Modelling Recreation Demand using Choice Experiments:
Climbing in Scotland (*)

Nick Hanley (**)
Economics Department
University of Glasgow

Robert E. Wright
Department of Economics
University of Stirling

Gary Koop
Department of Economics
University of Glasgow

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Abstract

This paper is concerned with the use of the choice experiment method for modelling the demand for recreation, using the example of rock-climbing in Scotland. We begin by outlining the method itself, including its theoretical and econometric underpinnings. Data collection procedures are then outlined. We present results from both nested and non-nested models, and report some tests for the implications of choice complexity and rationality. Finally, we compare our results with a revealed preference data model based on the same sample of climbers.

Keywords: choice experiments, environmental valuation, recreation demand, rock climbing, complexity, rationality, convergent validity.

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(**) Please address all correspondence to Professor Nick Hanley, Economics Dept., University of Glasgow, Glasgow G12 8RT, email n.d.hanley@socsci.gla.ac.uk.

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1. Introduction

This paper is concerned with investigating the potential of the choice experiment technique for modelling the demand for recreation. More specifically, the data that we examine is based on a survey of mountaineers and climbers in Scotland, with the recreational activity in question being technical climbing. The paper has four aims. The first is to estimate the preferences of climbers for alternative sites as a function of site characteristics and climber characteristics. The second is to derive implicit prices for these attributes. The third is to investigate whether results are sensitive to the complexity of the choice task. The fourth is to incorporate tests of the underlying rationality of respondents' behaviour. We also compare our stated preference models with a revealed preference data model based on the same sample; and offer some general comments on the usefulness of choice experiments for recreation demand modelling.

The remainder of this paper is organised as follows. Section 2 sets out the basic choice experiment approach. Section 3 is a brief description of climbing in Scotland. Section 4 discusses the design of the survey used to collect our data, along with several tests incorporated into the design. Section 5 presents results. Discussion and conclusions follow in Section 6.

2. Choice Experiments

The Choice Experiment (CE) approach was initially developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983), and is one option in a family of empirical stated preference approaches known as choice modelling (for a review, see Hanley and Mourato, 1999). Respondents are asked to choose between alternative goods, defined in terms of their attributes. CE share a common theoretical framework with other environmental valuation approaches in the random utility model (Thurstone, 1927; McFadden, 1973). According to this framework, the indirect utility function for each respondent *i* (U_i) can be decomposed into two parts: a deterministic element (*V*), which is typically specified as a linear index of the attributes (*X*) of the *j* different alternatives in the choice set, and a stochastic element (*e*), which represents unobservable influences on individual choice:

$$U_{ij} = V_{ij}(X_{ij}) + e_{ij} = bX_{ij} + e_{ij} \quad (1)$$

The probability that any particular respondent prefers option "*g*" in the choice set to any alternative option "*h*", can be expressed as the probability that the utility associated with option "*g*" exceeds that associated with all other options:

$$P[(U_{ig} > U_{ih}) \forall h \neq g] = P[(V_{ig} - V_{ih}) > (e_{ih} - e_{ig})] \quad (2)$$

In order to derive an explicit expression for this probability, it is necessary to know the distribution of the error terms (e_{ij}). A typical assumption is that they are independently and identically distributed with an extreme-value (Weibull) distribution:

$$P(e_{ij} \leq t) = F(t) = \exp(-\exp(-t)) \quad (3)$$

The above distribution of the error term implies that the probability of any particular alternative g being chosen as the most preferred can be expressed in terms of the logistic distribution (McFadden, 1973) stated in equation (4). This specification is known as the conditional logit model:

$$P(U_{ig} > U_{ih}, \forall h \neq g) = \frac{\exp(mV_{ig})}{\sum_{j} \exp(mV_{ij})} \tag{4}$$

where m is a scale parameter, inversely proportional to the standard deviation of the error distribution. This parameter cannot be separately identified and is therefore typically assumed to be one.

