Analysis

One model fits all? — On the moderating role of emotional engagement and confusion in the elicitation of preferences for climate change adaptation policies

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ABSTRACT

Environmental economic and psychological studies often implicitly assume homogeneity of respondents’ decision strategies in questionnaire-based surveys. However, social psychology and behavioural research suggests that there is a wide variety of approaches that individuals use to make such choices. We explore this heterogeneity against the backdrop of so-called ‘dual process models’, analysing participants’ responses in a survey of public beliefs about and preferences for climate change adaptation policies. We find that the postulate of two different types of decision-making, the systematic–analytical and the heuristic–holistic, does indeed help us to understand patterns in respondent behaviour that are, in turn, underpinned by respondents’ motivation and ability to process information. Participants who were motivated and able to process the information provided were more likely to express preferences in line with their beliefs about adaptation policies, whereas those less motivated and more confused were more likely to use generalised rules-of-thumb that were not specific to the policy issue at hand. Depending on the theoretical framework of a study, such heterogeneity in response consistency and use of generic rules-of-thumb might have implications for the usefulness of survey outcomes. We discuss the implications of our findings, and draw conclusions for survey-based environmental research.

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1. Introduction

Environmental economics and psychology are disciplines concerned with understanding and predicting environmentally relevant choices and behaviours. Psychological research on information processing and decision making suggests that there is a wide variety of strategies that individuals use to make such choices (Gigerenzer, 2001; Kahneman, 2003). Not only characteristics of the situation, but also personal factors lead to heterogeneity in the use of these different approaches. For example, Payne et al. (1993) describe individuals as ‘adaptive decision makers’ that draw on a toolkit of strategies to evaluate choice options in a flexible manner. Authors such as Petty and Cacioppo (1986) and Chaiken (1987) develop ‘dual process models’ that imply heterogeneity of information processing on a continuum between the ‘systematic–analytical’ (Chaiken, 1987) or ‘central’ (Petty and Cacioppo, 1986) mode, where issue-relevant information is carefully considered, and the ‘heuristic–holistic’ or ‘peripheral’ mode that draws on rules of thumb and peripheral cues, i.e. information not directly related to the issue at hand. In such dual process models, choices of information processing and decision modes are considered as dependent on individuals’ motivation and cognitive ability to engage with the topic in question: rather than assuming that individuals have a general tendency to decide in a particular fashion, ‘motivation’ and ‘ability’ are described as a mix of situational and personal factors, of which some are enduring (such as the ‘need for cognition’), but most are context-dependent (such as the personal relevance and the complexity of the issue at hand) (Petty and Cacioppo, 1986). From a statistical perspective, motivation and ability can here be seen as moderators (Baron and Kenny, 1986) of information processing; while individuals who feel motivated and able to process relevant information in a specific decision situation are more likely to use a systematic–analytical or central way of decision making, those who feel less motivated and able tend to make decisions in a heuristic–holistic or peripheral manner.

Such models have been the framework and inspiration for countless studies in social and cognitive psychology and related disciplines such as consumer research (Mackenzie and Spreng, 1992; Lien, 2001). However, to date, few authors have drawn on such models of heterogeneity in decision making to understand environmentally-relevant choices in interview situations. Attempts to explain and understand variation in such choices typically assume homogeneity of decision-making strategies across individuals, and usually draw on one single model of their choice to interpret and contextualise their findings: an explanatory model either fits a sample or not. While this is most typical of quantitative (inductive) studies, many qualitative studies follow a similar pattern, too. In the tradition
of methodological individualism, theoretical frameworks of many studies in environmental psychology and economics are based on (i) (variations of) the rational choice paradigm, i.e., the assumption that humans generally strive to increase their utility and/or (ii) cognitivistic frameworks such as the Theory of Planned Behaviour (Ajzen, 1988), the Norm-Activation Model (Schwartz, 1977), or more generally, theories of cognitive hierarchies (Homer and Kahle, 1988). The term ‘cognition’ refers here to mental constructions such as values, beliefs and attitudes. Such theories tend to distinguish between more concrete, situation-specific cognitions such as behavioural intentions and attitudes towards concrete objects, and more generalised, i.e., abstract constructs that are applicable to a range of situations, such as values, value orientations, and generalised beliefs.

Most importantly, the more abstract constructs are stipulated to inform the more concrete ones, and thus form the basis of concrete instances of decision-making. While the more abstract constructs, such as values, are considered relatively stable over time, the more concrete constructs are influenced by a wide and varying range of such generalised cognitions that depends on an individual’s interpretation of the situation, and are thus less stable.

Operationalisations of cognitive hierarchies in research contexts can include two (e.g., values and attitudes), three (e.g., values, attitudes and behavioural intentions) or more levels, ordered from the abstract to the concrete (the term ‘hierarchy’ aims to denote this order). Whether a particular construct is considered ‘more abstract’ or ‘concrete’ is relative to the other constructs in the hierarchy: for example, attitudes are relatively abstract when compared to behavioural intentions, but relatively concrete when compared to values.

According to such models, attitudes towards concrete objects, for example, are thus informed by more generalised and situation-transcendent cognitions, such as values, social norms and value orientations. Individuals’ choices are thus assumed to reflect their underlying values, beliefs and attitudes (Frey and Irlé, 1993; Diekmann and Preisendörfer, 2001).

If in environmental surveys, respondents are assumed to respond (boundedly) rationally and/or in a way that is consistent with their values, beliefs and generalised attitudes, what can we learn from dual process models? Rather than to compare different theoretical models of decision making, we investigate here the heterogeneity of decision making strategies, exploring the idea that participants in environmental surveys might use a range of strategies to state their ideas, preferences and attitudes. Our analysis is thus not concerned with heterogeneity of taste, preferences or attitudes, but with heterogeneity “in the attention individuals pay to choice options and attributes [and] heterogeneity in the rules that underlie choices” (Adamowicz et al., 2008, p. 224). While the dichotomisation inherent to dual process models is certainly an oversimplification of the complexity of human decision making (for neurobiological approaches see e.g., Kalenscher and Pennartz, 2008; Krieshok et al., 2009), they are extremely useful to provide a framework for investigating and operationalising heterogeneity. In addition, such models can also serve to explore the implications of such heterogeneity for environmental economic and psychological research. Typically, researchers aiming to elicit environmental (economic) preferences or behavioural intentions will probably want their participants to decide in a systematic–analytical way, as such decisions are most likely to be in line with ideas of rational choice and cognitive hierarchies (McElroy and Seta, 2003).

