tendency towards altruism, and a general preference against nuclear sources for power production. In general, altruism is accented in younger participants and in those with young children.

5. Collective and individual valuation

Table 2 presents the estimates from the MNL models applied both to Cumbria and Zaragoza. The goodness-of-fit (Pseudo R^2) in both models is relatively high, and most of the variables are significant and have the expected sign. Socio-economic-demographic covariates were included in the first stage of the analysis. However, since they were not of interest in this analysis, even though they were significant, we opted for the versions with attributes only.

>>>>>>>>>>>> Table 2 about here <<<<<<<<<<<<<<<<<<<<<<<<

The MNL estimates were very similar at both locations, with the exception of animal welfare, which was not important to Zaragoza's jury, and heritage, which was not important for the Cumbria's group. This does not mean that these attributes were not important to the groups, but rather they simply were less important for determining their choices at the time they were made. In other words, their decisions were guided by those impacts that they felt were fundamental. In the case of Zaragoza, there is a complete absence of tradition animal protectionism, which is stressed by the urban nature of participants. For Cumbria's group, apart from the well known British protectionist tradition, they had the recent experience of foot and mouth disease a few months before this experiment took place, which might help to explain the significant valuation of this attribute. Moreover, during deliberation the participants showed real

concern, and the dramatic moments that were experienced in the area could be appreciated. Animal welfare was a subject of long discussion and deliberation.

The MNL models do not allow for testing whether or not the CJ system has any influence on the heterogeneity of opinions. In other words, MNL models cannot show, as mentioned above, that CWs can be used to elicit community values as opposed to individual values. Community values are identified when heterogeneity in responses decrease from one session to the next. Since private views are inhibited, it is easier to reach an agreement about what is good for the group as opposed to the individual. This may be possible with models such as the RPL or Latent Class, which can test if there is heterogeneity in certain attributes. Table 3 shows the estimates from the RPL model for the two sessions at both locations. At Cumbria (first column), in the first session there was heterogeneity for landscape and animal welfare (the two random parameters identified normally distributed), as shown by the significance of the standard deviation parameter, but correlation between both parameters was somewhat weak (0.25). In other words, those who exhibited a preference to prevent damage to the landscape also chose to prevent harm to animals. The rest of the estimates were significant, even cultural heritage, which was not in the MNL model. Moreover, all parameter estimates had the expected sign. Participants preferred restoration strategies to be performed but paying the minimum cost. The most valued impact was landscape restoration, followed by animal welfare, as in the MNL model. During the second CJ session at Cumbria, impacts maintained the same relative importance, but there was a decrease in the heterogeneity of the two random parameters initially considered, given

that landscape was no longer significant. Heritage became more significant and the goodness of fit did not differ considerably from the previous session.

>>>>>>>>>>>>>>>Table 3 about here <<<<<<<<<<<<<<<<<<<<<<<<<<<

For Zaragoza's CJ, the random parameters identified were animal welfare and heritage (normally distributed too). Animal welfare was not significant as a mean value, but the standard deviation was. It can be explained as a controversial attribute with varying opinions; it was an important attribute for some participants while it was not for the majority. Heritage was significant and had the expected sign for both the mean and the standard deviation, thereby showing heterogeneity in preferences that disappeared during the next CJ session. The rest of the attributes selected were all significant, and the most valued one was the landscape, as in Cumbria's case, followed by the attributes referring to water contamination and disruption of daily life. The alternative specific constant for Zaragoza (ASCZ) in all models refers to the mean effect of the unobserved factor on the error term (Ben-Akiva and Lerman, 1985), which, in this case, is related to the choice of any alternative, rather than the status quo. The inclusion of a constant means the assumption that the unobserved aspects of a respondent's choices are the same across all options, which is likely in this exercise. ASCZ is significant in all models, which can be interpreted as the utility derived from choosing some remediation strategy rather than none.

Positions converged during the second session within each group itself, except for animal welfare, which was still insignificant during the second session for Zaragoza.