This model can be estimated by conventional maximum likelihood procedures, with the respective log-likelihood functions stated in equation (5) below, where y_{ij} is an indicator variable which takes a value of one if respondent j chose option i and zero otherwise:

$$\log L = \sum_{i=1}^{N} \sum_{j=1}^{J} y_{ij} \log[\frac{\exp(V_{ij})}{\sum_{j=1}^{J} \exp(V_{ij})}] \tag{5}$$

Once the parameter estimates have been obtained, a willingness-to-pay (WTP) compensating variation welfare measure that conforms to demand theory can be derived using the formula given by (6) (Parsons and Kealy, 1992) where V^0 represents the utility of the initial state and V^1 represents the utility of the alternative state. The coefficient b_y gives the marginal utility of income and is the coefficient of the cost attribute:

$$WTP = b_y^{-1} \ln \left\{ \frac{\sum_i \exp(V^1{}_i)}{\sum_i \exp(V^0{}_i)} \right\} \quad (6)$$

It is straightforward to show, for the linear utility index specified in (1), that the value of a marginal change in any of the attributes can be expressed as the ratio of coefficients given in equation (7) where b_C is the coefficient on any of the attributes. These ratios are often known as implicit prices:

$$WTP = \frac{-b_C}{b_y} \quad (7)$$

An important implication of this specification is that selections from the choice set must obey the "independence from irrelevant alternatives" (IIA) property (or Luce's Choice Axiom; see Luce, 1959). This property which states that the relative probabilities of two options being selected are unaffected by the introduction or removal of other alternatives. This property follows from the independence of the Weibull error terms across the different options contained in the choice set. If a violation of the IIA hypothesis is observed, then more complex statistical models are necessary that relax some of the assumptions used. These include the multinomial probit (Hausman and Wise, 1978), the nested logit (Wiseman and Koppleman, 1993), the random parameters logit model (Train, 1998) and the heterogeneous extreme value logit (Bhat, 1995; Allenby and Ginter, 1995). We test for violations of the IIA assumption below using a test developed by Hausman and McFadden (1984).

CE have now been fairly widely applied in the environmental economics literature (for a survey, see Hanley, Wright and Adamowicz, 1998). Previous applications to recreation include: Adamowicz, Louviere and Williams (1994) on water-based recreation in Alberta; Boxall et al (1996) and Adamowicz et al (1998) on moose hunting in Alberta; Bullock, Elston and Chambers (1998) on deer hunting in Scotland; and Hanley et al (1998) on visits to environmentally sensitive areas in Scotland.

3. Climbing in Scotland

Mountaineering and climbing are increasingly popular sports in Scotland. Figures from Highlands and Islands Enterprise[1] suggest that 767,000 mountaineers from the UK visited the Highlands and Islands for hillwalking, technical climbing, ski mountaineering or high level cross-country ski-ing in 1996 (HIE, 1996). Spending by mountaineers is an important source of income for many areas of the Highlands. Climbing participation is harder to estimate. In the HIE survey, mountaineers classified the main purpose of their trips to the area as hillwalking (77.2%); rock-climbing (10.8%); ski-mountaineering (5.5%) and ski-touring (6.5%). Using a mean of 14 trips per annum implies a total participation of between 82,836-153,400 total climbers, and 1,159,704 - 2,147,600 climbing days in Scotland per year.

Climbs are usually classified according to two-tier grading systems in Britain, which between them describe both the overall difficulty and exposure of a route, and the degree of difficulty in making the hardest move on the climb (the crux). Climbers' appreciation of routes though extends beyond this technical grading, to include

[1] Based on UK general population sample of 3,539 adults and a sample of 550 readers of *High Mountain Sports* magazine.

aspects such as length of climb, scenic quality, and degree of crowding on a route. One may thus think of individual climbs as different bundles of a given set of attributes, although it may be hard for the researcher to completely describe a particular climb using this set. Climbers make choices from the set of all climbs in Scotland in deciding on where to go on a particular trip: a natural way to model this choice problem is thus to make use of random utility theory (although for an alternative view, see Loewenstein, 1999).