By contrast, decisions made in the heuristic–holistic mode are often made based on cues and generalised rules of thumb with little or no connection to the issue at hand (such as the appearance of the interviewer), and would thus not necessarily meet assumptions that stipulate consistency with more enduring preferences and values related to the issue under investigation.

Among the few authors to address these issues in relation to economic preferences, Frör (2008) explored the diversity of decision making in contingent valuation (CV) surveys, and investigated impacts of self-reported preferences for decision strategies on willingness-to-pay (WTP). Araña and León (2008) found heterogeneity with regard to the impact of general emotional intensity, unconnected to the issue in question, on respondents’ reaction to cues in the valuation scenario: in a CV survey on the restoration of ancient walking paths in Gran Canaria, anchoring and scope effects were moderated by respondents’ emotional intensity. Schunk and Betsch (2006) elicited their participants’ general preferences for more deliberative as opposed to more intuitive decision strategies. In a lottery-based experiment, they found that individuals who preferred the deliberative mode revealed utility functions that were more linear than those of respondents with a preference for intuitive decisions. Ajzen et al. (1996) found that experimentally manipulated personal relevance of a valuation scenario moderated impacts of information on WTP.

By its very nature, research on choice modelling has an inherent interest not only in the outcomes but also in the processes of choosing. Striving for models that better fit their data, choice modellers have grown aware that it is unrealistic to assume that respondents make use of all the information provided by the researcher, and identified a need to account for the ways in which respondents construct choice sets and attend to the information provided (Louvière et al., 2005).

Approaches to modelling heterogeneity in choice strategies are thus relatively widespread (Swait, 2001; Scott, 2002; Cameron and DeShazo, 2008; Pukett and Hensher, 2008; Campbell et al., 2008; Araña and León, 2009), and often refer to ideas of the “adaptive decision maker” on compensatory and non-compensatory decision making (Payne et al., 1993). For example, Hensher (2007) discerns six types of decision strategies. While some of these can clearly be classified as systematic (such as compensatory strategies), it is unclear to which degree others, such as lexicographic choices, are based on systematic deliberation and reflect a person’s values, or on rather peripheral cues such as the layout of the questionnaire.

While research involving choice experiments tends to be generally more sophisticated in including heterogeneity of decision making (Gilbride and Allenby, 2004; Hensher, 2008; Scarpa et al., 2009; Greene and Hensher, 2010), possibly due to its focus on statistical analyses that lend themselves to a consideration of attribute weight and latent classes, little of this thinking has been included in research on attitudes and contingent valuation. Given the widespread use of these techniques, the strong theoretical appeal of ideas on heterogeneous decision strategies and the convincing empirical evidence in general, it seems surprising that these approaches have seemingly been neglected in research on environmental behaviour, attitudes and preferences out with the realm of choice modelling.

Our study set thus out to investigate the moderating effects of respondents’ motivation and ability to process information on (i) the relationships between preferences for climate change adaptation policies and related, more general beliefs and (ii) the use of heuristics in decision making. We challenge current research practices that limit themselves to finding an explanatory model that fits the data sufficiently well, and that tend to neglect systematic effects of moderation that might be hidden in these models. Finally, we explore the reasons for heterogeneity in decision making, and discuss consequences for environmental research that draws on survey techniques.

2. Previous Research: Dual Process Models in Environmental Surveys

Previous research on the diversity of decision making strategies in environmental (non-choice experiment) surveys has been limited (see also Frör, 2008; Araña and León, 2008), but has highlighted a few key insights. In an earlier study (Fischer and Hanley, 2007), we used a framework from consumer psychology that distinguishes four modes
of decision making in purchase situations (Weinberg, 1981; Kroeber-Riel and Weinberg, 1996). As contingent valuation scenarios are often theorised as 'hypothetical markets', we tested the hypothesis that in CV surveys, individuals use similar decision modes as in actual market situations. We distinguished between (i) those modes that enabled an expression of preferences with regard to the good in question and (ii) modes that did not take preferences for the environmental good into account, such as impulsive reactions to peripheral cues, or heuristics such as "I always give £5 if someone asks me for a donation". To diagnose decision modes, we used a range of criteria that were mainly based on behavioural observation (such as decision time, number of check-back questions asked) and interviewer assessment (such as emotional issue involvement). Results of a cluster analysis (n = 299) suggested that decision modes were indeed highly heterogeneous, and similar to those used in real purchase situations. Interestingly, choice of a decision mode seemed highly susceptible to verbal cues in the valuation scenario, with significantly more respondents choosing an impulsive mode (in dual process terms: 'heuristic–holistic' or 'peripheral') when the scenario contained expressions such as "a new tax" or "subsidies for farmers".

This earlier study (Fischer and Hanley, 2007) aimed to identify decision modes and their variation between individuals in a survey situation, and to discuss these in relation to the economic assumptions that underpin CV. However, it did not investigate actual implications of this heterogeneity for survey outcomes. In a second study (n = 248), we thus explored the moderating effects of motivation, operationalised as interviewer-rated emotional issue involvement, on the relationship between biodiversity-related values, beliefs and attitudes towards biodiversity management options (Fischer and Van der Wal, 2007). Based on ideas of cognitive hierarchies, i.e., that concrete and specific constructs are informed by more generic and stable cognitions (Homer and Kahle, 1988, see Section 1), we expected attitudes to be informed by relevant values and beliefs where respondents decide in a systematic manner. In contrast, participants who responded in a more heuristic fashion and beliefs where respondents decide in a systematic manner. In a third study (Lienhoop and Fischer, 2009), these are still not well understood. Third, much of the research to date has focused on specific heuristic–holistic processes such as so-called 'biases' (Mitchell and Carson, 1989) or on distinguishing systematic from non-systematic decision making (see above), but not investigated in detail the heterogeneity of decision strategies within a comprehensive framework.