When comparing estimates, we need to consider that the estimated parameters are confounded with a scale parameter which is inversely

proportional to the variance of the random term. Therefore, as proposed by Swait and Louviere (1993) and applied by Black et al. (2005), we have performed a grid search technique by pooling the two datasets and rescaling one of them (Zaragoza's) by 0.9, thereby implying that Zaragoza's dataset has a lower variability than Cumbria's. The LR test is -2*[-571.98 - (-319.31-196.38)] = 112.58, which is above the critical X^2 value for nine degrees of freedom at 5 percent significance level of 16.92. As a consequence, the null of parameter equality is rejected. Thus, Cumbria's and Zaragoza's CWs do not get closer in their choices, at least during the second session. However, it will be interesting to see what happens after a third choice experiment at both places.

>>>>>>>>>>> Table 4 about here <<<<<<<<<<<<<<<<<<<<<<<<<<<<

During the third choice experiment, participants had to "vote" on the preferred option, and unless lexicographic preferences came out or there was strong opposition, the majority vote was what would be chosen through the sixteen choice sets. That is, participants had to choose over every choice set which option, as a group, they chose, in such a way that any opposition or rejection of a choice determined NONE OF THEM choice. Table 5 shows the parameter estimates for this "referendum". The estimates have to be compared through the aforementioned scaling proposed by Swait and Louviere. A ratio of 0.9 for the Zaragoza set (as previously stated) turned out to be appropriate. The LR test was -2*[-28.6728 - (9.234+10.523)] = 8.9158, which, in this case, was well under the critical value, at the 5 percent significant level, of 16.92. The null of parameter equality can not be rejected. These numbers, however, should be considered with the appropriate caution, since the size of the experiment is modest. However, we think that this could be more valuable if implemented and improved in future research for obtaining community values as opposed to

self-interested values. Furthermore, we think that the comparison between different communities' values can be facilitated through this approach.

6. Conclusions

In this study, we proposed the use of CWs as a useful tool for eliciting community preferences. We also demonstrated that participants' views change when they are allowed to deliberate and are given enough time to think about and develop ideas. Moreover, we have shown that heterogeneity in responses diminishes over various sessions. However, the effects of deliberating on and discussing an issue, and the maturation of preferences through knowledge and understanding, are mixed in our database. Therefore, we cannot distinguish between them here. The only thing that can be asserted is that values are changed by giving people more time to think and by giving them the opportunity to enter into a discussion. Moreover, there is a move from individual to collective (citizen) values, a point raised by Sagoff (1988) in his seminal and famous study.

Results from this study can be extended in further directions. First, more time and deliberation might help to find convergence in the position maintained by two or more different groups, which could be a good indicator for benefit transfer possibilities. Future work could also include experimental designs that separate the effects of information, group discussion, and collective choice and that compare alternative stated preference methods and workshop formats. The issue of how to aggregate value estimates from a valuation workshop setting to the wider population is an awkward one that also needs to be addressed, given that the preferences and values of a jury participant at the end of a

multi-session process are changed with respect to their "naive" preferences/values as pre-selected members of the sampling frame.

Finally, the question emerges as to whether a combination between stated preferences and the jury method would provide more comprehensive answers for input into policy processes, as opposed to only consider one alternative. As previously stated, moving from a standard survey to the deliberative workshop procedure may change the consideration given to an attribute, as was the case for heritage in Cumbria's group, and in general, it reduced the heterogeneity of opinions. In general, policy advice could well differ from valuation workshops, such as those in this experiment, compared to a standard stated preference approach. The search for citizen values versus self-interested values for social decision-making is, of course, not solved and should be a subject of further multidisciplinary research, but we consider that this approach offers a basis for an informed public voice.

