CBESS Discussion Paper 15-06

Putting Bambi in the Firing Line: Applying Moral Philosophy to Environmental and Economic Attitudes to Deer Culling

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This work also emphasises the necessity to consider context-specifics when investigating ethically contentious topics. Under an environmental setting, we explore how 'nature connectivity' (or engagement with the natural world) may influence how easily we can achieve sustainable ecological or economic objectives.

JEL classification codes
Q26, Q57, H42, C35, D63, D71

Keywords
intentions, doctrine of double effect, choice experiment, nature connectivity, local wildlife valuation

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1. INTRODUCTION

Supported by decades of research in experimental and behavioural economics, it is now well understood that humans do not always behave in accordance with the model of a 'fully rational' agent. The associated literature is vast, with many key examples of such 'bounded rationality' and their potential explanations presented in both classic and modern reviews (Kahnemann & Tversky, 1984; Marwala 2014). Sometimes people deviate from the rational choice model through suboptimal or erroneous decisions. However, it is also true that choices which fail to align themselves with theoretical predictions are not necessarily mistakes, but instead represent a genuine preference construction that is beyond at least the more narrow of frameworks that standard economics have used to describe utility maximisation.

Whilst it is instructive to identify systematic deviations from the standard behavioural assumptions of the *homo oeconomicus*, it is equally vital to understand the underlying causes of these departures in order to gauge the transferability of choice practices. Procedure is proposed as one reason why people may behave in a boundedly rational manner. A classic example involves our perceptions regarding procedural fairness. Work by Fehr & Schmidt (1999) and Bolton & Ockenfels (2000) show how adjusting a standard utility function so as to incorporate measures of equity or relativities readily improves the predictive nature of a model. Other studies, including those of Ajzen (1991), Terry et al. (1999), Falk et al. (2003) and Bolton et al. (2005) consider the roles of intention and procedure in determining our choices and preferences. In this study, we present two alternative procedural theories, namely intentions-based reasoning taken from behavioural economics and the Doctrine of Double Effect, a principle which attempts to explain our moral and philosophical perspectives. Applied to the subject of deer culling, we use discrete choice experiments to test whether these two theories do outperform the rational choice model, and, if so, then identify the extent to which either can better represent the stated preferences of individuals.

When decisions are driven by 'intentions', people focus less heavily on the outcome of an act *per se*, and instead contemplate whether the procedure by which a result was achieved can be judged as just or ethical. Whilst both alternative theories are similar in their belief that choice is not driven solely by outcomes, they differ in *how* they imagine procedure to impact upon decision-making. 'Good' intentions, as defined by behavioural economics, attach weight to how an agent justifies their choice and the morality of their underlying motivations to select a particular option. The Doctrine of Double Effect has a slightly different focus, and supposes that permissibility is dictated by perceptions on whether a harmful impact is created as a direct consequence of a given action, or whether it is a foreseen but unintended secondary effect. Whilst Section 2 provides greater detail regarding the latter, this distinction can be characterised by the two statements below:

Intentions-Based Reasoning: "Why did you undertake that (harmful) act?"
Doctrine of Double Effect: "Did you mean to cause that (harmful) outcome?"

Focussing upon intention may be particularly relevant when decisions involve ethically difficult choices. Our findings give evidence that intention does play an important role in delivering choice, but neither economic theory nor the Doctrine of Double Effect are able to truly capture people's preferences when considered in isolation. Instead, our results suggest that the roles of

intention, action and outcome interact when shaping the moral decisions of an individual. Only by appreciating the nature of this fusion are we able to better understand the underlying determinants of an individual's choice and use this to produce more robust predictions on their true preferences.

We apply the exploration of these different theories to the subject of deer culling. Attitudes and perspectives in this area are often driven by emotive or moral stance, and it has been shown that under these conditions an agent is unlikely to base their decisions purely by event outcomes (Boyce et al, 1992; Falk et al, 2003). It is plausible to believe that one's perception of whether a process by which deer numbers are reduced is well intended, or indeed necessary, will largely depend upon their level of knowledge and style of interaction they hold with their local environment. Therefore, a second reason to explore this subject within an environmental setting pertains to how humans derive Subjective Well-Being (SWB). The associated literature promotes activities where people can obtain a sense of responsibility, dependence and/or repeated interaction (see Diener & Biswas-Diener, 2008 for an overview). Practices advocated as enhancing life satisfaction include strong interactions with one's community, religion and family, all of which stimulate feelings of interconnectivity whilst simultaneously providing stability and routine to our lives. Engagement with our local environment, which can be termed as 'Nature Connectivity' (Dutcher et al, 2007), seems another channel from which one could plausibly attain the same type of life satisfaction. In such instances, humans could derive pleasure from performing a 'warden' role, inducing valued qualities of repetitiveness and protective care. Furthermore, this type of benefit seems more applicable to local nature and could constitute a distinct and disparate worth from that of conservation or preservation which people establish through classic donation mechanisms.

Studying intention in this setting also allows us to assess how engaging with local wildlife might conflict with long-term sustainability. Generally, a warden mentality should complement wider environmental objectives. Take the example of feeding birds; this not only endows the human feeder with a 'warden-style' utility, but simultaneously raises the survival chances of fed birds, benefitting long-term conservation efforts. Such complementarity disappears when nature connectivity is applied to culling. Here, human interference is typically seen as 'necessary' because a species' population is sufficiently high to negatively impact upon the wider ecosystem, local economy or another social aspect. A justification is seen as particularly strong if humans are at least partially responsible for the population explosion (i.e. via predator removal or species introduction). Despite this, culling conflicts with our warden desire to protect individual creatures and the action to cull, even if 'well-intended' for long term sustainability, may be highly objectionable to those placing a strong value upon nature connectivity.

Our results indicate that these 'warden ethics' may deliver the crucial missing determinant in shaping the alternative preferences we discover. This study therefore seeks to identify not only how people exhibit warden-style preferences, but also acknowledge the views of Scholtz (2005) by considering, how society should organise culling effectively if it is then deemed morally permissible. Regarding policy, deer management has both an environmental and economic importance, and the various types of destruction caused by these animals are estimated to cost £4.3m in the UK each year (Haw, 2013). Thus, this work nicely exemplifies how policy-makers ought to exercise caution as they seek to create schemes designed to maximise societal welfare. This requires inventing sustainable habitat management strategies which compromise between nature connectivity and the need to protect wider biodiversity.

The remainder of the paper is set out accordingly. Section 2 outlines the theory and associated literature on the Doctrine of Double Effect and Trolley Problems; Section 3 gives a comprehensive overview of the survey design, methodology and implementation; Section 4 presents the results whilst Section 5 then proceeds with a discussion of these. Section 6 concludes, and proposes some next steps in light of these findings.

SECTION 2: THE DOCTRINE OF DOUBLE EFFECT AND TROLLEY PROBLEMS

The Doctrine of Double Effect (hereafter DDE) is a longstanding philosophical theory which illustrates how our moral attitudes my hinge upon the perceptions we hold of a perpetrator's intention from their action. This ethical exploration was resurrected by Philippa Foot in 1935, who describes these adjustments in moral permissibility through a combination of theoretical examples. Perhaps the most famous (and certainly most intensely scrutinised) of these is the 'Trolley Problem'. Whilst various strains of this ethical dilemma have emerged since Foot's initial proposal, its basic principles are detailed below:

Story 1: *When standing next to a rail track you see an out-of-control trolley hurtling down a hill. In its path are five individuals. The sides of the track are steep and the five have no way of escaping. You cannot stop the trolley and if you do nothing it will hit and kill all five with certainty. There is a switch next to you that you can flick. By doing so, you would divert the trolley onto an alternative track, preventing the death of the five. However, on this other line is one individual with no means of escape. If the trolley is switched to the other line, this individual will be killed with certainty.* ***Should you flick the switch?***

Story 2: *When standing on a bridge overlooking a rail track, you see an out-of-control trolley hurtling down a hill. In its path are five individuals. The sides of the track are steep and the five have no way of escaping. You cannot stop the trolley and if you do nothing it will hit and kill all five with certainty. There is a large man stood next to you on the bridge. You realise that, given his size, if you pushed this man into the path of the trolley then it would de-rail, preventing the death of the five. However, the force of the trolley hitting the man will kill him with certainty.* ***Should you push the large man?***

Foot's conjecture is that whilst people on average believe flicking the switch is ethically permissible, pushing the large man is not. However, from an outcomes-perspective we see no distinction between the two stories - the consequence of either is to sacrifice one to prevent the death of five. This creates the 'Doctrine of Double Effect'.

Foot proposes that the opposing moral stances are caused through differences in the intentions of one's action. In Story 1, flicking the switch saves the five individuals through a means which, under different circumstances, could have achieved that result without any death (i.e. had no individual been on the alternative line). Here, the one's death is a foreseen but unavoidable and unintended side-effect of the initial action. By contrast, the death of the large man in Story 2 is

necessary and integral component to achieve saving the five. Foot believes it is this aspect which creates the ethical objection, and immorality is expressed despite the final outcome appearing justifiable.

Many philosophers and theorists have since revisited and extended this dilemma. Notable contributors include Thompson, 1976; 1985, Ungur, 1992 and Kamm, 1996. These authors explore this ethical conundrum by adjusting aspects like anonymity, rail-track set-up and other social dynamics. More recently, the theoretical literature has been complemented by hypothetical experiments such as those by Lanteri et al, 2008 and Liao et al, 2012, which have generally reinforced the conjectures of Foot and others. Furthermore, experimental studies have extended the focus of their analyses to explore the effect of the type of harm endured (Greene et al, 2009; Gold et al, 2013) or introducing 'trilemmas' to assess the impact of similarity effects (Shallow et al, 2011) or self-sacrifice (Di Nucci, 2013).

It is true that many economic theories are reluctant to move away from consequence-based analyses (Iliev et al, 2009) and, as such, DDE and its related moral conjectures are potentially troublesome for such pragmatic theories. The result of Story 1 and Story 2 is identical and because a utility-maximising agent should only ever consider the final outcomes or pay-offs, Rational Choice Theory and those like it have no way to explain the ethically-driven switch in preference which occurs.