Several previous papers have applied recreational demand models to rock-climbing. Shaw and Jakus (1996) estimate demand models based on a survey of members of the Mohonk Preserve in New York State in 1993. A site choice model based on choices between four sites (Mohonk, Ragged Mountain, the Adirondacks and the White Mountains) was estimated, using two site attributes: (i) travel costs (from respondent's home); and (ii) the number of routes within each area which the respondent was technically able to climb. This was estimated jointly with a double-hurdle count model which controlled for the participation decision (whether to go climbing at all), in addition to the decision as to how many trips to make to Mohonk, given a decision to climb. Estimates from these models were then used to produce consumer surplus figures for changes in climbing opportunities at Mohonk. Cavlovic et al (2000) report results from a national repeated nested random utility model of climbers in the USA, which estimates the welfare losses associated with closing access to certain sites on Forest Service lands. Principal attributes governing site choice were the number of rock climbing areas in a region and climate. Results showed that proposed changes had welfare losses in excess of $100million per annum. In a similar context, Cavlovic and Berrens (1999) carried out a climbing participation study of 1,084 members of the general public. They found that gender, education and membership in environmental organizations were all significantly related to participation in 1998, although income was not. Finally, in a somewhat different vein, Jakus and Shaw (1996) analyzed the response of climbers to hazard warnings relating to the degree of protection on routes. They found that more skillful climbers were more likely to undertake hazardous climbs than less-skillful climbers, but that they "mitigate the likelihood of a hazardous outcome by reducing the technical difficulty of the hazardous route chosen" (page 581). Their empirical results add to the support for an underlying economic rationale behind climber decision-making. This paper adds to this literature in that it is the first application of choice experiments to modelling the demand for rock-climbing.

4. Study Design

The initial steps in this study were to identify the choice alternatives and their relevant attributes. To accomplish this, focus groups were conducted with climbers from university mountaineering clubs in Edinburgh and Stirling. Eight principle Scottish climbing areas were identified (Figure One). These are: (1) Northern Highlands; (2) Creag Meagaidh; (3) Ben Nevis (including Glen Nevis); (4) Glen Coe (including Glen Etive); (5) Isle of Arran; (6) Arrochar; (7) The Cuillins of Skye; and (8) The Cairngorms. The six attributes of climbs that were established by the focus groups as been central to the choice decision are (along with the levels of each of these attributes that we used) are:[2]

[2] All categorical variables were effect coded.

Length of the climb. The hypothesis is that (ceteris paribus) longer climbs are preferred to shorter climbs. The attribute has four levels: (1) “50 meters”; (2) “100” metres; (3) “200 metres”; and (4) “300 metres”.

Approach time. This attribute refers to the amount of time required to walk to the base of the climb from place where a car may be parked. The hypothesis is that (ceteris paribus) shorter approaches are preferred to longer approaches. The reason being that given a fixed allocation of time, a shorter approach time leaves more time for climbing. There are four levels; (1) "3 hours"; (2) "2 hours"; (3) "1 hour"; and (4) "30 minutes".

Crowding on the climb. This refers to whether on not other climbers are present on the chosen climb. Crowded climbs are more dangerous and crowding usually results in slower climbing times as queues develop. The hypothesis is that (ceteris paribus) less crowded climbs are preferred to more crowded climbs. This attribute has two levels: (1) "crowded"; and (2) "not crowded".

Overall “quality” of the climb. It is common for most guidebooks to employ a "star rating system" which provides information on the overall quality of the climb. This attribute has four levels: (1) "no stars"; (2) "1 star"; (3) "2 stars"; and (4) "3 stars". The hypothesis is that (ceteris paribus) climbs with more stars are preferred.