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Table 1. Sets of environmental and social impacts derived from the implementation of anti-pollution measures considered in the two locations

	Zaragoza	**Cumbria**
Cost in € and £	€ 0-18-60-108-150	£ 0-12-50-85-110
Loss of scenic landscape and biodiversity: Scenic	Absence of plant cover: just dirt, no grouse, and reduced possibility of seeing birds of prey	Covered by heather and grass, with the possibility of seeing grouse and birds of prey
Water pollution: Water	No recreational use possible	Possibility of recreational use: swimming, fishing, canoeing
Disruption in daily life: Disruption	No independent monitoring, so you have to trust local inspectors, and no systems for checking radiation levels yourself	Existence of independent inspectors and possibility of checking for yourself the levels of safety in products, places, etc.
Animal welfare: Animal	Livestock slaughtered immediately by shooting in fields	Scheduled slaughtering using the most humane method possible to try to avoid unnecessary suffering
Heritage	No restoration after cleanup	Restoration of buildings (walls, surfaces, roofs) to their original appearance

Table 2. Parameter estimates from Multinomial Logit models

	Cumbria	*Zaragoza*
Scenic	0.89 (6.05)[iii]	1.11 (5.97) [iii]
Water	0.36 (2.79) [ii]	0.60 (3.44) [iii]
Disruption	0.39 (3.03) [iii]	0.57 (3.67) [iii]
Animal	0.68 (5.20) [iii]	0.22 (1,47)
Heritage	0.18 (1.35)	0.31 (1.99) [i]
Cost	-0.01 (-1.89) [iii]	-0.014 (-2,24) [iii]
ASCs	1.26 (3.84) [i]	2.06 (4.62) [iii]
Log-L	-345.26	-226.05
Pseudo R^2	0.17	0.16

t-values in parenthesis [iii] significance at 1%; [ii] at 5%; [i] at 10%

Table 3. Parameter estimates from the Random Parameter Logit Models for the two sessions at Cumbria and Zaragoza

	CUMBRIA 1	**CUMBRIA 2**	**ZARAGOZA 1**	**ZARAGOZA 2**
Random parameters in utility functions				
Scenic	2.29 (2.71)[iii]	1.19 (6.29) [iii]		
Animal	1.70 (2.61) [iii]	1.04 (4.52) [iii]	0.22 (1.4)	0.23 (1.2)
Heritage			0.31 (2.0) [ii]	0.37 (2.3) [ii]
Non random parameters in utility functions				
Water	0.69 (3.07) [iii]	0.84 (3.93) [iii]	0.61 (3.35) [iii]	0.99 (3.3) [iii]
Disruption	0.64 (2.74) [iii]	0.73 (4.12) [iii]	0.60 (3.44) [iii]	0.88 (3.4) [iii]
Heritage	0.40 (1.77) [i]	0.42 (2.76) [iii]		
Cost	- 0.03 (-2.79) [iii]	-0.02 (-2.59) [iii]	-0.014 (-2.2)	-0.03 (-3.3) [iii]
Scenic			1.13 (5.5) [iii]	1.75 (4.9) [iii]
ASCZ	1.66 (3.16) [iii]	-3.37 (-7.34) [iii]	2.08 (4.5) [iii]	2.16 (3.7) [iii]
Standard deviations of parameter distributions				
Scenic	2.82 (1.92) [ii]	0.0005 (0.00)		
Animal	1.56 (1.6) [i]	1.22 (3.4) [iii]	0.21 (1.8) [i]	0.72 (1.2)
Heritage			0.014 (2.1) [ii]	0.40 (0.8)
Log-L	-339.34	-319.31	-226.05	-195.68
Pseudo R^2	0.18	0.16	0.16	0.21