The present study aims to address these three shortcomings, drawing on the following key hypotheses: to begin with, we hypothesise that survey participants who are more motivated and able to process survey-relevant information are more likely to give responses that are consistent with each other, and that do not rely on rules of thumb unconnected to the options at stake. In contrast, less motivated and able survey participants will tend to draw on rules of thumb, and give responses that are less consistent with each other. While the former strategy exemplifies the systematic–analytical way of decision making, the latter can be seen as a type of heuristic–holistic decision process. We test these hypotheses by means of a study on public preferences for policy options to adapt to climate change in Scotland.

3. Case Study

Climate change is predicted to cause major changes in precipitation patterns all over the world (IPCC, 2007). Over the next decades, this will heavily influence riverine water flows and availability of water resources in general; and due to an increasing frequency and severity of extreme events the likelihood of both flooding and low flows will rise even in countries that might be seen as relatively resilient. For Scotland, scientists project more extreme high flows in winter and spring especially in the Western part of the country, and higher likelihoods of low flows in summer, especially in the East (Black and Burns, 2002; Werritty, 2002; CRU, 2008). This is predicted to result in an increased flood risk and potential water shortages.

Our study investigated how members of the public evaluate policy options that aim at an adaptation to such consequences of climate change. Drawing on the idea of cognitive hierarchies (Homer and Kahle, 1988), we explored how networks of values and beliefs shaped public preferences and attitudes towards two different policies to reduce the risk of flooding and low flows, namely an insurance and a sustainable flood management scheme (Glenk and Fischer, 2010). In particular, we assessed the role of beliefs about governance principles such as efficiency, solidarity and sustainability in informing attitudes towards policies, as such governance-related criteria had played a major role in preceding qualitative studies.
To analyse the influence of motivation and ability on respondents’ decision making, we focus here on the relationship between beliefs about and preferences for policy options. To probe the use of heuristics, we asked respondents to explain the reasons for their choices.

Following the idea of dual process models, we operationalised systematic–analytical decision making as leading to a high consistency between beliefs and preferences. Respondents deciding this way would thus be likely to choose an option that corresponded to their beliefs about the policy option and the situation in general. For example, individuals who believed that future flooding would not be severe would be likely to choose the ‘do nothing’ option. Respondents who believed that sustainable flood management was not efficient would be less likely to opt for it.

In contrast, we operationalised heuristic–holistic decision making as reliant on heuristics, i.e., rules of thumb, and to lead to a relatively low consistency between beliefs and preferences.

4. Methods

4.1. Study Design: Adaptation Options to Changes in River Flows

Our study aimed to investigate public preferences for policies that facilitate adaptation to changes in river water flows induced by a changing climate. Survey participants were given information on projections of future river flows in Scotland and their potential consequences, focusing on increased seasonal risks of both flooding and low flows. In addition to a ‘do nothing’ option, two policy options were presented to address these increased risks, proposing a public ‘water and climate change fund’ that could be used to support (i) a soft engineering scheme and/or (ii) an insurance scheme for councils. The soft engineering option reflected recent policy developments in Scotland, such as the Flood Risk Management (Scotland) Act, which appears to be moving towards supporting a greater role for Sustainable Flood Management (SFM). SFM tools include soft engineering approaches such as creating wetlands and restoration of forest areas upstream. Soft engineering can have positive impacts on river flows in both wet and dry periods by enhancing the absorptive capacity of a landscape.

The second option, a council insurance scheme, represented a fundamentally different approach to adapting to changing river flows. In contrast to soft engineering that aims at pre-damage avoidance of flooding, a ‘council insurance’ is concerned with improved post-damage assistance (Scottish Executive, 2004). To implement an insurance scheme, a superfund would be created that provides guaranteed and direct access to funds for councils to restore any damage to public infrastructure and public facilities such as schools, hospitals, roads and bridges. It would cover both damages from floods and low flows, and all Scottish residents would pay into such fund. Thereby, the burden for those councils heavily affected by floods or water shortages would be limited. Because home insurance covers flood risk for most private and business property in Scotland, respondents were reminded that the council insurance would not cover damage to private property.

Both schemes, the soft engineering intervention and the council insurance, would be funded through an additional tax, payable by all residents and collected by means of monthly payment of the regular council tax (see Section 4.3).

4.2. The Sample

We employed a two-stage random sampling process to arrive at a sample of Scottish residents aged 18 and over. The first stage involved a random draw of census output areas in Scotland. Within these, starting addresses were randomly drawn. Interviewers of an independent market research company were instructed to follow a random route approach from the starting point (List, 2005) until 12 interviews were completed. Out of a total of 7419 addresses contacted, 3457 replied and 1055 interviews were achieved, an acceptable response rate given that the topic of the interview was not of immediate local interest. The interviews were conducted face to face at people’s homes and lasted for approximately 30 min. Overall, our final sample matched the socio-demographic characteristics of the Scottish population well. Notable differences are a slightly higher proportion of females (57.5% in the sample versus 52%; Scottish Government, 2008) and people aged 60–74 (27.7% versus 22%).

4.3. Questionnaire Design

Our survey design was informed by eight focus group discussions on issues of water management, held in 2007 across Scotland with randomly selected members of the general public. Early versions of the scenario description were discussed in two additional focus groups discussions. A draft questionnaire was then qualitatively pre-tested with respondents from a range of different backgrounds, to ensure that participants understood our questions and the scenario as intended. A quantitative pilot study (n = 106) with a random sample of the general public led to further refinement of the survey design.

The final questionnaire included the following constructs relevant to this study (Table 1).

4.3.1. Preferences for Policy Options

The elicitation of preferences for the two policy options (insurance and soft engineering), plus a do-nothing option, was framed as a WTP question. First, respondents were asked whether they were, in principle, willing to contribute financially to the fund. If generally willing to pay, they were given the possibility to divide their contribution up between the two options (any proportion in steps of 25% possible), or to allocate the entire amount to one single scheme. A modification of the randomised card sorting procedure (RCS; first applied by Carthy et al., 1999) was then used to elicit concrete WTP amounts; however, these will not be used in this study (see Glenk and Fischer, 2010). In open-ended questions, both those respondents who contributed and those not willing to contribute were asked for their reasons for their choice.