Scenic quality. This refers to the area where the climb is located, and is meant to capture the relative beauty of the landscape that surrounds the climb. This attribute has four levels: (1) "not at all scenic"; (2) "not scenic"; (3) "scenic"; and (4) "very scenic". The hypothesis is that (ceteris paribus) more scenic climbs are preferred to less scenic climbs.

Distance as a proxy for cost. This refers to the distance that the road head of the climb is away from one’s home and is used to indirectly estimate the cost or price of the climbing activity. This attribute has six levels: (1) "30 miles" (2) "70 miles" (3) "110 miles" (4) "160 miles" (5) "200 miles"; and (6) "250 miles". After the questionnaires were administered, this mileage distance measure was converted into a travel cost or price (Cost), measure by application of the following simple formula*:* *Cost = 2 x Distance in miles * 10 pence per mile,* using an estimate of the marginal cost of motoring. The hypothesis is that (ceteris paribus) "cheaper" climbs are preferred to more "expensive" climbs.

The sampling frame was provided by the Mountaineering Council of Scotland through a list of climbing club members in Scotland. A random sample of these addresses was selected, and questionnaires mailed to these individuals, who were asked to complete and return the questionnaire. A donation of £2 was promised to the John Muir Trust (a charity which exists to conserve wilderness areas in Scotland) for every questionnaire returned as an incentive. Questionnaires were also administered at climbing walls in Edinburgh, Glasgow and Falkirk. A sample of 267 useable responses from climbers in total was acquired.

Various versions of the questionnaire were used. Climbers were asked questions relating to their total trips in the last twelve months to each of the eight areas; to score each area in terms of the seven attributes used; to complete a number of choice experiments, ranging from four to eight choice pairs; to provide information on their climbing abilities and experience; and finally, to provide standard socio-economic information.

An example choice set is given in Table 1. As may be seen, respondents are asked to choose between two routes described in terms of their attributes, including price; or choose to consume neither (e.g. “stay at home”). Choice sets were produced using a fractional factorial design, and climbers were instructed to assume that all routes described in the choice experiment were within their technical ability.

As mentioned above, climbers were presented with either four or eight choices. This split was used in order to test whether the complexity of the choice task (as measured by the number of choice sets the respondent had to complete) has an effect on measures of preferences. Evidence in the literature on the impact of choice complexity is somewhat mixed (see, for example, Swait and Adamowicz, 1996).

We also included two simple tests of the rationality behind respondents' answers. The first was to include for a sub-set of respondents a choice pair where one alternative strictly dominates the other. This was achieved by making these alternatives identical except for price (that is, travel cost). Respondents would be expected to reject the more expensive option. The second was to include, for a different subset of individuals, identical choice pairs as their first and fourth choice occasion. The answer which respondents gave in the first instance was expected to be the same as the answer they gave when the pair was repeated.

5. Results

5. 1 Multi-nomial Logit Model

Columns 1 and 2 in Table 2 are the parameter estimates for the multinomial logit model (MNL). Column 1 is for a model that does not include any individual-specific covariates. Column 2 is for the model that includes four covariates: the respondent's income; whether the respondent is married; and whether the respondent has children; and the respondent's age. The parameter estimates associated with these covariates are not shown since they are of no direct substantive importance. Both specifications include alternative-specific constant terms [i.e. *a(Option A)* and *a(Option B)* in Table 1].

The first point to note is that the parameter estimates associated with each of the attributes are very similar across the two specifications suggesting that the model is robust to the inclusion of individual-specific covariates. In both models all the site-choice attributes are statistically significant at conventional threshold levels, with the only exception being for the "two-stars" climb quality attribute. In addition all the attributes have the expected signs and their changes in magnitude are consistent with the hypotheses discussed above. More specifically, climbers are shown to prefer longer climbs with shorter approach times, climbs which are not crowded, and climbs in more scenic areas. The star rating of climbs in the guidebooks is also important, with "three-star" climbs attracting the highest probability of visit. The cost variable has a negative sign which is in agreement with the hypothesis that "cheaper" climbs are preferred to "more expensive" climbs after other characteristics of climbs are held constant.