To the best of our knowledge, this is the first study to apply discrete choice modelling to Trolley Problems, and certainly the first to do so in order to explore animal death. Thus, this paper will gauge how moral perceptions for non-human harm may correspond to those for our own species. Ethically, this may be particularly poignant: our study, through its emphasis upon 'warden tendencies', presents one possible reason why people can hold seemingly inconsistent perspectives between different types of animal welfare, for example for the protection of local wildlife and that for meat-producing livestock. As a research area, experimental philosophy is relatively young, yet the ever-sharpening experimental skills of behavioural economists could considerably help to reveal answers to these ethical quandaries which theoretical philosophers throw into the academic sphere. This is another potential contribution of this study. By applying economic experimentation to long-standing philosophical dilemmas, it seeks to maximise the research synergies which exist between the two disciplines.

3. SURVEY DESCRIPTION AND METHODOLOGY

Designing the Survey

The survey comprised a 16-case discrete choice exercise, followed by a questionnaire. The latter sought to establish each individual's topic-related attitudes and socio-demographic status.

a) The Choice Experiment

Based on Lancaster's Characteristics Approach (Lancaster, 1966), discrete choice experiments assume that a good's value can be established through its constituting attributes. Not only do the characteristics carry value, but these are formed independently from the way in which

they are bundled. This section describes each of the attributes used, explaining not only how each was characterised and defined to respondents, but also how their presence should help seek answers to the objectives of the study. To provide a visual interpretation of how characteristics were displayed, an example choice set is given in Appendix A. Explanations of all attributes were provided through tutorial-style instructions. All respondents received this prior to undertaking the choice task, and abbreviated versions are provided in both Appendix B and throughout this section.

Constituting the main part of the survey, this section offered each respondent 16 forest management 'cases'. Each such case presented two alternative schemes and a constant 'business as usual' baseline. Presenting three-alternative sets in this way is believed to improve model robustness (Bennett & Rolfe, 2009) and because people were asked to express both their first and second preferences, a complete ranking was established for every choice set. A description of the baseline (shown in Figure 1) was given at the instructions stage, and a copy was available on each respondent's desk for them to review if necessary. This choice ("Option C") was based upon the current practices and plans and was developed following consultations with East Anglia's Forestry Commission.

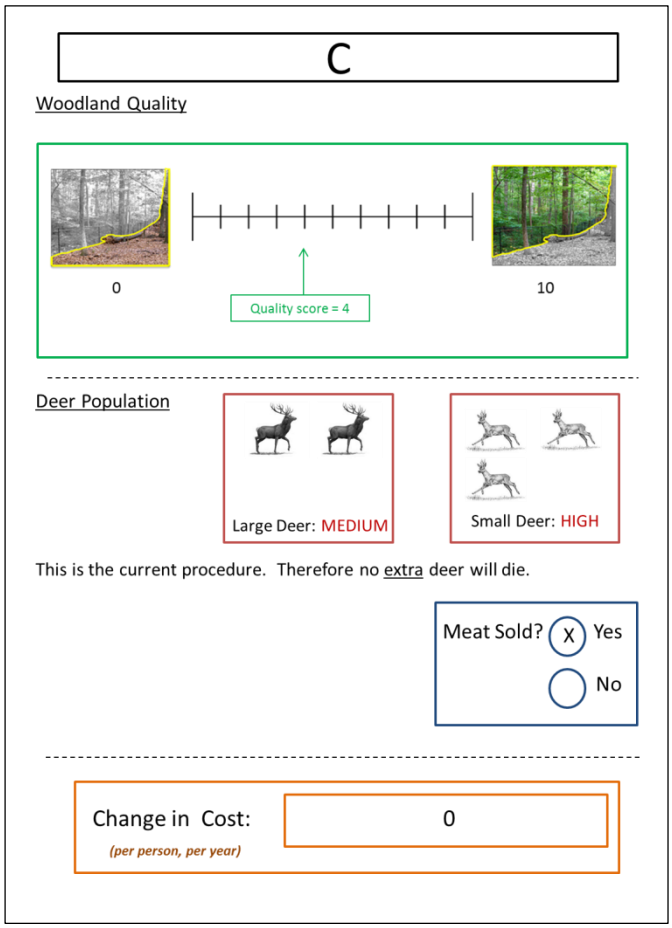

Figure 1: The Baseline (Option C)

Whilst answer sheets were paper-based, the instructions and survey were presented on computer screens. A researcher read the tutorial-style instructions aloud to subjects in order to overcome any issues of illiteracy or ambiguity. Provided in Appendix B, a laminated copy of the (albeit abbreviated) tutorial was also made available for a participant to refer to.

Woodland Quality

Exemplified in Figure 2, all alternatives held a corresponding woodland quality, with scores ranging from 0 to 10. The integer scale was deemed the simplest way to present this grading system, and this was confirmed in pilot testing when a range of alternative mechanisms were displayed. The yellow-bordering on the images within Figure 2 illustrated this scales' extremes, and related to a photograph shown at the start of the tutorial instructions which depicted the impact deer-proof fencing could have on woodland vegetation. Respondents were informed that a 'high quality' woodland related to an ecosystem which enjoyed a superior and sustainable health. Whilst focus groups seemed to grasp the scoring concept fairly well, the tutorial text was complemented by reiterating that scores further to the left-hand side of the scale represented more greatly degraded forests.

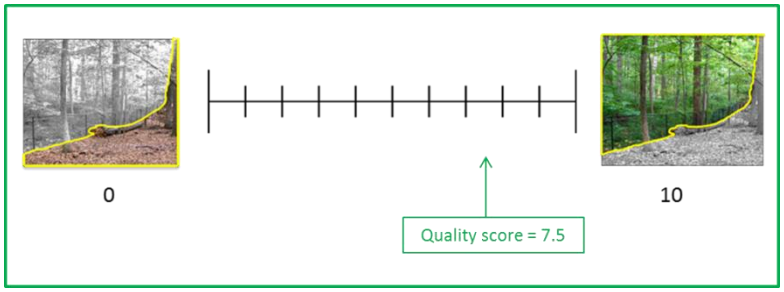

Figure 2: The 'Woodland Quality' Attribute

Respondents were told that a woodland quality could be achieved through either exclusive or mixed use of policies. This could involve deer management through fencing or culling, or via other methods unrelated to deer population control. This 'vagueness' held two purposes. From a respondent perspective, this should prevent over-speculation regarding how quality changes might occur between cases. For us, this enabled orthogonal choice sets to be achieved with both greater ease and credibility.

Deer Populations

A description of East Anglia's deer populations were presented in the form shown through Figure 3 below. Regarding 'Large' and 'Small' deer, each characteristic could exist at Low, Medium

or High thresholds, and a key gave visual and written representations of these levels. In relation to the latter, it was described how each threshold might compare with the likelihood of seeing a deer, indicating a form of a use value. Respondents were given a brief description of the types of destruction that each size of deer might cause, alongside simple background information such as species names.

Deer population changes were relative to Option C and would occur over a two-year period. Reiterated in the next subsection, instilling that changes were comparable to the constant Option C was important as this was the area of pilot testing where initially respondents had struggled.

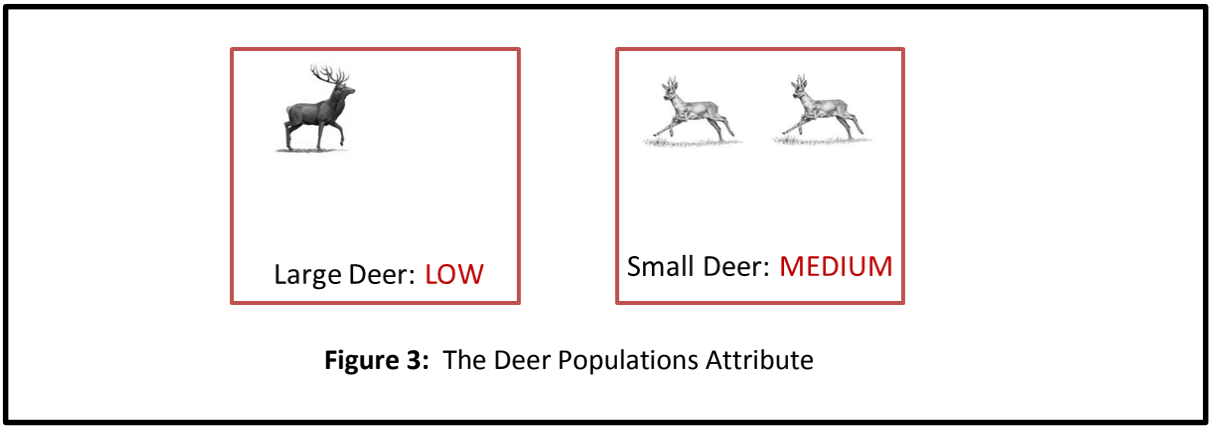

Figure 3: The Deer Populations Attribute

Although many species of deer reside in East Anglia, we defined deer through just two 'types'. The first reason for this related to simplicity; with no prior information on a respondent's deer knowledge (i.e. whether species were native, common, destructive etc.) a broad categorisation prevented a need to relay such detail, which in turn could have led to survey disengagement and/or unnecessary cognitive burden. Nevertheless, some level of species disaggregation was necessary to meet our survey's aim to test the role of nature connectivity. We told respondents that large and small deer were equally destructive, meaning any elevated values expressed for small deer could represent warden-type preferences. Small deer such as Roe and Muntjac certainly appear more vulnerable and dependant on human aid than the more physically robust large species of Fallow or Red. Furthermore, these two groups vary behaviourally, with Roe and Muntjac deer typically visiting suburban areas more frequently (Austin et al, 2013), affording greater opportunities for repeated interaction. Of course, a respondent could hold species-related historical experiences which interfere with this valuation story and we approach this interpretation cautiously.