4.3.2. Governance-related Beliefs

In addition, we elicited beliefs about the policy options – the insurance and the soft engineering scheme – with regard to five governance principles that had been brought forward in qualitative pre-studies, where participants had discussed their views on (good) governance, politicians’ and public authorities’ behaviour at great length. This included beliefs about (i) the efficiency, i.e., value for money, (ii) safety from damages through flooding and low flows, (iii) solidarity, i.e., sharing of benefits and costs among all citizens, (iv) sustainability, i.e., long-term effect and acceptability, and (v) naturalness (minimal intrusion). Thereby, we obtained scores from 1 (strongly disagree) to 5 (strongly agree) that captured beliefs about the degree to which each of these principles were, in the respondent’s view, met by each of the two policy options. Each of these principles was also rated on a scale from 0 (unimportant) to 10 (absolutely essential). Average importance scores ranged from 7.32 to 8.75, indicating that all of these were generally seen as very relevant.

4.3.3. Threat Appraisal

Constructs from Protection Motivation Theory (PMT; Rogers and Prentice-Dunn, 1997) and similar models (Laska, 1990) have repeatedly been used to understand behavioural adaptation to flood risk (Grothmann and Reusswig, 2006). The PMT posits that threat appraisal (i.e., beliefs about risk related to a situation) and coping appraisal (i.e., beliefs about efficacy of a coping option) shape
### Table 1

Key constructs of the survey, their operationalisations and descriptive results (n=1033).

<table>
<thead>
<tr>
<th>Construct</th>
<th>Response options [Cronbach's α]</th>
<th>Items</th>
<th>Mean score (std. dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beliefs: governance principles</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree)</td>
<td>Safety; Soft engineering; Council insurance</td>
<td>3.89 (0.9) 2.65 (1.15)</td>
</tr>
<tr>
<td><strong>Sustainability</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree)</td>
<td>Soft engineering; Council insurance</td>
<td>3.90 (0.99) 2.8 (1.2)</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree)</td>
<td>Soft engineering; Council insurance</td>
<td>3.72 (0.95) 2.70 (1.03)</td>
</tr>
<tr>
<td><strong>Solidarity</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree)</td>
<td>Soft engineering; Council insurance</td>
<td>3.76 (0.95) 3.21 (1.16)</td>
</tr>
<tr>
<td><strong>Naturalness</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree)</td>
<td>Soft engineering</td>
<td>4.06 (0.88)</td>
</tr>
<tr>
<td><strong>Threat appraisal: perceived severity of future flooding</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree) [α = 0.49]</td>
<td>• More frequent flooding in Scotland would have serious negative consequences for Scottish society in general. • More frequent flooding in Scotland would have serious negative consequences for me personally.</td>
<td>3.42 (0.95)</td>
</tr>
<tr>
<td><strong>Coping appraisal: trust in government</strong></td>
<td>1 (strongly disagree) — 5 (strongly agree) [α = 0.82]</td>
<td>• I trust that the local councils and the Scottish Government will do the right thing with the money of the water and climate change fund. • I think the local councils and the Scottish Government will be competent and effective in implementing a soft engineering or insurance scheme.</td>
<td>2.93 (1.12)</td>
</tr>
<tr>
<td><strong>Discretionary income: additional income needed</strong></td>
<td>0 (no additional income at all) — 10 (a lot of additional income)</td>
<td>• Considering your life these days, how much additional income do you feel you would need to comfortably meet all your needs?</td>
<td>5.24 (2.8)</td>
</tr>
<tr>
<td><strong>Preferences: general WTP</strong></td>
<td>Yes (1)/No (2)</td>
<td>• In principle, would you be willing to contribute financially to the fund — under the condition that every Scottish resident would have to contribute, dependent on their council tax rate?</td>
<td>yes: 51.3% (n = 530)</td>
</tr>
<tr>
<td><strong>Preferences: allocation of funds to policy options</strong></td>
<td>1. Entire fund in council insurance 2. ¼: insurance, ¼: soft engineering 3. ½: insurance, ½: soft engineering 4. ¾: insurance, ¾: soft engineering 5. Entire fund in soft engineering</td>
<td>• If YES: If such a fund existed, would you like to see the money spent on the council insurance, on the soft engineering scheme, or would you like to divide it up? Please choose the option that comes closest to your view.</td>
<td>1. n = 16 2. n = 16 3. n = 221 4. n = 164 5. n = 113</td>
</tr>
<tr>
<td><strong>Motivation in interview situation: emotional involvement</strong></td>
<td>–3 (aloof, disinterested, disengaged) – 0 (neutral, polite and attentive but not emotionally engaged) – +3 (very involved, interested, engaged)</td>
<td>• Interviewer-rated: how emotionally involved did you feel the respondent was? We refer her to the degree to which the respondent was emotionally engaged in the interview. Such an engagement can be positive (e.g., interest, fascination) or negative (e.g., respondent is upset because s/he feels that questionnaire misrepresents the real issue). We don’t need to distinguish here whether respondents were engaged because of the issue or because of the interviewer (they might just thoroughly enjoy talking to the interviewer). Please don’t be afraid to state that the respondent was not engaged.</td>
<td>1.19 (1.36)</td>
</tr>
<tr>
<td><strong>Ability to process information in interview situation: confusion</strong></td>
<td>1 (not at all) — 5 (extremely)</td>
<td>• What we’ve just discussed has probably left you with a mix of different thoughts. I’ve now got a list of words here. I would like to know for each of these words to which degree it describes what you are feeling right now: “confused”.</td>
<td>2.05 (1.13)</td>
</tr>
<tr>
<td><strong>Anger</strong></td>
<td>1 (not at all) — 5 (extremely)</td>
<td>Text as for confusion: “angry”</td>
<td>1.63 (0.99)</td>
</tr>
<tr>
<td><strong>Worry</strong></td>
<td>1 (not at all) — 5 (extremely)</td>
<td>Text as for confusion: “worried”</td>
<td>1.89 (1.04)</td>
</tr>
<tr>
<td><strong>Use of heuristics</strong></td>
<td>Dummy variable, manually coded: yes (1)/no (0)</td>
<td>Decision rules (Chaiken, 1987) expressed in open-ended question that revealed a strategy based on ideas similar to “50:50 is a good idea”, independent from topic-related or technical considerations.</td>
<td>yes: n = 115</td>
</tr>
</tbody>
</table>
behavioural responses to perceived hazards. In line with Miceli et al.'s findings (2008), we operationalised threat appraisal here as the perceived severity (rather than the likelihood) of a hazard. We used two items each to capture perceived severity of flooding and water shortages (for own person and society, respectively). As for all constructs, we investigated discriminant validity of the variables capturing threat appraisal by means of confirmatory factor analysis in AMOS 18 (see Glenk and Fischer, 2010 for details). Despite strong covariation (covariance = 0.8), perceived severity of floods and water shortages were best modelled as two (interconnected) factors in a confirmatory factor analysis. As the inclusion of both would lead to multicollinearity, we draw in our models only on perceived severity of future flooding.