Implicit prices associated with the MNL model that includes covariates are shown in Column 1 of Table 3. Theses prices were calculated for each of the attributes by applying Equation (7) and may be interpreted as willingness-to-pay amounts. An extra metre of length adds £0.11 to the value of a climb. A one-hour reduction in approach time adds £11.61. Big increases in value are also found for moving from crowded to not crowded climbs, with the latter adding £18.22 in value. Scenic quality also matters. Climber are willing-to-pay more for climbs that are located in areas with better scenic quality. "Very scenic" climbs add £25.05 in value.

The quality of climb as described by the star rating system is also important. "Three stars" climbs are highly valued, adding $30.81 to the value of a climb. Finally, these implicit price values can be compared with the consumers' surplus of an "average" climb, which may be calculated as the inverse of the travel cost coefficient, which gives a sensible value of about £30 per day.

5. 2 Nested-logit Model

As noted in Section 2, one critical assumption of the MNL model is the Independence of Irrelevant Alternatives. We tested for the validity of this assumption using a test developed by Hausman and McFadden (1984). The test is a chi-square test of the form:

$$c^2 = (\boldsymbol{b}_s - \boldsymbol{b}_f)'[\boldsymbol{V}_s - \boldsymbol{V}_f]^{-1} (\boldsymbol{b}_s - \boldsymbol{b}_f)$$

where $\boldsymbol{b}_s$ is a vector of parameter estimates from a model with a restricted *"s"* number of choices (i.e. two in our application) and $\boldsymbol{b}_f$ is a vector of parameter estimates from the model with the full *"f"* number of choices (i.e. three in our application). $\boldsymbol{V}_s$ and $\boldsymbol{V}_f$ are the estimates of the covariance matrices from the restricted and full models respectively. Degrees of freedom for this test are the number of attributes "*K*". We applied this test and found that IIA assumption is firmly rejected. For example, a χ^2 value of 83.25 was found for a MNL model (without covariates) which drops the stay at home alternative from the choice set.

One possible solution to violation of IIA is to recast the model as a nested structure. We adopted such an approach by considering two levels of choice. The first level is: Option 1--"Stay at home" or Option 2--"Route A or B". Conditional on

Option 2 being chosen, in the second level there are two further options: Option 1--"Route A" or Option 2--"Route B". With this structure, there are only two choice alternatives at each level and the notion of "irrelevant alternatives" is no longer relevant. The structure of this nested model is summarised in Figure 2.

Columns 3 and 4 in Table 2 are the parameter estimates for the nested logit model (NL). Column 3 is for a model that does not include any individual-specific covariates while Column 4 is for the model that includes four individual-specific covariates discussed above. *g(Yes)* is a constant term for the first level of choice. A comparison of the four columns in Table 2 reveals that the parameter estimates (including the cost attribute) from the NL model are larger in absolute magnitude than the parameter estimates from the MNL model.

The MNL and NL models are more similar that the simple comparison of parameter estimates might suggest. This similarity becomes apparent when the implicit prices suggested by the two models are compared. The implicit prices for the NL model (with covariates) are shown in Column 2 of Table 3. When standard errors are taken into account, these implicit prices are not much different between two models. More importantly, the same substantive conclusions are reached with respect to the relative importance of the attributes. Despite the fact that the Hausman and McFadden test clearly rejects the IIA assumption, violation of this assumption does not appear to have much impact on the estimated implicit prices which for practical and policy purposes are of central interest. It however worth noting that consumers' surplus for an "average" based on the NL model is slightly lower than that based on the MNL model, about £28 per day.