t-values in parenthesis [iii] significance at 1%; [ii] at 5%; [i] at 10%

Table 4. Results from testing estimated parameter equalities at both locations

	CUMBRIA 2	ZARAGOZA 2	POOL
Random parameters in utility functions			
Scenic	1.19 (6.29) [iii]		0.52 (6.3) [iii]
Animal	1.04 (4.52) [iii]	0.26 (1.2)	0.01 (0.1)
Heritage		0.37 (2.3) [ii]	0.50 (3.8) [iii]
Non random parameters in utility functions			
Water	0.84 (3.93) [iii]	1.01 (3.5) [iii]	0.11 (1.3)
Disruption	0.73 (4.12) [iii]	0.87 (3.4) [iii]	0.01 (0.1)
Heritage	0.42 (2.76) [iii]		
Cost	-0.02 (-2.59) [iii]	-0.03 (-3.5) [iii]	-0.02 (-4.4) [iii]
Scenic		1.78 (5.5) [iii]	
ASCZ	3.37 (7.34) [iii]	2.14 (3.8) [iii]	-1.15 (-3.9) [iii]
Standard deviations of parameter distributions			
Scenic	0.0005 (0.00)		0.04 (0.1)
Animal	1.22 (1.7) [i]	0.88 (1.7) [i]	0.69 (1.7) [i]
Heritage		0.004 (0.01)	1.04 (2.5) [iii]
Log-L	-319.31	196.38	571.98
Pseudo R^2	0.16	0.21	0.15

t-values in parenthesis [iii] significance at 1%; [ii] at 5%; [i] at 10%

Table 5. Parameter estimates corresponding to the consensus session

	CUMBRIA 3	**ZARAGOZA 3**
Random parameters in utility functions		
Scenic	2.25 (2.2)[ii]	
Animal	2.14 (1.7)[i]	0.26 (1.6)[i]
Heritage		0.37 (1.9) [ii]
Non-random parameters in utility functions		
Water	1.5 (1.9) [ii]	1.22 (2.2)[ii]
Disruption	0.68 (0.8)	0.55 (2.4)[ii]
Heritage	1.16 (1.6)[i]	
Cost	-0.05 (-1.8)[i]	-0.01 (-1.9)[ii]
Scenic		1.63 (2.6)[ii]
ASCZ	-5.4 (-2.4) [ii]	-1.26 (-1.8)[i]
Standard deviations of parameter distributions		
Scenic	0.003 (0.0)	
Animal	0.35 (0.0)	0.10 (0.0)
Heritage		0.08 (0.0)
Log-L	-9.234	10.523
Pseudo R^2	0.44	0.30

t-values in parenthesis [iii] significance at 1%; [ii] at 5%; [i] at 10%

APPENDIX

Priorities

A good state education system
Clean environment
High quality National Health Service
Moderate cost of living
Good old age pension
Low levels of criminality
Low unemployment levels

Effects of radioactivity

The health of fish in the sea, lakes, and rivers
Local wildlife
Human health
Scenic quality of the landscape
Future generations
Farming
Economy

Attitudes

Cumbria

There is not enough understandable information about radioactive pollution for ordinary people.	A
The consumers in Great Britain were given too little information about how to act after the Chernobyl accident.	A
All products in stores should be labelled, clearly stating the amount of radioactivity they contain.	A
All products in stores should be labelled, stating clearly if the area where they come from has been affected by radioactivity.	A
In case of local radioactive contamination, I would prefer to eat imported food from another region or country free of radioactivity.	A
I would be willing to accept a payment to remediate the consequences of removing radioactivity after an accident.	I
I believe that the benefits to humanity from nuclear energy are greater than the disadvantages.	I
The health risk associated with radioactivity is considerably exaggerated.	I
I don't mind if my family and I eat food which has been treated to remove all or most of the radioactive contamination.	D
Public authorities should withhold information about areas that could be severely affected by radioactivity after an accident in order to avoid scaring the population.	D
I would allow my family and myself to eat products that are said to be safe by experts but that have some radioactive contamination.	D

Zaragoza

All products should be clearly labelled to show the GMO contained and the origin.	A
There is not enough comprehensible information for the lay public about the pollutants in our local environment.	A
Future generations will inherit a more degraded environment than us.	A
I will be willing to contribute to remediate the consequences of a pollutant after a spill.	A
I buy bio products, even if they are more expensive, because they are healthier.	I
I think that the present environmental policy has substantially improved the preceding situation.	I
My family and I are willing to consume products with GMO.	D
Before we help developing countries, we should solve our own national problems.	D
I think that the gains for humanity from the generation of nuclear power are greater than the disadvantages.	D
The health risks associated with radioactivity are generally exaggerated.	D
Authorities spend too much on protecting and preserving the natural environment.	D

A: Agreement; D: Disagreement; I: No defined position