Deer Population Change

The third characteristic the tutorial introduced were deer population reduction mechanisms. Table 1 gives an overview of how each method relates to both DDE and intentions-based reasoning:

		Trolley/DDE Equivalent	Intentions Perception
1	Licenced Hunter Culling	Story 2 (Unethical)	Bad Intention
2	Forestry Commission Culling	Story 2 (Unethical)	Good Intention
3	Fencing	Story 1 (Ethical)	Good Intention

Table 1: How Deer Population Reduction Methods relate to DDE and Intentions

Licenced hunting most closely resembles the bridge version (Story 2) of the Trolley Problem. By indicating that these hunters undertake culling for leisure, we imply that the deer's death is both a necessary and intended component of their action of shooting. Furthermore, the hunters cull for 'bad' reasons in that they do not shoot deer for environmental sustainability and its affiliated benefits for woodland management. Instead, their motivation is to fulfil their private utility from killing. It is this second (intentions-based) component which distinguishes licenced hunters from Forestry Commission culling. Because Commission culling still involves the shooting of deer, this form of population control would still conform to Story 2 if we were to follow Foot's description of DDE when applied to human harm in a Trolley Problem context. However, a Forestry Commission huntsperson is employed to ensure long-term woodland preservation and society might perceive this as a 'better intended' and therefore more ethically permissible reason for culling to be undertaken.

Fencing coincides with Story 1 of the Trolley Problem because the associated action (erecting a fence) is done to ensure long-term woodland sustainability. A foreseen but secondary consequence of this action is that deer starve, yet their death was not a necessary condition for the fencing to have achieved its primary aim. Through DDE reasoning, this action would be seen as ethically permissible.

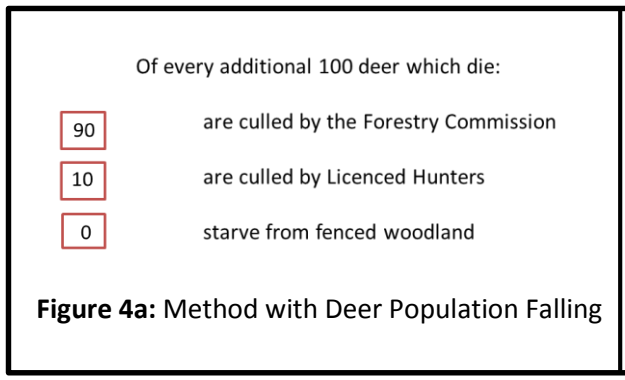

Figure 4a: Method with Deer Population Falling

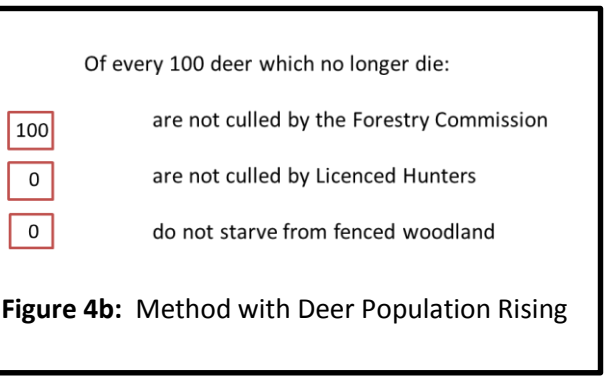

Figure 4b: Method with Deer Population Rising

Figures 4a and 4b illustrate how these population changes were portrayed and again it was explained that these adjustments were relative to Option C. Some alternatives allowed populations to actually rise and in these cases the wording was altered to that in Figure 4b. Because the word adjustment was so slight, an identical verbal prompt was issued to every respondent by the experimenter whenever the first case of rising populations appeared in the choice task. Alongside this, each alternative included a box which explicitly indicated whether populations were projected to "Rise" or "Fall" (see Appendix A). This combination of prompts seemed sufficient to ensure respondents recognised when each scenario was being presented.

A detailed slide within the tutorial explained each method. Agreement with a system of licencing heavily depends upon public perceptions surrounding the extent to which licenced hunters are regulated (Holzer et al, 2012) and it was explicitly stated that training would be provided to a sufficient standard. Whilst maintaining ethical impartiality was crucial to this experiment, the

tutorial had to draw attention to the private enjoyment which licenced hunters yielded from culling and to the deer starvation that would occur should an intense level of fencing be pursued by the woodland management organisation. Although this may have seemed emotively influential, a failure to include these aspects could mean respondents would not view each scenario in their intended ethical contexts. One strategy employed to try and dilute these potential biases was to intersperse the statements with more factual ones, such as the aforementioned training standards and the cost implications to each system.

Very few problems arose regarding task comprehension. Indeed, the many instances of verbal reasoning which participants expressed as they made their decisions suggest a fairly active engagement with this method-based attribute.

Meat Sales

A simple attribute to describe, it was explained that venison meat could be sold from deer which had been killed (via culling methods only). The beneficiary from these revenues would be whichever party had undertaken the cull.

Once again, the financial advantages were explicitly mentioned. Should the Forestry Commission be the group receiving these revenues, it was also highlighted that this could reduce the costs to managing the woodland. We provided this information in part to retain consistency with previous cost-related cues. However, from an intentions-based standpoint, this also sought to test attitudes toward licenced hunters selling venison. A rise in the support for this form of culling could represent an ethical judgement that these hunters now held an alternative and more permissible justification to shoot deer. Likewise, such hunters profiteering from their ill-intended deed may actually decrease instances of agreement with this method. Of course, such moral adjustments only concern our behavioural intentions and this should not influence any participant who are driven by DDE reasoning. We return to this in our results section.

The Cost Attribute

Vital to any choice modelling exercise is the construction a payment vehicle. One of the greatest difficulties in choice modelling is to ensure that this attribute instils both credibility and realism in both its magnitudes and format of delivery. Given that the Forestry Commission is funded by the government, the use of taxation was an obvious instrument of cost to use. In the UK there has been a relatively intense and well documented debate on how public forestry is financed[2] . Advantageous from our perspective, this has meant that people are now better informed on how woodlands are funded and possibly increases the belief they hold that their responses could impact upon policy. Put another way, if taxation alterations may actually be enforced through ongoing public funding pressures, subjects are likely to provide more honest answers because of the greater degree of control and realism they assume for this topic (Boyce et al, 1992; Iliev et al, 2009). Whilst wary of the ethical or cognitive disadvantages which accompany the use of taxation, it was felt that such impacts may be considerably lessened given the nature of the topic and the associated magnitudes of change involved.

[2] See http://www.independent.co.uk/news/uk/politics/government-plans-huge-selloff-of-britains-forests-2115631.html for this article

Once again, cost changes were expressed relative to Option C. The tutorial described that cost adjustments would involve a flat annual levy placed upon each and every resident in East Anglia in an attempt to ensure that each respondent felt that any change would impact upon them personally. In terms of magnitude, consultations with the Forestry Commission regarding associated training, staffing and monitoring costs took place to derive realistic levels. Subsequently, changes in costs took four possible tiers, namely to cost £5.00 less, yield no change or impose an additional £5.00 or £10.00 payment.

b) The Socio-demographic Survey

This questionnaire covered a range of topics regarding one's environmental attitudes, associated behaviour and demographic status. Respondents were informed that all questionnaires were anonymous and that disclosed information would be used solely for data analyses. A sample questionnaire is provided in Appendix C.

Attitudinal and Behavioural Questions

Six questions within the survey looked to gauge a mix of actions and opinions that respondents held regarding forests. Each were asked their woodland visit frequency (question 1) and range of activities they undertook (question 2) there. Questions 4 and 5 respectively asked if they had contributed to animal welfare and/or environmental charities within the last 12 months, or whether they regularly fed birds in their garden. Whilst question 5 was of particular interest given previous work in the field (see Brock, Sugden & Perino; 2014), we perceived that those who engaged in bird feeding may place value upon the aspect of local nature connectivity which formed one of the study's main focuses.

Questions 3 and 6 invited more subjective answers from participants. The former asked whether participants agreed in principle with culling and fencing as schemes for population control. For culling, this was asked in relation to both deer and badgers. Badger culling is a highly topical and contentious UK initiative, and there exists conflicting scientific evidence as to whether killing these animals would actually achieve its intended aim of preventing the spread of tuberculosis in cattle. Providing robust and verifiable scientific evidence is deemed crucial for topics such as culling (Waber et al, 2013) and so it seemed reasonable to compare the culling of badgers to that of deer where the reasoning is widely seen as more defensible. For all three policies, respondents could select a 'Don't Know' option, deliberately designed to make no distinction between those possessed a lack of knowledge and those who, in view of the current evidence, felt unable to actively express an opinion. Question 6 offered a (1 – 5) Likert Scale which asked for one's strength of agreement with whether they believed (a) effective forest management was important, (b) culling deer was preferable to starvation as a means of reducing deer numbers and (c) that educating children in environmental studies was important. We expected a general agreement with these statements, but they gave some measure for people's notions of nature connectivity and of sustainably managing resources for future generations.

Socio-demographic Questions

Forming the final five questions of our survey, these requested standard demographics of gender (question 7), age (question 8) and income (question 9). The two final questions asked whether those surveyed had participated in shooting or fishing (question 10) or were vegetarian or vegan (question 11), both of which correspond with attributes of the choice task itself. Confirmed by the response distributions contained in Appendix D, the small sample size for those responding positively to question 10 meant only question 11 was fit for analysis.

Conduct and Execution of the Survey

All 200 surveys took place through February 2014, with half being conducted at a Norwich garden centre with the remainder held at a country park in Thetford Forest, Suffolk. Inclusive of the ten to fifteen minute tutorial, the average completion time was between twenty and thirty minutes. The two locations were deliberately selected in order to offer a meaningful contrast. Based near Norwich city centre and therefore away from woodland of any substantial magnitude, the former site constitutes one in East Anglia where deer populations are typically low. Conversely, the Thetford site should provide a greater fraction of respondents who live within close proximity to dense forest. These two samples therefore may hold preference structures which convey different practical understandings of woodland management or on average possess disparate use values for forestry. Furthermore, it is quite plausible that because each location holds a different focus (i.e. garden centre versus forest park) that this could impact upon the stance or approach that a respondent possesses at the point at which the conducted the survey. These elements constitute cultural aspects that can be highly influential in shaping decisions in such ethically driven contexts (Machery et al. 2004). In both locations we assume that on average a participant would hold an accentuated interest in outdoor and/or environmental issues. We therefore appreciate that this form of sample-selection bias could create an inflation of their subsequent valuations. On a practical note, both sites formed non-obligatory environments in which to conduct a survey. This ensured that when approached, any potential respondent felt confident to decline to partake in the survey if they so wished.