5. 3 Testing for the Effects of Choice Complexity

Does the complexity of the choice task matter? Our a priori hypothesis is that the complexity of the choice task, as measured by the number of choice sets to be completed, may impact on measures of preference. This could either be do to respondents learning how better to complete tasks as the number of tasks increase; or that respondents become fatigued and pay less attention to accurately completing tasks as the number of choice sets increases. If preference measures are sensitive to the number of choice tasks, then this means that welfare estimates can turn on experimental design (a well-known problem with contingent valuation). In order to explore this issue separate NL models where estimated for respondents who were asked to complete four choice sets and these models were compared to NL models estimated separately for respondents who were asked to complete eight choices sets. A likelihood ratio test was carried out to test the hypothesis that the parameters between these four choice and eight choice models were not statistically [i.e H_0: β(4 choices) - β(8 choices) = 0]. This hypothesis was rejected, implying (somewhat worryingly) that the complexity of the choice task, as measured by the number of choice problems, does have a significant impact on the measurement of preferences

5. 4 Testing for Rationality

Finally,we note the outcomes of the two informal tests for response rationality in responses described in the previous section. As will be recalled, these were two-fold. First, in four versions of the questionnaire, strictly-dominated alternatives were included, where in one of the choice pairs route A (B) was identical to route B (A) in every respect except price. Some 42 responses were returned from this distribution of questionnaire versions. Of these 42 responses, there was only one individual who chose the strictly-dominated alternative route B rather than the identical-but-cheaper route A. There were insufficient responses to perform any formal statistical tests of rationality.

Second, in two versions of the questionnaire, identical choices were included. In these cases, the first and fourth choice pair were identical to each other. An individual choosing A on the first occasion would be expected to choose A again on the second occasion. Only 22 responses were returned of this questionnaire version. In only one case out of these 22 did a respondent change their mind when the identical choice pair was repeated.

We note that a problem of testing for rationality in the random utility model in this way is that choices are, to an extent, assumed to be random! This randomness is usually captured in the error term when MNL or NL models are estimated. Given that the small number of responses to our two rationality questions made estimation impossible, we cannot "control" for randomness in the usual way.

5.5 Convergent Validity with Revealed Preference Returns

One test of validity frequently applied to environmental valuation studies is that of convergent validity, whereby estimates of WTP are compared with estimates from some other valuation technique. A convergent validity check was carried out in this study by estimating a comparable model to that shown in Table 2 using revealed preference data from the same survey (for fuller details on revealed preference analysis from this study, see Hanley *et al*, 1999). An advantage of this approach here is that since both the revealed and stated preference approaches used are based on the same random utility theory, and on the same econometric model, their results should be directly comparable with each other.

In our survey, climbers were asked how many visits they had made in the last 12 months to each of the 8 sites. They were then asked to score each of these sites in terms of the same set of attributes contained in the choice experiment[3]. Travel distances were computed for each individual for each site by using postcodes and the AUTOROUTE package, and were then converted into prices using a figure of 10 pence per mile. Travel time was computed using the same procedure, and converted into a money costs using one third of the individual's estimated hourly wage. Time and distance costs were then summed to give travel costs. Site dummies were incorporated into the model, with the excluded site being Cairngorm. As this has the greatest number of visits we expect the site dummy parameters all to be negative.

Table 4 gives some results. As may be seen, all but one of the site attributes (scenic quality) are significant at the 95% level, and all variables have the "correct" sign, as with the choice experiment results. Using the coefficient on travel costs gives an average consumer surplus per day of £25.08, which is somewhat lower than the stated preference estimates. However, the revealed and stated preference models can be seen to be revealing very similar pictures of climbers' preferences over different sites.