4.3.4. Coping Appraisal

Coping appraisal, the second core construct of the PMT, was operationalised as trust in government to make wise use of the suggested ‘water and climate change fund’ — whether using it for the soft engineering or the council insurance scheme.

4.3.5. Income

As the question on preferences was framed as a WTP question and might thus be influenced by respondents’ available budget, we also included a measure of individuals’ income. In addition to net household income, which often produces a high proportion of missing values, we asked for perceived need for additional income as a proxy for discretionary income (Green and Tunstall, 1999). Additionally, information on a number of standard socio-demographic variables such as age, gender and education was collected.

4.3.6. Motivation and Ability to Process Information

Motivation was gauged by interviewer-rated emotional involvement, a measure that had been found useful in previous studies and tends to be more discriminatory than self-reports of emotional involvement (Fischer and Hanley, 2007; Fischer and Van der Wal, 2007).

Cognitive ability (as described by Petty and Cacioppo, 1986) was here understood as the ability to process information provided in the interview situation rather than as an enduring attribute of the individual, and operationalised as self-reported confusion. It should be noted that this notion of ‘confusion’ is not necessarily related to an interviewee’s knowledge or cognitive capacity in general. Instead, it was meant to capture the degree to which individuals felt they were coping with the demands on information processing that the survey placed on them, at the very moment of being interviewed.

In a similar vein, we assessed feelings such as anger and worry, which will later be used to explore factors informing motivation and ability (Section 5.4). These self-reports of confusion, anger and worry were elicited towards the end of the questionnaire, after beliefs and preferences had been elicited (Table 1).

4.3.7. Use of Heuristics

To investigate the use of heuristics, we explored the responses to the open-ended question on their reasons for those respondents who had expressed a general WTP. A think-aloud technique as used by Araña and León (2009) was not appropriate here as, unlike maybe in a choice experiment, only few respondents spontaneously expressed their thoughts while taking their decision. Rather than modelling the likelihood of an individual to use a certain strategy (Araña et al., 2008) or assigning individuals to categories based on behavioural observations (Lienhoop and Fischer, 2009), we drew on direct verbal reports of our respondents, an approach also used by Schkade and Payne (1994) and Araña and León (2009). The 530 participants who expressed positive WTP were thus prompted with a simple ‘Why?’ directly after they had stated their allocation of the funds to the different options. Among these, many gave reasons that referred to specific attributes of the two policy options, for example “because soft engineering is a better long-term solution”. Others drew on rules such as “not sure so better to spread things out”, “50:50:50 is a good idea” or “equal: that’s fair to go half and half”. No other clear decision rules emerged from the data, apart from six respondents who stated “prevention is better than cure”, and it could be argued that rather than being ‘rule-of-thumb’ this entailed a mediated preference for hazard avoidance as opposed to coping with hazards once they occurred. We thus coded arguments that expressed a desire for an equal split not based on technical reasons, but on more general rules, as ‘use of heuristics’. Four researchers identified, independently from each other, those respondents (n = 115) who used this type of rule (Fleiss’ Kappa 4 = 0.69). Chaiken (1987, p. 4) describes such “simple schemas or decision rules” as learned through past experience in other, not necessarily related situations. Underscoring this, McFadden (1999, p. 97) observes that when an individual feels unsure about a choice, responses might be driven by rules evoked by “contextual features that suggest analogies to familiar exemplars” and thus “may receive particularly high weight”. In our study, we hypothesised the use of these cognitive heuristics to replace the detailed processing of information in the systematic–analytical mode.

4.4. Data Analysis

Our data analysis centred on the way our respondents made choices with regard to the policy options at stake. As we hypothesised motivation and information processing ability to be moderators of the ways these choices were made, we drew on their respective proxies, emotional involvement and confusion, converted them into binary variables split at the median, and thus assigned respondents to four groups: (i) those who showed strong involvement and little or no confusion (n = 230), (ii) those who showed strong involvement and high levels of confusion (n = 206), (iii) those with limited involvement and little or no confusion (n = 213), and (iv) those with limited involvement and high levels of confusion (n = 384). We hypothesised the first group to be most likely to decide in a systematic–analytical way, whereas the last group was expected to be most likely to decide in a heuristic–holistic manner.

To analyse the role of motivation and ability in moderating relationships between beliefs and preferences for policy options, we then computed a multinomial logistic regression (SPSS for Windows 17.0) with preferences for policy options as a categorical dependent variable. This variable had the following values: (i) preference for soft engineering: 75–100% of funds allocated to soft engineering (n = 277), (ii) preference for council insurance: 75–100% of funds allocated to insurance (n = 32), (iii) preference for both options: 50% of funds allocated to either of the options (n = 221), and (iv) preference for ‘do nothing’ (0 WTP, n = 503) (Section 5.1).

Beliefs about governance principles, threat and coping appraisal as well as income were entered as explanatory variables. SPSS computes an overall regression model and, in addition, gives parameter estimates for every pair of categories of the dependent variable, expressed as contrasts. Thus, we are not only able to describe the predictive power of single variables within the overall model, but can also estimate the parameters of variables when using, for example, ‘do nothing’ as a reference category. As we wanted to assess the role of all the beliefs included in the study, and as some beliefs, while non-
significant in the total sample, might be significant for a sub-sample, non-significant explanatory variables were not excluded from the model. A more detailed analysis of the factors influencing respondents' preferences, including the correlations between these factors, can be found in Glenk and Fischer (2010).

Following Baron and Kenny's (1986) generic suggestion for the investigation of moderation effects, we then split the sample up in four groups (here termed 'behavioural groups') according to individuals' degree of confusion and emotional involvement (see above), and run identical multinomial regression models for each of these groups (Section 5.2). Each of these models included the same explanatory variables (Table 3). This approach has, for example, also been used by Castro and Lima (2001) to distinguish between respondents with coherent and non-coherent responses. We expected those respondents who were strongly involved and limitedly confused to express preferences that were highly consistent with their beliefs about the policy options, and their views on flood risk, the implementing organisations and their own income (see hypotheses, Section 2). Consistency was here approximated through the four models' pseudo r-square values: the more consistent a group's preferences, the higher its model's r-square, as beliefs and preferences would be statistically closely related. Consequently, we hypothesised the model for the first group (strongly involved, low level of confusion) to produce a relatively high r-square, whereas the model for the fourth group (little involvement, high confusion) should produce the lowest r-square.

In a separate step, we investigated the use of heuristics by means of cross-tabulations, including the measures of confusion and emotional involvement mentioned above (Section 5.3). In addition, we explored the factors that might influence a person's emotional involvement and confusion in the interview situation, again drawing on multinomial logistic modelling, with the four groups split up by confusion and involvement as a dependent variable (Section 5.4).

5. Results

5.1. What Explains Preferences for Policy Options? A Multinomial Logistic Regression Model

Approximately half of the respondents were willing to pay for policy action. Of these, a majority preferred the soft engineering option over a council insurance, and only a small minority had clear preferences for the council insurance (Table 1).

On average, the soft engineering scheme was seen as significantly safer, more useful, efficient, sustainable and enhancing solidarity than the council insurance (t-test for paired samples, p<0.001), although differences between the two options were probably lowest with regard to perceived solidarity, where the council insurance was rated relatively highly (Table 1, for more details see Glenk and Fischer, 2010).

To test the relationships between respondents' preferences for policy options and their beliefs about the policy options and the situation, we ran a multinomial regression model, with the four preference categories as a dependent variable (Section 4.4). The model produced a pseudo r-square (Cox and Snell) of 0.312 (Table 2).

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Table 2

Sample sizes and pseudo r-square values of multinominal logistic regression models, total sample and split up by confusion (C) and emotional involvement (I). ↑: high; ↓: low. Dependent variable: preferences for policy options.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample size (n)</th>
<th>Pseudo r^2 (Cox and Snell)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1033</td>
<td>0.312</td>
</tr>
<tr>
<td>↑↑ C↓ I</td>
<td>230</td>
<td>0.510</td>
</tr>
<tr>
<td>↑↑ C↑ I</td>
<td>206</td>
<td>0.408</td>
</tr>
<tr>
<td>↑↓ C↓ I</td>
<td>213</td>
<td>0.364</td>
</tr>
<tr>
<td>↑↓ C↑ I</td>
<td>384</td>
<td>0.285</td>
</tr>
</tbody>
</table>

---

Table 3

Likelihood ratio test for multinominal logistic regression models, total sample (df=3; n=1033) and split up by confusion (C) and emotional involvement (I). ↑: high; ↓: low. Dependent variable: preferences for policy options. CI = council insurance, SE = soft engineering. **: p<0.001; *: p<0.01; ns: not significant.
Interestingly, participants’ beliefs about soft engineering had a less strong influence on their preferences than their beliefs about the council insurance (Table 3): of the five governance beliefs related to soft engineering, only beliefs about its sustainability seemed to matter. This might in part be due to the overall relatively low variation in respondents’ beliefs about soft engineering (Table 1), but it seems that beliefs about the council insurance were simply more powerful in explaining variation in preferences. Among all the explanatory variables in the model, the perceived solidarity and efficiency of the council insurance, and the perceived severity of future floods were particularly useful in explaining preferences (Table 3).

Comparisons between pairs of preference groups suggested, for example, that positive beliefs about the efficiency of the council insurance were a key factor that explained preferences for the insurance over all other options. Respondents who were willing to pay for one of the policy options were more likely to consider future floods as severe as those who preferred to ‘do nothing’. Those who opted for soft engineering or an equal split of funds between both options were also more likely to trust their local council and to express a lesser need for additional income to meet their needs than those who were not willing to contribute at all. In contrast, those who preferred soft engineering over an equal split of funds between both options were less likely to consider the council insurance as efficient and safe, and more likely to consider soft engineering as sustainable.

5.2. Moderating Effects of Confusion and Emotional Involvement

To assess the effects of confusion and emotional involvement (descriptive findings see Table 1) on the consistency of beliefs and preferences, we ran the same multinomial regression model for the four behavioural groups (Section 4.4). As this led to a split of the total sample into 16 sub-groups (four categories of the dependent variable, and four behavioural groups), the sub-groups expressing a preference for the council insurance were rather small (4 and four behavioural groups), the sub-groups expressing a preference sample into 16 sub-groups (four categories of the dependent variable, preferences, we ran the same multinomial regression model for the received effects related to beliefs in the high involvement/low confusion group is the motivation, was a more influential factor than cognitive ability in influencing decision mode.

In line with the observation that preferences were most closely related to beliefs in the high involvement/low confusion group is the finding that in this group, four of the governance-related beliefs were significant explanatory variables (Table 3). Here, particularly perceived efficiency and solidarity of the insurance scheme had an influence on respondents’ preferences, but also its safety and the naturalness of the soft engineering scheme. In contrast, in the group expected least likely to draw on systematic–analytical strategies only two governance beliefs were significant in explaining preferences. The same held for the low involvement/low confusion group, whereas three governance-related beliefs were significant in the highly involved/highly confused group.

5.3. The Use of Heuristics

The previous sections investigated the effect of motivation and information processing ability on relationships between beliefs and preferences as an aspect of systematic–analytical decision making. However, dual process models describe decision making strategies not merely as systematic or non-systematic, and non-systematic decision making is not simply characterised by the absence of systematic information processing, but by the presence of alternative approaches: both Petty and Cacioppo (1986) and Chaiken (1987) describe ‘peripheral’ or ‘heuristic–holistic’ strategies as an alternative way of decision making in cases where motivation and ability are low. Such strategies can, for example, rely on simple decision rules such as the “50:50 is a good idea”–heuristic coded in our data (Section 4.3). The use of such a heuristic was hypothesised to be more prevalent where confusion was high and emotional involvement low (Section 4.4). And indeed, a cross-tabulation that included the two variables (i) use of heuristic and (ii) behavioural group suggested that among those who were generally willing to contribute to the scheme (n = 530), those who were less involved and more confused were significantly more likely to draw on the “50:50 is a good idea”–heuristic than expected, were there no effects (χ², p < 0.01, two-tailed). Conversely, both groups with high involvement were significantly less likely to draw on this heuristic, with the high involvement/low confusion showing the greatest diversion from the statistically expected counts (Table 4). This latter observation underscores, again, the important role of emotional involvement in moderating decision strategies.