Surveys were collected through face-to-face interviews. Whilst answer sheets were paper-based, the instructions and survey were presented on computer screens. This enabled participants to engage orally with the researcher over the topic, and provided complementary qualitative statements to accompany quantitative data. This also did not restrict our sample to those more confident in the use of IT. The response rate was very good, averaging 50% at the Norwich site and 80% at the Thetford one. Reasons for decline typically consisted of time constraints as opposed to subject disengagement or disinclination. Whilst uptake was roughly consistent across genders, 110 (55%) respondents were female.

The optimal number of cases to present participants with is widely debated and different stances exist within the field (Swait & Adamowicz, 1997; Adamowicz et al,1998; Scheufele & Bennett,2012). By issuing 16 choices, this study sits at the upper bound of this recommended range. However, it was felt that the familiarity respondents would hold with this particular topic should lead to such cognitive burden being significantly offset.

As reward for participation, each respondent was issued with a voucher for a hot drink and snack at the respective cafes located at each site. This incentive scheme seemed highly suitable for the study. Firstly, it made no financial promise which could influence participant responses through a form of 'interviewer effect' (Bowling, 2005). Secondly, the average redemption value came to approximately £4.00, which is judged as adequate compensation given the survey duration. We were pleased with this system of reward and would advocate such a monetary-alternative compensation method if both the topic's nature and survey's duration permits.

The Empirical Model

Described in greater detail below, characteristics were presented across alternatives in a way which ensured choice-set orthogonality. The coefficient for the 'Quality' represents the probability change for increasing one integer score on the 1-10 scale denoted by Figure 2. Figure 3 confirms that deer species appeared through two size-differentiated attributes, each appearing at one of three levels. Culling variables compare people's relative preference for these methods relative to that of fencing, which acts as the base case.

Attribute	Description
Quality Level	With all other attributes remaining constant, this is the probability change in choosing an option because the woodland score increases by one integer value.
Large Deer	With all other attributes unchanged, this is the change in the probability that a respondent chooses an option because 'large deer' are of one frequency level higher.
Small Deer	With all other attributes remaining constant, this is the probability change in a respondent choosing an option because 'small deer' are of one frequency level higher.
Commission Culling	With all other attributes unchanged, this is the probability change in a respondent selecting an option because one percentage point of fencing has been replaced with that of Forestry Commission-led culling.
Licenced Hunter Culling	Holding all other attributes constant, this is the probability change in a respondent choosing an option because one percentage point of fencing has been replaced with that of hunter-led culling.
Meat Sales	With all other attributes remaining constant, this is the probability change in a respondent choosing an option because the meat is now being sold.
Cost	With all other attributes remaining constant, this is the probability change in a respondent choosing an option because the taxation-based price to deliver that management scheme has risen by one penny (£0.01).

Table 1: A Description of the Variables

The data is analysed using a conditional logit model[3]. Algebraically, this means that the utility person n derives from alternative j is assumed to take the form characterised by (1).

$$U_{nj} = \beta_n' x_{nj} + \varepsilon_{nj} \qquad (1)$$

[3] Our econometric specification does not deviate from that which is used widely in the literature, yet much of the notation and descriptions are adapted from Train (2009).

Here, x_{nj} constitutes the variables which are observed by a participant for any given choice option and which are pre-determined by the researcher through the survey's design. β_n then relates this to the person n's personal preferences over the attributes at these particular levels. These models apply a Gumbel distribution to the random element of people's utility (ε_{nj}), which is deemed appropriate when included, as above, as an additive element to the utility function (McFadden, 1974; Louviere et al, 2000; Hoyos, 2010). Consequently, it is possible to establish the projected probability change for a participant's selection of a given alternative i based upon the rule that person n will only select option i if that derives them the greatest utility relative to any other option (j) available to them in a given and fixed choice set. A formula demonstrating this is again shown below:

$$Prob\ (ni) = \int \left(\frac{exp^{\beta' x_{ni}}}{\sum_j exp^{\beta' x_{nj}}} \right) f(\beta) d\beta \qquad (2)$$

Attribute coefficients thus represent the respondent's change in probability for choosing an option if, *ceteris paribus*, there is a unit change in that attribute's level when described as a discrete variable, or through its presence relative to a base case for dummy (0-1) coded attributes (Bennett & Blamey, 2001). The coefficient on price (β_{price}) represents the marginal utility of income, which for such environmental commodities is assumed to remain constant and negative (Hanley et al, 1998a). Presuming that product characteristics act as normal goods, determining any attribute's marginal valuation then involves taking a ratio of its coefficient against that of price (Hoyos, 2010).

$$WTP_x = \frac{-\beta_x}{\beta_{price}} \qquad (3)$$

Participants were asked to state both their first and second preferences, essentially creating a ranking of the three alternatives for each choice set. Our econometric specification is able to incorporate the fact that each individual is making multiple choices and therefore can identify any participant-specific patterns in decision-making. Our regression does just this, grouping responses by choice set whilst clustering these over individuals

SECTION 4: RESULTS

Sample Representation

Given its taxation-based payment vehicle, the study hoped to predominately survey people who were knowledgeable on household budgeting and responsible for their financial management. Table 2 decomposes the sample's age profile and compares this to the 2011 Census data for Norfolk's population (www.norfolkinsight.org.uk). Wilcoxon Mann- Whitney U tests confirm no significant differences exist between these (z = -0.85, $p(z)$ = 0.3955).

Age Bracket	Sample Population (%)	Norfolk Representation (%)
18-25 years	23/200 (11.5%)	52/681 (7.6%)
26-35 years	25/200 (12.5%)	96/681 (14.1%)
36-45 years	26/200 (13%)	105/681 (15.4%)

46-55 years	35/200 (17.5%)	118/681 (17.3%)
56-65 years	44/200 (22%)	114/681 (16.7%)
Over 65 years	47/200 (23.5%)	196/681 (28.7%)

Table 2: Age Profile Comparison

Table 3 provides similar summary statistics for income, acknowledging that 15% of respondents opted not to provide this information. The remaining distribution adequately represents that of the Norfolk region (z = 1.295, $p(z)$ = 0.1952). The slight under-representation of lower income households potentially relates to our below-average proportion of pension-age respondents. Anecdotally, this group typically show a reluctance to view pensions as 'income' which often leads to greater tendencies to select the non-disclosure option.

Income Bracket	Sample Population (%)	Norfolk Representation (%)*
Under £20,000	54/200 (27%)	39%
£20,000 - £29,999	37/200 (18.5%)	21%
£30,000 - £39,999	21/200 (10.5%)	24%
£40,000 - £49,999	23/200 (11.5%)	
£50,000 - £59,999	10/200 (5%)	
£60,000 - £69,999	9/200 (4.5%)	
£70,000 - £79,999	5/200 (2.5%)	16%
£80,000 - £89,999	6/200 (3%)	
Above £90,000	5/200 (2.5%)	
Preferred not to disclose	30/200 (15%)	N/A

Table 3: Income Profile Comparison

**Data approximations from Norfolk Insight (CACI), 2010*

Regression Results: Parameter Estimations

Using our Conditional Logit model, Table 4 estimates the results from our complete sample of 200 participants. The dataset benefits from the fact that fully ranked preferences were derived for every choice set. Table 5 displays Models (2) and (3), which analyses the same explanatory variables from particular subgroups. The former extracts those from both the lowest age bracket and the highest age bracket, each of which can then be contrasted against the full sample estimates in Table 3. Model (3) does likewise for income groups. Whilst not presented here, many similar analyses were conducted in this way, isolating a certain subset of respondents who held particular characteristics. These are referred to in later discussion and Appendix E contains a matrix displaying these valuations.

	Full Sample *(n=200)*		**Associated Valuation** *(£)*
	Coef.	*P>|z|*	***£***
Quality Level	0.319	0.000	**3.88***
Large Deer	0.349	0.000	**4.25***
Small Deer	0.741	0.000	**9.02***

Commission Culling	0.010	0.000	**0.12***
Licenced Hunter Culling	0.001	0.494	**0.01**
Meat Sales	1.086	0.000	**13.21***
Cost	-0.082*	0.000	
Model Fit (χ^2)	2288.03	0.000	
Pseudo R^2	0.1068		

** Significant Coefficient (p<0.05)*

Table 4: Regression Results from the Choice Experiment

In each case, columns in bold give the average marginal valuation associated with each attribute. Reiterating the descriptions given in Table 1, in most cases this implies the willingness to pay for a one-step improvement in a characteristic (for example increasing the woodland grade score by one for 'Quality Level'). However, for our culling attributes the interpretation adjusts slightly, and these values represent the willingness to pay for a one percentage point shift away from fencing and instead towards the particular culling type[4].

