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A day in the city

Using conjoint choice experiments to model urban tourists' choice of activity packages

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This paper introduces and tests a conjoint choice experiment approach to modeling urban tourists' choice of activity packages. The joint logit model is introduced as a tool to model choices between combinations of activities and an experimental design approach is proposed that includes attributes from multiple alternatives as well as interactions between attributes of different alternatives. Tests for possible differences in parameter values for attributes when introduced in different parts of the day are also supported. The proposed approach was implemented and tested in a case study on Dutch urban tourists' choices of activity packages for a weekend in Paris. Shopping and sightseeing were the activities evaluated most positively. A number of significant interactions between choices of activities for different parts of the weekend was observed, with a general preference for variation in activities, and no significant interactions between choices of evening and daytime activities. It was found that respondents in the case study did not evaluate activities differently depending on the period of the weekend in which they were introduced.

Keywords: tourists' choice behavior, joint logit model, activity packages, experimental design

One of the main attractions of the city as a tourist destination is its diversity and complexity, its large array of possibilities in terms of cultural activities, shopping facilities, historic signs etc.[1,2] Most studies on urban tourism behavior to date have, however, mainly addressed tourists' perceptions and usage of specific and separate urban tourism attractions and relatively little attention has been paid to tourists' behavior towards complexes of attractions.[3,4] Consequently, little research has been done on how urban tourists evaluate combinations of activities they can undertake in the urban environment, and how they choose between them. Also, little is known as to how tourists' preferences for different activities will change for different periods of the day and when combined with different alternative activities.

In marketing and managing urban tourist destinations the answers to these questions may, however, have important managerial consequences. Marketing and planning strategies that focus on tourists' evaluations of separate activities, when, in reality, combinations of activities are determining the tourist choice, may lead to erroneous decisions on which market and urban development strategies to follow.[5,6] It has often been observed, for example, that unless extremely high investments are made, stand-alone urban attractions are seldom enough to draw in substantial numbers of new visitors to urban areas and/or to increase the number of repeat visits.[7] Therefore, clustering of urban attractions can potentially open up new avenues for planning and marketing strategies that are more successful in attracting urban tourism.

To support the evaluation of planning and marketing strategies of packages of urban attractions we will in this paper address the issue of how to model urban tourists' choices of activity patterns in the city. We will introduce a conjoint choice experiment approach that allows one to estimate parameters in choice situations where respondents choose between packages of different activities. The obtained parameter estimates can be used in *ex ante* evaluations of the expected impact of planning and marketing strategies in urban tourism.

The reason that we choose to apply a conjoint choice experiment approach is that over the past 10 years it has successfully been applied in a growing number of studies in tourism and recreation research as a technique to describe and predict tourist choice behavior.[8] Examples of applications of conjoint choice experiments in the field of recreation and tourism are Lieber and Fesenmaier's study of tourists' choice of hiking trails,[9] Haider and Ewing's study of tourists' choices of hypothetical Caribbean destinations[10] and Louviere and Timmermans's work on recreational destination choice.[11]

Except for some earlier work by the authors,[12] in which tourists' combined choices of transportation and destination were studied, none of the conjoint choice applications in recreation and tourism has to the best of our knowledge to date addressed the issue of modeling combinations of choices that tourists make. In this paper we therefore propose to extend our previous work on models in choice situations in which only two alternatives were involved, to a conjoint choice experiment that supports estimation of models including multiple alternatives. In doing this we will also draw from a study in transportation research by Timmermans and van der Waerden[13] who introduced a conjoint choice model to describe consumers' sequential choice of two shopping centers: one for convenience goods and one for specialty goods. The approach we propose in this paper allows for estimation of main effects for multiple different activities and of interaction effects between choices on different activities within tourists' activity packages. Interaction effects may occur, for example, when tourists seek variation between their activities or select 'themed' packages. It also supports estimates of different utilities for alternatives when introduced at different positions within activity packages. This allows one to determine tourists' favorite time periods for different activities.