5.4. Who is Confused? Who is Emotionally Involved?

Our findings seem to suggest that, as hypothesised, respondents who are less involved and more confused tend to draw on heuristics for their decisions, whereas those who are strongly involved and less confused are most likely to make decisions that are closely related to their beliefs. However, who are these respondents? Which factors make survey participants confused? Which factors foster their emotional engagement?

We computed a second multinomial logistic regression, using behavioural group as a dependent variable. While to some degree, emotions are necessary to stimulate information processing, emotions that are too strong, whether positive (such as joy) or negative (such as worry) might have an inhibiting effect (Kals et al., 2000; see application in Araña and León, 2008). We thus aimed to explore the role of anger and worry in relation to confusion and emotional involvement. As we hypothesised respondents with higher education to be more likely to decide in a systematic way (Fischer and Hanley, 2007), we added education as a categorical variable. Other socio-

Table 5
Likelihood ratio test for multinomial logistic regression model (n = 1033). Dependent variable: behavioural group, classified by emotional involvement and confusion. ***: p < 0.001; **: p < 0.01; *: p < 0.05; ns: not significant.

<table>
<thead>
<tr>
<th>Variable</th>
<th>χ²</th>
<th>Significance (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional income needed</td>
<td>12.08</td>
<td>**</td>
</tr>
<tr>
<td>Anger (self reported)</td>
<td>8.7</td>
<td>*</td>
</tr>
<tr>
<td>Worry (self reported)</td>
<td>65.5</td>
<td>***</td>
</tr>
<tr>
<td>Rurality of place of residence</td>
<td>32.2</td>
<td>**</td>
</tr>
<tr>
<td>Education</td>
<td>56.4</td>
<td>***</td>
</tr>
</tbody>
</table>

Table 4
Results of cross-tabulation: use of “50:50 is a good idea” heuristic (yes/no) versus behavioural groups. χ² = 15; df = 3; p = 0.002. I: involvement, C: confusion, 1: high, 2: low.

<table>
<thead>
<tr>
<th>Behavioural group</th>
<th>n respondents using heuristic (expected)</th>
<th>n respondents not using heuristic (expected)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 I; C2</td>
<td>21 (31.6)</td>
<td>124 (113.4)</td>
<td>154</td>
</tr>
<tr>
<td>1 I; C3</td>
<td>22 (28.1)</td>
<td>107 (100.9)</td>
<td>129</td>
</tr>
<tr>
<td>1 I; C4</td>
<td>18 (17.2)</td>
<td>61 (61.8)</td>
<td>79</td>
</tr>
<tr>
<td>2 I; C2</td>
<td>54 (38)</td>
<td>120 (136)</td>
<td>174</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td>412</td>
<td>527</td>
</tr>
</tbody>
</table>
demographic variables such as age, gender, rurality of place of residence and income were also explored (Lienhoop and Fischer, 2009). Neither respondents’ age nor gender had a significant relationship with behavioural groups.

Although the models’ pseudo r-square was rather small ($r^2 = 0.167$, Cox and Snell), some interesting insights could be gained (Table 5). The strongest influence was exerted by worry and educational level. Anger, rurality of the interviewee’s place of residence and additional income needed had weaker influences.

Comparisons of pairs of behavioural groups suggested that in relation to the high involvement/low confusion group, participants in the two ‘high confusion’ groups tended to be angrier and more worried. In addition to this, highly confused and less involved participants were more likely to express a need for additional income and tended to be less well educated. Participants who expressed little confusion and little involvement, in contrast, were less likely than the strongly involved ones to be worried, tended to live in rural places and to be less well educated. In summary, in both ‘low involvement’ groups there was a higher probability for the respondents to be less well educated. In comparison, the two ‘high confusion’ groups tended to express more worry and anger. This raises questions on the relationship between involvement and educational background: while we might expect that education was linked to confusion, with more educated respondents feeling more competent and less confused, it seems that in our study, education was related to involvement. This might be a general tendency: surveys might generally be more likely to appeal to more educated participants (see also Fischer and Hanley, 2007), despite all our efforts to make the questionnaire accessible, relevant and easy to answer for all respondents (Section 4.3). Similarly, we need to explore if our questionnaire actually caused worry and anger and, related to this, confusion and low involvement, and thus hindered respondents in making a systematic-analytical decision.

6. Discussion

In our study, we found moderating effects of respondents’ motivation and cognitive ability on (i) the relationships between preferences for climate change adaptation policies and related, more general beliefs and (ii) the use of heuristics in decision making. In line with the ideas of dual process models and previous research in other psychological and behavioural disciplines (Section 1), this provides evidence that in environmental surveys, participants use a range of different approaches to give their responses. We distinguished here between a systematic-analytical way of decision making that fostered consistency between beliefs about and preferences for policy options, and a more heuristic-holistic way that was characterised by less consistency between beliefs and preferences, and a stronger role of rules of thumb. Choices that were more consistent with a person’s beliefs were most likely made by respondents who were more motivated (i.e., emotionally involved) and able to process information (i.e., not confused). This can, for example, be seen by the differences in model fit between the four behavioural groups (Section 5.2). Less involved and more confused respondents were more likely to use rules of thumb (Section 5.3).

This suggests that research practices that focus on identifying one single model of decision-making at a time might systematically limit our understanding of the respondents’ behaviour in environmental surveys. In the majority of cases, such theoretical models assume attitudes, behaviour or preferences to be the product of underlying values and beliefs, and a choice as generally in line with respondents’ views on utility. However, research on dual process models (as well as studies on heterogeneity in choice modelling) shows that there is heterogeneity in decision-making processes. Strategies that are non-systematic, non-rational, not necessarily conscious, and do not reflect cognitive hierarchies might still follow analysable patterns (Kahneman, 2003). While it might be desirable to create theoretical models that are as simple as possible, frameworks that allow for heterogeneity might actually help us to understand choices far better. We thus need more differentiated models that do not only consider cognitive hierarchies, but also rules of thumb and peripheral cues.

While we have used a rather simplistic, dichotomised approach, it would potentially be more rewarding to use models that reflect a continuum of strategies, or alternatively, distinct categories (Kroeb-Riel and Weinberg, 1996; Frör, 2008) in an integrated fashion. In a choice modelling context, Hensher (2007) suggests that decision making should be regarded as an active process, with strategies changing over the course of the decision process, dependent, for example, on context and learning effects. Through latent class analysis (Boxall and Adamowicz, 2002; Scarpa et al., 2009), it might also be possible to identify participants’ probability to decide in a certain way, rather than to deterministically assign them to behavioural groups. Fundamental insights might be gained through experimental settings using tools such as eye tracking, unobtrusive physiological monitoring or facial pattern recognition. However, decision contexts that are too artificial, such as laboratory settings, might trigger an unrealistically high percentage of systematic approaches (Chaiken, 1987).

Analyses of the systematic-analytical end of the decision-making spectrum often build on the vast body of research drawing on cognitive hierarchy-type approaches. In contrast, contemporary analyses of heuristic-holistic decision-making in interview situations often seem less structured and more ad-hoc, and can potentially include quite a diverse mix of decision strategies. In our study, we used only one proxy for heuristics, namely ’50:50 is a good idea’ and related rules of thumb. This code was assigned where respondents did not seem to take any technical arguments into consideration, but just relied on the idea that an equal split of funds was usually a good option. However, it is generally also possible that heuristics reflect underlying fundamental values in relation to the policy options in questions. Respondents might also draw on very different heuristics that relate to the person conveying the information (Do they appear to be experts? Do I like them?) or to the perceived quality of the argument (Chaiken, 1987), which could be investigated through experimental manipulations (Ajzen et al., 1996). Research on non-compensatory choices (Payne et al., 1993; Swait, 2001) could be useful here to develop more differentiated theoretical models of heuristic-holistic decisions in environmental surveys.

In our study, we did not distinguish between ‘cognitive’ versus ‘emotional’ decision making, as emotional factors are an essential element of both decision modes: emotional involvement is required to motivate respondents to engage with a topic and to process information in a systematic way, but strong emotions such as anger can also hamper systematic information processing. Emotions are needed to weigh and assign meaning to the governance beliefs and policy options addressed in our interviews, and can also work to identify subjectively particularly relevant peripheral cues (Weinberg, 1981; Kals et al., 2000; Parrott, 2001). Although through a number of open-ended questions we gained some (albeit limited) insights into perception of the survey itself (ranging from “a valuable exercise” to “waste of time”), we did not investigate if the feelings captured in our study were mere short-lived moods – potentially evoked through the study itself – or longer-living emotions connected to the content of the questionnaire. For example, while the anger that our respondents reported might have been directly related to the issues raised in the survey, such as climate change or flooding, it might also be caused by the disturbance due to the interviewer, or the fact that a tax rise was part of the scenario (Fischer and Hanley, 2007), and some respondents explicitly expressed that they were annoyed with the survey and its format. Such reactions would also explain why anger and worry inhibited rather than stimulated information processing, as often suggested (Parrott, 2001). However, as Kahneman’s (2003)
overview suggests, both types of feelings are of relevance, as moods as well as more persistent emotions might influence decision behaviour.

Also, our measurement of emotions was rather crude, based on self-reports and interviewer ratings. Other techniques, such as behaviour observation relying on a range of clearly specified indicators as used by Lienhoop and Fischer (2009), or well-established psychological scales (Araña and León, 2009), albeit often causing respondent fatigue, might be more reliable and valid. Experimental manipulation of motivation or ability to process information will provide additional insights (Ajzen et al., 1996).

Dual process models could potentially also be useful to understand findings that suggest diversity in cognitive hierarchies (Castro and Lima, 2001) and interviewer effects on information processing (Bateman and Mawby, 2004) with formal appearance of the interviewer potentially encouraging systematic decision making.

The implications of heterogeneous decision-making depend on a survey’s theoretical framework. Whereas some studies postulate decisions that reflect the utility derived from an environmental good or an individual’s values with regard to the issue in question, others might be based on more relaxed assumptions. In the former case, decisions based on peripheral cues (such as the appearance of the interviewer) or rules of thumb that do not specifically relate to the issue in question might lead to flawed results if these are taken at face value.

A further conclusion might be that the idea of systematic decision making generally seems to be a working assumption, as can be seen from the abundance of significant statistical models that rely, for example, on cognitive hierarchies. However, our analysis suggests that such models work better for some parts of the sample than for others. Use of decision modes seemed more strongly influenced by emotional involvement than by level of confusion (Sections 5.2 and 5.3). These, in turn, seemed to be related to education (see also Fischer and Hanley, 2007), and emotions such as worry and anger. In previous studies, we found effects of age, gender and income on motivation, with younger and male respondents and those with higher incomes less likely to be motivated (Lienhoop and Fischer, 2009). Perceived complexity and prior knowledge can also inform the choice of a decision strategy (Fischer and Hanley, 2007). Our study did not make any assumptions about participants’ general cognitive skills or preferences, such as their need for cognition (Petty and Cacioppo, 1986), and rather focused on situation-specific factors. However, if there are systematic patterns of factors facilitating systematic decision making, it might be useful to design surveys in a dynamic and adaptive rather than in a static way, to maximise the proportion of the population that feels comfortable and motivated to participate. As demands for information might vary, and confusion is a major factor influencing decision mode, a flexible, but controlled approach to information provision ‘on demand’ (as used in Fischer and Hanley, 2007) and group deliberation (Lienhoop and MacMillan, 2007) could be useful, and might at the same time increase respondents’ active engagement with the survey and thus enhance motivation. As the additional heterogeneity introduced by such flexible approaches is not yet well understood, further research elucidating the effects of deliberation and information-on-demand is required. However, it might be that such modifications are not sufficient (McFadden, 1999), and that we need to develop fundamentally different techniques to elicit and understand people’s views on environmental issues and policies.

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