	Youngest (Aged 18-25) Respondents *(n= 23)*			**Oldest (Aged 65 +) Respondents** *(n=47)*			**Low Income (<£20,000) Respondents** *(n= 54)*			**High Income (>£40,000) Respondents** *(n=58)*		
	Coef.	*P>|z|*	**£**	*Coef.*	*P>|z|*	**£**	*Coef.*	*P>|z|*	**£**	*Coef.*	*P>|z|*	**£**
Quality Level	0.478	0.000	**5.98***	0.229	0.000	**3.84***	0.305	0.000	**5.24***	0.327	0.000	**3.39***
Large Deer	0.880	0.000	**11.00***	0.323	0.000	**4.14***	0.497	0.000	**8.76***	0.359	0.000	**3.73***
Small Deer	0.861	0.000	**10.76***	0.515	0.000	**6.61***	0.632	0.000	**10.85***	0.803	0.000	**8.33***
Commission Culling	0.003	0.256	**0.04**	0.011	0.000	**0.14***	0.007	0.000	**0.13***	0.010	0.000	**0.10***
Licenced Hunter Culling	-0.008	0.026	**-0.10***	0.000	0.837	**-0.01**	-0.004	0.049	**-0.07***	0.001	0.635	**0.01**
Meat Sales	0.802	0.000	**10.03***	1.356	0.000	**17.42***	1.464	0.000	**25.15***	0.981	0.000	**10.18***
Cost	-0.080*	0.000		-0.078*	0.000		-0.058*	0.000		-0.096*	0.000	
Model Fit (χ^2)	328.30	0.000		543.11	0.000		729.48	0.000		681.14	0.000	
Pseudo R^2	0.1435			0.1093			0.1276			0.1108		

**** Significant Coefficient (p<0.05)***

Table 5: Comparison of Results by Age Group (Model 2) **Comparison of Results by Income Group (Model 3)**

Across all samples, the 'quality' characteristic remains positive and significant, showing that participants prefer a management policy which, *ceteris paribus*, raises woodland quality. Reviewing Tables 5 and 6, these quality valuations increase significantly for both the youngest participants (χ^2 = 127.68, $p(z)$ = 0.000) and low income respondents (χ^2 = 62.21, $p(z)$ = 0.000). A range of possible explanations exist for these findings. For one, those on low incomes are more greatly restricted by

[4] For example, if 'Commission Culling' holds a value of 0.12, this suggests respondents would be willing to pay £0.12 to see one percentage point of fencing replaced with culling of this type. In the cases where deer numbers rise, they would pay £0.12 to see one percentage of fencing retracted instead of reducing Commission culling by that proportion.

the set of activities they can engage in. They may therefore place extra emphasis on public forestry being of high quality. We would imagine that younger respondents, on average, could utilise woodlands for a wider variety of physical and aesthetic uses, raising their desire to have quality forest within close proximity to them. From a broader perspective, young people also have longer personal time-span in which to utilise a woodland resource. This may lead them to adopt a less myopic stance regarding sustainable forest management compared with older users.

The coefficients on both deer attributes are positive and significant, with absolute values again elevated among young[5] and low-income[6] respondents. The relative difference between these two size-differentiated variables is important given our conjecture that this may correspond to nature connectivity and a disposition to engage with local wildlife. As previously described, we propose that this would arise because small deer possess greater 'warden-inducing' qualities and habits compared with larger deer. Relative to the full sample, the disparity is most pronounced for older respondents and those who gave to animal welfare charities. It is least prevalent for younger participants and men.

Our culling attributes reveal an interesting story. Econometrically, their coefficients describe the projected probability change for selecting an option whereby a fencing policy is partially replaced by the respective culling alternative. For example, Table 4 suggests that on average our sample would pay £0.12 for a one percentage point swing away from fencing and towards Forestry Commission culling. A fairly consistent pattern forms across both the main sample and many of our analysed sub-groups. This suggests a small yet significant preference for moving from fencing to Commission-based culling, with no statistically significant difference placed upon a similar swing from fencing towards the use of licensed hunters. Exceptions to this rule include those who agreed with badger culling and respondents of the lowest age bracket. The former express a positive and significant preference for either version of culling relative to fencing, whilst the latter place a negative and significant value upon licensed hunting, yet state indifference between fencing and Commission culling. In analyses not given here, we included interactions between deer population thresholds and method of population change to our regression, testing if participants responded to the magnitudes of adjustment over alternatives. Including these attributes added very little explanatory power to our model, and we attribute this to the fact that deer populations were described through levels as opposed to numbers. This creates a hugely burdensome cognitive challenge for a respondent who wishes to consider how many deer might be affected by each method of population change.

Finally, 'Meat' and 'Cost' variables hold intuitive signs. Respondents strongly value the efficiency of selling the meat from culled deer. As discussed later, this relationship is quite complex, and meat valuation is apparently highly sensitive to who the beneficiary from venison revenues is. Our negative cost parameter stays fairly consistent in magnitude across sub-samples.

Decision Making for Deer Population Reduction

This paper used choice experiments in order to provide evidence that would either support or refute the conjectures contained within Rational Choice Theory, behavioural economics and

[5] Large Deer: χ^2 = 186.45, $p(z)$ = 0.000; Small Deer: χ^2 = 14.54, $p(z)$ = 0.000

[6] Large Deer: χ^2 = 83.15, $p(z)$ = 0.000; Small Deer: χ^2 = 16.22, $p(z)$ = 0.000

philosophy theories such as the Doctrine of Double Effect regarding how people make ethically challenging decisions. If we assume, as with Trolley Problems, that people typically view a needless killing of animals as bad, then DDE would assume people to hold the following preference structure:

Culling by Licenced Hunters ~ Culling by the Forestry Commission < Fencing (1)

To briefly recap, 'Fencing' constitutes an action which does not require deer death as a necessary means to achieve the desired outcome of long-term woodland preservation. Instead, their death through starvation is just a foreseen and regrettable side effect. Thus, this branch of moral philosophy would assume individuals to find this method ethically permissible. This is in contrast to the 'morally wrong' act of culling. Here, the deer's death must be incurred in order to achieve the sustainable woodland. To this end, it is irrelevant whether a Commission worker or hunter conducts the cull as it is the action (of firing the gun) which is unethical.

Let us now introduce the impact of perceived *intention*, which behavioural economics has regularly demonstrated can play a vital determining role in the way people make decisions. For our purposes, it may then be possible to segregate the culling methods and issue an adjusted preference profile:

Culling by Licenced Hunters < Culling by the Forestry Commission < Fencing (2)

Participants would now be able to state a clear preference for a Commission employee to conduct a cull over a licensed hunter. Because 'hired' by society to maintain and preserve public forestry, the former's intention for pulling the trigger is to enable long-term woodland sustainability. Put another way, they are not assumed to derive any private pleasure from the culling action itself, but undertake this procedure as a means to achieve their target of providing well-managed forests. Conversely, because licenced hunters pay for a permit to hunt deer for pleasure, they cannot be assumed to cull for these same 'good intentions'. Briefly considering our other school of thought, Rational Choice Theory, we acknowledge that all methods would be viewed equivalently so long as the environmental outcomes are the same.

In light of these theoretical assertions, we now apply our empirical findings to this preference-construction methodology. Upon doing so, we see our rankings structure in (3) fails to fully adhere to any of the aforementioned hierarchies:

Culling by Licenced Hunters ~ Fencing < Culling by the Forestry Commission (3)

This ranking structure represents both our full sample and the majority of our 'extracted' sub-samples. Constructed through the culling variables of Table 4, it suggests that Commission culling is preferable to fencing, yet no difference exists between a policy of fencing and licensed hunting.

An initial response might claim that people do not always adhere to the ethical conjectures proposed by moral philosophers or economists. Another conclusion could be that human perspectives to animal harm do not correspond to those for mankind, bringing into question our permissibility to transfer our moral projections more widely.

However, before we dispel the findings here, it may be worth considering that there are in fact other factors which, when combined with these procedural or intentions-based aspects are able to explain our preference structures. A major difference between the procedural theories we assess here and our study is that the former often claim an identical form of death occurs from each eventuality. Use the example of the Trolley Problem: whoever dies does so through the collision with a truck and this *type* of death is the same regardless of which choice the individual makes. This may allow respondents to more easily construct preferences over these situations because they are devoid of any empathetic or emotive differences that may arise from the *way* in which death occurs.

It is in this respect that our study potentially produces a complication, and the starvation of deer through a policy of fencing may be emotively received very differently to that of shooting, as occurs when deer are culled. Whilst one might argue to the contrary, starvation suggests a suffering that is more drawn out and thus less appealing when compared to the almost instantaneous death when deer are shot. This is particularly true given the tutorial's insistence that both sets of hunter would be sufficiently trained, lessening concerns that a deer could be shot inaccurately then preventing immediate death. Equally, in order to impose DDE onto the study in question, the instructions also insisted that deer would die through starvation as a result of widespread fencing, increasing the salience of this factor from what might otherwise been an unconsidered aspect the minds of our respondents.

Table 7 adds this extra factor, *method of death,* to those which seek to test our two theories in attempting to uncover the most salient determining factors in describing how an individual constructs moral preferences. This table also signals how these factors translate to the preference hierarchies above. If one soley considered DDE when making ethical decisions, they would only concentrate upon Table 7's second column, leading them to profile (1). By introducing intentions, a combination of columns 2 and 3 must be considered and this forms preference hierarchy (2). Finally, by incorporating the death heterogeneity within our choice experiment, one's moral stance would require them to extend their consideration to all of the aspects contained in columns 2, 3 and 4.

	Good Action *(As seen by pure DDE)*		Good Intention *(as seen by behavioural economics)*		Good Consequence *(shown by method of deer death)*	
Fencing	Yes	L	Yes	M	No	0
Commission Culling	No	0	Yes	M	Yes	N
Hunter Culling	No	0	No	0	Yes	N

Table 7: A matrix to illustrate how perceptions appear over deer reduction methods

Introducing this third element means no obvious preference ranking can be extracted and a respondent's moral preferences will depend upon the weight they attach to each column. With 'good' aspects being assigned the letters L, M and N in each respective column, we can denote each deer reduction method's relative merits:

Fencing : L & M
Commission Culling : M & N

Licenced hunter Culling: N

We can now explore our preference structure using this notation. Let us take this type of reasoning to the valuation profile given by (3) as an example:

Culling by Licenced Hunters ~ Fencing < Culling by the Forestry Commission (3)

The preference for Commission culling over licensed hunting implies M > 0. Thus, the role of intentions is important in determining choice, and a woodland manager's more genuine mandate for culling makes it more morally just for them to shoot deer. As assumed in other studies, intentions must be considered 'in conjunction with other factors' (Greene et al, 2009 p.369) and a second thing we can decipher is that N > L. This is because Commission culling is stated as preferable to fencing and M (the importance of intention) is common to both methods. This infers that, in aggregate, our sample attach a greater weight to *how* deer are killed, and find starvation distasteful, than whether a method adheres to the ethical permissibility advocated by DDE reasoning.

This style of analysis can be insightful for a number of reasons. It illustrates very clearly why context-specific details matter for ethically contentious topics. People often have emotively-charged reasons which dissuade them from selecting certain policies and whilst this study has found evidence to support intentions-based reasoning, less obvious factors such as method of death can also determine choice. This echoes the scepticism which surrounds 'pure economic' theories which believe that the rational agent should not look beyond the basic outcomes which accrue from any given option. Thus, great caution must exist regarding the ability to transfer ethical reasoning from one case to another, or in the delegation of such decision-making to an expert analyst (Liao et al, 2012).

Specific to this research topic, these findings give additional evidence of how our relationships with wildlife may hold weight in determining human utility. Valuation profile (3) suggests that people care about how an animals' death occurs and the type of suffering the creature may endure. This alludes again to the role which 'nature connectivity' might perform and its potency for influencing optimal collective choice policies.

Overall, these results seem to adhere to many *a priori* intuitions held within the relevant literature. The primary aim of this paper seeks to discover if, and to what extent, the preferences people form for deer reduction programmes align the schools of Rational Choice Theory, behavioural economics and/or the Doctrine of Double Effect. Secondary objectives explore the underpinnings of these values within the contexts of Subjective Well-Being and economic optimisation. The coefficients upon both the deer species and meat sales attributes appear to confirm that the latter relationships, even if intricate, do occur. A more thorough exploration of the data is now required in order to fully address the remainder of the study's aims. This will look to explain where and why our departures from the existing literatures appear, with one credible reason relating to the role of warden mentality and nature connectivity. The following section also delves deeper in to our secondary motivations, and will assess what drives our preferences for environmental engagement and economic efficiency.

SECTION 5: FURTHER DISCUSSION

Behavioural and Attitudinal Data

Regarding our behavioural data, 39% and 42.5% of those questioned had donated to an environmental or animal welfare charity within the last 12 months respectively. No restrictions were imposed upon an interpretation of 'donating', meaning that this could be understood as direct payment, environmental membership or engagement in conservation work. In contemplation of this broad definition, these ratios appear fairly reasonable. 63.5% said that they did regularly feed birds, and this level is not exceptionally disparate from factual statistics for rates of bird-feeding and related activities in the UK (Saggese et al, 2011; Fuller et al, 2008),. It is encouraging that this level corresponds well to that of our previous study, which surveyed a similar demographic (Brock, Perino & Sugden, 2014). Regarding woodland management attitudes, Table 6 summarises the sample's perceptions on the acceptance of various animal population control policies.

	Fencing to Control Deer (%)	Culling to Control Deer (%)	Culling to Control Badgers (%)
Yes *(Agreed it was legitimate)*	62	76.5	26
No *(Disagreed it was legitimate)*	25.5	12	41
Don't Know *(was unsure or not sufficiently informed)*	12.5	11.5	33

Table 6: Overview of Animal Population Control Question

We exercise caution when assessing these distributions. This is because the question had been posed after the choice exercise, where we had explicitly informed respondents that fencing woodlands caused deer starvation. Nevertheless, it is interesting to see that nearly two thirds agree with a principle of fencing and over three quarters do so regarding deer culling. Such rates could reflect an above-average level of environmental understanding from our sample, especially given their self-selected participation in a woodland management survey. Yet, this may instead reveal a wider realisation that deer populations must be reduced in order to sustainably safeguard forestry.

This conjecture could also explain the difference between the "don't know" responses for deer and badger questions. The latter, being more contentious and less scientifically-proven, may mean a higher proportion of respondents felt a disinclination to state a definite viewpoint. Conversely, the greater familiarity our sample may have with deer and woodland processes may endow them with an increased confidence to issue an opinion in both cases. On a broader note, these notions exemplify the importance of policymakers and environmental managers to issue credible, factual information regarding animal population control if they are to receive a strong and unified backing to their proposal.

Regarding frequency and type of use, 54% of respondents accessed forestry at least once per month, with only seven participants never visiting woodlands. The most popular use was walking (75%), with lower rates for nature watching (42%) and cycling or sport (26%). Stated "Other" uses included general recreation, spending time with family and photography. The

frequency distributions differ significantly between the two sites (z = 21.497, $p(z)$ = 0.000), with respondents at the Thetford site accessing forests on a much more regular (weekly or even daily) basis. Data collected on forest usage potentially provide a direct linkage to aspects of nature connectivity, with certain users holding particular preferences regarding both deer populations and associated reduction methods. Take the example of cyclists. For these users, high populations of large deer are concerning as this increases the risk of personal injury through collision, yet this group would voice concerns over the widespread use of fencing given that it provides a physical barrier to their own recreational usage.

Deer Valuation and Nature Connectivity

Aside from its influence in shaping our moral preferences over deer death, the role of 'nature connectivity' is cautiously assumed as the valuation disparities between Large and Small deer, with the latter enjoying more favourable appearances and habits to instil a 'warden-style' satisfaction.

When firstly considering absolute deer species valuations, it is perhaps unsurprising that these are greatest for groups such as vegetarians and animal welfare charity donors. In contrast, men and those who agreed with badger culling express some of the lowest absolute values for deer.

By extending our analyses by combining absolute and relative values, we speculatively review the possible role of nature connectivity. Let us exemplify this by contrasting the deer valuations of animal welfare donors against those who feed birds regularly. It seems reasonable to assume that members of each group on average hold a stronger connection to nature. Appendix E reinforces this view by confirming that both sub-samples hold an elevated worth for small deer over larger ones. However, whilst absolute deer values expressed by 'bird-feeders' adhere quite closely to those of the full sample, the values elicited from animal charity donors rise by 22% and 42% for large and small deer respectively. Such increments are even more pronounced for vegetarians. One possible way to interpret this would consider the 'environmental mind-set' of each group. Whilst attaching a 'warden-style' worth for deer, those who feed birds may acknowledge the potentially detrimental impact that artificially high deer numbers can have for long-term woodland biodiversity. If this is so, the average member of this sub-group would then prioritise wider environmental processes when forming their valuation. This would be reflected in a more pragmatic stance to culling (Scholtz, 2005) and an alignment of absolute deer values with those of the full sample. By contrast, the average vegetarian or donor to animal charities could be assumed to prioritise the welfare of an individual beast over that for a collective ecosystem, creating the warden-style inflationary values upon the deer attributes.

Such reasoning could be extended to other sub-group valuations, potentially resonating with slightly deflated deer values from arguably more informed woodland users, including those who visit more frequently, or live in closer proximity to forestry.

Age is the final parameter which we explore regarding the deer valuation and nature connectivity relationship. The disparities between our two sized deer attributes appear to diminish as the age of a respondent falls, and our youngest band of participants (aged between 18 and 25) do

not seem to differentiate between the two. To confirm this, we introduce an interaction term between age and each deer variable. With full regression results contained within Appendix F, the impact of adding these interactions, named "largeage" and "smallage", is given in Table 8:

	Model 1	Model 4	
	Absolute Value	*Absolute Value*	*Average change as Age Group rises by 1*
Large Deer	£4.25	£7.54	-£0.83
Small Deer	£9.02	£6.41	+£0.65

Table 8: The impact of age in determining deer values

Both interaction terms hold strong statistical significance, and our results suggest that as somebody ages, they will reduce their value for large deer whilst simultaneously placing a greater worth upon smaller ones.

This finding implies that 'nature connectivity' is highly driven by age, with the oldest members of society gleaning most value from local engagement with nature. This assertion corresponds to those made within the existing literature who suggest that older people can derive particular utility by engaging in activities like keeping pets (Johnson, 2011), bird-watching (Brock, Perino & Sugden, 2014) or gardening (Rappe, 2005). Assessing this through the rationale of SWB, these members of society are on average endowed with fewer channels from which to obtain warden-style interconnectivity. One removed avenue is that their children grow up and are no longer dependent upon their parents. Many older people also do not work and thus have no employment-related responsibilities. Finally, those in the higher age brackets may suffer from a decrease in their mobility. This limits the range of actions they can undertake to otherwise engage and interact with the wider community.

An alternative yet equally relevant theory is that older people have the greatest amount of leisure time in which to engage with their local environment, and subsequently appreciate the wildlife which resides close to them more fully. This combination of factors builds a strong case to suggest the importance of local wildlife as a tool for improving the wellbeing of otherwise isolated and vulnerable groups in society and surely testing the scope and robustness of this conjecture in future research could prove highly informative to a range of agents.

Meat sales and the Role of Economic Efficiency

Our penultimate discussion area investigates the perspectives of participants to the sale of culled deer meat. The 'Meat' variable is consistently positive and statistically significant, suggesting that whilst deer reduction methods may be contentious, people possess a desire to see a productive utilisation of any resulting carcasses. Verbal statements supported this, with many respondents expressing their dislike for options which failed to sell meat. Further analyses show that this value is accentuated among the oldest respondents, perhaps aligned to this group's dislike for food wastage given their historical experiences of rationing. An equally quirky finding is a slight deflation in meat values for respondents whose identifier tallied to an (inefficient) non-use of their voucher!

Considering that our sample appear to care about intention, we tested whether any attitudinal differences existed when the Commission sold venison as opposed to when the beneficiary was a licenced hunter. A persuasion towards hunter profiteering could relate to the idea

that this forms a second, more ethically legitimate, reason for them to cull deer and we label this the 'alternative justification' theory. On the other hand, people could hold a heightened distaste from licenced-based meat sales if they feel the hunter profits from an ill-intended activity. We call this the 'worse if he prospers' idea. To examine this, we include an interaction term between the licenced cull method and meat sales into our model. Full regressions again appear in Appendix F, with the salient elements listed below:

	Model 1	Model 5	
	Absolute Value	*Absolute Value*	*Average change if meat is sold by licenced hunters (relative to Commission sales)*
Value for 1% rise in Commission Culling *(at the expense of fencing)*	£0.12*	£0.09*	
Value for 1% rise in Licenced Hunter Culling *(at the expense of fencing)*	£0.01	£0.12*	-£0.21*
Meat	£13.21*	£16.50*	

** Significant Coefficient (p<0.05)*

Table 9: The Impact of Who Sells the Meat

By including this interaction, we witness licensed culling adjust from being judged indifferently against a policy of fencing to being strongly preferred. Commission culling retains its significance and each now stands at roughly equitable levels. However, the negative sign on the interaction term signals that when meat is sold by licenced hunters, people support this action less than if the Commission oversee the culling and sell the resulting venison.