6. Conclusions

This paper reports results from a choice experiment study of rock-climbing in Scotland. Climbers' choices over substitute sites are modelled as a function of the attributes of these sites, plus an error term. A broad conclusion is that the CE approach succeeds in this case in adequately representing demand, in that much of the variation in site choice is explained in an intuitively-plausible manner by the logit

[3] For any individual, the attribute score for each site they had visited was the score

models, which themselves represent an underlying process of probabilistic utility maximisation. We should not expect such representations to be exact, due to errors and inaccuracies in peoples' responses to the survey instrument, due to the limitations of the econometric techniques used, and due to Loewenstein's observation that the behaviour of climbers is probably not entirely capture-able within the conventional economic model of utility maximisation anyway. Using the logit model results, implicit prices were then obtained, showing the marginal utility of changes in site attributes. This might be useful information in two contexts. First, where there is a desire to estimate the economic costs or benefits of land-use changes which have an impact on climbing sites (such as an increase in access times or decreases in scenic quality). Second, where management of outdoor recreation areas can be guided by knowledge of the relative economic values of those site attributes which can be affected by management.

In terms of the wider development and use of the CE method in modelling recreation demand, this paper has a number of interesting findings. First, that fact that moving to a nested model from an MNL model (due to the violation of IIA in the latter) produced relatively small changes in welfare measures or model coefficients. Second, that changes in the number of choice tasks which individuals were asked to perform had significant effects on parameter values in our estimated conditional indirect utility functions. Third, some limited (and informal) tests for rationality showed that the great majority of respondents behave rationally in answering choice questions. The impacts of the number of choice tasks on welfare estimates is perhaps the most significant of these findings, and raises the obvious question as to what is the "correct" number of choices to specify in questionnaires. This has parallels with

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they assigned it; for sites they had not visited, we used the sample average score.

findings in contingent valuation of the impacts of different information sets on value, in deciding how much and what type of information to provide (Munro and Hanley, 1999).

In closing we note that our CE results were broadly comparable with Revealed Preference (RP) results from the same study. Whilst this is somewhat reassuring, it does raise the question as to which is the preferred method for modelling recreation demand. This is a question which many have addressed in the past, and which has no obvious answer: CE approaches have advantages in terms of avoiding co-linearity between measured levels of attributes, and in being able to study attribute levels beyond the range of those currently observed. RP approaches, on the other hand, have the advantage of being derived from actual behaviour and thus avoiding hypothetical market effects. Whilst we have not attempted it here, a combined CE-RP approach has been proposed as a promising way forward (Adamowicz, Louviere and Williams, 1994).

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Table 1

Illustrative Choice Experiment Question

Which of the two routes described below would you rather visit? Please tick one of the options shown at the foot of the page:

Characteristics of route	**Route A**	**Route B**
Length of climb in metres	100 metres	200 metres
Approach time [The time it takes you to walk to the base of the climb from where you leave the road].	3 hours	2 hours
Quality of climb [i.e. No. of stars]	2 stars	0 stars
Crowding at route [How many other people there are on the route you are climbing i.e. Crowded / Not crowded].	Crowded	Not crowded
Scenic quality of route [Very scenic / Scenic / Not scenic / Not at all scenic].	Not at all scenic	Not at all scenic
Distance of route from home [The time it takes to travel from home to where you leave the road].	160 miles	110 miles

I WOULD CHOOSE ROUTE A __
I WOULD CHOOSE ROUTE B __
I WOULD CHOOSE NEITHER, AND STAY AT HOME __

Table 2
Parameter Estimates
(Absolute values of t-statistics in parentheses)