The article is organized as follows. In the next section, we will first discuss the theoretical concepts and assumptions underlying conjoint choice experiments in general and of the proposed approach specifically. Then, an application of the approach in urban tourism will be discussed, using the results from a case study on Dutch tourists' choices of activity patterns for a weekend in Paris. The article closes with a discussion of our findings and conclusions.

Theory

Conjoint choice models are based on the assumption that consumer choices can be modelled as a process in which attributes of the alternatives relevant to a given choice are evaluated in terms of the utility that they represent to the consumer. The part-worth utilities associated with each of the attributes are then assumed to be cognitively integrated into overall utilities of the alternatives, after which the alternative with the highest overall utility is selected. Various evaluation functions can be used to describe the consumer evaluation process, but generally the utility function consists of two basic parts: (i) a deterministic component that describes the structural utility that the consumer derives from the alternative and (ii) a stochastic component that describes the error over the structural utility. This error can be due to various sources such as measurement errors, omitted explanatory variables and variations in taste.[14]

Mathematically, conjoint choice models are generally based on the assumption that the choice probabilities related to the utility function can be described with the so-called simple multinomial logit (MNL) model. In the simple MNL model it is assumed that the stochastic elements in the utilities of the various alternatives follow independently and identically distributed (IID) Gumbel distributions. The simple MNL model supports estimation of parameters that allow one to express the choice probability of a given alternative as a function of the attributes of that alternative and those of the other alternatives in the choice set. In formula the model can be expressed as:

$$U_j = V_j + \varepsilon_j$$
$$= \mu\beta' X_j + \varepsilon_j$$

$$P(j) = P(U_j \geq U_{j'};\ \forall\, j' \varepsilon\, J;\ j' \neq j)$$

$$= \frac{\exp(V_j)}{\sum_{j' \varepsilon\, J} \exp(V_{j'})}$$

where: U_j is the utility of alternative j, V_j is the structural utility of alternative j, μ is the scale factor of the utilities, β is the vector of parameter values of the attributes, X_j is the vector of attributes of alternative j, ε_j is the disturbance, J is the total number of alternatives j, and $P(j)$ the probability that alternative j is chosen. The parameter values in the model indicate the relative influence of the various attributes on the probability that an alternative will be selected. A general overview of the theoretical background of the model can be found in, for example, the book by Ben-Akiva and Lerman that discusses choice modeling in transportation research.[15]

Parameter estimates in conjoint choice analysis are based on observations of choices that consumers make in hypothetical choice situations. These hypothetical choice situations are created by the researcher on the basis of statistical experimental designs, in which the levels of the attributes in the choice alternatives are systematically varied. Depending on the exact specification of the applied design, this procedure will support statistically efficient estimation of some or all main effect parameters and their interactions. The prerequisite for efficient estimation is that the columns in the design that describe the effects are orthogonal.

The alternatives generated in the statistical design are placed in different choice sets either according to a second experimental design that indicates the presence or absence of each alternative in the different choice sets or, alternatively, by applying constant choice set designs in which only the attribute levels of the alternatives are varied, but not the number of alternatives present within the choice set. Often, a base alternative is added to each choice set (eg the option to choose none of the presented alternatives) and the other alternatives' utilities are estimated in relation to this base.

The modeling approach and experimental design we propose to model combinations of choices is based on assumptions similar to those in the simple MNL model. It is assumed that choices between packages of several alternatives can be treated similarly to choices between single alternatives. This implies that we describe the overall utility of the package as the sum of utilities of all the alternatives present in the package and introduce one overall error term that describes the disturbance on the overall utility. As in the simple MNL model, it is assumed that this error term is IID Gumbel distributed. This approach is also known as the joint logit model. In formula it is expressed as:

$$U_{\{j1,\dots,jN\}} = \sum_{n \in N} V_{jn} + \varepsilon_{\{j1,\dots,jN\}}$$

$$= \sum_{n \in N} \mu\beta j X_{jn} + \varepsilon_{\{j1,\dots,jN\}}$$

$$P(\{j1, \dots, jN\}) = P(U_{\{j1,\dots,jN\}} \geq U_{\{j'1,\dots,j'N\}};$$

$$\forall\, n \in N;\ \forall\, j'n \in J_n;\ j'n \neq jn)$$

$$= \frac{\exp(\sum_{n \in N} V_{jn})}{\sum_{j'1 \in J_1} \sum_{j'2 \in J_2} \dots \sum_{j'N \in J_N} \exp(\sum_{n \in N} V_{j'n})}$$

where: $U_{\{j1,\dots,jN\}}$ is the utility of the combined set of alternatives $\{j1, \dots, jN\}$, N is the total number of choices in the combined choice, V_{jn} is the structural utility of alternative j in choice n, μ is the scale factor of the overall utilities, β is the vector of parameter values of the attributes and interactions between attributes across all choices, X_{jn} is vector of attributes of alternative j in choice n, $\varepsilon_{\{j1,\dots,jN\}}$ is the error term, which is assumed to be IID Gumbel, J_n is the total number of alternatives j in choice n, and $P(j1, \dots, jN)$ is the probability that the combined set of alternatives $\{j1, \dots, jN\}$ is chosen.

Given the assumption of IID error terms in combinations of choices, the same statistical techniques can be used to develop experimental designs for combined alternatives as those that are applied in single-choice experiments. The only difference is that attribute levels of all alternatives of the combined choice process are varied in the design instead of the attributes of only one alternative. Estimation of interaction effects between attributes of different alternatives can be supported by selecting designs in which the product of the columns of the respective attributes is orthogonal with the main effect columns in the design and those of other interactions. If the parameter estimates for interaction effects between attributes of different alternatives are significant, it can be concluded that choices on these alternatives are not independent.

The estimation procedures applied to estimate the influence of the main effects and their interactions are essentially the same in the joint logit model and in the simple MNL model. Generally, maximum likelihood procedures are applied in which the overall log-likelihood of the models is minimized to determine the optimal parameter values in the logit probability function.

Log-likelihood ratio tests can be applied to test for the possible differences in parameter values of identical attributes that are part of different alternatives.[16] These tests compare the log-likelihood of models that can be nested in terms of their model structure, ie where one model can be regarded as an extension of the other. In this context models with different parameter values on identical attributes occurring in different alternatives are compared with models with identical parameters for those attributes. The difference of the log-likelihoods is expressed as $2[\mathcal{L}^*(\beta_1) - \mathcal{L}^*(\beta_2)]$, where $\mathcal{L}^*(\beta_1)$ and $\mathcal{L}^*(\beta_2)$ are the adjusted log-likelihoods of the models under comparison. This statistic is asymptotically chi-square distributed. If the observed difference in value is significantly different from zero, it is concluded that the attribute under comparison is significantly different when evaluated in different alternatives.

Urban tourists' choice of activity packages

The proposed modeling approach was implemented in a case study on Dutch urban tourists' choices of activity packages for a weekend in Paris. Paris represents the most popular urban tourism destination for Dutch tourists, and many travel organizations offer several types of trips to Paris, including various optional activity packages from which tourists can choose.

Table 1 Utility values of the attribute levels and their significance

Attributes	Levels	Utility over intercept	Standard error	*t*-statistic
Intercept		1.52720	0.31864	4.793
Saturday morning	1 shopping	0.95542	0.34967	2.732
	2 take a bus tour	0.52042	0.35427	1.469
	3 sightseeing	–	–	–
Saturday afternoon	1 shopping	0.90504	0.33304	2.718
	2 non-guided walk	0.51074	0.37596	1.359
	3 sightseeing	–	–	–
Saturday evening	1 visit a show	0.09241	0.32656	0.283
	2 a bus tour by night	−0.49884	0.34145	−1.461
	3 a drink in a café	–	–	–
Sunday morning	1 visit a museum	0.36280	0.35012	1.036
	2 non-guided walk	0.83095	0.38600	2.153
	3 sightseeing	–	–	–

Note: McFadden's ρ-square without interactions: 0.4672.