Two different stories could explain this result. Our respondents might express a desire for Commission-directed sales through the (tutorial-reinforced) belief that the revenues reduce the cost of woodland management. Equally, it is plausible that people dismiss the 'alternative justification' theory and instead adhere to the 'worse if he prospers' notion. They do not disapprove of licenced hunting *per se* and, given that hunters pay for permits, reluctantly accept that some humans gain pleasure from killing animals for leisure. This tolerance may rise further if respondents feel that permit sales reduce Commission costs, whilst employing those to cull 'in-house' is a large overhead for a woodland management operative. However, once hunters prosper financially from this bad action via the sale of the venison, society's acceptance quickly erodes. This trade-off between cost efficiency and morality is another of the study's conjectures that would be great to explore further.

Income Effects and Public Forests as Inferior Goods

The final aspect judged here is how our sample's woodland values adjust with income. This information is contained in Table 6 and suggests that, on average, the worth people ascribe to forestry falls as they become wealthier.

Whilst this appears surprising at first, considering pubic forestry as an inferior good seems highly plausible. It is a free and fairly local amenity which can be openly accessed. Therefore those on low incomes, who are relatively restricted in their range of substitutable activities, should prove the most intense users of this resource. At the other extreme, wealthy people have a much broader spectrum of alternative activities in which they may choose to partake in. This could involve national or international travel, attending sporting and entertainment events or visiting more 'prestigious' tourist attractions. Their affluence also raises their scope to gain a utility from engaging with the

natural world via other sources, including national parks, international wild-scape, entry to zoos and safari parks or even owning a personal woodland estate!

If public woodlands are indeed inferior goods, this could majorly influence how they are funded. Many public amenities rely upon contributions from wealthy benefactors to finance their upkeep, and this has been a lifeline for many art galleries, charities and museums. If rich and influential members of society place a relatively low value upon public forestry, the ability to either raise additional revenues or defend the scale of existing ones could be severely jeopardised. This study provides only a first insight here, and complementary studies would be needed to reinforce this idea. However, it is vital that this type of question is addressed if financial securities are to exist for the maintenance of or improvement to our local natural environment.

SECTION 6: CONCLUSION

Whilst behavioural economists have comprehensively illustrated that choice theories based purely on outcomes fail to replicate empirical decision making, scepticism also exists around the ability of these or traditional philosophical theory to meet these needs when a topic involves moral or 'sacred' values. We use discrete choice experiments to test the impacts of procedure, intention and justification upon the preferences people hold over the ethically sensitive subject of deer culling.

Overall, the results of this study have confirmed many *a priori* beliefs held within what exists of the affiliated literature. At the same time, they have introduced some fresh ideas and injected some new thoughts into this area. The preferences of our sample regarding the 'just' method of deer population control fails to fully adhere to those predictions given by any one traditional theory. This reinforces the stance that morals are neither rigid nor universally transferable (Machery et al, 2004; Greene et al, 2009; Iliev et al 2009) and that the ethics surrounding harm are instead built on a 'complex set of rules, concepts and principles' (Gold et al, 2013 p.215). Rational choice theorists, behavioural economists and moral philosophers do concentrate upon consequences, intentions and actions to varying degrees, yet this work suggests a more subtle blend of these characteristics is required if empirical choices are to be most accurately replicated. We echo the recommendations of other studies in ethically sensitive areas, suggesting a need to apply mixed methodology approaches given the futility of using outcomes-based, materialist or attitudinal analyses in isolation (Azjen, 1991; Falk et al, 2003). Furthermore, researchers should consider the *type of harm* incurred by a victim from a given policy. For the wildlife of this study, these preferences may be highly influenced by our degree of 'nature connectivity' and the obligation we feel as a warden to protect and minimise the suffering of creatures in our local area.

Nature connectivity and our desire to act as a protector may also explain why lower values are held for large, remote or robust species against those which are smaller or more 'locally engaging'. These disparities are seemingly correlated to one's age, with older respondents possessing valuation structures more akin to that of a local environmental guardian. Other studies make similar conclusions when analysing our attitude to culling, stating that humans could be 'likened to trustees responsible for protecting … resources' (Scholtz, 2005 p.24). Nature connectivity might prove problematic if a woodland manager trustee finds opposition to culling from the public,

who likewise perceive themselves as 'trustees'. This group prioritise the welfare of individual creatures at the expense of the detrimental impacts deer cause for long-term sustainability. The study also analyses the roles of income and efficiency, seeking to identify how and to what extent woodland habitats can be managed in a socially and economically efficient way.

"Social Scientists need a number of tools in their behavioral toolbox to appeal to a variety of motivations" (Delmas & Lessem, 2014 p.366) and this work suggests the benefits which can accrue by combining economic and philosophic thought to morally-sensitive subjects. Through inter-disciplinary collaboration, it tries to synergise the strengths of each field in order to answer complex questions. This work provides only preliminary conjectures regarding how humans approach environmentally sensitive issues and how these correspond to our economic and ethical stance. Similar future research would be valuable, not only to corroborate or dismiss the claims made here, but to more widely question the moral transferability of environmental topics. If verified, our results suggest that the existence of emotional and ethical attachments to nature and the environment must be acknowledged and incorporated into the associated academic field. If a more sound grasp can be gauged in such areas, collective decision-making will become more efficient, productive and welfare maximising, creating wider social and economic benefit.

Acknowledgements

We would like to thank both Suffolk County Council and the Centre for Behavioural and Experimental Social Science (CBESS) based at the University of East Anglia. Without these two centres we would not have been able to produce this survey and its findings possible.

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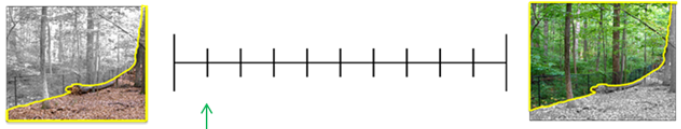
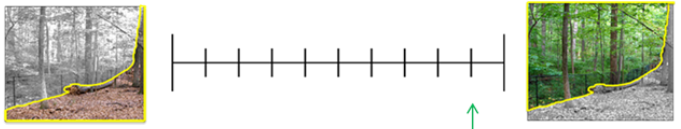
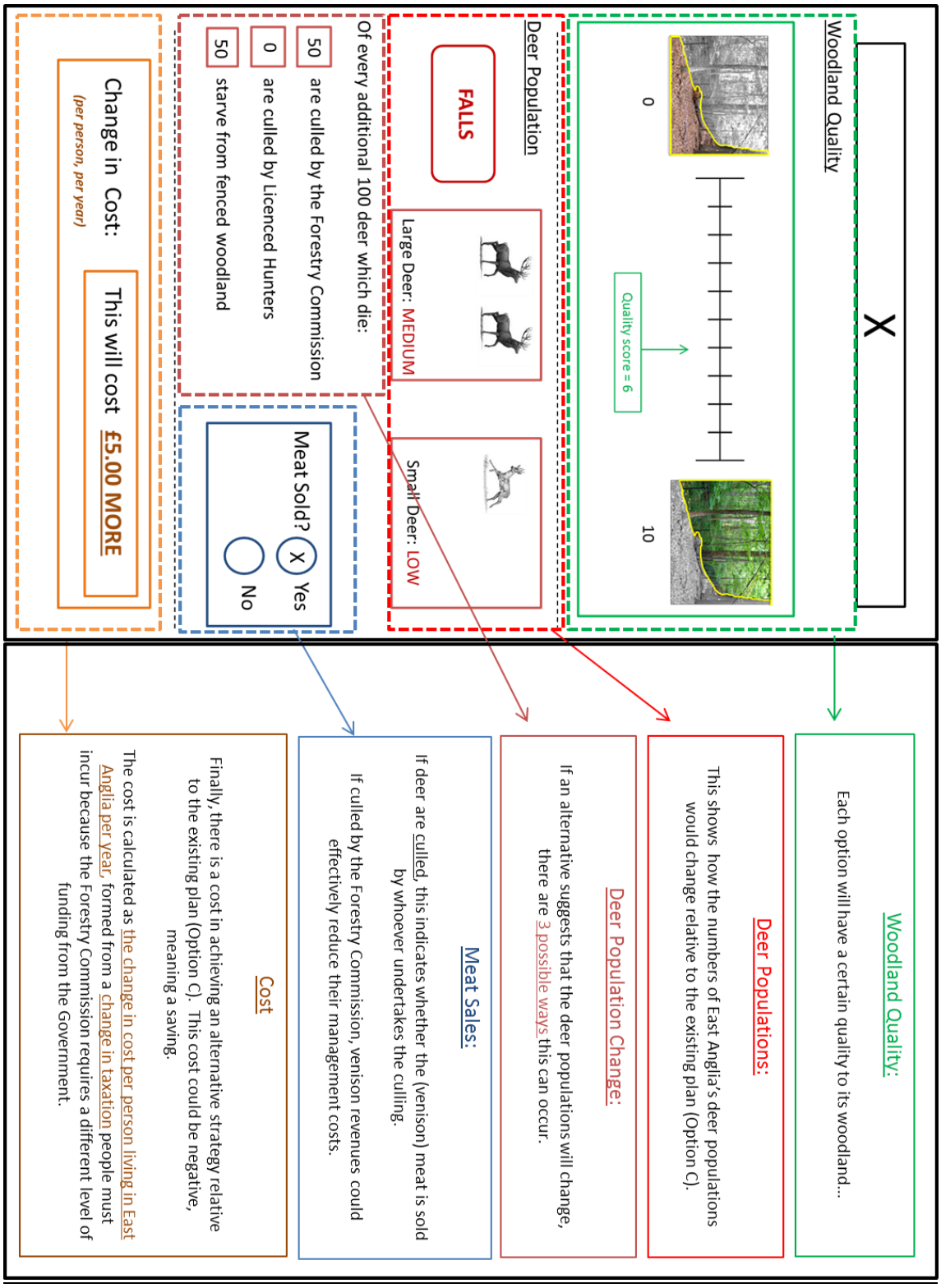
APPENDIX A: AN EXAMPLE CHOICE SET

A	B
Woodland Quality	Woodland Quality
	
Deer Population	Deer Population
RISES	FALLS
 Large Deer: HIGH	 Large Deer: LOW
 Small Deer: HIGH	 Small Deer: MEDIUM
Of every 100 deer which no longer die:	Of every additional 100 deer which die:
100 are not culled by the Forestry Commission	0 are culled by the Forestry Commission
0 are not culled by Licenced Hunters	100 are culled by Licenced Hunters
0 do not starve from fenced woodland	0 starve from fenced woodland
Meat Sold? ( ) Yes (X) No	Meat Sold? (X) Yes ( ) No
Change in Cost: *(per person, per year)* — This will cost **£5.00 LESS**	Change in Cost: *(per person, per year)* — 0

Choice xx

Please indicate your preferences on Page 1 of the Answer Sheet by placing a **1** in the box of your top choice and a **2** in that of your second choice

APPENDIX B: ABBREVIATED TUTORIAL INSTRUCTIONS



APPENDIX C: THE RESPONDENT QUESTIONNAIRE

Survey Number: ☐

Respondent Survey

1. On average, how often do you visit East Anglia's Forests?

- ☐ At least once per month
- ☐ Once every 2 -3 months
- ☐ Once or twice per year
- ☐ Less than once per year
- ☐ Never (Please move to Question **3**)

2. When visiting these forests, what is normally the reason for your visit? (Tick all that apply)

- ☐ Walking or Dog Walking
- ☐ Nature- Watching
- ☐ Cycling / Sport
- ☐ Other (please specify)

☐

3. Please indicate your view regarding the following:

	I agree with this action		
Erecting Fences to prevent deer from accessing woodlands in East Anglia in order to protect forestry	YES	NO	Don't know
Culling deer in woodlands in East Anglia in order to protect forestry	YES	NO	Don't know
Culling badgers in the UK under the assumption that this will prevent the spread of TB in livestock.	YES	NO	Don't know

4. In the last 12 months, have you donated to or done voluntary work for either of the following:

(a) An Animal Welfare Charity ☐ Yes ☐ No

(b) Another Environmental Organisation ☐ Yes ☐ No

5. Do you regularly feed birds in your garden?

☐ Yes ☐ No

6. Please indicate the extent to which you agree with the following statements:

(1 = Strongly Disagree; 2 = Disagree; 3 = Neither Agree or Disagree; 4 = Agree; 5 = Strongly Agree)

a)	Effective Forest Management is Important	○ 1	○ 2	○ 3	○ 4	○ 5
b)	If deer populations must be reduced, culling is a better way than starvation.	○ 1	○ 2	○ 3	○ 4	○ 5
c)	Educating children about nature and the environment is important	○ 1	○ 2	○ 3	○ 4	○ 5

---

7. Gender: ☐ Male ☐ Female

8. Age: ☐ 18-25yrs ☐ 26-35yrs ☐ 36- 45yrs ☐ 46- 55yrs ☐ 56 - 65yrs ☐ 65yrs +

9. What is your approximate annual *(monthly)* post-tax household income?

☐ Below £20,000 *(Below £1,667)*
☐ £20,000- £29,999 *(£1,668 - £2,499)*
☐ £30,000 - £39,999 *(£2,500 - £3,333)*
☐ £40,000 - £49,999 *(£3,334 - £4,166)*
☐ £50,000 - £59,999 *(£4,167 - £4,999)*
☐ £60,000 - £69,999 *(£5,000- £5,833)*
☐ £70,000 - £79,999 *(£5,834 - £6,666)*
☐ £80,000 - £89,999 *(£6,667 - £7,499)*
☐ Above £90,000 *(Above £7,500)*
☐ Prefer not to disclose

10. In the last 12 months, have you participated in either of the following activities?

(a) Game Hunting or Shooting ☐ Yes ☐ No

(b) Fishing ☐ Yes ☐ No

11. Are you Vegetarian or Vegan?

☐ Yes ☐ No

This is the end of the survey! Thanks again for your participation; both your responses and time have been invaluable and essential to the research.

APPENDIX D: AGGREGATED RESPONSE DISTRIBUTIONS

1. Visit Frequency	%
At least Once per Month	54
Every 2-3 months	12.5
2-3 times per year	23
Less than Once per year	7
Never	3.5

2. Type of Use	%
Walk	75
Nature-Watching	42
Cycle	26
Other	21

3(a). Attitude to Fencing	%
Yes	62
No	25.5
Don't Know	12.5

4(a). Give to Animal Welfare Charity	%
Yes	42.5
No	57.5

3(b). Attitude to Deer Culling	%
Yes	76.5
No	12
Don't Know	11.5

4(b). Give to Environmental Organisation	%
Yes	39
No	61

3(c). Attitude to Badger Culling	%
Yes	26
No	41
Don't Know	33

5. Feeds Birds?	%
Yes	63.5
No	36.5

6(a). Mean Score on Effective forest Management	4.53

6(b). Mean Score on Culling better than Starvation	4.34

6(c). Mean Score on Educating Children	4.74

7. Gender	%
Male	45
Female	55

8. Age	%
18-25	11.5
26-35	12.5
36-45	13
46-55	17.5
56-65	22
65+	23.5

9. Income	%
Less the £20,000	27
£20,000 – 29,999	18.5
£30,000 – 39,999	10.5
£40,000 – 49,999	11.5
£50,000 – 59,999	5
£60,000 – 69,999	4.5
£70,000 – 79,999	2.5
£80,000 – 89,999	3
Above £90,000	2.5
Prefer not to Disclose	15

10(a). Partake in Hunting	%
Yes	4
No	96

10(b). Partake in Fishing	%
Yes	7
No	93

11. Vegetarian or Vegan	%
Yes	13.5
No	86.5

Location	%
Norfolk	50
Suffolk	50

Survey Day	%
Weekday	50
Weekend	50

Voucher Used	%
Yes	74.5
No	25.5

APPENDIX E: VALUATIONS MATRIX

	Valuations in £0.00						
	QUALITY	LARGE	SMALL	MEAT	FC CULL	TH CULL	N
MAIN SAMPLE	**3.88**	**4.25**	**9.02**	**13.21**	**0.12**	**0.00**	**200**
1. VEGETARIANS	4.99	10.19	17.20	19.32	0.16	-0.06	27
2. WELFARE CHARITY	4.70	5.19	12.89	14.90	0.16	-0.01	85
3. BIRDFEEDERS	4.38	**4.26**	9.96	15.15	0.16	0.01	127
4. MEN	3.46	3.73	6.59	11.98	**0.10**	0.02	90
5. NON-VOUCHER USER	4.09	6.53	9.66	10.83	0.10	0.04	51
6. FREQ USER	3.70	**4.25**	8.69	16.74	0.14	0.00	108
7. PRO-BADGER CULLERS	2.76	1.57	4.90	12.15	**0.12**	0.06	52
8. CYCLISTS	3.51	3.49	7.27	14.87	**0.11**	-0.01	52
9. SUFFOLK	3.29	3.95	7.10	13.66	**0.12**	0.01	100
10. YOUNGEST	5.98	11.00	10.76	10.03	0.04	-0.10	23
11. AGE = 65+	**3.84**	**4.14**	6.61	17.42	0.14	-0.01	47
12. WEEKENDERS	4.12	4.86	10.50	12.69	0.09	-0.02	100
13. INCOME LOW (< £20K)	5.24	8.53	10.85	25.15	**0.13**	-0.07	54
14. INCOME MED (£20-40K)	3.72	**4.25**	8.51	9.88	**0.11**	0.04	58
15. INCOME HIGH (> £40K)	3.39	3.73	8.33	10.18	**0.10**	0.01	58

Insignificant	*Weakly Significant*	*No statistical difference from main sample*

APPENDIX F: INTERACTION REGRESSIONS

Age Interaction (Model 4)

```
. clogit choice1 quality large small fclevel thlevel meat  smallage largeage cos
> t, group(set)
note: multiple positive outcomes within groups encountered.

Iteration 0:   log likelihood = -9633.4961
Iteration 1:   log likelihood = -9557.0471
Iteration 2:   log likelihood = -9556.8102
Iteration 3:   log likelihood = -9556.8102

Conditional (fixed-effects) logistic regression   Number of obs   =      16000
                                                  LR chi2(9)      =    2305.65
                                                  Prob > chi2     =     0.0000
Log likelihood = -9556.8102                       Pseudo R2       =     0.1076
```

choice1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
quality	.3201952	.0140856	22.73	0.000	.2925879	.3478025
large	.6212441	.0769063	8.08	0.000	.4705105	.7719776
small	.5283679	.0642902	8.22	0.000	.4023615	.6543744
fclevel	.009716	.001061	9.16	0.000	.0076365	.0117955
thlevel	.0006992	.0010685	0.65	0.513	-.0013951	.0027935
meat	1.087223	.044512	24.43	0.000	.999981	1.174465
smallage	.0539088	.0132587	4.07	0.000	.0279222	.0798954
largeage	-.0681937	.0163221	-4.18	0.000	-.1001845	-.0362029
cost	-.082368	.0054417	-15.14	0.000	-.0930336	-.0717023

Meat Interaction (Model 5)

```
. clogit choice1 quality large small fclevel thlevel meat   thmeat cost, group(s
> et)
note: multiple positive outcomes within groups encountered.

Iteration 0:   log likelihood = -9597.0798
Iteration 1:   log likelihood = -9526.2657
Iteration 2:   log likelihood = -9526.0202
Iteration 3:   log likelihood = -9526.0202

Conditional (fixed-effects) logistic regression   Number of obs   =      16000
                                                  LR chi2(8)      =    2367.23
                                                  Prob > chi2     =     0.0000
Log likelihood = -9526.0202                       Pseudo R2       =     0.1105
```

choice1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
quality	.3433026	.0146141	23.49	0.000	.3146596	.3719457
large	.2800033	.0414334	6.76	0.000	.1987952	.3612113
small	.8326203	.038665	21.53	0.000	.7568383	.9084022
fclevel	.0081375	.0010856	7.50	0.000	.0060098	.0102653
thlevel	.0111266	.0015504	7.18	0.000	.0080878	.0141654
meat	1.499199	.0647407	23.16	0.000	1.372309	1.626088
thmeat	-.0186615	.0020914	-8.92	0.000	-.0227606	-.0145625
cost	-.0908779	.0055585	-16.35	0.000	-.1017723	-.0799835