	(1)	(2)	(3)	(4)
Estimator:	**MNL**	**MNL**	**NL**	**NL**
Covariates?:	**No**	**Yes**	**No**	**Yes**
Length	*0.00372* *(6.5)*	*0.00379* *(6.5)*	*0.00450* *(6.4)*	*0.00447* *(6.4)*
Approach time	*-0.384* *(6.8)*	*-0.391* *(6.9)*	*-0.454* *(6.8)*	*-0.451* *(6.8)*
Not crowded	*0.602* *(11.3)*	*0.613* *(11.4)*	*0.692* *(10.2)*	*0.691* *(10.1)*
Not scenic	*-0.309* *(3.6)*	*-0.317* *(3.7)*	*-0.331* *(3.3)*	*-0.337* *(3.6)*
Scenic	*0.354* *(3.8)*	*0.357* *(3.8)*	*0.415* *(4.0)*	*0.411* *(4.0)*
Very Scenic	*0.826* *(8.7)*	*0.843* *(8.9)*	*0.990* *(8.3)*	*0.989* *(8.3)*
One star	*-0.162* *(1.9)*	*-0.168* *(1.9)*	*-0.228* *(2.4)*	*-0.226* *(2.4)*
Two stars	*0.127* *(1.3)*	*0.136* *(1.4)*	*0.236* *(1.9)*	*0.231* *(1.9)*
Three stars	*1.019* *(11.6)*	*1.037* *(11.7)*	*1.120* *(11.3)*	*1.125* *(11.4)*
Cost	*-0.0334* *(9.5)*	*-0.0337* *(9.5)*	*-0.0361* *(9.6)*	*-0.0361* *(9.5)*
α(Option A)	*1.679* *(9.4)*	*2.231* *(10.1)*	*2.207* *(7.7)*	*2.816* *(7.8)*
α(Option B)	*1.361* *(7.7)*	*1.839* *(8.4)*	*1.873* *(6.7)*	*2.415* *(6.9)*
γ (Yes)	--	--	*0.725* *(10.1)*	*0.753* *(9.0)*
Pseudo-R^2	*0.30*	*0.31*	*0.39*	*0.39*
χ^2	*724*	*762*	*1,296*	*1,331*
N =	*1,332*		*3,996*	
IIA χ^2 =	*83.25*		-	

Table 3
Implicit Prices
(£s Sterling)

	(1)	**(2)**
Estimator:	**MNL**	**NL**
Covariates?:	**Yes**	**Yes**
Length:	*0.11*	*0.12*
Approach time:	*-11.61*	*-12.49*
Crowding:		
Crowded	*-18.22*	*-19.55*
Not crowded	*18.22*	*19.55*
Scenic quality:		
Not at all scenic	*-26.25*	*-29.41*
Not scenic	*-9.43*	*-9.34*
Scenic	*10.62*	*11.37*
Very scenic	*25.05*	*27.38*
Quality of climb:		
No stars	*-29.85*	*-31.27*
One star	*-5.00*	*-6.27*
Two stars	*4.03*	*6.39*
Three stars	*30.81*	*31.15*

Table 4
Revealed Preference Model Estimates
(Absolute values of t-statistics in parentheses)

Attributes		**Correct sign?**
Length (*)	*0.675* *[2.5]*	*Yes*
Approach time (**)	*-0.287* *[6.0]*	*Yes*
Star quality	*0.086* *[2.9]*	*Yes*
Crowding	*-0.120* *[3.0]*	*Yes*
Scenic quality	*0.057* *[1.7]*	*Yes*
Travel cost (**)	*-3.99* *[17.8]*	*Yes*
Northern Highlands	*-0.008* *[0.1]*	*Yes*
Creag Meaghaidh	*-2.296* *[27.5]*	*Yes*
Ben Nevis	*-0.805* *[15.0]*	*Yes*
Glencoe	*-0.384* *[8.6]*	*Yes*
Arran	*-2.25* *[28.1]*	*Yes*
Arrochar	*-2.070* *[28.5]*	*Yes*
Cullins	*-0.520* *[7.2]*	*Yes*

Notes:

(1) * = values rescaled by 0.001 prior to estimating; ** = values rescaled by 0.01.
(2) Likelihood function value at convergence =10,529.6.
(3) N = 261 people and 5,849 choice occasions.
(4) Excluded site is the "Cairngorms".

List of Figures: