TMD evaluation with stated-preference-methods

TDM Evaluation with *Stated-Preference*-Methods

Contribution to WP2 of the TASTe-Project

KW Axhausen

Institut für Straßenbau und Verkehrsplanung
Leopold-Franzens-Universität
Technikerstr. 13
A - 6020 Innsbruck

Tel.: +43-512-507 6902
Fax.: +43-512-507 2906
EMail: k.w.axhausen@uibk.ac.at

H Köll

Ingenieurbüro Köll
Agenbachsiedlung 16a
A - 6060 Ampass

October 1997

CONTENTS

Deliverable

TDM evaluation with *Stated-Preference*-methods

KW Axhausen
Institut für Straßenbau und Verkehrsplanung
Leopold-Franzens-Universität
Innsbruck

H Köll
Ingenieurbüro Köll
Ampass

ABSTRACT

This paper outlines the *stated-preference* (SP) methodology and its cousin *conjoint analysis* (CA) as a possible tool for the a-priori evaluation of the TDM measures and for the development of choice models appropriate for the evaluation of the TDM measures.

The model of travel behaviour suggested highlights the nature of SP as an approach, which trades off simplification of the behavioral model against tractability and the ability to develop practical forecasting models. The review of the development of the SP and CA methodologies outlines their similarities, but also their differences, which are mostly due to their application environments and their respective professional traditions.

The main sections of the paper describe the various elements of the approach and how it can be implemented in practice. The paper stresses three areas in particular:

- a SP study is based on an a-priori behavioral hypothesis which is tested for a-priori specified market segments and behavioral frames of reference
- a SP study is a normal survey study; everything which applies to surveys applies to SP's in terms of methodology and required care
- the results of a SP study are sensitive to its timing. It has to be undertaken at a point in time, when the respondents have an incentive to reveal their true preferences, i.e. when neither the provision nor the price of the good/service have been decided upon.

When these points are accepted and implemented in the SP work, SP studies can make an important contribution to TDM implementation, as they help to identify early, if the measures can achieve their stated goals or only marginal changes to the transport system. SP studies allow the public to participate in the planning process in their role as customers of the transport system. This does not replace their contributions as citizens through the ballot box or the public participation process, but it helps the planner to reflect on any differences between their political willingness to initiate change and their private willingness to act on that change.

KEYWORDS

TASTe - 4th Framework Programme - TDM - Evaluation - Stated Preferences - Conjoint Analysis - Review

1 INTRODUCTION AND CONTEXT

Travel Demand Management (TDM) measures try to influence one or more of the dimensions of travel behaviour to achieve the goals of the municipality or the city concerned. The most frequently cited dimensions are respectively:

Dimensions of change

- Departure time
- Route
- Mode
- Destination

Dimensions of concern

- Congestion
- Traffic volumes
- Safety
- Noise and emissions

While the provision of new facilities or the increases/decreases in the capacity of existing facilities could be a TDM measure, the term is most frequently associated with so called *soft* measures, such as the provision of information, public awareness campaigns, changes in opening or working hours, car pooling initiatives etc. and with *changes in pricing* of public transport, parking, bridges, motorways or other roads. For a discussion of detailed measures see the earlier deliverables of the project.

The evaluation of such measures, which are in general outside the current scope of transport policy or transport practise is a challenge for the generally applied transport planning methodology. This methodology has been developed in the main to describe the effects of changes in network capacities on travel behaviour (Schnabel and Lohse, 1997; Ortuzar and Willumsen, 1994; ITE, 1994, Papacostas and Prevedouros, 1993; Hutchinson, 1974 or Chicago Area Transportation Study, 1960), but travel behaviour only conceived in terms of route, mode and destination choices. The methodology is based on models derived from the current situation in the study area and these models depend in their quality on the behavioural, network and situational variability of the study area. The supply situation is captured through inventories of the networks and services available and the demand situation is observed through surveys of the *revealed preferences* of the population, i.e. its actual travel behaviour. Policies not present in the study area cannot be modelled or only modelled by extrapolating from the current situation to ranges of values not currently present or to policies not currently present. While some TDM measures are within a safe range for such extrapolation, most are not.

Politicians and their public, in most instances, do not like to experiment with such, sometimes drastic and expensive measures without prior qualitative and quantitative assessment of their likely impacts. The gap between the available information from the revealed preferences (RP) of the population and the information required to assess these future, hypothetical situations has been obvious for some time and has stimulated the development of a range of methodologies, which aim to close it. Examples are:

- *Expert forecasting and assessment*: Delphi-technique and similar
- *Personal intensive interviewing*
- *Stated-Preference* (SP) methods or *Conjoint Analysis* in all of their forms, see below

The boundaries between the two last approaches are fluent, as both attempt to place the interviewee into a future, hypothetical situation and to obtain a response to that future situation from him, which can be modelled within the framework desired. Transport planning has not developed these techniques from scratch, but has adapted and modified them from other disciplines, which had to address similar situations earlier, here in particular marketing. Still, the methodological history of transport planning remains visible in the way in which this adaptation has taken place and in the way, in which these approaches are used today.

The next section illustrates the position of the SP methods vis-a-vis a more realistic model of travel behaviour and highlight the drastic, but necessary and acceptable simplifications, which are inherent in SP surveys. The following section discusses the core of the SP approach, as understood in transport and marketing, and the methodologies used to implement it. The possible protocols, into which this core can be placed, are presented next. The question of when to implement SP-surveys to obtain valid responses is the subject of the last substantive section, which is followed by conclusions.

A large set of applications are listed in a seperate list of references (see below).

2 POSITION OF SP IN A BEHAVIOURAL FRAMEWORK

TDM measures change the relative generalized costs of various behavioural alternatives and change behaviour as a result, but not necessarily in the direction intended as the behavioural system is much more complex than mostly acknowledged. Figure 1 shows a dynamic framework of travel behaviour to illustrate this point (Axhausen und Goodwin, 1991). Social norms and urban structures, which have to be accepted by the individual and household as given in the short term, constrain the life style choices for a given position in the life cycle. These long-term choices, such as housing type, residential location, family structure, type of work and work location, are based on the experiences of the person and household and on their available financial and social resources. They imply activity needs and desires, which are modulated by the seasonal and structural changes of the environment. The activities selected are then allocated and roughly scheduled by the household for an intermediate time horizon, such as the week or month, and the members of the household are provided with the resources required to achieve them, such as a bicycle, a car, a season ticket for public transport or a mobile phone. The member will schedule these activities and tasks in detail over a shorter time horizon, such as a couple of hours, a day or a small number of days. Scheduling includes the time, duration, location and order of activities plus the required resources (vehicles, money, information, information technologies etc.). The execution of the schedule requires a constant comparison between plan (schedule) and progress, i.e. actual activity performance, which can better and quicker then expected, but also worse and slower. The person has then the choice of altering his schedule in various forms based on the information available at the time, the slack in the schedule and the importance of the remaining activities. Equally, the traveller has to monitor his progress against his expectations to take, if necessary, corrective action during the trip by rerouting in a general sense including both route, parking type, parking location and mode or by rescheduling the activity programme undertaken. The experience of schedule performance against plan will lead to a feedback to the higher levels of the hierarchy through changes in daily scheduling, household scheduling and in the life-style choices to resolve the conflicts, which have become visible. Given the complexity of this feedback system, it is unclear a-priori at which level of the hierarchy and at which time horizon a specific TDM will become effective. It is useful to translate the framework into specific choices, which could be influenced, e.g.:

- Residential location
- Type of housing
- Resource availability, especially:
    - cars
    - season tickets
    - information technologies
    - parking facilities

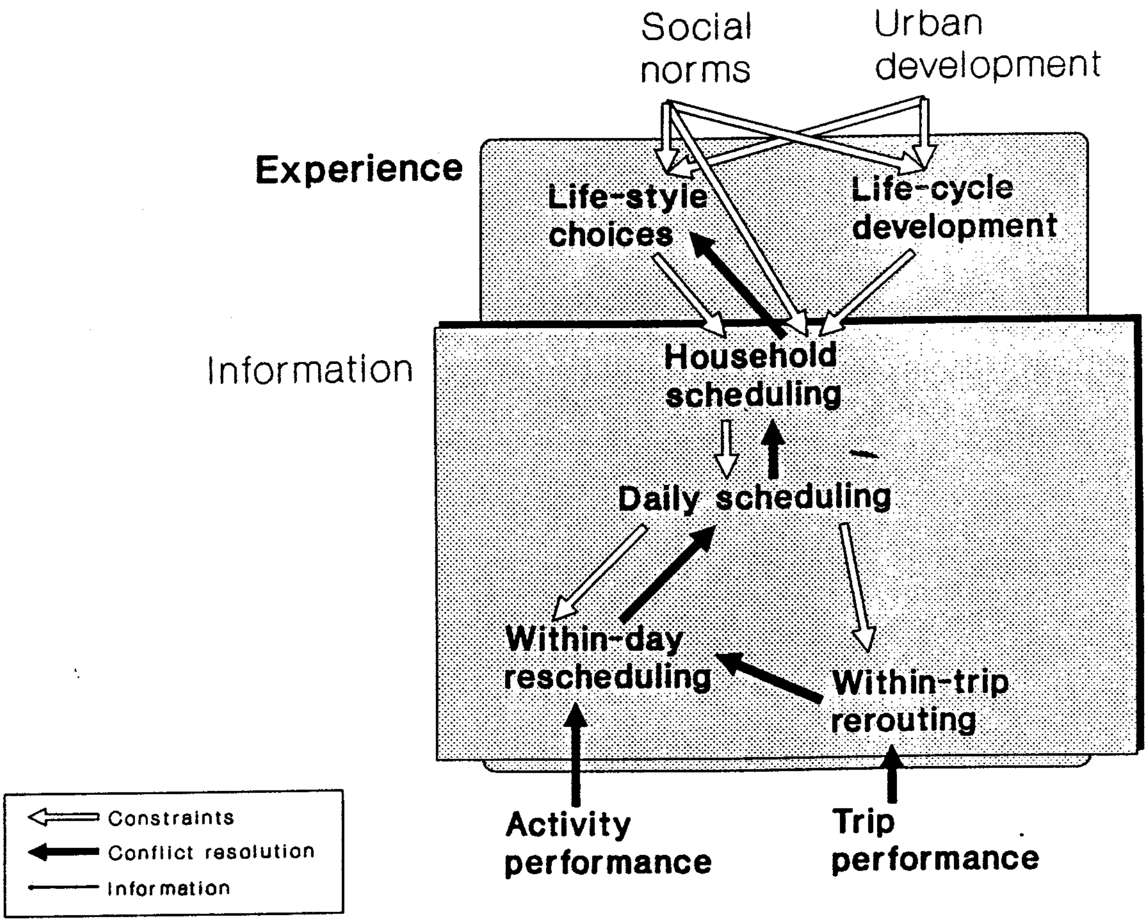
- Work/education location
- Amount of work/educational activities
- Work schedule/education schedule
- Resources at work/school (parking, information sources etc.)
- Commitment to other activities (church, social clubs, sports etc.) (amount, frequency and schedule)
- Location of other committed activities

- Choice of medium/long term projects, such as holiday preparation, education, training, visit to friends, information acquisition etc.
- General task and resource allocation in the household

- Activity schedule (including frequency and time of the scheduling):
    - Sequence of activities
    - Start time of activities
    - Duration of activities
    - Location of activities

- Size and membership of the party involved in the activities
- Costs of activity participation or expenses involved and their allocation between the members of the party (including non-monetary costs, such as social goodwill or "time trading")
- Departure time (with implied preferred arrival time)
- Mode sequence
  - Mode
  - Vehicle/means
  - Location of mode/means switch (station, stop, parking facility)
  - Type of mode switch facility (type of station or stop, type of parking)
  - Search strategies, if required
  - Size and membership of travelling party
  - Costs of mode use and their allocation between travellers (s.a.)
  - Route
  - Speed

Figure 1 A dynamic framework of travel behaviour



Source: Axhausen and Goodwin (1991), 1025

The very complexity of the choices involved force the travellers to rely very often on past choices, i.e. past solutions, to reduce the complexity of the decision and to speed it up, as time for generating a new good solution is often not available.

It is also clear, that the amount of information provided by external sources, such as parking guidance systems or route guidance systems, is small in comparison with the information embodied in these past choices and experiences. This is especially true in the "activity space" of the traveller, i.e. the locations and networks, which are used regularly.

The framework implies, that each behaviour we observe should be understood against the specific situation of the traveller at that time in terms of:

- the activity schedule ahead (as part of the tasks, commitments and projects of the person)
- the immediate past in terms of activity and trip performance and schedule deviations, if any
- information available
- experiences available

and in terms of the personal preferences, suitable for this situation. This clockwork of different rhythms and sequences moving around longer-term trends and decisions requires an enormous amount of information from the traveller, which the analyst has to disentangle.

Transport planning models have, as a rule, ignored this complexity for a number of pragmatic and theoretical reasons, among them computing capacities, cost and difficulty of data collection, lack of explanatory models and difficulty of forecasting. The time horizon at which the models operate has never been properly identified, but their contents imply that they intend to model the medium- to long-term decision horizon[1].

There is one tradition, which tries to acknowledge this complexity, although can do so only in parts due to the otherwise required unacceptable interview durations: the *situational approach* of Socialdata (Brög und Erl, 1980 or 1983). While it has been able to identify constraints on behaviour in terms of information, tasks and preferences, the lack of proper choice and forecasting models has held its application back. The intensive interviews of this approach have been used to elicit responses to hypothetical situations, but in general, only one or two new situations, which made it impossible to generalize the results to models of wider scope. While the intensive testing of one scenario can be very useful, the clients generally prefer models of a wider scope even if that implies lower validity.

[1] It is surprising then, that they are developed and estimated on the basis of short-term data (travel diaries and screen line counts) which in turn are supplemented with long-term data (the equilibrium results of the network models used in choice modelling).

The alternative approach, *Conjoint Analysis* or *Stated Preferences*, in the general tradition of the social sciences, sociology and microeconomics in particular, accepts the complexity, but focuses the attention of the respondent and researcher on those factors under the control of the authority or firm undertaking the study. This simplification is accepted as the price to obtain results of predictive value within an acceptable time frame (see Brög, 1997, for an opposing view).

The Stated-Preference or Conjoint-Analysis approach encompasses a wide variety of specific methodologies, which all share the aim of

- obtaining holistic statements of preference in a specified format
- for a series of (hypothetical) goods described by varying levels of a small number of attributes
- within a specified behavioral frame (overall context)

The decision problem is reduced for the respondent, as he has only the given response format, but he has both to imagine the stimuli and to adjust to the specified behavioural frame. The analyst looses the full behavioural context detail, but can focus on those aspects under management control. The control over the description of the hypothetical goods permits in addition the generation of better behaved statistical data for the estimation of appropriate decision models.

SP-methods can be placed into a larger family of survey methodologies, which all aim to obtain behavioral responses to hypothetical goods and situations. Lee-Gosselin (1996) suggested the name *Stated-Response* for all of the methods and then distinguishes SP, *Stated Tolerance*, *Stated Adaptation* and *Stated Prospect* depending on the control the interviewer exerts over the description of the good and the specification of the behavioural response (See Figure 2). SP methods are the most rigid as they constrain for the respondent both the description of the good and of the response. This loss of subtlety is balanced by the lower demands on the respondent and by higher response speeds/shorter interviews, which make the methodology cheaper to apply and which make it easier to find participants for the surveys.

Aside: Brief history of SP and CA

SP and Conjoint Analysis methods were first developed in the 1970's in response to the advances of psychometrics in the late 60's and early 1970's (Green and Rao, 1971). While the developers of the methodology moved then easily between transport and marketing, as can be shown by the work of J.J. Louviere (Louviere, Meyer, Stetzer and Beavers, 1971 etc.), this communality came to an end by the

Figure 2 Classification of Stated-Response approaches

		CONSTRAINTS **(expressed as attributes: personal/household/social/spatial/supply, etc)**	
		Mostly given	***Mostly elicited***
BEHAVIOURAL OUTCOMES	***Mostly given***	**STATED PREFERENCE** **(focus = tradeoffs, utility)** *"Given the levels of attributes in these alternatives, which would you prefer: [A].......? [B].......? etc ....."*	**STATED TOLERANCE** **(focus = limits of acceptability, and thresholds for change)** *"Under what circumstances could you imagine yourself doing: [r1].......? [r2].......? etc......."*
	Mostly elicited	**STATED ADAPTATION** **(focus = reactive and trial behaviour; problem-solving, rules)** *"What would you do differently if you were faced with the following specific constraints: [......detailed scenario]"*	**STATED PROSPECT** **(focus = learning processes; information seeking; the imaging, formation and testing of choice-sets; metadecisions)** *"Under what circumstances would you be likely to change your travel behaviour and how would you go about it [..broad context]"*

Source: Lee-Gosselin (1996), 124

early 80's and two streams of development emerged under the names of Stated Preferences and Conjoint Analysis, which are clearly influenced by the respective professional concerns and methods of transport planning and marketing. The development of Conjoint Analysis is well documented in a series of scholarly reviews in the marketing research literature (Green and Srinivasan, 1978; Böcker, 1986; Huber, 1987; Louviere, 1988). The growing usage of the methodology in marketing over the last two decades is equally well documented by three surveys of market research firms (Cattin und Wittink, 1982; Wittink and Cattin, 1989 and Wittink, Vriens and Burhenne, 1994). The development of the methodology in transport planning can only be reconstructed from a series of How-to-manuals, which have been published over the years (Kocur, Adler, Hyman and Aunet, 1982; Pearmain, Swanson, Kroes and Bradley, 1991; FGSV, 1996 or Pearmain, Swanson and Ampt (forthcoming), but see also Bates, 1988; Hensher, 1994 or Axhausen, 1995). The usage of the methodology in transport planning has not been surveyed yet. Wittink et al.'s work does not give a good estimate as the firms most active in transport were outside the scope of their surveys.

The psychometric tradition (Krantz, Luce, Suppes and Tversky, 1971) had been concerned with the construction of metric scales of utility from non-metric rankings and ratings of conjoint (compound) goods, while the functional measurement tradition (Anderson, 1974) focused on the development of models of object perception. Both traditions were based on orthogonal designs of the stimuli (objects or descriptions of goods). The transformation of these traditions into a tool of market research and the change of name from conjoint measurement to conjoint analysis had been achieved by the early 70's (Green and Rao, 1971). Conjoint analysis was used to derive a) estimates of *utility part-worths* for each level of the attributes tested for each respondents and b) to forecast market shares for new products based on these part-worths. The estimation methodologies were based on the traditions of conjoint and functional measurement and paid substantial attention to different functional forms possible. Practise in marketing settled quickly on the widely understood and available OLS-approach (ordinary least squares estimation), especially after various studies had shown it to be no worse than the more sophisticated approaches based on ranks. The spread of the methodology through market research was sped up by the co-development of personal computers and various PC-based implementations of conjoint analysis, of which the *Adaptive Conjoint Analysis* (ACA) approach was by far the most important (Sawtooth, 1996). This programme combines utility estimation with the adaptive generation of the stimuli for a large number of attributes, which makes commercial application easy for market research practioneers.

While the first large review of Green and Srivasan (1978) had especially identified transport planning and urban public transport as a potential application area, market research firms did not initially obtain a foothold in this market, in contrast to air transport, which they entered via the market research of the airlines. While the early documented applications in transport had been performed in the US (see for example Kocur, Hyman et al., 1982; Louviere and Hensher, 1982; Lerman and Louviere, 1978, Norman, 1977; Davidson, 1973) the first wide-spread offical acceptance of the methodology in transport planning was tied to work in the UK and the Netherlands (see for example the first UK Value of Time study (MVA, ITS and TSU, 1987)). The practioneers in the UK were normally transport demand modellers, which cast the analysis of the data into their framework of aggregate logit-modelling of choices (e.g. Ben-Akiva and Lerman, 1985), which had been developed in the 1970's. The now Stated-Preference methodologies were added to an existing set of SR-methods, such as *transfer pricing* (Stated Tolerance) (e.g. Bonsall, 1983) or the *Priority Evaluator,* a methodology developed in the UK to obtain preferences for public services under explicit public-sector budget constraints (Hoinville, 1971, 1973 or 1977; Pearmain, 1989). While various response formats were used in SP work (see below), the choice between alternatives became dominant by the 1990's in spite of it drawbacks (see below), again reflecting the influence of the general choice-based paradigm of transport demand modelling. The surge in SP applications in transport stimulated the development of various software tools to automate the generation of stimuli and performance of *computer-aided personal interviews* (CAPI).

The current return of SP to the US, the coming together of professional market researchers and transport planners in the commercialized public transport firms (bus, rail and air) and the growing interest in market research in choice-based conjoint formats (Louviere and Woodworth, 1983 or Sawtooth, 1995) opens up new opportunities for the further development of the methodology, both in application and model estimation (i.e. hierarchical logit-structures, joint estimation of SP and RP data (Ben-Akiva, Morikawa and Shiroishi, 1992 or Morikawa, Ben-Akiva and Yamada, 1991), utility functions of individuals etc.).

3 CORE SP METHODOLOGY AND IMPLEMENTATIONS

The core of the SP-methodology was defined above as:

- statements of preference in a given format for a
- series of goods, described by varying levels of a small number of attributes
- within a given behavioural frame

This definition needs to be complemented by the aim of the data collection, which is to develop estimates of the utility functions of the respondents or groups of respondents. These four aspects will be discussed in the next four subsections.

3.1 Formats of the preference statements

A number of formats has been developed to obtain holistic statements of the preference of the respondent for a given good. A good in the tradition of Lancaster (1966) is any physical good or service which can be described by the bundle of services it provides in terms of its characteristics, such as price, quality, weight, colour, comfort, reliability, prestige, brand etc. The respondent has the task to judge this bundle of attributes as one. SP methodologies, in contrast to other approaches is not interested in judgements of the individual attributes (See for example Schubert, 1991 and Tscheulin, 1992 for alternative approaches).

The following main formats are used in practise[2]:

- *Rating* of a single good on a given scale
- *Ranking* of a set of goods in order of preference
- *Choosing* between two or more competing goods. In the case of two goods it is common practise to request a statement of the strength of preference (likelihood of purchase)

Rating

In the case of rating the respondent is offered one good at a time and is asked to judge it on a common scale. Normally Likert-scales or related 7- and 9-point scales are used, but other scales (percent out of hundred) are equally common. This is an easy to understand format, but does not force the respondent to make trade-offs, as he could rate all goods offered in sequence with the same value. In spite of the ease of understanding its implementation is difficult for the respondent, as he has to keep track of past decisions and has to maintain the scaling consistently through a reasonably long list of goods.

Ranking

In ranking exercises the respondent is offered a set of goods, up to 15 or 20, which must be brought into a unique sequence of preference. This forces the respondents to make trade-offs, although ties can be accommodated, if desired. The ranking task is difficult and time-consuming for the respondent, as he has to make potentially n*(n-1) comparisons to obtain the unique sequence requested. To reduce this difficulty the respondent is often asked to group the goods first into a small number of classes, then rank the classes and finally rank goods within the classes. While the original conjoint analysis literature used models based directly on rank, such as MANOVA (see Kruskal, 1965), to derive the utility estimates, the transport literature interpreted the ranks as a sequence of a binary choices to fit the data into their choice-based paradigm.

Ranking is still a popular approach in application, as it generates a large number of data items quickly and can be interesting and challenging for the respondent. Unfortunately, the literature has documented many cases, in which the utility estimates vary substantially depending on which part of the ranking sequence is used for estimation (See for example Ortuzar und Garrido, 1991; Ben-Akiva, Morikawa and Shiroishi, 1992 or Johnson and Orme, 1996). While rules-of-thumb for the selection of rank information for estimation are available, caution is necessary.

Choosing

---

[2] In the transport literature the transfer pricing approach (see Bonsall, 1983) and the priority evaluator (Hoinville, 1971, 1973 or 1977; for later applications see Pearmain, 1989) are frequently subsumed under SP. These two forms of SR-methodology will be excluded here from further discussion following the classification of Lee-Gosselin, 1996.

In choice-SP's the respondent has the task of selecting one good out of a small set of two to maybe five alternative goods. The advantage of this format is that it is simple to understand, quick and mimics the real life situation rather well. Its main disadvantage is that it generates little information for the utility estimation, as it provides information only about the best alternative.

In the case of the choice out of two alternative goods many applications replace the simple choice question by asking the respondent to indicate the strength of their preference. A typical format is a scale of likelihood of purchase (certainly yes, in most cases, in many cases ... or some other similar formulation). Some authors have suggested that the respondents should express the strength of their preference by indicating the utility-equalizing payment balancing the weaker with stronger option. While gaining additional information, which can be used in estimation as an indication of choice probability, the analyst has the additional problem of estimating, which choice probability was meant by which scale item. This problem is normally not addressed leading to the unsatisfactory practise of determining the implied choice probabilities untested a-priori (Ortuzar and Garrido, 1994).

3.2 Generation of the descriptions of the goods

The respondents are presented with a number of goods, which are grouped into various contexts depending on the preference format chosen. These goods are characterized by a number of selected attributes, which each occur at a specified number of levels, e.g.:

- price at two levels: 5 ECU and 8 ECU
- comfort at three levels: low, medium and high
- Brand at four levels: VW, Mercedes, Opel or Ford

It is possible to present the goods with *full* or *partial* profiles. In the case of full profiles, which is the rule in SP and the preferred option in Conjoint Analysis, the good is described simultaneously by all attributes which have been selected as relevant (see below for the question of how and how many attributes to select). In the case of partial profiles the good is described by a subset, traditionally two attributes at a time. The subset can vary between goods. This approach is still important as ACA implements it in its procedure.

In the case of full profiles the number of possible goods, which could be presented, becomes large very quickly, as it grows combinatorially:

$$\prod 2^{n_2} 3^{n_3} 4^{n_4} 5^{n_5} \ldots$$

$$n_i \text{ : } \textit{Number of attributes with i levels}$$

$$\sum_i n_i = \textit{Number of attributes}$$

While early studies used *full factorials*, i.e. all possible combinations, practise adopted *fractional factorials* very quickly to reduce the number of goods to a size managable for the respondent without fatigue or loss of interest. Fractional factorials are a subset of the full factorials with a-priori specified statistical properties:

- they are (nearly) orthogonal, i.e. the main effects of the attributes can be estimated independently, but for a known amount of confounding with known higher order interactions
- they specify the number, if any, of higher-order, in particular two-way, interactions which can be estimated independently

The fractional factorials of a given full factorial are catalogued in a number of sources (Addelman, 1962a, b; Hahn and Shapiro, 1966; Kocur, Adler et al., 1982 or McLean and Anderson, 1984) and are also available in a number of software packages (SAS or SPSS, for example). Especially in the case, when no catalogued design is available, it is possible to generate the design as a random selection from the full factorial, which is tested for an acceptable correlation structure, i.e. orthogonality and absence of a strong "factorial" structure in the factor-analytic sense. A simple analysis of correlations can be misleading.

The loss of the three-way and higher interactions is judged to be no significant problem (Louviere, 1988), but the two-way interactions can be a problem, especially, if they are confounded with a weak main-effect, i.e. if the strength of the estimate of a main effect is attributable to a confounding two-way interaction of two different main effects, e.g. if the estimate of {A} is actually {A + C*E}. If the designer of the study is concerned about an interaction at the outset, then he should choose a design, which permits the independent estimation of the interaction. If the concern arises after the study, then careful analysis of the data is required, although the confounding cannot be removed after the fact.

In the case of ranking and choice-SP's it is advisable to remove dominant and dominated goods from the sets. That is goods which are either better/equal or worse/equal to all other alternatives in the set of goods presented. While such *anchor* goods are recommended in rating SP's at the top and the bottom of the set to provide the respondent with a feeling for the scales of the attribute levels, it is not necessary to do so in ranking and choice-SP's.

Factorial designs can produce unrealistic combinations of attribute levels, especially if there are strong correlations in the real markets; e.g. price and distance in rail travel, speed and road type, brand name and prestige etc. It is either possible to remove such combinations in advance or to formulate the values of the "dependent" attributes as a function of a selected independent attribute. The function then specifies differences between or ratios of the variables concerned. It is possible this way to ensure enough variability in the data sets for estimation. For example in the case of travel times by bus and car, the rule could be: bus travel time = car travel time + (-0.2; 0.2; 0.4) * car travel time.

Fowkes and his colleagues (e.g. Fowkes, 1991; Fowkes and Wardman, 1988 and 1992; Pearmain, Swanson and Ampt, forthcoming) have pointed out, that strictly orthogonal designs can be undesirable, if the interest of the study is the ratio of two main effect parameters, such as the value-of-time-savings in transport. In this case deviations can improve the estimates of the ratio. They also point out that in this case, the goods need to be selected in a way, which offers a wide range of choices in the ratios and not in the values of main effects themselves.

In the case of choice and rating-SP's a *decision situation*, i.e. the group of goods to be ranked or the set of goods to be selected from, needs to be constructed. Louvière (1988) suggests a two-stage procedure of a) constructing m goods from a suitable fractional design with the n attributes for each good and b) a second fractional design with m attributes coded zero (not present) and one (present) indicating the presence of the m^{th} good in the decision situation. Most transport applications use a different approach, in which they associate the first n_1 attributes of a fractional factorial with good 1, second n_2 with good 2 and so on. The first approach is suited to situations, in which the choice set can be variable in real life, as is the case with most consumer goods or destinations in transport, while the second approach is suited to situations in which the choice set will not vary, as is case with mode choice or tv channels.

Number of preference statements

The number of goods or decision situations (groups of goods) to be presented is a function of the model to be estimated (i.e. the number of parameters), the acceptable multicollinearity in the design and the level of aggregation of the analysis (e.g. person or group).

In the case of individual level models the estimation requires at least n+1 decisions/preference statements from the respondent to estimate the n parameters of the model. It is therefore not surprising that such models concentrate on simple main-effects models and a limited number of attributes to avoid overloading and fatiguing the respondents. Up to 20 decision situations plus some are deemed acceptable in conjoint analysis practise (Sawtooth, 1996).

For transport planning SP-practise lower values reflecting the higher loads of choice or ranking tasks are suggested (nine to twelve). Johnson and Orme (1996) suggest on the basis of a detailed analysis of studies conducted with Sawtooth CBC-software that up to 20 decision situations could be acceptable. The way, in which transport planning SP studies define their fractional factorials, results often in fractional factorials with a relatively large number of choice situations, in particular when interaction effects are explicitly estimated as well. It is therefore common practise to block the fractional factorial into groups of nine to twelve choice situations, which are then administered to each respondent. The model can then only be estimated at the group level, where all blocks are pooled. The total number of attributes is normally restricted to a maximum of 12-15, with a maximum of 5 to 6 per choice alternative, e.g. 5 attributes to define the car option, 4 to define the public transport option and 3 for cycling in a hypothetical mode choice study.

In the methods described so far, each respondent is presented with a fixed number of choice situations for which the structure, i.e. the coding of the levels, as 0, 1, 2 or +,- is known in advance. The exact values of the levels can be customized (see below).

Many authors have objected to this approach, arguing that many choice situations will not elicit new information as prior choices will already have revealed where the utility boundaries are located. To remove such redundant choice situations they have suggested *adaptive designs*, where the prior choices are used to construct the next choice situation/good. The most important of these approaches is the ACA approach, which dominates the commercial conjoint analysis market with the software of the same name (Sawtooth, 1996). In transport the work of Holden (1993) has received most attention. The attractions of these approaches are obvious, as they reduce the number of choices required from each respondent and as they make each choice situation more interesting for the respondent, because they are increasingly focused on the choice boundary. Still, concerns have been raised about the statistical properties of these approaches, in particular that they generate correlations between subsequent choice situations violating the (implicit) assumption of the analysis, that each observation can be treated as independent (Bradley and Daly, 1993).

The hybrid ACA approach falls slightly outside to what has been described so far as the orthodoxy of SP and conjoint analysis studies. The ACA approach combines both compositional and decompositional elements by starting the procedures with explicit questions about the importance and weight of each attribute followed by pairwise comparisons. It is main advantage is its ability to accommodate large number of attributes (20 or more), as the process screens out the unimportant ones early for each respondent.

3.3 Behavioural frame

The model of transport behaviour presented above suggests that a choice can only be understood against the frame of the particular situation, in which it was taken (e.g. schedule, resource availability, time pressure, information available, experience obtained so far, presence of other travellers etc.). It is therefore necessary to specify this behavioural frame to the respondent to assure that all respondents act/decide under the same constraints/assumptions.

This issue has not been addressed intensively in the market research conjoint literature until recently (Green and Krieger, 1995). It is also not addressed in *experimental economics* (Hey, 1992). In contrast, in the related *contingent valuation*[3] literature (see for example Mitchell and Carson, 1989) on environmental (public good) evaluation these frame effects have been central methodological concerns from the start. The transport SP literature became quickly aware of the issue and is addressing it normally by using past journeys as the starting point for the construction of the choice situations, in particular of the values of the attribute levels. This base journey is typically the one just made, a journey made yesterday or the last journey of a particular type. The respondent is asked to use the constraints of that journey as his reference. While this clearly improves the realism of the answers, the analyst has the problem of characterizing these constraints properly in the estimation. The description of the base journey and of the socio-demographics of the respondent might or might not be sufficient for this task. Clearly the SP-literature, as known to the authors, has not made this aspect of the SP interview a concern so far.

[3] *Contingent Valuation* (CV) is the name given to a range of survey approaches developed by economist to obtain valuations of public goods. This literature seems to independent from the conjoint and SP literatures, although developing at the same time. CV surveys generally employ auction models to obtain one valuation, or willingness-to-pay, for a specified public good. Experimental designs are not employed even if more than one scenario is tested.

The approach of the transport literature assures that a cross-section of situations is reflected in the data. This will be acceptable in many cases to the client, but it might be necessary to specify this behavioural frame more precisely to reflect a particular market or behavioural situation better. This greater precision is at the expense of the scope of the model, as specifying the behavioural frame clearly indicates that the model estimated is only valid for this frame. There are no studies known to the authors, in which the effects of different frames were tested.

3.4 Utility model

The proper specification of the underlying utility model was a major concern of the traditions underlying SP and conjoint analysis. Initially three main preference models and three main forms of aggregation were tested. The preference models are:

- the vector model:

  $$u_i = ß_0 + ß_1 y_{ip}$$

  which stipulates that the utility of attribute i is a linear function of the value of the attribute i for good p

- the ideal point model:

  $$u_i = ß_0 - ß_i(y_{ip} - y_i^*)^2$$

  which calculates the utility of an attribute in terms of the deviation of the attribute value from some ideal value y_i^*

- the part-worths model:

  $$u_i = ß_{ip}$$

  which determines a separate utility value for each value of each attribute.

The aggregation rules are:

- Linear additive rule:

  $$u_p = \sum u_{ip}$$

  which adds the utilities across the attribute values u_{ip} of the product p

- Non-additive models:

Multiplicative: $u_i = \prod u_{ip}^{\beta(i)}$

Disjuntive: $u_i = \prod [1/u_{ip}]^{\beta(i)}$

which do not allow for the simple trade-offs of the linear model

- Lexicographic rule, which describes the choice a sequential process of ranking products by one attribute at a time, and stopping when the attribute gives an unique best alternative. Among the three products:

Product	Attribute values 1	2	3
A	10	30	5
B	10	28	50
C	8	50	2

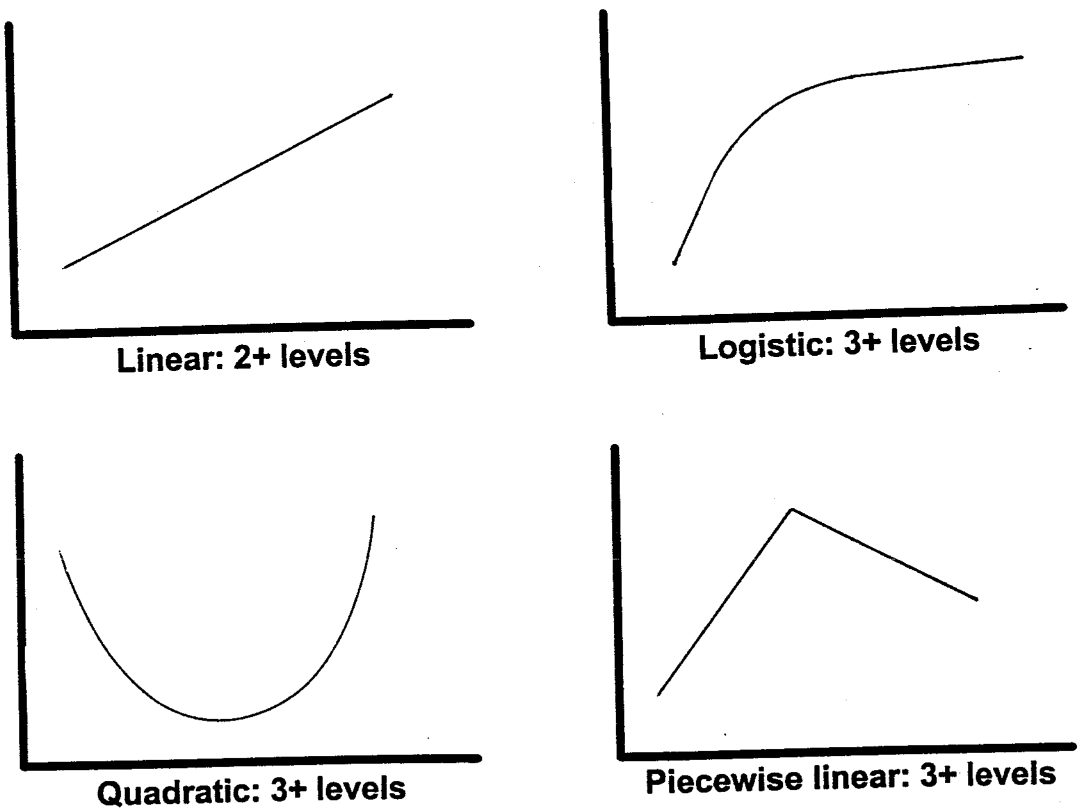
The lexicographic chooser with the attribute order: 1, 2, 3, would first choose A and B as equal on attribute 1 and then decide on A as better on attribute 2.

The conjoint analysis and SP-practise settled quickly on the linear additive models, as the most flexible model form, which can accommodate the two other utility formulation (through dummies and quadratic terms) and includes the lexicographic rule, as a particular pattern of parameter values (e.g. $\beta_1 >> \beta_3 >> ... >> \beta_n$). Conjoint analysis prefers the part-worths model, whereas SP uses the vector description. Current practice does not spend time on analysing these issues.

While the overall model form is not discussed any more, the detailed specification is still a major issue, as it determines the number of levels to be tested for each attribute. The conjoint analysis practise is relatively unconcerned with the specification of the number of levels per attribute, as the widely used ACA approach screens out irrelevant levels. This is feasible as many attributes in CA studies are ordinal, i.e. list of brands or unrelated product characteristics, which are captured in their respective utility through the quasi-dummy part-worths. Against the background of the usual vector-model SP studies would describe these from the start as dummy variables to indicate their presence or absence, thereby increasing the number of attributes to be tested. SP studies are also focused more strongly on continuous variables, such as costs, distances or times. For the continuous variables it is necessary to specify a-priori the functional form of the attribute (linear, quadratic, cubic, log etc.) as this in turn specifies the minimum number of levels required to test for this functional form (Figure 3).

A discussion of the estimation techniques is not required, as these are covered in detail in for example: Ben-Akiva and Lerman, 1985; Train, 1986; Chatterjee and Price, 1977; Daganzo, 1979; Greene, 1994; Wrigley, 1985; Pudney, 1989 or Box, Hunter and Hunter, 1978; Winer, 1971; Montgomery, 1984). It should be pointed out though, that the analysis in general ignores the serial correlation between preference statements, which can have serious effects on the parameter estimates. The simple correction methods for the t-statistics might not suffice (Louviere and Woodworth, 1983).

Figure 3 Minimum number of levels per attribute and functional form



Source: after FGSV (1996), 25

4 SP-SURVEY PROTOCOLS AND PROCESS

The core of the SP approach defines the task of the respondent and the number of choice situations to be answered and how they are constructed. It does not specify, what model/hypothesis is being tested, how the values of attribute levels are derived and how the choice situation is presented to the respondent. This section will first discuss these three issues before summarizing the discussion by describing the overall process of a SP-study.

4.1 Model specification

The SP experiments are based on a known set of attributes and assumptions about the functional form of their influence for a given behavioural frame. These three sets of assumptions define a hypothesis about an abstract behavioural model, which is to be tested with the SP. It has to be stressed again, that this abstract model is a serious, but necessary simplification of the real decision process, as presented with the travel behaviour model above. The closer the stipulated behavioural frame is to the current environment the better, but the possibility to define future, hypothetical situations is a real strength of the approach. The degree of the simplification will vary with the study object and the behavioural frame, but it should always kept in mind. The simplification is the price paid to obtain operational models with testable properties, such as goodness-of-fit or parameter significance.

The hypothesis to be tested should be developed from three sources:

- the *client*, who needs to specify the behavioural frame(s) of interest, the attributes of the good under management influence and the study object/good
- the *literature* as a source of information about the study domain, in particular providing information about the relative weights of attributes from prior studies
- the *traveller/customer* through in-depth personal or focus group discussions specifying possible behavioural responses and relevant attributes.

The three sources should, if the time and budget available permit, all be consulted to obtain a rounded view of the problem, as the client might be preoccupied with the new idea/good, as the literature might be addressing yesterday's concerns, while the customers could ignore new possibilities.

There is a natural tendency for this process to generate a collection of attributes, which is too numerous to be tested in a single SP-experiment, at least of the choice-type. Three approaches can be pursued in this case unless it is possible to pare the number down to a manageable level a-priori:

- the *ACA approach*, which uses the respondent's reaction in a first screening part of the survey to pare the number down. This has the disadvantage that some attributes, which are of particular interest to the client, could be lost. The client might want the respondent to react to this attribute.
- the *hierarchical approach* suggested by Louviere and Timmermans (1990a-d) and others. In this approach the attributes are distributed across a number of SP-experiments of lower rank, which measure trade-offs within particular abstract concepts, such as comfort, style, accessibility etc. These concepts are then used in a single higher rank SP to obtain trade-offs at the concept level.

- the *linked approach*, where one or a small number of attributes are present in a series of SP-experiments. The parameters of a particular SP are then scaled against the parameters of these common attributes (the estimate could be derived from a SP or RP study). The approach has the advantages of simplicity and of an explicit scaling, but the disadvantage, that a master attribute/experiment has to be defined. In transport applications popular choices have been costs or fare and mode choice.

  The explicit scaling is an advantage as it is known, that minor attributes can be overvalued by respondents, if the major attributes are not present in the SP or not evoked. An example would be an SP looking at bus stop design without fare, travel time or reliability attributes.

The attribute set defines one side of the equation, the decision alternatives offered define the other side of the equation. The conjoint tradition largely circumvents this problem by concentrating on objects or services of the same type, i.e. cars, credit cards, tv sets. The basic service provided is the same and all alternatives can be described with the same attributes. The attribute "brand" captures the prestige differences perceived by the respondent. In transport or similar applications this cannot be taken for granted. In the most widely studied case of mode choice very different services are offered by a car drive, a bicycle ride, a bus or a LRT trip, which need to be described by different attributes. The number of alternatives is a crucial issue, as the defined set might or might not be the relevant set for the respondent given the specified behavioural frame. The omission of relevant alternatives biases the results, as respondents either choose second best alternatives, refuse to choose at all or start to choose randomly. If the number of alternatives described with attributes becomes too large to handle, then it is possible to employ the linked approach again, but this time linking the sets of choice alternatives through one or more common members.

In addition to the described alternatives frequently undescribed alternatives, such as "None of the above", are added. While Sawtooth (1995) suggests only the use of the "None of the above" category in choice SP's, transport planners have used a wider variety of alternatives capturing responses at different levels of the trip response hierarchy, e.g. change of destination in the case of a mode choice SP, departure time change in the case of a route choice SP etc. Their inclusion can increases the realism of the SP task, but also increases the complexity for the respondent and lowers the precision of the estimated models, as the not described alternatives can only be included with alternative specific constants[4].

[4] Unless some further information about the alternative is available from other parts of the interview.

4.2 Determination of attribute level values

The hypothesis specifies the number of levels per attribute, but not the values of these levels. For the case that the values are fixed before the interview the recommendation is to choose values, which cover the natural variability for the study object at may be the 10% and 90% percentile for a two-level attribute and similar definitions for attributes with more levels. While most applications use levels which are symmetrical around the mean and equal differences between levels, there is no necessity to do so. The differences between the levels must be large enough to be noticeable, i.e. have a behavioural impact. The prior determination of the attribute level values requires that these are relevant to all respondents. This is normally true in consumer market research, but the experience in transport shows that it is normally not the case in its applications.

Transport applications have therefore either to resort to a-priori market segmentation to ensure the homogeneity of the respondents or to obtain the relevant values from the respondent.

A-priori segmentation

In this approach, the natural values are determined from prior surveys of travel behaviour. The respondents are then classified by location, car ownership, licence ownership or other relevant variables and are sent or given the appropriate SP with fixed values for the attribute values. This approach is costly and error-prone and is therefore rarely implemented.

Customized SP experiments

In customized SP experiments, which are the standard and preferred approach in transport research, the researcher will select a fixed experimental design and attribute level values, which are defined relative to user specified values, e.g.

- travel time of the user minus 5 minutes
- 0.5 * fare paid by the user
- maximum of the search times given

The rules are supplemented by constraints, which ensure that the values remain in a realistic range, in particular to avoid negative values for prices, distances or travel times, and in realistic proportions.

Customized SP's consist of three phases. In the first phase, the details of the trip, journey or purchase of interest are recorded. These details cover at minimum the selected attributes, but normally additional attributes are collected as well. In the second phase the customized SP is calculated and implemented and made available to the respondent. In the third phase the respondent participates in the SP. The usual forms of survey administration can be employed: PAPI (paper and pencil interview), CAPI or CASI (computer-aided self-interview) etc. The most frequently implemented protocols are:

- *On-line PAPI*
  Phase I) Interviewer conducts prior interview (in transport frequently a travel diary and/or a transfer price experiment)
  Phase II) Interviewer constructs SP-experiment (description of the goods in the form of rating cards or choice/ranking sets
  Phase III) Respondent performs SP

- *Off-line PAPI* (e.g. Polak, Jones, Vythoulkas, Meland and Tretvik, 1991)
  Phase I) Respondent participates in a PAPI travel diary and returns it to the researcher
  Phase II) The diary is coded and a PAPI-SP is generated on the basis of a selected trip and its attributes and sent to the respondent within a day or two of receipt of the survey.
  Phase III) Respondent performs PAPI-SP and returns it to the researcher

- *On-line CAPI* (e.g. most of the recent transport SP's in the literature)
  Phase I) CAPI travel diary or relevant survey
  Phase II & III) CAPI SP is generated on-line and administered to the respondent

Each of the three has advantages and disadvantages, but the choice is generally not based on survey methodological concerns, but on questions of costs and availability of interviewers and CAPI terminals plus the structure of the overall study.

4.3 Presentation formats

SP tasks can be presented in any format, which allows the respondent to see, understand and integrate the different attributes of the experimental design:

- *Written descriptions* either as a listing of the attribute values or as a written text, may be in the form of an advertisement or product description. This is the standard format, in particular for CAPI interviews
- *Pictorial descriptions* are possible, but require substantial care, as the picture or sketch used must be concrete enough to convey the attribute values, but abstract enough to avoid contamination through other picture elements (for a detailed discussion see Swanson, Ampt and Jones, 1997). The quickly growing multi-media capabilities of CAPI-software will no doubt increase the use of pictorial descriptions in SP.

* *Prototypes* can be employed, where the goods have a managable size and weight. While very vivid and present for the respondent, the same concerns as with pictures have to be addressed: Can the design attributes be distinguished and recognized ? Is there any contamination through outside variables ?

Mixtures of these formats are possible, but must be treated with care to avoid an imbalance in the impact of the different information sources. Pictures could, for example, dominate a written description.

4.4 Study process

SP/CA studies should follow the logic of all interview/survey research, which suggests the following elements in the following order:

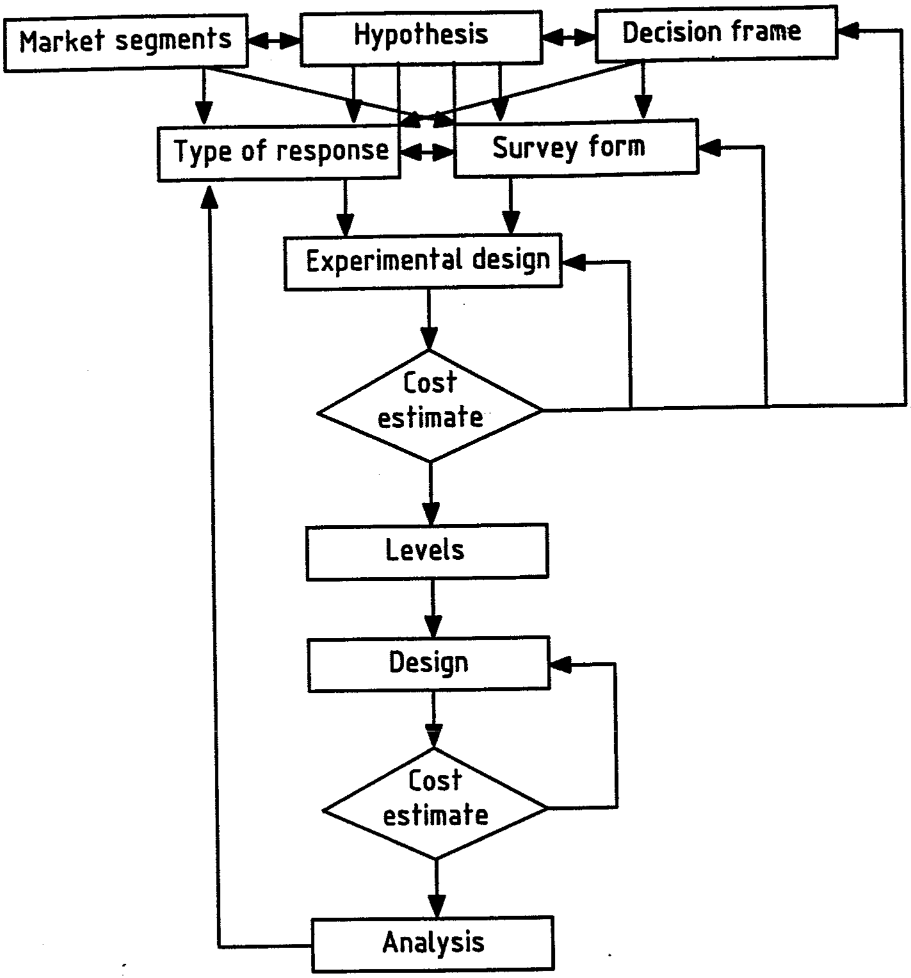
* *Literature review*
* *Focus groups* or *in-depth interviews*
* *Instrument development*
* Small scale *pilot* of the instrument
* *Revision* of the instrument
* *Application*

This process and the requirements of each step are discussed in depth in all basic survey methodology textbooks and does not need to be rehearsed here again. The process of the instrument development is specific enough to warrant a discussion at this point. Figure 4 gives an overview of the elements and their feed-backs.

The first three steps, definition of the market segments, of the hypothesis and of the behavioral frames to be studied, have to be undertaken together, as there are numerous interactions: an attribute can be irrelevant for a particular behavioral frame; a choice alternative is not available to a market segment or a behavioral frame is irrelevant for a market segment. The three aspects have to be consistent.

In CA market segmentation is frequently performed on the basis of the utility functions estimated. This a-posteriori segmentation is implemented at the aggregate level in transport applications through the use of socio-economic variables in the specification of the utility functions. Any a-priori segmentation has to be based on the overall modelling framework into which the SP-results are to be integrated. In transport modelling this implies the socio-demographic categories of the trip generation and distribution models.

Figure 4 Development process of an SP



Source: FGSV (1996), 23

Based on the first three choices, the survey protocol and the format of the preference statements have been selected to achieve the best fit with the study objectives, including the ability to estimate precise utility models. The experimental design (number of attributes, levels and choice alternatives) plus the choice of adaptive or customized varieties follows from the decisions so far.

A cost estimate is required at this point in the process to avoid unnecessary work later in the process. In transport planning SP practise the rule-of-thumb is that a minimum of 30, but better 50-70 returned surveys/interviews are required per block of choice situations, market segment and behavioral frame. For example:

Three blocks of 12 choice situations each
Two market segments (e.g. males and females, car owners and non-car-owners etc.)
Two behavioral frames (e.g. work and shopping trips on a weekday)

Minimum sample size: 30 * 3 * 2 * 2 = 360 successful interviews/returned surveys
Preferred sample size: 60 * 3 * 2 * 2 = 720 successful interviews/returned surveys

Johnson (1996) suggests, that the sample size is determined as a function of the desired precision for the estimate of the choice proportions.

If the cost estimate is higher than the budget available, then a reduction of the complexity preferred so far or a simplification of the survey protocol is required. If not, then the next two steps concern the determination of the values of the attribute levels, including any analysis of existing data (s.a.) and the final design of the survey instrument (format of presentation, development of software, prototypes, pictures and forms etc.). A final cost estimate should be performed before the design is finalized and approved.

As a last step, or jointly with the selection of the attribute level values, the instrument should be tested with regards to its ability to estimate the desired models from its results. It is possible to specify utility functions for a hypothetical population and to use these functions to answer the SP instrument. The resulting hypothetical answers should be used in an estimation of the planned type and it should be verified that the specified utility functions can be recovered from the data and the parameters estimated with sufficient precision. If not, a further iteration starting with the format of the preference statement is required.

5 VALID CONTEXTS FOR SP

The internal validity of SP results in forecasting has been documented in numerous studies (See Louviere and his collaborators in a transport context or the literature in Green and Srivasan, 1978 or Leigh, McKay and Summers, 1984 from marketing). The studies of internal consistency use hold-out choice tasks of various formats, which are part of the SP/CA interview. These studies have consistently shown that the models derived can identify the choices made satisfactorily. The various studies in the transport literature, which have estimated joint models from SP and RP data, support this conclusion, as these models reveal scale differences, i.e. differences in variability, but reveal in general identical functional structures. Furthermore, the growing use of the technique indicates that the clients are satisfied with the results, which in turn must indicate a satisfactory track record in terms of insights and prediction.

More important for the practise in transport or public goods provision is the issue of when to conduct the study during the overall public decision process to which the study belongs. The transport and market research literature is generally silent on this point, but the contingent valuation literature does discuss it at length. Mitchell and Carson (1989) summarize their discussion as shown in Figure 5.

Figure 5 Valid contexts for SP studies

	Obligation to pay perceived as:		
	Amount offered	Uncertain amount	Fixed amount
	Provision of good perceived as contingent on revealed preference		
Motivation	True preference revelation (TP)	Variable (SB_1)	Overpledge (SB_2)
Direction	True value	Uncertain	Overbid
Strength	Strong	Weak to moderate	Strong
	Provision of good perceived as likely, regardless of revealed preference		
Motivation	Free Ride (SB_3)	Free Ride (SB_4)	Nonstrategic – Minimize effort (ME)
Direction	Underbid	Underbid	Random
Strength	Strong	Weak to moderate	Moderate

Source: Mitchell and Carson (1989), 144

CV studies establish willingness-to-pay (WTP), normally in terms of entry fees for a facility or of dedicated taxes, an instrument frequently used in the US to pay for particular services or investments. They argue that it is possible to define a-priori expectations about the respondent's response strategy on the basis of two dimensions: the perceived obligation to pay the stated amount and the importance of the survey in the decision process. Only in one of the six resulting cases (the good will only be provided, if the WTP of the population (respondents) is high enough and if the price will be fixed at the WTP results) can we a-priori expect, that the respondents will reveal their true preferences. In all other cases will we either encounter strategic behaviour misguiding the analyst (Free riding or overpledging) or random behaviour of unknown properties. This approach highlights the need to engage in SP/CA surveys at particular points in the planning/design cycle, in particular, if the respondents have to give WTP indications, as is certainly frequent in transport related studies. This point is early in decision process, well before the decision has been taken to go ahead with the service/investment.

Other policy biases remain even at this point, but they can be much more easily identified and dealt with.

6 CONCLUSIONS

This paper has outlined the *stated-preference* methodology and its cousin *conjoint analysis* as a possible tool for the a-priori evaluation of the TDM measures and for the development of choice models appropriate for the evaluation of the TDM measures.

The model of travel behaviour suggested has highlighted the nature of SP as an approach, which trades off simplification of the behavioral model against tractability and the ability to develop practical forecasting models. The review of the development of the SP and CA methodologies outlined their similarities, but also their differences, which are mostly due to their application environments and their respective professional traditions.

The main sections of the paper described the various elements of the approach and how it can be implemented in practice. The paper stressed three areas in particular:

- a SP study is based on an a-priori behavioral hypothesis which is tested for a-priori specified market segments and behavioral frames of reference
- a SP study is a normal survey study; everything which applies to surveys applies to SP's in terms of methodology and required care
- the results of a SP study are sensitive to its timing. It has to be undertaken at a point in time, when the respondents have an incentive to reveal their true preferences, i.e. when neither the provision nor the price of the good/service have been decided upon.

When these points are accepted and implemented in the SP work, SP studies can make an important contribution to TDM implementation, as they help to identify early, if the measures can achieve their stated goals or if they are nice, but marginal changes to the transport system. SP studies allow the public to participate in the planning process in their role as customers of the transport system. This does not replace their contributions as citizens through the ballot box or the public participation process, but it helps the planner to reflect on any differences between their political willingness to initiate change and their private willingness to act on that change.

7 LITERATURE

Addelman, S. (1962a) Orthogonal main-effect plans for asymmetrical factorial experiments, *Technometrics*, **4** (1) 21-46.

Addelman, S. (1962b) Symmetrical and asymmetrical fractional factorial plans, *Technometrics*, **4** (1) 47-58.

Anderson, N.H. (1974) Algebraic models in perception, in R.C. Carterette and M.P. Friedman (eds.) *Handbook of Perception*, **2**, 215-298, Academic Press, New York.

Axhausen, K.W. (1995) Was sind die Methoden der Direkten Nutzenmessung, Conjoint Analysis oder Stated Preferences, *Straßenverkehrstechnik*, **39** (5) 210-218.

Axhausen, K.W. and P.B. Goodwin (1991) EUROTOPP: Towards a dynamic and activity-based modelling framework, in *Advanced Telematics in Road Transport*, 1020-1039, Elsevier, Amsterdam.

Bates, J.J. (ed.) (1988) Stated Preference Methods in Transport Research, *Journal of Transport Economics and Policy*, **22** (1).

Ben-Akiva, M.E. and S.R. Lerman (1985) *Discrete Choice Analysis*, MIT Press, Cambridge.

Ben-Akiva, M.E. and T. Morikawa (1990) Estimation of switching models from revealed preferences and stated intentions, *Transportation Research*, **24A** (6) 485-495.

Ben-Akiva, M.E., T. Morikawa and F. Shiroishi (1992) Analysis of the reliability of preference ranking data, *Journal of Business Research*, **24** (2) 149-164.

Böcker, F. (1986) Präferenzforschung als Mittel marktorientierter Unternehmensführung, *Zeitschrift für betriebswissenschaftliche Forschung*, **38** (7/8) 543-574.

Bonsall, P.W. (1983) Transfer Price data: Its use and abuse, presentation at the 11th PTRC Summer Annual Meeting, Warwick, September 1989.

Box, G.E.P, W.G.. Hunter, and J.S. Hunter (1978) *Statistics for Experimenters*, John Wiley & Sons, New York.

Bradley, M.A. and A.J. Daly (1993) New issues in stated preferences research, presentation at the 21st PTRC Summer Annual Meeting, Manchester, September 1993.

Brög, W. (1997) Raising the standard: transport survey quality and innovation, paper presented at the *International Conference on Transport Surveys: Raising the Standard*, Grainau, May 1997.

Brög, W. and E. Erl (1980) Interactive measurement methods - theoretical bases and practical applications, paper presented at the 59th Transportation Research Board Annual Meeting, Washington D.C.

Brög, W. and E. Erl (1983) Application of a model of individual behaviour (situational approach) to explain household activity patterns in an urban area and to forecast behavioral changes, in S. Carpenter and P.M. Jones (eds.) *Recent Advances in Travel Demand Analysis*, 350-370, Gower, Aldershot.

Cattin, P. and Wittnik, D.R. (1982) Commercial use of Conjoint Analysis: A survey, *Journal of Marketing Research*, **16** (1) 44-53.

Chatterjee, S. and B. Price (1977) *Regression Analysis by Example*, John Wiley and Sons, New York.

Chicago Area Transportation Study (1960) *Chicago Area Transportation Study: Data Projections*, **2**, Chicago Area Transportation Study, Chicago.

Daganzo, C. (1979) *Multinomial Probit: The Theory and Its Applications to Demand Forecasting*, Academic Press, New York.

Davidson, J.D. (1973) Forecasting traffic on STOL, *Operations Research Quaterly*, **24**, 561-569.

FGSV (1996) *Hinweise zur Messung von Präferenzstrukturen mit Methoden der Stated Prefernces*, Forschungsgesellschaft für das Straßen- und Verkehrswesen, Köln.

Fowkes, A.S. (1991) Recent developments in stated-preference techniques in transport research, paper presented at the 19th PTRC Summer Annual Meeting, Brighton, September 1991.

Fowkes, A.S. and M. Wardman (1988) Design of SP travel choice experiments with special reference to taste variations, *Journal of Transport Economics and Policy,* **22** (1) 27-44.

Fowkes, A.S. and M. Wardman (1992) Non-orthogonal stated preference design, paper presented at the 20th PTRC Summer Annual Meeting, Manchester, September 1992.

Green, P.E. and A.M. Krieger (1995) Attribute importance weights: Modification in assessing a brand's competitive potential, *Marketing Science*, **14** (3) 253-269.

Green, P.E. and V.R. Rao (1971) Conjoint measurement for quantifying judgmental data, *Journal of Marketing Research*, **8** (8) 355-363.

Green, P.E. and V. Srivasan (1978) Conjoint analysis in consumer research: issues and outlook, *Journal of Consumer Research*, **5** (September) 103-123.

Greene, W.H. (1994) *Econometric Analysis*, Maxwell Macmillan, New York.

Hahn, G.J. and S.S. Shapiro (1966) A catalog and computer program for the design and analysis of orthogonal and asymmetric fractional factorial experiments, Report 66-C-165, General Electric Research and Development Center, Schenectady, NY.

Hensher, D.A. (1994) Stated preference analysis of travel choices: the state of practice, *Transportation*, **21** (2) 107-133.

Hey, J.D. (1992) *Experiments in Economics*, Blackwell, Oxford.

Hoinville, G. (1971) Evaluating community preferences, *Environment and Planning*, **3** (1) 33-50.

Hoinville, G. (1973) Evaluating community preferences, *Journal of the Marketing Research Society*, **15** (1) 1-23.

Hoinville, G. (1977) The priority evaluator method, *SCPR Working Paper*, **3**, Social and Community Planning Research, London.

Holden, D.G.P. (1993) Design procedure for stated preference experiments, PhD dissertation, University of Leeds, Leeds.

Huber, J. (1987) Conjoint analysis: how we got here and where we are, paper presented at the *Sawtooth Sotfware Conference*, Sawtooth Software Inc., Evanston, 1997[5].

Hutchinson, B.G. (1974) *Principles of Urban Transport Systems Planning*, Scripta Book Company, Washington, D.C.

Institute of Transportation Engineers (1994) *Transportation Planning Handbook,* Prentice Hall, Englewood Cliffs.

Johnson, R.M. (1996) Getting most from CBC: Part 1, Sawtooth Inc., Evanston[6].

Johnson, R.M. and B.K. Orme (1996) How many questions should you ask in choice-based conjoint studies, paper presented at ART Forum, Beaver Creek, 1996.[7]

Kocur, G., T. Adler, W. Hyman and B. Aunet (1982) *Guide to Forecasting Travel Behavior with Direct Utility Assessment*, Bericht UMTA-NH-11-0001-82-1, US Department of Transportation, Urban Mass Transit Administration.

Krantz, D.H., R.D. Luce, P. Suppes and A. Tversky (1971) *Foundations of Measurement*, **1**, Academic Press, New York.

Kruskal, J.B. (1965) Analysis of factorial experiments by estimating monotone transformations of the data, *Journal of the Royal Statistical Society*, **27B**, 251-263.

Lancaster, K.J. (1966) A new approach to consumer theory, *Journal of Political Economy*, **14** (2) 132-157.

Lee-Gosselin, M. (1996) Scope and potential of interactive stated response data collection methods, *Conference Proceedings*, **10**, 115-133, Transportation Research Board, Washington, D.C.

Leigh, T.W., D.B. McKay and J.O. Summers (1984) Reliability and validity of Conjoint Analysis and self-explicated weights: a comparison, *Journal of Marketing Research*, **21**, 456-462.

[5] Obtained as http://www.sawtoothsotware.com/TechPap.htm/HowweW.zip

[6] Obtained from http://www.sawtoothsoftware.com/TechPap.htm/Gettin1.zip

[7] Obtained as http://www.sawtoothsoftware.com/TechPap.htm/Howmany.zip

Lerman, S.R. and J.J. Louviere (1978) On the use of Functional Measurement to identify the functional form of the utility expression in travel demand models, *Transportation Research Record*, **673**, 78-86.

Levin, I.P., J.J. Louviere, A.A. Schepaski and K.L. Norman (1983) External validity tests of laboratory studies on information integration, *Organizational Behaviour and Human Performance*, **31**, 173-193.

Louviere, J.J. (1988) Analyzing decision making: Metric Conjoint Analysis, *Sage University Papers*, **67**, Sage, Newbury Park.

Louviere, J.J., D.H. Henley, G.G. Woodworth, R.J. Meyer, I.P. Levin, J.W. Stoner, D. Curry and D.A. Anderson (1981) Laboratory simulation versus revealed preference methods for estimating travel demand models, an empirical comparison, *Transportation Research Record*, **794**, 42-51.

Louviere, J.J. and D.A. Hensher (1982) On the design and analysis of simulated or allocation experiments in travel choice modelling, *Transportation Research Record*, **890**, 11-17.

Louviere, J.J. and G. Kocur (1983) The magnitude of individual level variations in demand coefficients: a Xenia, Ohio, case example, *Transportation Research*, **17A**, 363-374.

Louviere, J.J. and R.J. Meyer (1981) A composite attitude-behaviour model of traveller decision making, *Transportation Research*, **15B**, 411-420.

Louviere, J.J., R.J. Meyer, F. Stetzer and L.L. Beaver (1973) Theory, methodology and findings in mode choice behaviour, *Working Paper*, **11**, Institute of Urban and Regional Research, University of Iowa, Iowa City.

Louviere, J.J. and M. Piccolo (1977) Information Integration Theory applied to choice behaviour: validation experiments involving out-of-town shopping and residential choice, *Great Plains Rocky Mountain Journal*, Special Edition, 5-21.

Louviere, J.J. and G. Woodworth (1983) Design and analysis of simulated consumer choice and allocation experiments: An approach based on aggregate data, *Journal of Marketing Research*, **20**, 350-367.

Louviere, J.J. und H. Timmermans (1990a) Hierarchial information integration applied to residential choice behaviour, *Geographical Analysys*, **22**, 127-144.

Louviere, J.J. und H. Timmermans (1990b) Using hierarchial information integration to model consumer responses to possible planning actions: recreation destination choice illustration, *Environment and Planning A*, **22**, 291-308.

Louviere, J.J. und H. Timmermans (1990c) Review of recent advances in decompositional preference and choice models, *Tijdschrift voor economische en sociale geografie*, **81**, 214-224.

Louviere, J.J. und H. Timmermans (1990d) Stated preference and choice models applied to recreation research: A review, *Leisure Science*, **12**, 9-32.

McLean, R.A. and V.L. Anderson (1984) *Applied Factorial and Fractional Designs*, Marcel Dekker, New York.

Meyer, R.J., I.P. Levin and J.J. Louviere (1978) Functional analysis of mode choice, *Transportation Research Record*, **673**, 1-7.

Mitchell, R.C. and R.T. Carson (1989) *Using Surveys to Value Public Goods: The Contingent Valuation Method*, Resources for the Future, Washington, D.C..

Montgomery, D.C. (1984) *Design and Analysis of Experiments*, Wiley & Sons, New York.

Morikawa, T., M.E. Ben-Akiva and K. Yamada (1991) Forecasting intercity rail ridership using revealed preference and stated preference data, *Transportation Research Record*, **1328**, 30-35.

MVA Consultancy, Institute for Transport Studies (Leeds), Transport Studies Unit (Oxford) (1987) The value of travel time savings: A report of research undertaken for the UK Department of Transport, *Policy Journals*.

Norman, K.L. (1977) Attributes in bus transportation, *Journal of Applied Psychology*, **62** (2) 164-170.

Ortuzar, J. de D. and L.G. Willumsen (1994) *Modelling Transport*, Wiley and Sons, New York.

Ortuzar, J. de Dios und R.A. Garrido (1991) Rank, rate or choice ? An evaluation of SP methods in Santiago, Vortrag, 19. PTRC Summer Annual Meeting, Brighton.

Ortuzar, J. de Dios und R.A. Garrido (1994) On the semantic scale problem in stated preference rating experiments, *Transportation*, **21** (2) 185-202.

Papacostas, C.S. and P.D. Prevedouros (1993) *Transportation Engineering and Planning*, Prentice-Hall International, Englewood Cliffs.

Pearmain, D. (1989) The measurement of passenger valuations towards rail station facilities: an application of the "Priority Evaluator Method", presentation at the 17th PTRC Summer Annual Meeting, Brighton, September 1989.

Pearmain, D., J. Swanson and E. Ampt (Forthcoming) *Stated Preference Explained*, SDG, London.

Pearmain, D., J. Swanson, E. Kroes and M. Bradley (1991) *Stated Preference Techniques: A Guide to Practice*, Steer Davies and Gleave, London.

Polak, J.W., P.M. Jones, P. Vythoulkas, S. Meland und T. Tretvik (1991) The Trondheim toll ring: results of a stated preference study of travellers' response, *Working Paper*, **662**, Transport Studies Unit, University of Oxford, Oxford.

Pudney, S. (1989) *Modelling Individual Choice*, Basil Blackwell, Oxford.

Sawtooth Inc. (1995) *The CBC System for choice-based Conjoint Analysis*, Sawtooth Software Inc., Evanston.[8]

Sawtooth Inc. (1996) *ACA System - Adaptive Conjoint Analysis - Version 4.0*, Sawtooth Software Inc., Evanston.[9]

Schnabel, W. and D. Lohse (1997) *Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung*, **II,** Verlag für Bauwesen, Berlin.

Schubert, B. (1991) *Entwicklung von Konzepten für Produktinnovationen mittels Conjointanalyse*, Poeschel-Verlag, Stuttgart.

Swanson, J., E. Ampt and P.M. Jones (1997) Measuring bus passenger preferences, *Traffic Engineering and Control,* **38** (6) 330-336.

Train, K. (1986) *Qualitative Choice Analysis*, MIT Press, Cambridge.

Tscheulin, D.K. (1992) *Optimale Produktgestaltung*, Neue Betriebwirtschaftliche Forschung, **94**, Gabler, Wiesbaden.

Winer, B.J. (1971) *Statistical Principles in Experimental Design*, McGraw Hill, New York.

Wittnik, D.R. and P. Cattin (1989) Commercial use of conjoint analysis: An update, *Journal of Marketing,* **53** (7) 91-96.

Wittink, D.R., M. Vriens and W. Burhenne (1994) Commerical use of conjoint analysis Europe: results and critical reflections, *International Journal of Research in Marketing,* **11** (1) 41-52.

Wrigley, N. (1985) *Categorical Data Analysis for Geographers and Environmental Scientists*, Longman, London.

8 SELECTED REFERENCES TO SP/CA APPLICATIONS (IN GERMAN AND ENGLISH)

Abay, G. (1990) Analyse der Nachfrage im öffentlichen Personennahverkehr, Bericht an das Bundesamt für Verkehr, Abay und Meier, Zürich.

Abay, G. (1992) Der öffentliche Verkehr im Kanton Zug, Bericht an die Volkswirtschaftsdirektion des Kantons Zug, IPSO Planungsgrundlagen und Datenanalysen und Abay & Meier, Zürich.

Adamowicz, W., Louviere, J. and Williams, M. (1994). Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities, *J. Environmental Economics and Management*, **26**, 271-292.

[8] Obtained as http://www.sawtoothsoftware.com/TechPap.htm/CBCTchWp.zip

[9] Obtained as http://www.sawtoothsoftware.com/TechPap.htm/ACATchWp.zip

Akaah, I.P. and Becherer, R.C. (1983) Integrating a consumer orientation into the planning of HMO programs: An application of conjoint segmentation, *J. of Health Care Marketing,* **3**, 9-18.

Akaah, I.P. and Korgaonkar, P.K. (1988) A conjoint investigation of the relative importance of risk relievers in direct marketing, *JAR,* **28**, 38-44.

Albers, S. (1983) Schätzungen von Nachfragereaktionen auf Variationen des Tarif- und Leistungsangebots im öffentlichen Personennahverkehr, *Zeitschrift für Verkehrswissenschaft*, **54**, 207-230.

Amirani, S. and Gates, R. (1993) An attribute-anchored conjoint approach to measuring store image, *International Journal of Retail and Distribution Management,* **5**, 30.39.

Ampt, E., M.A. Bradley und P.M. Jones (1986) Development of an interactive, computer-assisted stated preference technique to study bus passenger preferences, *Working Paper*, **340**, Transport Studies Unit, University of Oxford.

Andersen, P.B., J. Moeller und R.J. Sheldon (1986) Marketing Danish State Railways rail services using a Stated Preference approach, Vortrag, 14. PTRC Summer Annual Meeting, Brighton.

Anderson, D.A., Louviere, J. J., Daniel, T. and Orland, B. (1993) Comparing Verbal and Visual Attribute Representations in Choice-Based Conjoint: Videotapes versus Paper and Pencil, *Working Paper*, Department of Marketing, University of Utah.

Anderson, J. G. and Anderson, J. L. (1990) Quantitative Approaches for Analyzing Consumer Choice Decisions Regarding Seafood Quality and Safety, *Enhancing Consumer Choice: Proceedings of the Second International Conference on Research in the Consumer Interest,* Edited by Mayer, R. N., Columbia, Missouri: American Council on Consumer Interests.

Auty, S. (1995) Using Conjoint Analysis in Industrial marketing: The Role of Judgment, *Industrial Marketing Management,* **24**, 191-206.

Axhausen, K.W. (1989a) Direkte Nutzenmessung: Ein Ansatz zur Schätzung von Entscheidungs-modellen - Zwei Anwendungen, *Zeitschrift für Verkehrswissenschaft*, **60**, 323-344.

Axhausen, K.W. (1989b) Ortskenntnis und Parkplatzwahlverhalten, Abschlußbericht an die Deutsche Forschungsgemeinschaft, Institut für Verkehrswesen, Universität Karlsruhe, Karlsruhe.

Axhausen, K.W. und J.W. Polak (1991) Choice of parking: Stated preference approach, *Transportation*, **18**, 59-81.

Axhausen, K.W. und R.L. Smith (1986) Bicyclist link evaluation: A stated-preference approach, *Transportation Research Record*, **1085**, 7-15.

Backhaus, K. *et al.* (1989) Eine Marketingkonzeption für den grenzüberschreitenden Güterfernverkehr der Deutschen Bundesbahn: Die Relation Rhein/Ruhr - Paris, Gutachten für das Verkehrsforum Bahn e.V., Universität Münster, Münster.

Backhaus, K. *et al.* (1992) Marketingstrategien für den schienengebundenen Güterfernverkehr, *Beiträge aus dem Institut für Verkehrswissenschaft an der Universität Münster,* **126**, Göttingen.

Banister, D. (1979) A method for investigating consumer preferences for certain transport policy alternatives, *Resources and Planning,* Pergamon Press.

Barsky, J. D. (1992) Customer Satisfaction in the Hotel Industry: Meaning and Measurement, *Hospitality Research J.*, **16/1**, 51-73.

Bates, J.J. (1986) Sensitivity to level of service: Evidence from stated preference work, in: *Behavioural Research of Transport Policy*, 269-288, VNU Science Press, Utrecht.

Bates, J.J. , Dix, M. and May, A.D. (1987) Travel time variability and its effect on time of day choice for the journey to work, *Proceedings of Seminar C, PTRC Summer Annual Meeting,* Bath, PTRC, London.

Bates, J.J. (1988) Econometric issues in stated preference analysis, *Journal of Transport Economics and Policy*, **22**, 59-69.

Bates, J.J. (1984) Values of time from stated preference data, 12. PTRC Summer Annual meeting, Brighton.

Bates, J.J. und M. Roberts (1983) Recent experience with models fitted to stated preference data, 11. PTRC Summer Annual Meeting, Bath.

Bauer, H. H., Herrmann, A., and Mengen, A. (1995) A Method of Achieving Maximum-Profit Product Design on the Basis of Conjoint Measurement, *Pricing Strategy & Practice,* **4/1**, 28-33.

Bauer, H. and Thomas, U. (1984) Die Präferenzen von Arbeitnehmern gegenüber Tarifvertragskomponenten, *ZfbF,* **3**, 200-228.

Beane, T.P. und D.M. Ennis (1987) Market Segmentation: A Review, *European Journal of Marketing*, **21,** 20-42.

Becker-Suttle, C. B., Weaver, P. A., and Crawford-Welch, S. (1994) A Pilot Study Utilizing Conjoint Analysis in the Comparison of Age-Based Segmentation Strategies in the Full Service Restaurant market, *J. of Restaurant & Foodservice Marketing,* **1/2**, 71-91.

Beesley, M.E. und D.A. Hensher (1987) The Consistency of Choice Using Experimental Design, *Journal of Economic Psychology (Netherlands)*, **8,** 445-456.

Beggs, S., Cardell, N.S. and Hansman, J. (1981) Assessing the potential demand for electric cars, *J. of Econometrics,* **16**, 1-9.

Ben-Akiva, M.E. und D. McFadden (1990) Demand for telecommunications services and products, Center for Transportation Studies, Massachusetts Institute of Technology, Cambridge.

Ben-Akiva, M.E. und T. Morikawa (1990) Ridership attraction of rail compared with bus, Report UMTA-M.A.-11-0044-91-1, Massachusetts Institute of Technology Center for Transportation Studies, Cambridge.

Ben-Akiva, M.E. und T. Morikawa (1990) Estimation of switching models from revealed preferences and stated intentions, *Transportation Research*, **24A**, 485-495.

Ben-Akiva, M.E., T. Morikawa und F. Shiroishi (1991) Analysis of the Reliability of Preference Ranking Data, *Journal of Business Research*, **23,** 253-268.

Benwell, M. and Black, I.G. (1984) Train service reliability on British Rail InterCity services, Report 3, passenger attitudes to lateness, Unpublished report to British Railway Board, Centre of Transport Studies, Cranfield Institute of Technology.

Beyerle, A. (1986) Suchzeiten im Parkverkehr, Studienarbeit, Institut für Verkehrswesen, Universität Karlsruhe.

Bible, D.S. and Brown, L. A. (1981) Place Utility, Attribute Tradeoff, and Choice Behavior in an Intra-Urban Migration Context, *Socio-Economic Planning Sciences*, **15**, 37-44.

Bishop, R.C. und T.A. Heberlein (1986) Does Contingent Valuation Work?, in R.G. Cummings, D.S. Brookshire and W.D. Schulze (Hrsg.) *Valuing environmental goods: An assessment of the contingent valuation method*, 123-47.

Black, I.G. and J.G. Towriss (1993) Demand effects of travel time reliability, Bericht für das *London Congestion Charging* Forschungsprogram des Department of Transport London, Cranfield Institute of Technology, Cranfield.

Black, W.C., R.A. Westbrook und D.A. Plane (1985) An evaluation of alternative economic inducements to ridesharing for the Arizona commuter, Berichte FHWA-AZ-85-198-I/II/III, Arizona University Department of Marketing, Geography and Regional Development; Arizona University Transportation and Traffic Institute, Tucson.

Blackston, M. und N. van der Zanden (1981) Validity of Conjoint Analysis: Some Real Market Results, *European Research*, **8**, 243-250.

Blamires, C. (1987) 'Trade-Off' Pricing Research: A Discussion of Historical and Innovatory Applications, *Journal of the Market Research Society*, **29,** 133-152.

Blauwens, G. und E. Van de Voorde (1988) The evaluation of time savings in commodity transport *International Journal of Transport Economics*, **15**, 77-87.

Bojamic, D. C. and Calantone, R. J. (1990) A Contribution Approach to Price Building in Tourism, *Annals of Tourism Research*, **17**, 528-540.

Bonsall, P.W. (1983) Transfer Price data: Its use and abuse, Vortrag, 11. PTRC Summer Annual Meeting, Warwick.

Bovy, P.H.L. und M.A. Bradley (1985) Route choice analyzed with Stated-Preference approaches, *Transportation Research Record*, **1037**, 11-20.

Bovy, P.H.L. und M Bradley (1984) A stated preference analysis of cyclist route choice, 12. PTRC Summer Annual meeting, Brighton.

Bradley, M.A. (1988) Realism and adaptation in designing hypothetical travel choice concepts, *Journal of Transport Economics & Policy*, **22,** 121-137.

Bradley, M.A. und P.H.L. Bovy (1985) Functional measurement of route choice behaviour: A study of commuting cyclists in the Netherlands, *Working Paper*, **294**, Transport Studies Unit, University of Oxford.

Bradley, M.A. und A.J. Daly (1991) Estimation of logit choice models using mixed stated preference and revealed preference information, 6. International Conference on Travel Behaviour, Quebec.

Bradley, M.A. und A.J. Daly (1992) Uses of the logit scaling approach in stated preference analysis, Vortrag, 6. World Conference on Transport Research, Lyon, Juli 1992.

Bradley, M.A. und A.J. Daly (1993) New issues in stated preferences research, Vortrag, 21. PTRC Summer Annual Meeting, Manchester.

Bradley, M.A. und H.F. Gunn (1990) Stated preference analysis of values of travel time in the Netherlands, *Transportation Research Record*, **1285**, 78-88.

Bradley, M.A. und P.M. Jones (1989) Developments in stated preference methods and their relevance for activity-based and dynamic travel analysis, *Working Paper*, **470**, Transport Studies Unit, University of Oxford.

Bradley, M.A., P.M. Jones und E. Ampt (1987) Interactive household interview method to study bus provision policies, *Working Paper*, **379**, Transport Studies Unit, University of Oxford.

Bradley, M.A., A. Bouma und T. Grosvenor (1988) An application of computer based stated preference to study mode switching in the Netherlands, 18. PTRC Summer Annual Meeting, Bath.

Bradley, M.A., Marks, P. and Wardman, M. (1986) A summary of four studies into the value of travel time savings, Transportation Planning methods, Proceedings of Seminar M, PTRC London, 271-285.

Brown, GR (1974) Analysis of user preferences for system characteristics to cause a modal shift, *Highway Research Record*, **417**, 25-36.

Bull, A. O. and Alcock, K. M. (1993) Patron Preferences for Features Offered by Licensed Clubs, *International J. of Contemporary Hospitality Management*, **5/1**, 28-32.

Burke International Marktforschungsgesellschaft m.b.H., Frankfurt (1989) Autoreifen, Eiscreme, Eispralinen, PVC-Beläge, Kosmetika, Kundenkreditkarten, Unveröffentlichte Marktforschungsstudien.

Burke International Marktforschungsgesellschaft m.b.H., Frankfurt (1985) Antibabypillen, Kaffeemaschinen, Süßstoff, Unveröffentlichte Marktforschungsstudien.

Burke International Marktforschungsgesellschaft m.b.H., Frankfurt (1984) Kristalltiere, Unveröffentlichte Marktforschungsstudien.

Carmichael, B. (1992) "Chapter 6: Using Conjoint Modeling to measure Tourist Image and Analyze Ski Resort Choice" in *Choice and Demand in Tourism.*, edited by Johnson, P. and Thomas, B., 93-106.

Carpenter, G. S., Glazer, R., and Nakamoto, K. (August 1994) Meaningful Brands from Meaningless Differentiation: The Dependence on Irrelevant Attributes, *J. of Marketing Research,* **31**, 339-350.

Chakraborty, G., Ettenson, R., and Gaeth, G. (1994) How Consumers Choose Health Insurance, *J. of Health Care Marketing*, **14/1**, 21-33.

Chakraborty, G., Gaeth, G., and Cunningham, M. (1993) Understanding Consumers' Preferences for Dental Service, *J. of Health Care Marketing*, **13/3**, 48-58.

Claxton, J. D. (1994) "Conjoint Analysis in Travel Research: A Manager's Guide" in *Travel Tourism, Hospitality Research: Handbook for Managers and Researchers, 2nd Ed.*, Edited by Ritchie and Goeldner, 513-522.

Copley, G. und J.J. Bates (1988) Using the priority evaluator to measure traveller needs, Vortrag, 2. Oxford Conference on Travel and Transportation, Oxford.

Copley, G., G. Terzis, J.J. Bates, C. Heywood, R. Sheldon, A. Goulcher und G. Weston (1993) Use of stated preference methods to determine London Underground passenger priorities, Vortrag, 21. PTRC Summer Annual Meeting, Manchester.

Crawford, H.C. (1987) Uncertainty and the value of passenger waiting time, Unpublished Msc dissertation, Centre for Transport Studies, Cranfield Institute of Technology.

Cummings, C.P., M. Fairhurst, S. Labelle und D. Stuart (1989) Market segmentation of transit fare elasticities, *Transportation Quarterly*, **43**, 407-420.

Cuthbertson, T., N. Douglas, E. Granzow und A.W. Smyth (1988) Incorporating features of public transport design within a strategic urban transportation study, 16. PTRC Summer Annual Meeting, Bath.

de Groot, H., E. Pommer (1989) The Stability of Stated Preferences for public goods: Evidence from Recent Budget Games, *Public Choice*, **60**, 123-32.

Dichtl, E. und Thomas, U. (1986) der Einsatz des Conjoint Measurement im Rahmen der Verpackungsmarktforschung, *Marketing ZfP*, **1**, 35-40.

Didow, N.M. and Barksdale, H.C. (1982) Conjoint Measurement Experiment of Consumer Complaining Behavior, *J. of Business Research,* **10**, 419-429.

Ding, S., Geschke, U., and Lewis, R. (February 20, 1991) Conjoint Analysis and Its Application in the Hospitality Industry, *JIAHR (J. of the International Academy of Hospitality Research),* **2**, 1-31.

Dinwoodie, J. (1989) A stated preference approach to forecasting suburban railway demand in eastern Plymouth, 17. PTRC Summer Annual Meeting, Brighton.

Diwert, W.E. (1986) *The Measurement of the Economic Benefits of Infrastructure Services*, Springer, Berlin.

Dobson, R. (1975) Towards the analysis of attitudinal and behavioural responses to transportation system characteristics, *Transportation,* **4**, 267.290.

Donnelly, E.P. (1976) Preference elasticities of transit fare increases an decreases by demographic groups, *Transportation Research Record,* **589**, 30-32.

Dubè, L., Renaghan, L. M., and Miller, J. M. (1994) Measuring Customer Satisfaction for Strategic Management, *The Cornell Hotel & Restaurant Administration Quarterly,* 39-47.

Durvasula, S., Sharma, S., and Andrews, J. C. (1992) STOLRELOC: A Retail Store Location Model Based on Managerial Judgments, *J. of Retailing*, **68/4**, 420-444.

Embacher, J. and Buttle, F. (1989) A Repertory Grid Analysis of Austria's Image As a Summer Vacation Destination, *J. of Travel Research,* 3-7.

Emery, D. R., Barron, F. H., and Messier, W. F. Jr. (1982) Conjoint Measurement and the Analysis of Noisy Data: A Comment, *J. of Accounting Research*, **20/2**, 450-458.

Ettenson, R., Wagner J. and Gaeth G. (1988) Evaluating the Effect of Country of Origin and the „Made in the USA" Campaign: A Conjoint Approach, *J. of Retailing,* **64**, 85-100.

Evans, R., M. Brown, A.S. Fowkes, P. Mackie, R. Sheldon, C. Heywood (1993) Review and specification of model elasticities, London Congestion Charging, Bericht an das Department of Transport, Halcrow Fox Associates, Accent Market Research und Institute of Transport Studies, University of Leeds, London und Leeds.

Filiatrault, P. and Ritchie, J. R. B. (1988) The Impact of Situational Factors on the Evaluation of Hospitality Services, *J. of Travel Research,* 29-37.

Finn, A. and Louviere, J. (1990) Shopping-Center Patronage Models: Fashioning a Consideration Set Segmentation Solution, *J. Business Research,* **21**, 259-275.

Fowkes, A.S. (1991) Recent developments in stated preference techniques in transport research, 19. PTRC Summer Annual Meeting, Brighton.

Fowkes, A.S., C.A. Nash und G. Tweddle (1991) Investigating the market for inter-modal freight technologies, *Transportation Research*, **25A**, 161-172.

Fowkes, A.S. und G Tweddle (1988) A computer guided stated preference experiment for freight mode choice, 16. PTRC Summer Annual Meeting, Bath.

Fowkes, A.S. und M. Wardman (1988) The design of stated preference travel choice experiments, *Journal of Transport Economics & Policy*, **22**, 27-44.

Fowkes, A.S. und M. Wardman (1993) Non-orthogonal stated preference design, Vortrag, 21. PTRC Summer Annual Meeting, Manchester.

Franzen, O. und Scharf A. (1990) Imageanalyse für Farbfernsehgeräte, Unveröffentlichte Ergebnisse eines Marktforschungspraktikums am Institut für Marketing und Handel der Universität Göttingen.

Fujiwara, A. und Y. Sugie (1991) Panel analysis of stated preference data, Vortrag, 6. IATB Conference, Quebec.

Garrido, R.A. und J. de D. Ortuzar (1993) The Chilean Value of Time study: methodological developments, 21. PTRC Summer Annual Meeting, Manchester.

Gan, C. (1992) A Conjoint Analysis of Wetland-Based Recreations: A Case Study of Louisiana Waterfowl Hunting, *Unpublished Dissertation*, Louisiana State University.

Gelszus Marktforschung G.m.b.H., Hamburg (1988) Füllfederhalter, Unveröffentlichte Marktforschungsstudie.

Goldberg, S. M., Green, P. E., and Wind, Y. (1984) Conjoint Analysis of Price Premiums for Hotel Amenities, *J. of Business*, **57/1,** 111-132.

Gosh, A. and Craig C.S. (1986) An Approach to Determining Optimal Locations for new Services, *JMR,* **23**, 354-362.

Graf, M.A., Tanner, D.D. and Swinyard W.R. (1993) Optimizing the delivery of patient and physician satisfaction: A conjoint analysis approach, *Health Care Management Review,* **4**, 34-43.

Green, P. E. and Krieger, A. M. (1995) Attribute Importance Weights Modification in Assessing a Brand's Competitive Potential, *Marketing Science,* **14/3**, Pt. 1/2, 253-270.

Green, P. E. and Savitz, J. (1994) Applying Conjoint Analysis to Product Assortment and Pricing in Retailing Research, *Pricing Strategy and Practice,* **2/3**, 4-19.

Green, P. E. and Krieger, A. M. (1992) An Application of a Product Positioning Model to Pharmaceutical Products, *Marketing Science*, **11/2**, 117-132.

Green, P. E. and Krieger, A. M. (1990) Theory and Methodology: A Hybrid Conjoint Model for Price-Demand Estimation, *European J. of Operational Research,* **44**, 28-38.

Griner, B. P. and Farber, S. C. (1996) A Conjoint Analysis of Water Quality Enhancements and Degradations in a Western Pennsylvania Watershed, Watershed '96 *Conference Paper*, Water Environment Federation, Baltimore MD, 1996.

Griner, B. P. and Farber, S. C. (1996) Valuing Watershed Quality Enhancements using Conjoint Analysis, Fourth Biennial Meeting of the International Society of Ecological Economics, *Conference Paper*, Boston, MA, 1996.

Grunert, K.G. (1983) Die ermittlung entscheidungsrelevanter Produktmerkmale beim Autokauf, in: Dichtl, E., Raffée, H., Potucek, V. (Hrsg.) Marktforschung im Automobilsektor, *Schriftenreihe des Verbandes der Automobilindustrie,* **40**, 38-58.

Hargreaves, G., Claxton, J. D., and Siller, F. H. (1981) New Product Evaluation: Electric Vehicles for Commercial Applications, *Multivariate Analysis in Marketing, 2nd Ed.*, edited by Aaker, D. A., Palo Alto, CA: The Scientific Press, 105-107.

Harison, W.J., Pell, C., Jones, P.M. and Ashton, H. (1986) Some advances in model design developed for practical assessment of road pricing in Hong Kong, *Transportation Research,* **20A**, 135-143.

Hatch, D. und M. Flack (1974) Priority research techniques applied to public transport investment, *Journal of the Market Research Society*, **16** (1) 1-11.

Hauser, J. R., Tybout, A. M., and Koppelman F. S. (1981) Consumer-Oriented Transportation Service Planning: Consumer Analysis and Strategies, *Applications of Management Science,* edited by Schultz, R. L., Greenwich, CT: JAI Press Inc., **1**, 91-138.

Hensher, D.A. (1990) Hierarchical stated response designs: An application to bus user preferences, *Logistics and Transportation Review*, **26**, 299-321.

Hensher, D.A., P.O. Barnard und T.P. Truong (1988) The role of stated preference methods in studies of travel choice, *Journal of Transport Economics & Policy*, **22,** 45-58.

Hensher, D.A. und H. Battellino (1992) The use of discrete choice models in the determination of community preferences towards sub-arterial traffic management devices, Vortrag, 6. World Conference on Transport Research, Lyon, Juli 1992.

Hensher, D.A. und J.J. Louviere (1979) Behavioural intentions as predictors of very specific behaviour, *Transportation*, **8**, 167-182.

Hensher, D.A. und J.J. Louviere (1983) Identifying individual preferences for international air fares, *Journal of Transport Economics and Policy*, **17**, 225-245.

Hensher, D.A. und T.P. Truong (1985) Valuation of time savings, *Journal of Transport Economics and Policy*, **19**, 237-261.

Hensher, D.A. (1994) Stated preference analysis of travel choices: The state of practice, *Transportation*, **21**, 107-133.
Hirobata, Y. und S. Kawakami (1990) Modeling disaggregate behavioral modal switching models based on intention data, *Transportation Research*, **24B**, 15-25.
Hoinville, G. (1971) Evaluating community preferences, *Environment and Planning*, **3** (1) 33-50.
Hoinville, G. (1973) Evaluating community preferences, *Journal of the Marketing Research Society*, **15** (1) 1-23.
Hoinville, G. (1977) The priority evaluator method, *SCPR Working Paper*, **3**, Social and Community Planning Research, London.
Holden, D.G. and A.S. Fowkes and M. Wardman (1992) Automatic stated preference design algorithm, 20. PTRC Summer Annual Meeting, Manchester.
Hopkinson, P.G. (1989) The measurement of passenger valuation towards rail station facilities: An application of the 'priority evaluator method', UTSG Annual conference, Edinburgh.
Hu, C. (1994) Measuring meeting planner's preferences of hotel site selection: A hybrid conjoint analysis approach, *Unpublished master's thesis*, Purdue University, West Lafayette, Indiana, U.S.A.
Institut für Markt- und Werbeforschung GmbH, Hamburg (1982) Haushaltsreiniger, Schulfüller, Unveröffentlichte Marktforschungsstudien.
Institut für Markt- und Werbeforschung GmbH, Hamburg (1978) Fernsehgeräte, Shampoo, Unveröffentlichte Marktforschungsstudien.
Institut für Markt- und Werbeforschung GmbH, Hamburg (1977) Kühlerfrostschutzmittel, Unveröffentlichte Marktforschungsstudien.
Iten, R. (1990) Die mikroökonomische Bewertung von Veränderungen der Umweltqualität dargestellt am Beispiel der Stadt Zürich, *Schriftenreihe des Instituts für Empirische Wirtschaftsforschung*, **20**, Universität Zürich, Zürich.
Iten, R. und R. Maggi (1989) The economic value of traffic noise in an urban area: Empirical evidence from a hedonic and discrete choice approach, 5. World Conference on Transportation Research, Yokohama.
Jackson, W.B. and Tucker, J.V. (1982) An empirical study of travel time variability and travel choice behaviour, *Transportation Science*, **16**, 460-476.
Jakubiak, S., R.R. Mudge und R. Hurd (1990) Using market research to improve management of transportation systems, *NCHRP Report*, **329**, Transportation Research Board, Washington.
Johnson, L.W. und C.J. Nelson (1991) Market response to changes in attributes of a long-distance passenger rail service, *Managerial and Decision Economics*, **12**, 43-55.
Johnston, R.H., J.J. Bates und M. Roberts (1989) A survey of peak spreading in London, Methodology and initial results, 19. PTRC Summer Annual Meeting, Brighton.
Jones, P.M. (1989) An overview of stated preference techniques, *Working Paper*, **494**, Transport Studies Unit, University of Oxford.
Jones, P.M., M.A. Bradley und E. Ampt (1989) Forecasting household response to policy measures using computerised, activity-based stated preference techniques, in International Association for Travel Behaviour (Hrsg) *Travel Behavior Research*, 41-63, Gower, Aldershot.
Jones-Lee, M.W. (1990) The value of transport safety, *Oxford Review of Economic Policy*, **6** (2) 39-60.
Joseph, A. E., Smit, B. and McIlravey, G. P. (1989) Consumer Preferences for Rural Residences: A Conjoint Analysis in Ontario, Canada, *Environment Planning A*, **21**, 47-63.
June, L. P. and Smith, S. L. (1987) Service Attributes and Situational Effects on Consumer Preferences for Restaurant Dining, *J. of Travel Research,* 20-27.
Kaciak, E. und J.J. Louviere (1990) Multiple Correspondence Analysis of Multiple Choice Experiment Data, *Journal of Marketing Research*, **27**, 455-465.
Kara, A., Kaynak, E. and Kucukemiroglu, O. (1994) Credit Card development Strategies for the Youth Market: The Use of Conjoint Analysis, *International J. of Bank Marketing,* **12/6**, 30-36.
Kempe, P. (1992) Applications of Conjoint Analysis: Segmentation and New Product Development, *Marketing Opportunities with Advanced Research Techniques: Proceedings of the second SKIM Seminar*, Rotterdam, The Netherlands: SKIM Market and Policy Research, 27-32.

Knoblich, H., Franzen, O. und Schubert B. (1988) Einstellungen und Präferenzen gegenüber alternativen Radioprogrammkonzepten. Eine empirische Untersuchung, Unveröffentlichte Marktforschungsstudie, Göttingen 1988.

Knoblich, H., Schubert B. und Hapke W. (1986) Timotei. Einführung einer Marke. Erfolgreiche Positionierung in einem überbesetzten Markt, Hamburg 1986.

Kopel, P. S. and Kever, D. (1991) "Using Adaptive Conjoint Analysis for the Development of Lottery Games - An Iowa Lottery Case Study" in *1991 Sawtooth Software Conference Proceedings*, Ketchum, ID: Sawtooth Software, Inc., 143-154.

Koppelman, F.S. (1990) Market research evaluation of actions to reduce suburban traffic congestion, UMTA-IL-11-0033, Traffic Institute, Northwestern University, Evanston.

Kress, G. J. and Snyder, J. (1994) Analyzing Markets — Five Emerging Techniques. In *Forecasting and Market Analysis Techniques: A Practical Approach*, Westport, CT: Quorum Books, 257-282.

Krietemeyer, H. (1990) Die Conjoint-Measurement-Technik: Ein neues Analyseverfahren, *Der Nahverkehr*, **8**, 64-67.

Kroeber-Riel, W., Möcks, R. und Neibecker, B. (1982) Zur Wirkung von Duftstoffen, Untersuchungsbericht des Institutes für Konsum- und Verhaltensforschung für die Firma Henkel (Düsseldorf), Universität des Saarlandes, Saarbrücken.

Kroes, E.P. und R.J. Sheldon (1985) Stated Preference Techniques in Measuring Travel Elasticities, in G.R.M. Jansen, P. Nijkamp, C.J. Ruijjgrok (Hrsg.) *Transportation and Mobility in an Era of Transition*, 201-210, North-Holland, Amsterdam.

Kroes, E.P., R. Sheldon und J. Swanson (1987) Developing models used in stated preference research, 15. PTRC Summer Annual Meeting, Brighton.

Kroes, E.P. und R.J. Sheldon (1988) Stated Preference Methods: An Introduction, *Journal of Transport Economics & Policy*, **22,** 11-25.

Lattin, T. (1990) High-tech Helping to Target Guests' Preferences, *Hotel & Motel Management.*

Levesque, T.J. und J. Rothwell (1989) Evaluating the demand for commuter aircraft attributes, *Journal of the Transportation Research Forum*, **29**, 213-222.

Leutzbach, W., A. Buck and K.W. Axhausen (1986) Möglichkeiten und Grenzen der Führung des Radverkehrs auf Radfahrstreifen von anbaufreien Straßen, *Schriftenreihe Straßenbau und Straßenverkehrstechnik*, **488**, Bundesministerium für Verkehr, Bonn.

Louviere, J.J. (1988) Conjoint analysis modelling of stated preferences, *Journal of Transport Economics and Policy*, **22**, 93-119.

Louviere, J.J., D.H. Henley, G. Woodworth, R.J. Meyer, I.P. Levin, J.W. Stoner, D. Curry und D.A. Anderson (1981) Laboratory-simulation Versus Revealed-preference methods for estimating travel demand models, *Transportation Research Record*, **794**, 42-51.

Louviere, J.J. und H. Timmermans (1990a) Hierarchial information integration applied to residential choice behaviour, *Geographical Analysys*, **22**, 127-144.

Louviere, J.J. und H. Timmermans (1990b) Using hierarchial information integration to model consumer responses to possible planning actions: recreation destination choice illustration, *Environment and Planning A*, **22**, 291-308.

Louviere, J.J. und H. Timmermans (1990c) Review of recent advances in decompositional preference and choice models, *Tijdschrift voor economische en sociale geografie*, **81**, 214-224.

Louviere, J.J. und H. Timmermans (1990d) Stated preference and choice models applied to recreation research: A review, *Leisure Science*, **12**, 9-32.

Louviere, J. J. and Johnson, R. D. (1990) Reliability and Validity of the Brand-Anchored Conjoint Approach to Measuring Retailer Images, *J. of Retailing*, **66/4**, 359-382.

Mackenzie, J. (1992) Evaluating Recreation Trip Attributes and Travel Time Via Conjoint Analysis, *J. of Leisure Research.* **24/2**, 171-184.

Marks, P. und A.S. Fowkes (1986) Stated preference experiments concerning long distance business travel in Great Britain, *Working Paper*, **219**, Institute for Transport Studies, University of Leeds.

Maw, J. und J. Bradley (1977) Passenger evaluation of Underground improvements, *Greater London Intelligence Journal*, **37**, 28-31.

Mayall, P.D. and Winzar, H.F. (1995) Measuring the Adherence of Corporate Loan Officers to Bank Lending Guidelines: An Australian Study, Proceedings of the Third Management Control Systems Symposium, London, July 3-5.

Mayall, P. D. and Winzar, H. F. (1993a) Inter-Bank Comparison of Criteria Affecting Loan Assessment, *Conference Paper*, Australian Finance Educators' Conference, The University of New South Wales, December.

Mayall, P. and Winzar, H. F. (1993b) Loan Officer Loan Assessment: A Conjoint Analysis, Commerce Faculty Seminar Series, Murdoch University, August 6.

McCord, M.R. und O.G. Villoria (1987) Nonlinear utility in time and cost of trips: Disaggregate results from an ordinal methodology, *Transportation Research Record*, **1138**, 8-17.

Mladek, A. und Tupy N. (1983) Beratungsqualität oder Rabatte? Empirische Befunde zur Leistungsbeurteilung der Reisevermittler aus der Sicht der Reisekonsumenten, *Der Markt*, **85**, 24-26.

Mohn, N. C. (1990) Simulated-Purchase "Chip" Test vs. Tradeoff (Conjoint) Analysis -- Coca-Cola's Experience, *Marketing Research*, 49-54.

Morikawa, T. und M.E. Ben-Akiva (1992) Estimation of mode choice models with serially correlated RP and SP data, Vortrag, 6. World Conference on Transport Research, Lyon, Juli 1992.

Moskowitz, H. R. Gofman, A., and Tungaturthy, P. (1996) Multi-Media Development and Optimization of Concepts for a fast Food Restaurant, *Unpublished Paper*, White Plains, New York: Moskowitz Jacobs Inc.

Moskowitz, H. R. (1994) Incorporating Consumer Feedback into Package Description and Presentation: A Multi-Media Approach, *Conference Paper*, The Conference of Packaging Research with Consumers held by the American Society for Testing & Materials in Montreal, Canada.

Muhlbacher, H. und G. Botschen (1988) The Use of Trade-Off Analysis for the Design of Holiday Travel Packages, *Journal of Business Research*, **17**, 117-131.

Mummalaneni, V., Dubas, K. M., and Chao, C. (1996) Chinese Purchasing Managers' Preferences and Trade-Offs in Supplier Selection and Performance Evaluation, *Industrial Marketing Management*, **25**, 115-124.

MVA Consultancy, Institute for Transport Studies (Leeds), Transport Studies Unit (Oxford) (1987) The value of travel time savings: A report of research undertaken for the UK Department of Transport, *Policy Journals*.

Nickerson, C. A., & McClelland, G. H. (1987) Beliefs and values and the sterilization decision, *Population and Environment*, **29**, 74-95.

Newman, R.G. (1984) A Conjoint Analysis in Outpatient Clinic Preferences, *J. of Health Care Marketing*, **4**, 41-49.

Norris, B.B. und R. Golaszewski (1990) Economic development impact of airports: A cross-sectional analysis of consumer surplus, *Transportation Research Record*, **1274**, 82-88.

Okechuku, C. (1994) The Importance of Product Country of Origin: A Conjoint Analysis of the United States, Canada, Germany and the Netherlands, *European J. of Marketing*, **28/4**, 5-19.

O'Reilly, D., J. Hopkin, G. Loomes, M.W. Jones-Lee, P. Philips und K. McMahon (1992) The value of road safety: UK research on injury valuation,.

Ortuzar, J. de Dios und R.A. Garrido (1991) Rank, rate or choice ? An evaluation of SP methods in Santiago, Vortrag, 19. PTRC Summer Annual Meeting, Brighton.

Ortuzar, J. de Dios und R.A. Garrido (1993) Estimation of discrete choice models with mized SP and RP data, XIII World Conference on Operations Research, Madrid.

Ortuzar, J. de Dios und R.A. Garrido (1994) On the semantic scale problem in stated preference rating experiments, *Transportation*, **21** (2) 185-202.

Ortuzar, J. de Dios und R.A. Garrido (1993) A practical assessment of Stated Preference Methods, erscheint in *Transportation*.

Ortuzar J. de Dios und A. Palma (1988) Stated preferences in refrigerated and frozen cargo exports, 16. PTRC Summer Annual Meeting, Bath.

Ostrom, A. and Iacobucci, D. (1995 January) Consumer Trade-offs and the Evaluation of Services, *J. of Marketing*, **59**, 17-28.

Page, A. L. and Rosenbaum, H. F. (1987) Redesigning Product Lines with Conjoint Analysis: How Sunbeam Does It, *J. of Product Innovation Management*, **4**, 120-137.

Parker, B.R. and Srinivasan V. (1976) A Consumer Preference Approach to the Planning of Rural Primary Health-Care Facilities, *Operations Research*, **24**, 991-1025.

Palakurthi, R. R. (1991) Designing a mobile hotel system using metric hybrid conjoint analysis technique, *Unpublished master's thesis*, Purdue University, West Lafayette, Indiana, U.S.A.

Pearmain, D. (1989) The measurement of passenger valuations towards rail station facilities: an application of the "Priority Evaluator Method", Vortrag, 17. PTRC Summer Annual Meeting, Brighton.

Polak, J.W. (1992) Recent developments in the use of Stated Preference techniques for the valuation of travel time, *Working Paper*, **693**, Transport Studies Unit, University of Oxford.

Polak, J.W. und K.W. Axhausen (1989) The Birmingham CLAMP stated preference survey, *Working Paper*, **502**, Transport Studies Unit, University of Oxford.

Polak, J.W. und P.M. Jones (1991) Assessing the responses of travellers in Birmingham and Athens to in-home pre-trip information, *Working Paper*, **664**, Transport Studies Unit, University of Oxford, Oxford.

Polak, J.W., P.M. Jones und G. Stokes (1989) Computer-based personal interviews: a practical tool for complex travel surveys, 19. PTRC Annual Summer Meeting, Brighton.

Polak, J.W. und K.W. Axhausen (1990) Modelling the choice of mode and parking in Birmingham: Initial model estimation results, Report to Birmingham City Council, *Working paper*, **522**, Transport Studies Unit, University of Oxford.

Polak, J.W., P.M. Jones, G. Stokes, G. Payne und J. Strachan (1989) Computer-based personal interviews: A practical tool for complex travel surveys, *Working Paper*, **466**, Transport Studies Unit, University of Oxford.

Polak, J.W., P.M. Jones, P. Vythoulkas, S. Meland und T. Tretvik (1991) The Trondheim toll ring: results of a stated preference study of travellers' response, *Working Paper*, **662**, Transport Studies Unit, University of Oxford, Oxford.

Preston, J. und M. Wardman (1991) The use of hypothetical questioning techniques to assess the future demand for travel in the Nottingham Area, UTSG Annual Conference, Nottingham.

Preston, J. (1991) Demand Forecasting for New Local Rail Stations and Services, *Journal of Transport Economics & Policy*, **25**, 183-202.

Priem, R. L. (1992) An Application of Metric Conjoint Analysis for the Evaluation of Top Managers' Individual Strategic Decision Making Process: A Research Note, *Strategic Management J.*, **13**, 143-151.

Reddy, V. S., Bush, R. J., and Roudik, R. (1996) A market-oriented approach to maximizing product benefits: Cases in U.S. Forest Products Industries. In Environmental Issues and Market Orientation: Current Topics in Forest Products Marketing, Heikki Juslin and Miikka Personen (Eds.), Department of Forest Economics, University of Helsinki, Finland, **4**, 19-38.

Reddy, V. S. (1994). The Price Sensitivity of Industrial Buyers to Softwood Lumber Product and Service Quality: An Investigation of the U.S. Wood Treating Industry, *Unpublished dissertation*, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Research Business Report (1995 May) MJI's "magic Bullet" Cures Ailing Concepts & Brands, *Research Business Report*, 2p.

Rosko, M. D., McKenna, W., DeVita, M. and Walker, L. R. (1985) Strategic Marketing Applications of Conjoint Analysis: An HMO Perspective, *J. of Health Care Marketing*, **5/4**, 27-38.

Rowley, G. und S. Wilson (1975) The analysis of housing and travel preferences: A gaming approach, *Environment and Planning A*, **7**, 171-177.

Saunders, L. (1972) Value of time for air travellers on the land feederjourney to an airport, *Geographical Paper*, **13**, University of Reading, Reading.

Schumacher, H. (1987) Präferenzen bei der Wahl des Parkstandstypes, Studienarbeit, Institut für Verkehrswesen, Universität Karlsruhe.

Schumacher, H. (1992) Möglichkeiten einer besseren ÖPNV-Nutzung durch Angehörige und Besucher der Universität Karlsruhe, Diplomarbeit, Institut für Verkehrswesen, Universität Karlsruhe.

Schubert, B. (1991) *Entwicklung von Konzepten für Produktinnovationen mittels Conjointanalyse*, Poeschel-Verlag, Stuttgart.

Schubert, B. (1989) Conjointanalyse als Instrument zur Entwicklung von Verkaufsförderungskonzepten am Beispiel von Incentive-Reisen. Unveröffentlichter Untersuchungsbericht einer Pilotstudie, Göttingen.

Schubert, B. (1989) Conjointanalyse mittels computergestützter Datenerhebung. Ein Anwendungsbeispiel der adaptiven Conjointanalyse (ACA) zur Ermittlung kaufrelevanter Eigenschaften bei Autoreifen, Unveröffentlichter Untersuchungsbericht, Göttingen.

Schubert, B. (1989) Die Einschätzung der Konsumentenpräferenzen beim Kauf von Autoreifen durch Reifenhändler, Unveröffentlichter Forschungsbericht, Göttingen.

Schubert, B. (1987) Ermittlung einstellungsrelevanter Produkteigenschaften bei Absatzmittlern. Eine Conjointanalyse für Fahrradreifen, Unveröffentlichte Ergebnisse einer Pilotstudie, Göttingen.

Schubert, B. (1987) Konzeptentwicklung für ein Insektizid auf biologischer Basis mittels Conjointanalyse, Unveröffentlichter Untersuchungsbericht, Göttingen.

Schubert, B. (1987) Einsatz der Conjointanalyse bei Produktivgütern - dargestellt am Beispiel der Ermittlung einstellungsrelevanter Eigenschaften bei der Beurteilung von Fertigbau-Schornsteinen, Unveröffentlichte Ergebnisse einer Pilotstudie, Göttingen.

Schubert, B. (1987) Einsatz der Conjointanalyse bei Produktivgütern - dargestellt am Beispiel der Ermittlung einstellungsrelevanter Eigenschaften bei der Beurteilung von Fertigbau-Schornsteinen, Unveröffentlichte Ergebnisse einer Pilotstudie, Göttingen.

Schubert, B. (1983) Die Präferenzwirkung der Merkmale Farbe und Design bei der Produktbeurteilung. Conjointanalytische Untersuchungen mit Schreibtischlochern und Schreibtischlampen, Unveröffentlichter Forschungsbericht, Göttingen.

Schubert, B. (1981) Ermittlung einstellungsrelevanter Merkmale bei der Beurteilung von Studenten-Appartments, Unveröffentlichter Untersuchungsbericht, Göttingen.

Segal, R. (1995) Forecasting the Market for Electric Vehicles in California Using Conjoint Analysis, *The Energy Journal*, **16/3**, 89-111.

Sheldon, R.J., C. Bottom und T. Golob (1985) An examination of the priorities that passengers place upon features of the London Underground system, Vortrag, 13. PTRC Summer Annual Meeting, Brighton.

Sheldon, R.J. und E.P. Kroes (1988) Are there any limits to the amount consumers are required to pay for product improvements?, 16. PTRC Summer Annual Meeting, Bath.

Smith, S. L. (1989) "Conjoint Measurement" in Tourism Analysis: A Handbook, New York: John Wiley & Sons, Inc., 82-94.

Stanton, W. W. and Reese, R. M. (1983) Three Conjoint Segmentation Approaches to the Evaluation of Advertising Theme Creation, *J. of Business Research,* **11**, 201-216.

Suzuki, S., N. Harata und K. Ohta (1989) A study on the measurement methods of the value of time, *Transport Policy, Management & Technology*, **4**, 175-187, Western Periodical Company.

Swanson, J., D. Pearmain und D. Holden (1993) New approaches to the design of stated preference experiments, Vortrag, 21. PTRC Summer Annual Meeting, Manchester.

Tantiwong, D. and Wilton, P.C. (1985) Understanding Food Store Preferences Among the Elderly Using Hybrid Conjoint Measurement Models, *J. of Retailing,* **61**, 35-65.

Target Group (1992) Bevölkerungsstudie Hagen, Bericht an die Hagener Straßenbahn AG, Fürth.

Target Group (1993) Bevölkerungsstudie Oberhausen, Bericht an die STOAG, Fürth.

Thomas, L. (1983) Der Einfluß von Kindern auf die Produktpräferenzen ihrer Mütter, Berlin 1983.

Timmermans, H. (1987) Hybrid and Non-Hybrid Evaluation Models for Predicting Outdoor Recreation Behavior: A Test of Predictive Ability, *Leisure Sciences,* **9**, 67-76.

Timmermans, H. (1982) Consumer Choice of shopping centre: an information integration approach, *Regional Studies,* **16**, 171-182.

Toy, D., Rager, R., and Guadagnolo, F. (1989) Strategic Marketing for Recreational Facilities: A Hybrid Conjoint Analysis Approach, *J. of Leisure Research,* **21/4**, 276-296.

Tscheulin, D.K. (1992) *Optimale Produktgestaltung*, Neue Betriebwirtschaftliche Forschung, **94**, Gabler, Wiesbaden.

Ueda, T. (1994) Analysis of Preferences for Services Based on Conjoint Analysis, IEICE Transactions on Communications, **J77-B/9**, 542-549. Japan: Institute of Electronics, Information and Communication Engineers (in Japanese).

Verron, H. (1986) Verkehrsmittelwahl als Reaktion auf ein Angebot, *Schriftenreihe des Instituts für Verkehrsplanung und Verkehrswegebau*, **20**, TU Berlin, Berlin.

Vickers, Z. M. (1993) Incorporating Tasting into a conjoint analysis of taste, health claim, price and brand for purchasing strawberry yogurt, *J. Sensory Studies*. **8**, 341-352.

Wardman, M. (1985) An analysis of motorists' route choice using stated preference techniques, *Working Paper*, **212**, Institute for Transport Studies, University of Leeds.

Wardman, M. (1988) A Comparison of Revealed Preference and Stated Preference Models of Travel Behaviour, *Journal of Transport Economics & Policy*, **22** (1) 71-91.

Wardman, M. (1991) Stated Preference methods and travel demand forecasting: An examination of the scale factor problem, *Transportation Research*, **25A** (1) 79-89.

Weaver, W.C. (1984) Forecasting Office Space Demand with Conjoint Measurement Techniques, *The Appraisal Journal,* 389-398.

Weiner, J. (1994) Consumer Electronics Marketer Uses A Conjoint Approach to Configure Its New Product and Set the Right Price. *Marketing Research*, **6/3**, 7-11.

Weiss, P.A. (1992) *Die Kompetenz von Systemanbietern: ein neuer Ansatz im Marketing für Systemtechnologien*, Schmidt-Verlag, Berlin.

Wicks, J. und M. Beswick (1986) The nature of rail to rail interchange, Vortrag, 14. PTRC Summer Annual Meeting, Brighton.

Widlert, S., T. Gärling und S. Uhlin (1989) Evaluating the standard of public transport, Transportforskningsberedningen, *TFB Rapport*, **2**, Umeå.

Wind, Y, Green, P. E., Shifflet, D., and Scarbrough, M. (1989) Courtyard by Marriott: Designing a Hotel Facility with Consumer-Based Marketing Models, *Interface,* **19/1**, 25-47.

Winzar, H., Pidcock, P., and Johnson, L. (1993) Modelling Long Distance Preasure Travel Mode Using Perceived Modal Attributes, *J. of Travel & Tourism Marketing*, **2/1**, 53-67.

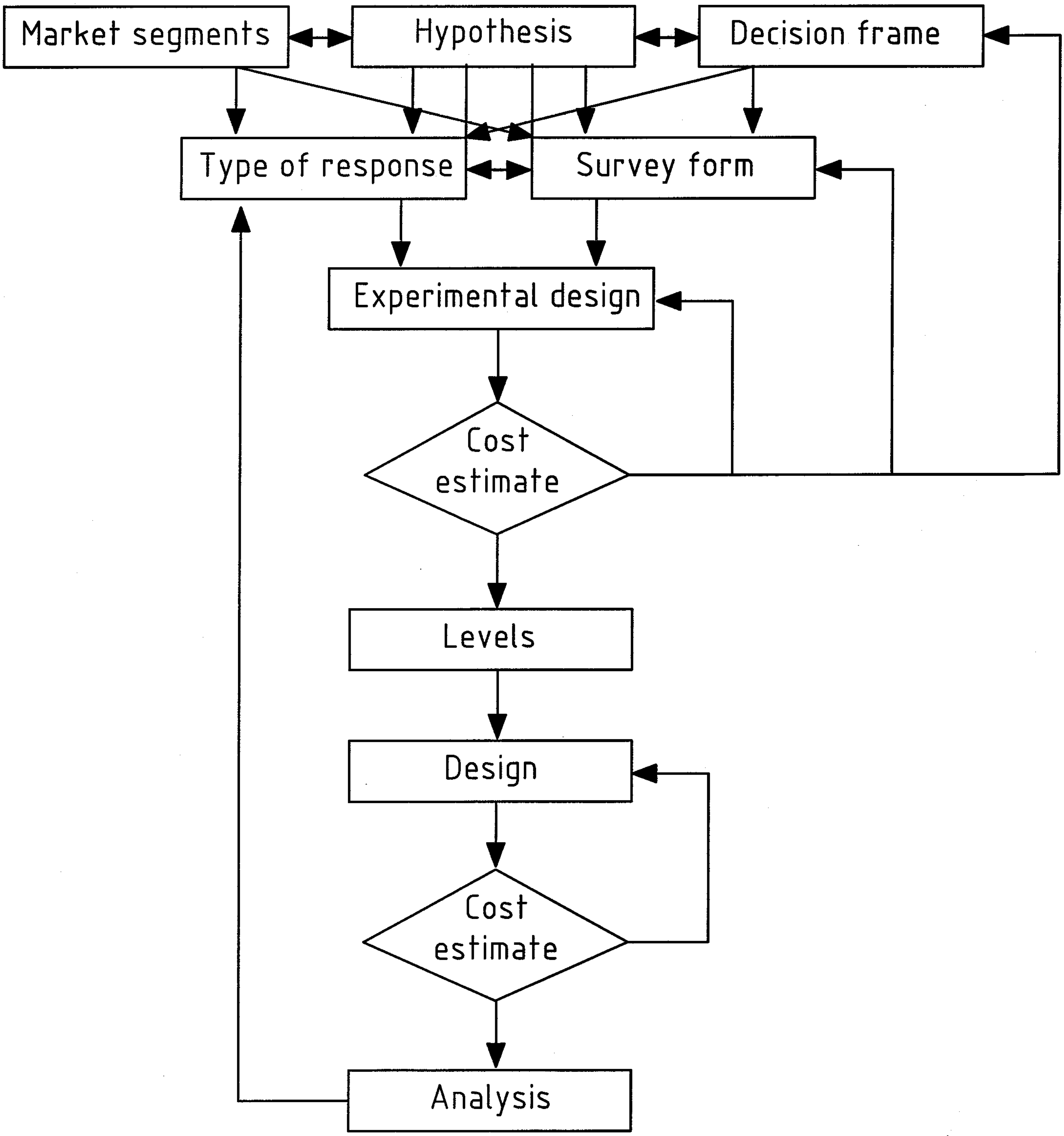
Wöhler, K. (1988) Der Einfluß der Senioren auf dem Reisemarkt nimmt zu. Anpassung im Angebot und in Beratung? *FVW-International,* **17**, 39-40.

Wolfgang Schaefer Marktforschung (1988) Fertiggerichte und Lotteriesparen, Unveröffentlichte Marktforschungsstudien, Hamburg.

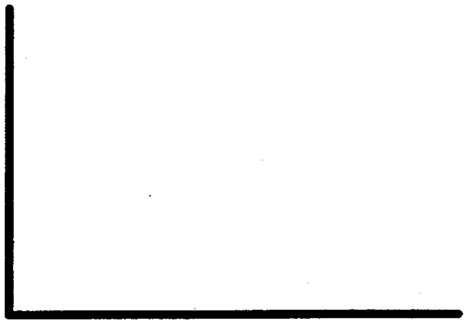
Woodside, A.G. und J.A. Carr (1988) Consumer Decision Making and Competitive Marketing Strategies: Applications for Tourism Planning, *Journal of Travel Research*, **26**, 2-7.

Wyner, G. A., Benedetti, L. H., and Trapp, B. M. (1984) Measuring the Quantity and Mix of Product Demand, *J. of Marketing,* **48**, 101-109.

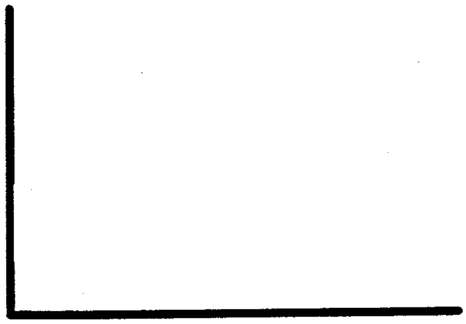
Zondag, E.R., J.T. Jetten und J.H.P. Van Rens (1989) The use of confounding and repeated measurement analysis to increase the sensitivity of stated preference experiments, in International Association for Travel Behaviour: *Travel Behavior Research*, 266-280, Gower, Aldershot.



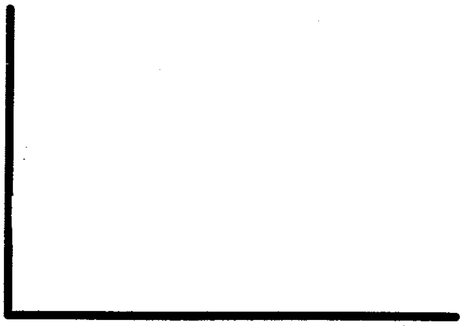
Market segments
Hypothesis
Decision frame
Type of response
Survey form
Experimental design
Cost estimate
Levels
Design
Cost estimate
Analysis



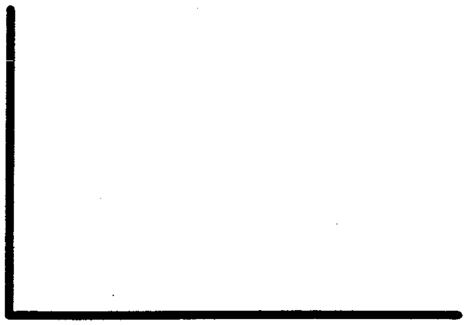
Linear: 2+ levels



Logistic: 3+ levels



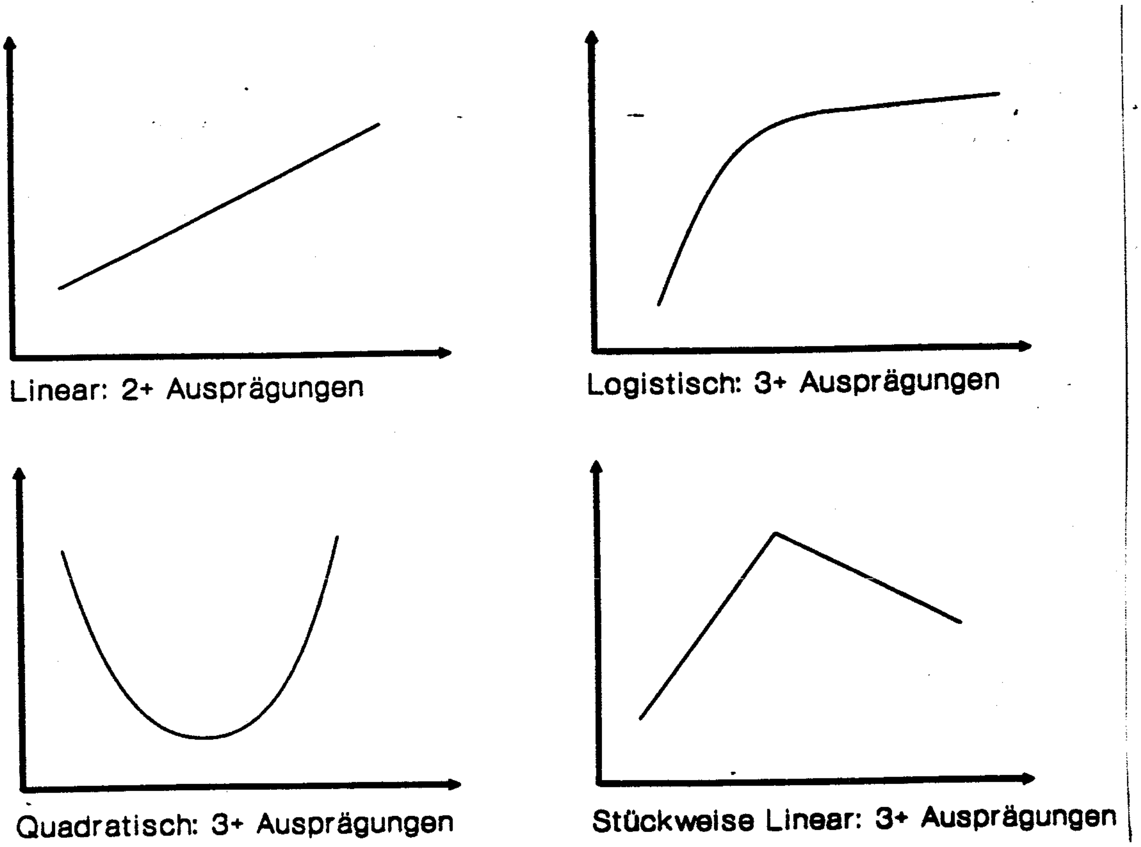
Quadratic: 3+ levels



Piecewise linear: 3+ levels

preference statements, which can have serious effects on the parameter estimates. The simple correction methods for the t-statistics might not suffice (Louviere and Woodworth, 1983).

Figure 3 Minimum number of levels per attribute and functional form



Source: after FGSV (1996), 25

4 SP-SURVEY PROTOCOLS AND PROCESS

The core of SP approach defines the task of the respondent and the number of choice situations to be answered and how they are constructed. It does not specify, what model/hypothesis is being tested, how the values of attribute levels are derived and how the choice situation is presented to the respondent. This section will first discuss these three issues before summarizing the discussion by describing the overall process of a SP-study.