Method

Data for this study were collected in May 1994 in the Eindhoven region, The Netherlands. A random sample of 60 streets was drawn from the map of the region and in each street a convenience sample of 10 households was selected that would agree to participate in the survey. Questionnaires were delivered and later collected at the household address. Households were also given the possibility to send the questionnaire back by mail. Thus, 510 completed questionnaires were collected. For the analysis presented in this paper only data from respondents who indicated that they had visited Paris in the past three years were used. This group represents 221 respondents of the total response, or 43%.

Alternatives were presented to the respondents in an experimental choice task which described a weekend in Paris in four time periods: *Saturday morning, afternoon* and *evening, and Sunday morning*. These are the most common time periods present in weekend trips to Paris from The Netherlands. For each time period a three-level attribute described possible activities. Activities used to describe the hypothetical activity packages were selected on the basis of results of previous research on urban tourism, where they were found to be the activities that were most frequently undertaken by urban tourists.[1,3] Attribute levels were varied in part over different time periods, to make choice alternatives more realistic and to support estimation of parameter values for a larger number of different activities. The levels used to describe the Saturday morning activity were: shopping, take a bus tour and sightseeing; for Saturday afternoon they were: shopping, a non-guided walk in the city and sightseeing; for Saturday evening: visit a show, take a bus tour by night and have a drink in a café; and for Sunday morning: visit a museum, a non-guided walk in the city and sightseeing. A base alternative was added to all choice sets. It was described as a non-guided walk in the city on Saturday morning, a visit to a museum on Saturday afternoon, stay in the hotel on Saturday evening, and take a bus tour on Sunday morning. *Table 1* describes the estimates for the main effects based on the survey and provides an overview of the attribute levels.

A 3^4 fractional factorial design in 81 profiles was used to construct the profiles in the experimental choice task. The design supported estimation of main effects and all two-way interactions between main effects. Choice sets were created by random combining alternatives from two identical 3^4 designs, with the restriction that the alternatives of each choice set should have different descriptions for all attributes. The base alternative was added to each choice set. Attribute levels were coded in dummy coding.

The choice tasks were presented to the respondents as part of a larger questionnaire. Each respondent was presented with 6- or 5-choice sets drawn from a randomization of all choice sets in the design, so that 15 respondents were required to observations for one full design. Respondents were asked to choose from each choice set the activity package that they found most attractive. An example of a choice set is presented in *Figure 1*. In the analysis observations were aggregated across all respondents.

Results

Table 1 gives the estimates for the utility value of the main effects of the first and second level of each attribute estimated relative to the intercept. The intercept represents the utility of the combination of the third levels of all attributes. The significance of the estimates is also indicated. Estimates for interaction effects and their significance are presented in *Table 2*, which describes the additional utility attached to combinations of attribute levels on top of their main effects. The overall fit of the model both with and without interactions was satisfactory, with McFadden's ρ-square values of 0.5454 and 0.4672 respectively.

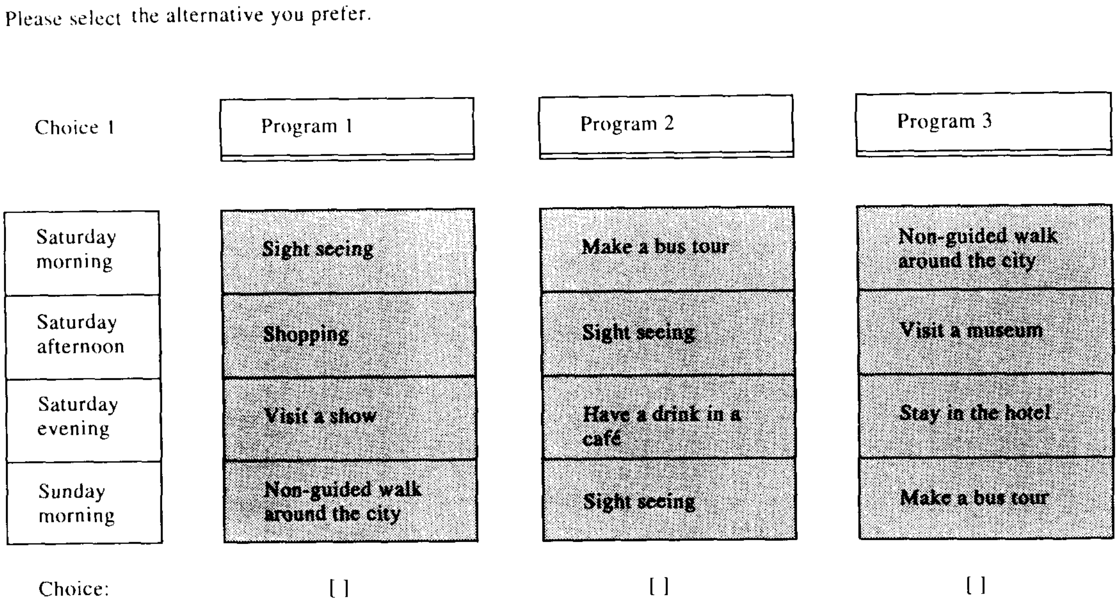

Figure 1 Example of a choice task as presented to respondents

The parameter estimates in *Table 1* show that the combination of sightseeing in different periods of the day and having a drink in a café at night, as expressed in the intercept, was highly evaluated as compared with the base alternative. Shopping was evaluated highly positively, and taking a bus tour or a non-guided walking tour were also positively evaluated, but less strongly so. Visiting a museum was evaluated somewhat less positively and its observed parameter was not significantly different from that for sightseeing. Of the activities on the Saturday evening, visiting a show had a parameter very close to zero, so that it was evaluated nearly identically to having a drink in a café. Taking a

Table 2 Utility values and significance for interaction effects

Interaction effects	Utility over intercept	Standard error	*t*-statistic
Sat.morn.shop * Sat.aft.shop	−2.19908	0.35007	−6.282
Sat.morn.shop * Sat.aft.walk	−1.27562	0.34343	−3.714
Sat.morn.shop * Sat.eve.show	0.39081	0.33299	1.174
Sat.morn.shop * Sat.eve.tour	0.45489	0.35739	1.273
Sat.morn.shop * Sun.morn.museum	−1.02010	0.38141	−2.675
Sat.morn.shop * Sun.morn.walk	−0.87580	0.33518	−2.613
Sat.morn.tour * Sat.aft.shop	−0.63581	0.33363	−1.906
Sat.morn.tour * Sat.aft.walk	−0.81755	0.40655	−2.011
Sat.morn.tour * Sat.eve.show	0.50117	0.34167	1.467
Sat.morn.tour * Sat.eve.tour	0.21225	0.31598	0.672
Sat.morn.tour * Sun.morn.museum	−0.89438	0.37420	−2.390
Sat.morn.tour * Sun.morn.walk	−1.42174	0.38719	−3.672
Sat.aft.shop * Sat.eve.show	−0.21843	0.33825	−0.646
Sat.aft.shop * Sat.eve.tour	−0.01884	0.32991	−0.057
Sat.aft.shop * Sun.morn.museum	−0.14842	0.40831	−0.363
Sat.aft.shop * Sun.morn.walk	−0.75597	0.37102	−2.038
Sat.aft.walk * Sat.eve.show	0.20316	0.34034	0.597
Sat.aft.walk * Sat.eve.tour	0.13854	0.34582	0.401
Sat.aft.walk * Sun.morn.museum	0.29294	0.36909	0.794
Sat.aft.walk * Sun.morn.walk	−0.62911	0.37569	−1.675
Sat.eve.show * Sun.morn.museum	−0.51885	0.34403	−1.508
Sat.eve.show * Sun.morn.walk	−0.17918	0.35833	−0.500
Sat.eve.tour * Sun.morn.museum	0.27828	0.33988	0.819
Sat.eve.tour * Sun.morn.walk	0.48198	0.32976	1.480

Note: McFadden's ρ-square including interactions: 0.5454.

Table 3 Test of differences in parameter values for identical attributes in different periods

Model	Log-likelihood	Chi-square value of difference	
Different parameter values for all periods of the weekend	−241.46	–	–
Identical parameter values for shopping on Saturday morning and afternoon	−241.47	0.02	–
Identical parameter values for shopping and non-guided tour on Saturday afternoon and Sunday morning	−241.71	0.48	0.46

Note: The critical chi-square value for one degree of freedom at the 0.95 level is 3.84.

night-time bus tour was evaluated negatively, but neither of the parameters for the Saturday evening was significant.

It can be seen in *Table 2* that approximately one-third of the parameters estimated for interaction effects between the attributes of activities was significant. As expected, combinations of identical activities for different parts of the weekend were evaluated negatively. Shopping on both Saturday morning and afternoon was evaluated negatively, as was taking a non-guided walk around town on both Saturday afternoon and Sunday morning. An exception was the combination of taking a bus tour by day and again by night, which were apparently seen as essentially different activities. It can be observed that all interactions between activities in the evening and daytime activities were not significant. This indicates that choices of evening activities were in general not interacting with choices of daytime activities. Some significant interactions occurred between activities that would perhaps seem to have a less clear relationship. The combination of shopping and taking a non-guided tour around town, for example, had a significant, negative parameter. This can be in part interpreted as a consequence of a less obvious commonality between the activities such as, for example, the fact that both involve a lot of walking, but can also be explained by the fact that these combinations were considered as less attractive than combinations that included sightseeing. Sightseeing was part of the intercept and was therefore not included separately in the interaction estimates.

Two tests for difference in attribute evaluation in different periods were conducted: (i) between shopping on Saturday morning and Saturday afternoon, and (ii) between a non-guided walk on Saturday afternoon and Sunday morning. Log-likelihood ratio tests were conducted to establish the significance of the difference between the models with different and identical parameter estimates on these attribute levels for the different parts of the weekend. The results are presented in *Table 3*. It was found that the model in which both the compared attribute levels were identical was not significantly different from the model in which they were allowed to be different, so that it was concluded that for these attributes no variation in utility existed between the periods of the weekend in which they would be undertaken.

Discussion and conclusion

The main purpose of this article was to introduce a test and conjoint choice experiment approach to modeling tourists' choice of activity packages. The joint logit model was introduced to model choices between combinations of activities and an experimental design approach including attributes from multiple alternatives and interactions between attributes of different alternatives was proposed. The approach also allowed for tests of possible differences in parameter values for identical attributes when introduced in different periods of the weekend.

The approach was implemented in a case study on Dutch urban tourists' choices of activity packages for a weekend in Paris. Respondents were asked to choose from different hypothetical descriptions of activity packages describing a Saturday and Sunday morning in Paris. It was found that interactions between activities introduced in different periods of the weekend occurred. The combination of shopping on both Saturday morning and Saturday afternoon, for example, was evaluated negatively, whereas shopping in itself was evaluated positively as a weekend activity. It was also observed that evening activities did not interact with daytime activities, so that it was concluded that choices on evening activities were made relatively independently of choices for daytime activities. The tests for possible differences in evaluations of identical activities in different parts of the weekend showed that, in this case study, respondents did not evaluate activities differently depending on the period of the weekend.

In managerial terms several implications for the planning and marketing of urban tourism facilities can be drawn from the results obtained in this study. First, it was observed that sightseeing and shopping were the most popular components in urban tourists' choices of daytime activity packages, so that it can be concluded that these can be used as major motivators to attract urban tourism. Second, it was observed that, as expected, tourists will often combine several different activities in their activity packages. This implies that in marketing a specific city, the possibility of combining tourism activities should be communicated to potential urban tourists and where possible facilitated. Interrelationships between urban areas and urban activities can be planned in networks and complexes of facilities and can be marketed as pre-set packages or as 'self-created' tourist opportunities. Third, it was observed that night-time activities were selected largely independent of daytime activities. This implies that they can also be marketed more or less independently and that there may be potential benefits in planning for night-time activities separately from daytime activities.

In future research it would be worthwhile to test the proposed approach in experiments applying more extensive descriptions of urban tourism packages, in order to further specify the relationships that exist between different urban activities and the way in which tourists plan their activity patterns. Also, it could be worthwhile to introduce further segmentation of the responses in the present study as well as in similar research, as sometimes observed interactions can be explained by the fact that different segments of respondents hold different preferences for different groups of attribute levels. Another potentially fruitful analysis would be to test whether differences exist between the way in which urban tourists evaluate separate activities and combinations of activities, and to develop corrections that allow one to combine estimates based on tourists' evaluations of single alternatives with estimates based on evaluations of combinations of alternatives. As we continue our research in this area, we hope to report on this type of analyses in the near future.

References

[1]Woodwide, A G, Pearce, B and Wallo, M 'Urban tourism: an analysis of visitors to new Orleans and competing cities' *J Travel Research* 1989 **28** 22–30

[2]Wylson A and Wylson P *Theme Parks, Leisure Centers, Zoos and Aquaria* Wiley, New York (1994)

[3]Jansen-Verbeke, M *Leisure, Recreation and Tourism in Inner Cities: Explorative Case Studies* KNAG/Geographical and planning Nijmegen Catholic University, Amsterdam/Nijmegen (1988)

[4]Murphy, P 'Urban tourism and visitor behavior' *American Behavioral Scientist* 1992 **36** 200–211

[5]Dietvorst, A 'Planning for tourism and recreation: a market oriented approach' in van Lier, H N Taylor P D (eds) *New Challenges in Recreation and Tourism Planning* Elsevier, Amsterdam (1994) 87–124

[6]Morey, E R, and Shaw, W D and Rowe, R D 'A discrete-choice model of recreational participation, site choice, and activity valuation when complete trip data are not available' *J Environmental Economics and Management* 1991 **20** 181–201

[7]Law, C M *Urban Tourism: Attracting Visitors to Large Cities* Mansell, London (1994)

[8]Louviere, J J and Timmermans, H J P 'Stated preference and choice models applied to recreation-research: a review' *Leisure Sciences* 1990 **12** 9–32

[9]Lieber, S R and Fesenmaier, D R 'Modelling recreation choice: a case study of management alternatives in Chicago' *Regional Studies* 1984 **18** 31–43

[10]Haider, W and Ewing, G O 'A model of tourist choices of hypothetical Caribbean destinations' *Leisure Sciences* 1990 **12** 33–47

[11]Louviere, J J and Timmermans, H J P 'Testing the external validity of hierarchical conjoint analysis models of recreational destination choice' *Leisure Sciences* 1992 **14** 179–184

[12]Dellaert, B G C, Borgers, A W J and Timmermans, H J P 'Modelling tourists' joint choices of transportation and destination: towards an analytical tool to support the marketing of complex tourism services' in *Expanding Responsibilities: A Blueprint for the Travel Industry*, Travel and Tourism Research Association 24th Annual Conference, Travel and Tourism Research Association, Wheat Ridge, CO (1993) 389–395

[13]Timmermans, H and van der Waerden, P 'Modelling sequential choice processes: the case of two-stop trip chaining' *Environment and Planning A* 1992 **24** 1483–1490

[14]Louviere, J J *Analyzing Decision Making: Metric Conjoint Analysis* Sage, Newbury Park, CA (1988)

[15]Ben-Akiva, M and Lerman, S R *Discrete Choice Analysis: Theory and Application in Travel Demand* MIT Press, Cambridge, MA (1985)

[16]Theil, H *Principles of Econometrics* Wiley, New York (1971)