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Solving Marketing Problems With Conjoint Analysis*

Conjoint analysis has become a popular research tool after its introduction in marketing in 1971 by Green and Rao. Both the academic as well as the commercial community have shown a strong interest in the conjoint methodology. In the academic literature attention is either directed at methodological issues or is aimed at application issues. A considerable amount of academic research is now available, both in the field of marketing as well as in other disciplines. The methodological developments have been reviewed extensively, as well as the commercial use of conjoint analysis. In the academic literature no systematic evaluation of the developments in the area of applications has been given. In this article we aim to fill this gap in the literature. After a brief discussion of the basic concepts of conjoint analysis we discuss the range of marketing problems which can be addressed by conjoint analysis. Issues to which attention is addressed include among others: (1) strategic issues, (2) segmentation issues, (3) product related issues (including market simulations), (4) pricing issues, (5) distribution issues and (6) promotion and advertising issues. For each kind of issue the applicability of conjoint analysis is systematically reviewed. By classifying the applications according to the research purpose (i.e. the marketing problem) we obtain insight into the areas in which conjoint analysis may be successfully applied. In addition, a brief discussion of the types of products (e.g. consumer durables, fast moving consumer goods, industrial goods, etc.) to which conjoint analysis may be applied is provided. Finally, we also comment on the limitations of the methodology with respect to its applicability.

1. Introduction

The starting point for the marketing discipline lies in an adequate analysis of consumers' preferences for specific products or services. Organizations underscoring the marketing conception will be eager to match their products (or services) as close as possible to these consumer preferences. To be able to do this, the marketing manager needs to know exactly to what extent the various characteristics of a product contribute to its overall attractiveness, or better yet to its overall profitability. This need not only concern the characteristics of the tangible product (e.g.

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features, brand name, packaging), but may also concern elements of the augmented product (e.g. after sales service, warranty, etc.; see Kotler 1988).

A general approach for the analysis of consumer preferences is the conjoint measurement methodology, developed originally by Luce and Tukey (1964), and for which Green and Srinivasan adopted the name conjoint analysis. In the academic literature on conjoint analysis attention is either directed at methodological issues (e.g. estimation methods, preference elicitation procedures, improving predictive validity, etc.) or is aimed at application issues (cf. Vriens 1992). Sometimes, the methodological angle cannot be separated from the specific application at hand. For example, several developments concerned with improving the predictive validity of conjoint analysis combined this issue with the issue of segmentation (e.g. Hagerty 1985; Kamakura 1988). Currently, a considerable amount of academic research is available both in the field of marketing as well as in other disciplines (e.g. Psychology, Transportation Research, Medical Decision Making). During the development of the technique, several review articles have been written (Rao 1977; Green and Srinivasan 1978; Timmermans 1984; Louviere 1988; Green and Srinivasan 1990). These review articles are mainly concerned with the methodological and statistical developments, and little attention is given to applications. In addition, the commercial use of conjoint analysis has been documented extensively (Cattin and Wittink 1982; Wittink and Cattin 1989; and Wittink, Vriens and Burhenne 1993). Wittink and Cattin have studied the commercial use of conjoint analysis in the U.S. and Wittink, Vriens and Burhenne have replicated their study in Europe. These studies report the incidence of conjoint analysis applications by market research suppliers during a prespecified period of time. In addition, these studies report the percentages of applications which were designed for specific study purposes. For example, Wittink *et al.* (1993) found that pricing was the single most frequently identified purpose in Europe, whereas in the U.S. it was the third in frequency. In Europe, new product/concept identification was ranked second and market segmentation was ranked third. Other purposes specified in these studies include competitive analyses, repositioning and distribution. The "commercial use" studies demonstrate the increasing popularity of conjoint analysis. However, to demonstrate the potential of conjoint analysis to solve marketing problems the "commercial use studies" remain incomplete for two reasons. First, several of the identified study purposes may in fact represent a rather broad class of marketing problems. For example, new product/concept identification probably represents marketing problems like product modification, redesigning of product lines and new product development (i.c. developing innovations). It is important to review the possibilities of conjoint analysis in each of these areas. Second, for some of the marketing problems (e.g. market segmentation) several approaches have been proposed in the literature to deal with the problem at hand. It is important to consider these approaches in some detail and to identify the pros and cons (which may even depend upon the specific application at hand).

Thus, to conclude, although in the academic literature a lot of attention is directed at the way in which conjoint analysis may be applied to all kinds of marketing problems, no systematic evaluation of these developments has been given. In this article we aim to fill this gap in the literature. In Section 2 we begin with a brief discussion of the basic concepts of conjoint analysis. Like in the "commercial use papers" we will also classify conjoint applications on the basis of the purpose for which it is used for (e.g. segmentation, product modification; pricing, etc.) and the

type of product on which the conjoint methodology is applied to (e.g. consumer durables, industrial goods, fast moving consumer goods, services, etc.). These classifications may serve as a useful framework for the practitioners who are currently using the technique or who are planning to use the technique in the near future. The purpose-based classification is discussed in Section 3 and the product-type based classification is discussed in Section 4. These considerations show the powerful possibilities conjoint analysis has to offer for quite a large number of marketing problems. We conclude our paper with some considerations regarding the limitations of the techique with respect to its applicability to certain application areas.

2. Basic Concepts

Conjoint analysis is a technique used by marketing managers to gain an insight into consumers' preferences for products and services. Products and services are hereby defined on a limited number of relevant characteristics. These characteristics are called attributes. These attributes can be defined on a number of levels. An example will make this clear. Coffee-makers can, among other things, be defined on the following attributes: price, brand name, capacity, colour and the presence/absence of a flavour-cap. Subsequently, these attributes are defined by the values that they can adopt. An example of this is given in Table 1.

Table 1. Attributes of coffee-makers

Capacity	*Price*	*Brand*	*Colour*	*Flavour cap*
Max. 6 cups	$20	Philips	White	Present
Max. 8 cups	$30	Moulinex	Black	Absent
Max. 10 cups	$40	Rowenta	Brown	
Max. 14 cups	$50	Ismet	Red	

The (hypothetical) coffee-makers can be specified on the basis of these five attributes and corresponding levels. In the example mentioned above, 512 ($4 \times 4 \times 4 \times 4 \times 2$) coffee-makers can be constructed by varying the levels within the attributes. Full product descriptions of this kind are called "full profiles". An example of a full profile is given below.

Table 2. An example of a full profile

Brand:	Philips
Capacity:	Max. 10 cups
Price:	$50
Colour:	White
Flavour cap:	Present

Next in a conjoint analysis experiment respondents are asked to evaluate a limited collection out of the complete set of 512 in terms of preference or attraction (e.g. ordering or rating).* The overall appreciations for the profiles can be related to the different levels of the attributes. To every level of each attribute a number is

* Using fractional factorial designs we only need 16 profiles, derived from Addelman's Basic Plans (1962).

attached in such a way, that given a certain model, the rating or ordering can be reconstructed as good as possible. The numbers attached to these levels are called partworth utilities. Summing the partworth utilities, which belong to a certain profile, yields the overall utility if the additive model is used. It should be noted that the levels of the different attributes are quantified on one common scale: the utility-scale. In this way we can see how the different characteristics are balanced against each other. This analysis takes place, in first instance, at the individual level. This means that we have a set of partworth utilities for each respondent and for each attribute. Such results enable us to answer the following questions.

—What is the importance or utility of a certain level within a certain attribute?
—What is the importance of the attributes? This is usually defined as the difference between the utility of the most attractive level (within that attribute) and the utility of the least attractive level (as indicated by the partworth utilities).
—How are the attributes balanced against each other?
—Can we identify sharp increases or decreases of partworth utilities within an attribute (the critical transitions or barriers)?
—What is the overall utility of the profiles not involved in our research? We cannot only make statements about the overall utility of the alternatives used in our experiment, but we can also compute the overall utility for the remaining possible alternatives.
—Are there any individual differences? Because each respondent gives a number of evaluations about a set of different profiles, enough degrees of freedom are available to perform analyses at an individual level. By making a comparison of the estimated partworth utilities at the individual level between respondents, one can investigate the existence of individual differences. Combining these analyses with a cluster analysis procedure may yield respondents which are homogeneous with respect to their preference structure. Such segments are referred to as benefit segments.
—Finally, conjoint results enable us to perform market simulations in which we can ask "what if" type of questions.

In most conjoint applications, questions like the above are answered. In the remaining part of this paper the discussion will center around which specific marketing problems may be solved by the conjoint analysis approach described above.

3. A Purpose-based Classification of Conjoint Analysis

Conjoint analysis studies can be classified according to the purpose they were meant to serve. Based on a survey among commercial users in U.S. Cattin and Wittink (1982) identified five different purposes (new product/concept identification, pricing, market segmentation, advertising, distribution). In their "update" study Wittink and Cattin (1989) added to this list competitive analysis and repositioning. Adapting the classifications found in the "commercial use" papers we arrived at a purpose-based classification (see Table 3) which will be used in this paper to discuss the various possibilities. It should be stressed that these categories are not mutually exclusive. In fact Wittink and Cattin (1989) observed that on the average more than two purposes were served by a given study, whereas Wittink *et*

Table 3. A purpose-based classification

1. Marketing segmentation
2. Product decisions
3. Competitive analyses
4. Pricing decisions
5. Promotional decisions
6. Distribution purposes

al. (1993) observed that on the average approximately 1·5 purposes were served by a given study. In this section the various marketing problems mentioned are discussed according with their appearance in Table 3. We believe this to be the best way to convey valuable information to the practitioner.

Segmentation Purposes

Modern marketing in industrialized countries cannot do without segmentation of the market. The implementation of the segmentation concept can take a variety of forms depending mainly on which type of segmentation base is used. Constructing segments on the basis of partworth utilities certainly assures that the responsiveness criterion is satisfied. Other criteria which should be satisfied for target segments include (1) substantiality (2) accessibility and (3) actionability. From the literature it is evident that the use of benefits outperforms the other segmentation bases, because this base is the only one which can (potentially) satisfy all of the aforementioned criteria (Wedel 1990). The most common approach to operationalize the concept of benefits is through the use of conjoint analysis. The partworth utilities obtained via conjoint analysis may serve as the numerical representations of the benefits. In practice the construction of benefit segments usually takes place in two stages (see for an overview of two stage benefit segmentation approaches Green and Krieger 1991). At the first stage partworths are estimated at the individual level. At the second stage individuals are clustered on the basis of similarity of benefits using some clustering algorithm. Examples can be found in Antilla *et al.* (1981) and Sands and Warwick (1981). Before we discuss some drawbacks of the two-stage approach the results of Antilla *et al.* (1981), Sands and Warwick (1981) and others will be discussed.

In Antilla *et al.* (1981) conjoint analysis is applied to the market of color television sets. The choice of color television sets is considered to be dependent on six attributes namely: (1) size, (2) brand name, (3) price, (4) guarantee, (5) color reproduction and (6) design. The full profile method was chosen for data collection, using a fractional factorial design of 26 profiles. The sample consisted of 200 respondents. After individual analyses of the preferences a cluster analysis was performed to identify meaningful segments. These segments (clusters) are constructed in such a way that respondents within a segment have similar partworth utilities while there exist important differences between the identified segments. The authors were able to identify a quality-prone segment, a price-conscious segment and a segment in which modern design and small-tube television sets were highly valued. These results were compared with the existing product line. It turned out that the current product line of the company did not cover the third segment. These results initiated some further research and this resulted in the

introduction of a new model specially designed for the third segment. In Sands and Warwick's study (1981) one was interested in the optimal specification of a new table radio, which still had to be designed at the time of study. Using the above described two-stage procedure, these authors found four benefit segments.

Knowing the attribute importances for every segment can also support the formulation of an appropriate communication message. For this purpose we may also want to link these segments to socio-economic and media-coverage data of the respondents. Wind *et al.* (1978) for example, studied preferences for a system to obtain Scientific and Technical Information (the STI-system) and they found five benefit segments. To obtain more detailed information about the nature of the five segments the authors performed a series of multiple discriminant analyses in which segments were linked to several background characteristics.

However, the traditional two-stage approach to consumer benefit segmentation has a number of important methodological limitations. First, estimating conjoint models at the individual level results in unreliable partworth estimates which may cause misclassifications (cf. Kamakura 1988). An *alternative* two-stage procedure may overcome this limitation. In the alternative two-stage procedure subjects are clustered, at the first stage, on the basis of their stated preferences. At the second stage, partworths are estimated across respondents within each of the resulting segments (e.g. Green and Srinivasan 1978). A second shortcoming which concerns both two stage procedures, is related to the criterion being optimized in clustering algorithms. Such algorithms are generally not directed at optimizing some measure of interest (e.g. predictive fit, R^2) of the conjoint models within the segments or the expected mean square error of prediction (Hagerty 1986). Fortunately, a number of procedures have been developed specifically to alleviate one or both of the aforementioned disadvantages. They have been proposed by, among others, Hagerty (1985), Kamakura (1988), DeSarbo *et al.* (1992), Wedel and Steenkamp (1989) and Wedel *et al.* (1991). It is beyond the scope of this article to discuss this issue fully (see for an overview Vriens *et al.* 1992).

Another important development in which the segmentation concept is linked to conjoint analysis is the componential segmentation procedure developed by Green and DeSarbo (1979). Componential segmentation involves an extension of conjoint analysis (Green 1977; Green and DeSarbo 1979). The principle behind componential segmentation is the acknowledgement that background characteristics or characteristics of the situation may interact with product attributes. This interaction between respondent background characteristics and product attributes is assumed to influence the respondents' overall preferences with respect to a set of multiattribute alternatives. In componential segmentation we are interested to what extent the interaction between respondents' background characteristics and product attributes contribute over and above the variance accounted for by the product attributes. It is important to see that we are not interested in the main effects due to respondents background variables because these main effects only represent response biases such as for example the tendency of some respondents to give higher evaluative ratings (Green and DeSarbo 1979). The procedure discussed in Green and DeSarbo (1979), called the COSEG-II approach, utilizes multiple regression model comparisons tests. The product attributes are entered first and unconditional in the regression equation. In the next step the interactions between product attributes and respondent or situation characteristics are systematically entered in the regression equation and tested by means of a model comparison

test. The procedure is extended in a recent paper by Green *et al.* (1989). In their article they discuss how optimal products can be found for segments and vice versa. However, the implementation of the componential segmentation procedure involves the availability of a large database from which the sample of respondents can be drawn according to the chosen fractional factorial design. In addition, model misspecification arises because the parameters are estimated across respondents. Furthermore it is not clear to what extent the componential segmentation procedure shows superior performance. Moore (1980) found no difference in the empirical performance of both the traditional two-stage procedure and the componential segmentation procedure.

Product Related Purposes and Competitive Analyses

Product related marketing problems, especially those concerned with new product development, require a considerable amount of information. Part of these decisions are currently made by intuition, sometimes supported by small scale qualitative research findings or simulated purchase testing procedures. In this section we discuss the possibilities conjoint analysis has to offer to several product related issues. Among the product related issues we consider in this paragraph those applications which are designed to assist possible product modifications, optimal product design, the redesigning of product lines, and the development and evaluation of new product concepts (see Table 4).

Table 4. Possible product decisions

1. Product modifications
2. Optimal product design
3. *Redesigning* of product lines
4. Evaluation of new product concepts

The product related purposes in Table 4 may concern both consumer goods as well as industrial products. The principles discussed in this section may also apply, to a certain extent, to services. Each of the possibilities depicted in Table 4 can be combined with *competitive analyses* by using market simulation models.

The possibilities depicted in Table 4 are more or less hierarchically related. Product modifications usually refer to modifications or changes on one or two attributes. Also, adding a new feature to the product may be characterized as a product modification. Decisions with respect to optimal product design take into account all the attributes on which the product is defined. The redesigning of product lines not only considers all relevant product attributes but is also concerned with what happens to the other products in the product line. At the highest level in the hierarchy we consider those decisions which are concerned with new product concepts.

The introduction of the flavour cap on coffeemakers by Braun can be considered as an example of a product modification. Questions typically asked by management are: (1) Would consumers be interested in the modification?; (2) How is the trade-off between this new feature and the other attributes?; and (3) Which amount of money is one willing to pay for this modification. Sometimes management is

completely unsure about the ideal specification of the product attributes. For example, in the study reported by Sands and Warwick (1981) the client was interested in introducing a new table radio and was completely unsure about what features to build into the radio. The conjoint results were used to identify a number of benefit segments, and the question was which combination of characteristics will lead to the highest utility within a given market segment. This problem is, in principle, easy to solve because one just has to choose the most preferred level of each attribute. In reality, such problems are somewhat more complicated for a number of reasons. First, the costs to implement the different levels of the attributes must be incalculated. Second, one should take into account the way in which other marketing mix variables are specified (e.g. distribution and promotion). Thirdly, it will be clear that product decisions can hardly ever be made isolated. For example, when we consider the whole product line the problem becomes more complex. We speak of a product line when we are dealing with a group of closely related products. The individual models in the product line are more or less related. Decisions to add or eliminate models may influence the cost structure as well as the demand for different models in the product line. Changes in demand may have two important effects: (1) cannibalization effects and (2) competition effects. Naturally cannibalization effects should be kept to a minimum. In addition, competition effects should seriously be taken into account as well and their deteriorating effects should also be minimized. When a market share is taken away from one or more competitors, it is important to know where it comes from. Page and Rosenbaum (1987) describe the way in which conjoint analysis can support redesigning decisions. The authors describe this in view of the Sunbeam case, in which the preferences for food processors were investigated. Sunbeam, the client of this research, thought it necessary to redesign the product line for food processors. Based on the reults of conjoint analysis a segmentation analysis was executed. This analysis produced a clearer insight into a number of likely product modifications. Next, an estimation was made of the preference shares of all brands and models currently existent on the market, based on the results of conjoint analysis. For each respondent, the overall utility was estimated for every brand and model. Further, the position of the preference shares (or estimated market shares) for the different brands and models were calculated. The correlation with the actual market shares appeared to be no less than 0·96. This situation is called "base case" and it will be clear that a reliable market simulation can be based on it. A market simulation examines the way in which market shares will move when the current product line is changing. For example by (1) adding a model in the product line, (2) adding two or more models in the product line, (3) adding one model and eliminate another, etc. These simulations will help us understand to what extent the proposed changes lead to an increase (or even decrease) of the organization's market share in the market concerned. Based on such a simulation the Sunbeam organization has added three completely new models to the product line. However, it is possible to go even one step further. The simulations also show from which competitors the market share is taken away and to what extent this has been done. In a case study reviewed by Clarke (1987), a similar research is described as the one by Page and Rosenbaum. This case centers around the product line of forklift trucks. The set-up of this study is basically similar to the study by Page and Rosenbaum. In this study, however, a Japanese firm was expected to enter the market on short term with a cheap, but qualitatively good model. The organization's management thought

"Japan" capable of producing cheaper models for the low price segment against lower costs. A second problem concerned the existence of a strong competitor on the market. Every increase in market shares made at that specific competitor's expense might cause undesirable strong reactions. Therefore a scenario was chosen that did not lead to an optimal improvement in market share. Instead a scenario was chosen that lead to an improvement of market share, which was taken away from weaker competitors, who were probably lacking the power to strike back.

The results of the product simulator approach, described above, have been used to provide an estimate of the probable market share of some possible product modifications or product line modifications. According to Zufryden (1988), who refers to product modifications as new products, this approach disregards two critical aspects of the so-called new product performance, namely: (1) the prediction of cumulative trial and (2) the prediction of repeated purchase patterns of the new product over time. Zufryden's approach consists of a stochastic model that utilizes the outputs of a market simulation, based on conjoint results, to estimate the distribution of purchase probability for a new product over a population of potential consumers. That is the actual predicted choice probabilities are used to fit a beta distribution. These results then, describe the consumer brand-choice behaviour *given* the occurrence of a product-category purchase occasion. This fitted distribution is then combined with a model of product-class purchase incidence. The brand-choice model and the product-category purchase incidence model are now integrated in a *brand-choice purchase incidence* model and enables us to estimate the cumulative purchase pattern of the simulated brands.

The development of new products probably is the most risky endeavour among product related marketing problems. Conjoint analysis has often been identified as a relevant method in the new product development process. Among the 24 methods and models to deal with new product development problems, Mahajan and Wind (1991) found conjoint analysis the sixth frequently used. Moreover, Mahajan and Wind (1991) found conjoint analysis to be the most satisfactory method. Among commercial conjoint applications Wittink *et al.* (1993) demonstrate that new product development was mentioned as one of the most frequent application areas. In the process of new product development, product evaluation takes place after generating new ideas. The aim of this is to eliminate ideas that do not correspond with the organization's long term objectives. Next, as a transition to the business economical analysis following, it could be investigated what the specification of the new product should look like to attract as much buyers as possible, this with the help of conjoint analysis.

Pricing Related Purposes

In most applications price is considered equally important as other attributes. In those cases where the effect of pricing is not the main course of interest, the definition of a number of realistic price levels will do. It is not advisable to simply omit the attribute from the study, because in that way non-realistic profiles develop and respondents will label prices to those profiles themselves. An example of a price application, in which price is considered equally important as other attributes, can be found in Currim *et al.* (1981). This study centers around the potential features of a subscription on to a number of theater shows. The management was

interested in the highness of the reduction the subscribers should get. Such reductions are usually based on the manager's intuition and/or experience. With the help of conjoint analysis this can be investigated systematically. The study by Currim *et al.* (1981) showed that pricing is relatively less important than some other attributes. The results of this study enabled the management to decide on the right marketing mix for subscriptions. It could be imagined that the fixing of an optimal price is so important that we cannot treat it as just another attribute in the conjoint analysis research. In the literature a number of methods are suggested to approach pricing problems with the help of conjoint analysis. Besides, it is well recognized that management should have information about the price elasticity of demand. Market planners, for example, do want to forecast brand demand at various alternative price levels in order to develop pricing strategies and in order to set sales goals (cf. Wyner *et al.* 1984). In some cases demand curves can easily be estimated for existing brands by multiple regression, using historical data. In other cases, for example, for new products, there are no historical data available to correlate quantities demanded at various price levels. Therefore other procedures have been proposed for dealing with these kinds of pricing problems. The traditional conjoint approach may be less attractive for these kinds of problems because of one of the following reasons. First, in the traditional conjoint approach it is assumed that each price can appear at each level of the other attributes, including brand name. This means that all brands are subject to identical variations in the price levels. Second, it is assumed that no interactions exists between price and brand name. Although it is possible to adapt the traditional conjoint approach, in order to relax these assumptions, a number of authors have proposed a series of alternative approaches which circumvent the above assumptions and which also exhibit some additional advantages.

A first alternative conjoint approach was proposed by Mahajan *et al.* (1982). By adapting the data collection procedure used by Jones (1975) they were able to determine own-product and cross-product price demand relationships. The main features of the procedure are discussed below. Let us assume that we only consider brand name and price. As opposed to traditional conjoint analysis each brand is seen as a single attribute. For these so-called brand-attributes a number of price levels are defined: the specific price levels belonging to that specific brand. If we have, for example four brand names, each defined on 5 price levels then a full factorial design would consist of $5^4 = 625$ combinations. The next step then is to select some fractional factorial design to construct a manageable stimulus set for the respondents. A stimulus of the type described above could look like:

brand A	brand B	brand C	brand D
$150	$165	$220	$125

In traditional conjoint analysis a stimulus would represent *one* product profile which can be evaluated by the respondent. In this approach *one* stimulus in fact represents 4 product profiles where each profile is defined on two attributes. In the procedure of Mahajan *et al.* the respondent is not asked to rate each product profile separately but the respondent is asked to allocate 100 points across the four alternatives so as to reflect the likelihood of choosing each brand-price combinations. Note that for each brand a set of brand-specific price levels is or can be defined. Sub-

sequently, the data are transformed in order to be able to estimate a conditional logit model using generalized least squares for parameter estimation at the segment-level (see Theil 1969). Because the model also includes the prices of competitive brands, the results yield price-elasticities as well as cross-price elasticities.

The procedure proposed by Mahajan *et al.* (1982) was extended by Wyner *et al.* (1984). Their procedure not only models the choice for a specific brand but also models the quantity bought. In addition it allows for the possibility that more than one type of product is chosen by an individual. Their procedure extends the procedure proposed by Mahajan *et al.* (1982) in at least two important ways. First, instead of considering only price and brand name other attributes are included. Second, their procedure not only models the choice for a specific brand but also the quantity bought. A similiar procedure was proposed by Louviere (1986).

An important disadvantage of procedures like the one proposed by Mahajan *et al.* (1982), Wyner *et al.* (1984) and Louviere (1986) is the fact that these choice-like data cannot be estimated at the individual level. Therefore, as an alternative, Goldberg *et al.* (1984) and Green and Krieger (1990) propose to use a hybrid conjoint modeling approach in which it is possible to estimate price-demand relationships while maintaining individual differences. An extensive discussion of this approach is beyond the scope of this article.

Promotion and Distribution Problems

A smaller number of applications of conjoint analysis focusing on promotional and distribution problems has appeared in the literature. Nevertheless, conjoint analysis can also be applied successfully in these areas, as the following discussion will illustrate. An example of how conjoint analysis may be applied to the design of optimal trade promotions can be found in Levy *et al.* (1983). They discuss how conjoint analysis can contribute to gain an insight in the way push strategies should be formulated. It is often clear which action variables are important to the distributors, but it is not always certain how high these variables should be. It is for instance known that distributors appreciate corporate advertising, but the highness of the available budget is to be discussed. Consequently, it may be wondered to what extent actions directed at increasing the distributor's preference for the product will have effect on the profits. This problem was solved by (1) identifying relevant action variables (in this case corporate advertising, use of coupons, financial payment conditions and service level), (2) determining the preference of possible combinations (the conjoint analysis part), (3) creating a sales response function, a cost function and finally the profit function. In this way the push strategy leading to an optimal profit can be selected. An example of the way in which sales quota are determined can be found in the study by Darmon (1979). In determining sales quota profits, among other things, a balance must be found between risk and reward. An example of a promotional/distribution decision can be found in a study by Akaah and Korgaonkar (1988). In this study the best way to style a direct mail offer is discussed. The applications mentioned above can be characterized by a combination of promotion and distribution decisions.

Although the concept of distribution represents a complex set of variables it is possible to include elements of distribution in a conjoint study. For example, suppose we assume that the demand for a product is negatively related to the

implicit costs. Implicit costs may include transportation costs as well as opportunity costs. Such aspects could be incorporated in a conjoint study by using attributes like "travelling time" or "availability". Another problem in this area may simply focus on the extent to which general attributes of a store, such as locational and architectural characteristics, affect store patronage. For example, Verhallen and DeNooij (1982) investigated to what extent characteristics of the store positively influence consumers' shopping behaviour. The characteristics involved were price level, distance to the shops, the assortment and the quality of the offered goods.

For some specialized retailers adding new products to their product line may constitute an important source of revenue. In such cases it is vital to assess the likely number of consumers who will try a particular new product. Louviere (1984) presents an approach for solving such problems. Louviere's approach attempts to forecast the likely number of consumers who can be expected to try new products offered at competing fast food restaurants.

The study of Verhallen and DeNooij (1982) models store choice and not choice of shopping centre. However, assessing the impact of changes in retail facilities, for example the opening of a new shopping centre, on the distribution of consumer expenditures among shopping centres appears to be another important retail marketing problem. Modelling the choice of a shopping centre provides incremental information to retailers and planners for two reasons. First, the prediction of sales levels of total shopping centres from store choice models is practically impossible. Second, it seems important to include relevant attributes of shopping centres that emerge at the shopping centre only (e.g. routing and furnishings, physical layout and atmosphere). An example of study where this retail marketing problem is tackled can be found in Oppewal and Timmermans (1991). These authors use the conjoint choice approach to tackle this retail marketing problem. Other studies where this type of marketing problem is tackled include the studies of Timmermans (1982), Timmermans *et al.* (1984).

Finally, we want to mention that a number of studies has focused on the application of conjoint analysis to physical distribution problems (e.g. Willet and Stephenson, 1969).

4. A Product-Type Based Classification

In reviewing the literature on conjoint analysis (both the methodological parts as well as the applications part) we encountered a broad range of products to which conjoint analysis has been applied. We can assign these products to a number of distinct product types. These product types are depicted in Table 5, along with some selected examples. The list of examples is probably not complete, but it provides the (prospective) user an overview of the possibilities.

A number of these examples were found in papers where the application of conjoint analysis on some product was meant to illustrate some methodological or statistical argument. For example, in Wedel *et al.* (1991) data obtained from a commercial study, which was concerned with preference for cakes, were used to demonstrate the potential of their maximum likelihood procedure for simultaneous segmentation and estimation. In other cases examples were found in papers which were fully application oriented. For example, Page and Rosenbaum (1987) devote a

Table 5. A product-type based classification

Product type	*Examples*
Fast moving consumer goods	Hair shampoos, potatoes, detergents, meat, yoghurt, cakes
Frequently bought consumer goods	Shoes, carpet cleaners, sweaters
Consumer durables	Type writing machines, automobiles, refrigerators, cameras, food processors, color television sets, cooking equipment, pick up trucks
Industrial products	Scientific technological information system, fork lift trucks
Services	
Financial services	Checking accounts, subscriptions to performing art series,
Entertainment services	menus
Transportation services	Airplane travelling
Health care services	Clinical laboratories, primary rural health care organizations, health maintenance organizations, medication drugs, treatment strategies

full paper to the application of conjoint analysis on food processors. All steps taken in a conjoint study are discussed extensively; from the data collection phase to the market simulation phase. Another example can be found in an article of Acito and Hustad (1981), which was fully devoted to the application of conjoint analysis to an industrial product.

Sometimes special problems are encountered in the application of conjoint analysis, which are related to the particular product category. For example, many high-tech products such as camera's or car stereos are so complex (i.e. attributes are perhaps unknown to the prospective buyer) and have so many possible relevant attributes that this becomes a problem in itself, because differences may then occur between respondents with respect to the set of relevant attributes. To accommodate this type of heterogeneity between consumers we either have to include a large number of relevant attributes, for which we then have to use special data collection methods, or we can individualize the conjoint tasks. For example in their study on price premiums for hotel amenities Goldberg *et al.* (1984) use 43 attributes. In order to keep respondents task manageable they use the hybrid modelling approach (Green *et al.* 1981). In an alternative approach, which individualizes the conjoint task, proposed by Böcker and Schweikl (1988), respondents have to indicate, before they are confronted with the actual conjoint task, the set of relevant attributes via either direct questioning, or working through a computer assisted information display matrix.

Finally, we want to mention that a number of previous studies have demonstrated the utility of conjoint analysis to solve health care marketing problems. Wind (1974), as one of the first to apply conjoint in a health care related, context, studied physicians selection of a clinical laboratory. A more general approach of how conjoint analysis may support marketing decisions in health care organizations was provided by Wind and Spitz (1976). Wind and Spitz (1976) present a pilot study ($n = 56$) in which they use conjoint analysis to model the hospital selection decision of individuals. In addition, these authors distinguish basically between two health care problem areas which can be tackled with the help of conjoint analysis. A first problem area is concerned with the determination of the objectives, criteria and decision rules for various health care decisions. An example of such a problem is How should we allocate resources among competing objectives (e.g. profits, expansions, etc.). A second problem area is concerned with the selection of target markets for a given health care organization. Problems in this

area could be (1) what target markets should a health maintenance organization (HMO) appeal to; (2) what product/service mix should be charged, where should the HMO be located. Parker and Srinivasan (1976), for example propose the conjoint methodology for the location problem of the rural primary health care facility. The problem in their study was to determine the number, location and physical characteristics of those additional facilities that would with respect to the existing system, yield the greatest incremental benefit to the regional population given a capital constraint. Other studies also demonstrated the usefulness of conjoint analysis for health care marketing (e.g. Malhotra and Jain 1982; Rosko and McKenna 1983; Akaah and Becherer 1983; Rosko *et al.* 1985). All these studies have used conjoint analysis to measure consumers' preference structure for health care services. The study of Rosko *et al.* (1985) provides, in addition to the other examples, a demonstration of how market responses can be simulated as a result of changes in the provider's marketing mix. For example, the study assessed the price elasticity for some new products.

Conjoint analysis has also been proposed for the measurement of service quality. For example, Neslin (1983) studied, with the help of conjoint analysis, the relation between objective features (like location and waiting time, etc.) and more subjective constants like quality and convenience. More recently, De Sarbo *et al.* (1992) have applied conjoint analysis to the measurement of the service quality model (the SERVQUAL model) introduced by Parasuraman *et al.* (1985).

A final health care problem area, to be mentioned here, in which conjoint analysis may be applied successfully is found in a number of papers published by Maas (1992). These papers dealt with ways in which conjoint analysis can be used to improve and support the medical decision making of patients. For example, how should patients choose among alternative treatment strategies. The basic idea is to identify the treatment with the highest utility (using pair comparisons data obtained from the patient) among outcomes that vary in quality and quantity of life.

5. Conclusions and Discussion

Conjoint analysis has received quite a lot of attention in the literature, ever since its introduction in marketing by Green and Rao (1977). Developments were either directed at methodological issues or were directed at application issues. Knowledge of the methodological state of affairs is of extreme importance and therefore several authors have reviewed these methodological developments. In these reviews the various ways in which conjoint analysis may be able to solve marketing problems are only scarcely covered. However, both the marketing manager and the market researcher would first like to know why they should use conjoint analysis in the first place. Therefore, it is important to know for which types of marketing problems conjoint analysis may be used and to which types of products it may be applied to. Reviewing the literature with respect to this matter shows that conjoint applications can be classified according to the marketing problem they were meant to solve. This purpose-based classification illustrates the value conjoint analysis has to offer for dealing with various marketing problems. Issues like market segmentation, product development and pricing have been the subject of

much research which has resulted in sound knowledge regarding the way to deal with these problems. Given the fact that these areas are also the most popular areas in commercial practice this knowledge seems especially relevant for both commercial users and their clients. Although promotion and distribution seems less popular in commercial practice the academic developments in these areas have clearly shown that there is much potential in these areas, especially in the area of consumers' retail choices. To provide a comprehensive discussion of conjoint applications we also investigated for which types of products and services conjoint analysis has been used. We found conjoint analysis to be applicable to practically all sorts of products such as fast moving consumer goods, consumer durables, industrial goods and various types of services. We also identified some characteristics of products which may have implications for the way conjoint analysis is applied. For example, products which need to be defined on a large number of attributes need some adaptation to make the task of the respondent manageable. For products in which the design-attribute may be expected to play an important role one has to adapt the stimulus (profile) presentation method. Instead of using verbal descriptions one should use pictorial representations (see for example Page and Rosenbaum 1987) or even better computer-assisted designing techniques to make realistic representations of the set of hypothetical products (see Vriens *et al.* 1993).

Thus, although we demonstrated that conjoint analysis may be useful in a broad range of situations, there are also circumstances under which the application of conjoint analysis may either be difficult or not advisable. One limitation of conjoint analysis mentioned by Mahajan and Wind (1991) includes the method's "inability to capture the complexity of the market". Furthermore it may be difficult to apply conjoint analysis in situations in which a product's preference is predominantly determined by image characteristics. Product categories like cigarettes and jeans are examples of these kinds of products. In situations where the research budget is very low or where the time to conduct the study is rather limited we probably would also not advise to use the conjoint approach, because a proper execution of a conjoint study requires both a considerable amount of time and money. The adoption of advanced methods and techniques in marketing research is strongly influenced by the extent in which these advanced techniques are able to solve marketing problems. We hope to have demonstrated the potential of conjoint analysis and as a result to have contributed to its adoption by marketing managers and market researchers.

References

Acito, Franklin and Hustad, Thomas P. (1981), "Industrial Product Concept Testing", *Industrial Management Review*, **10**, pp. 157–164.

Addelman, Sidney (1962), "Orthogonal Main-effect Plans for Asymmetrical Factorial Experiments, *Technometrics*, **4**, pp. 21–46.

Akaah, Ishmael and Becherer, Richard (1983), "Integrating a Consumer Orientation Into The Planning of HMO Programs: An Application of Conjoint Segmentation", *Journal of Health Care Marketing*, **3**, Spring, pp. 9–18.

Akaah, Ishmael P. and Korgaonkar, Pradeep K. (1988), "A Conjoint Investigation

of the Relative Importance of Risk Relievers in Direct Marketing", *Journal of Advertising Research*, August/September, pp. 38–44.

Antilla, Mai, van den Heuvel, Rob R. and Möller, Kristiaan (1981) "Conjoint Measurement for Marketing Management", *European Journal of Marketing*, **14**, No. 7, pp. 397–409.

Böcker, Franz and Schweikl, Herbert (1988), "Better Preference Prediction With Individualized Sets of Relevant Attributes", *International Journal of Research in Marketing*, **5**, pp. 15–24.

Cattin, Philippe and Wittink, Dick R. (1982), "Commercial Use of Conjoint Analysis: A Survey", *Journal of Marketing*, **46**, Summer, pp. 44–53.

Clarke, Darral G. (1987), *Marketing Analysis and Decision Making*, Redwood City, CA, The Scientific Press.

Currim, Imran S., Weinberg, Charles B. and Wittink, Dick R. (1981), "Design of Subscription Programs for a Performing Art Series", *Journal of Consumer Research*, **8**, June, pp. 67–75.

Darmon, Rene Y. (1979), "Setting Sales Quotas with Conjoint Analysis", *Journal of Marketing Research*, **XVI**, pp. 133–140.

De Sarbo, Wayne S., Huff, L., Rolandelli, M. M. and Choi, J. (1992), "On the measurement of perceived service quality: a conjoint analysis approach", working paper.

De Sarbo, Wayne S., Wedel, Michel, Vriens, Marco and Ramaswamy, Venkatram (1992), "Latent Class Metric Conjoint Analysis", *Marketing Letters*, **3**, No. 3, pp. 273–288.

Fishbein, M. (1966), "The Relationship between Beliefs, Attitudes and Behavior. In: *Cognitive Consistency*. (Ed) Feldman, S. (New York), Academic Press.

Goldberg, Stephen M, Green, Paul E. and Wind, Yoram (1984), "Conjoint Analysis of Price Premiums for Hotel Amenities", *Journal of Business*, **57**,. No. 1, pp. s111–s147.

Green, Paul E. (1977), "A New Approach To Market Segmentation", *Business Horizons*, **20**, February, pp. 61–73.

Green, Paul E., Douglas Carroll, J. and Goldberg, Stephen M. (1981), "A Hybrid Utility Estimation Model for Conjoint Analysis", *Journal of Marketing*, **45**, pp. 33–41.

Green, Paul E, and DeSarbo, Wayne S. (1979), "Componential Segmentation In The Analysis Of Consumer Tradeoffs", *Journal of Marketing*, **43**, Fall, pp. 83–79.

Green, Paul E. and Krieger, Abba M. (1990), "A Hybrid Conjoint Model for Price Demand Estimation", *European Journal of Operations Research*, **44**, pp. 28–38.

Green, Paul E., Krieger, Abba M. (1991), "Segmenting Markets With Conjoint Analysis", *Journal of Marketing*, **55**, No. 4, pp. 20–31.

Green, Paul E., Krieger, Abba M. and Zelnio, Robert N. (1989), "A Componential Segmentation Model With Optimal Product Design Features", *Decision Sciences*, **20**, pp. 221–238.

Green, Paul E. and Srinivasan, V. (1978), "Conjoint Analysis in Consumer Research: Issues and Outlook", *Journal of Consumer Research*, **5**, September, pp. 103–123.

Green, Paul E. and Srinivasan, V. (1990), "Conjoint Analysis in Marketing Research: New Developments and Directions", *Journal of Marketing*, **54**, No. 4, pp. 3–19.

Hagerty, Michael (1985), "Improving The Predictive Power of Conjoint Analysis:

The Use of Factor Analysis and Cluster Analysis", *Journal of Marketing Research*, **22**, May, pp. 168–184.

Hagerty, Michael (1986), "The Cost of Simplifying Preference Models", *Marketing Science*, **5**, No. 4, pp. 298–319.

Jones, D. Frank (1975), "A Survey Technique To Measure Demand Under Various Pricing Strategies", *Journal of Marketing*, **39**, July, pp. 75–77.

Kamakura, Wagner A. (1988), "A Least Squares Procedure For Benefit Segmentation With Conjoint Experiments", *Journal of Marketing Research*, **25**, May, pp. 157–167.

Kotler, Philip (1988), *Marketing Management*, Prentice-Hall, Englewood Cliffs, NJ, USA.

Leeflang, Peter S. H. and Beukenkamp, Pieter A. (1987), *Probleemgebied Marketin, een Management Benadering (Problem Area Marketing, A Management Approach)*, deel 1b, Stenfert Kroese, Leiden/Antwerpen.

Levy, M., Webster, J. and Kerin, R. A. (1983) "Formulating Push Marketing Strategies: A Method and Application, *Journal of Marketing*, **47**, Winter, pp. 25–34.

Louviere, Jordan J. (1984), "Using Discrete Choice Experiments and Multinomial Logit Choice Models to Forecast Trial in a Competitive Retail Environment: A Fast Food Restaurant Illustration, *Journal of Retailing*, **60**, No. 4, pp. 81–107.

Louviere, Jordan, J. (1986), "A Conjoint Model for Analyzing New Product Positions in a Differentiated Market with Price Competition", *Advances in Consumer Research*, pp. 375–380.

Louviere, Jordan J. (1988), "Conjoint Analysis Modeling of Stated Preferences: A Review of Theory, Methods, Recent Developments and External Validity", *Journal of Transport Economics and Policy*, **22**, January, pp. 93–119.

Luce, R. D. and Tukey, John W. (1964), "Simultaneous Conjoint Measurement: A New Type of Fundamental Measurement", *Journal of Mathematical Psychology*, **1**, pp. 1–27.

Maas, Arne (1992), "The Use of Conjoint Measurement in Medical Decision Making, A Theoretical and Practical Contribution", Dissertation, University of Nijmegen, The Netherlands.

Mahajan, Vijay, Green, Paul E. and Goldberg, Stephen M. (1982), "A Conjoint Model for Measuring Self- and Cross-Price/Demand Relationships", *Journal of Marketing Research*, **XIX**, pp. 334–342.

Mahajan, Vijay and Wind, Yoram (1991), "New Product Models: Practice, Shortcomings and Desired Improvements", Report No. 91-125, Marketing Science Institute, Cambridge, Massachusetts.

Malhotra, Naresh and Jain, Arun (1982), "A Conjoint Analysis Approach To Health Care Marketing and Planning", *Journal of Health Care Marketing*, **2**, Spring, pp. 35–44.

Moore, William L. (1980), "Levels of Aggregation in Conjoint Analysis: An Empirical Comparison", *Journal of Marketing Research*, **XVII**, November, pp. 516–523.

Neslin (1983), "Designing New Outpatient Health Services: Linking Service Features to Subjective Consumer Perception", *Journal of Health Care Marketing*, **3**, pp. 8–21.

Oppewal, Harmen and Timmermans, Harry J. P. (1991), "A Conjoint Choice Approach To Model Consumer Choice Of Shopping Centre", Paper presented for the Meeting of the SISWO Working Group Mathematical Geography and Urban Planning, Utrecht, 29 November 1991.

Page, A. L. and Rosenbaum, H. F. (1987), "Redesigning Product Lines With Conjoint Analysis: How Sunbeam Does It", *Journal of Product Innovation Management*, **4**, June, pp. 120–137.

Parasuraman, A., Teithaml, V. A. and Berry, L. L. (1985), "A Conceptual Model of Service Quality and its Implications for Future Research", *Journal of Marketing*, **49**, pp. 41–50.

Parker, Barnett and Srinivasan, V. (1976), "A Consumer Preference Approach to the Planning of Rural Primary Health Care Facilities", *Operations Research*, **24**, September/October, pp. 991–1025.

Rosko, Michael D. and McKenna, William (1983), "Modeling Consumer Choices of Health Plans: A Comparison of Two Techniques", *Social Science and Medicine*, **17**, July, pp. 421–429.

Rosko, Michael D., DeVita, Michael, McKenna, William F. and Walker, Lawrence R. (1985), "Strategic Marketing Applications of Conjoint Analysis: An HMO Perspective", *Journal of Health Care Marketing*, **5**, No. 4, pp. 27–38.

Rao, Vithala (1977), "Conjoint Measurement in Marketing Analysis". In: *Multivariate Methods In Market and Survey Research*. (Ed) Sheth, J. N. (Chicago), American Marketing Association, pp. 257–286.

Sands, Saul and Warwick, K. (1981), "What Product Benefits to Offer to Whom: An Application of Conjoint Segmentation", *California Management Review*, **XXIV**, No. 1, pp. 69–74.

Steenkamp, Jan-Benedict E. M. and Wedel, Michel (1991), "Segmenting Retail Markets on Store Image Using A Consumer-Based Methodology", *Journal of Retailing*, **67**, Fall, No. 3, pp. 300–320.

Theil, Henri (1969), "A Multinominal Extension of the Linear Logit Model", *International Economics Review*, **10**, October, pp. 251–259.

Timmermans, Harry J. P. (1982), "Consumer Choice of Shopping Centre: An Information Integration Approach", *Regional Studies*, **16**, pp. 171–182.

Timmermans, Harry J. P. (1984), "Decompositional Multiattribute Preference Models in Spatial Choice Analysis: A Review of Some Recent Developments", *Progress in Human Geography*, **8**, pp. 189–221.

Timmermans, Harry J. P., van der Heijden, R. E. C. M. and Westerveld, H. (1984), "Decision-Making Between Multiattribute Choice Alternatives: A Model of Spatial Shopping Behaviour Using Conjoint Measurement", *Environment and Planning A*, **16**, pp. 377–387.

Verhallen, Theo M. M. and de Nooij, G. J. (1982), "Retail Attribute and Shopping Patronage", *Journal of Economic Psychology*, **2**, pp. 39–45.

Vriens, Marco (1992), "Strenths and Weaknesses of Various Conjoint Analysis Techniques and Suggestions for Improvement". In: *Proceedings of the 2nd SKIM Seminar Market Opportunities with Advanced Research Techniques*, Rotterdam.

Vriens, M., Loosschilder, G., Rosbergen, E. and Wittink, Dick R. (1992), "Het Nut van Foto-Realistische Stimuli in Conjuncte Analyse (The Value of Photo-Realistic Stimuli in Conjoint Analysis). In: *Jaarboek van de Nederlandse Vereniging van Markt onder zoekers*, pp. 174–189.

Vriens, Marco, Wedel, Michel and Wilms, Tom (1992), "Segmentation For Metric Conjoint Analysis: A Monté Carlo Comparison", working paper.

Wedel, M. (1990), "Clusterwise Regression and Market Segmentation, Developments and Applications", Doctoral Dissertation, Wlacenincen.

Wedel, Michel and Kistemaker, Cor (1989), "Consumer Benefit Segmentation

Using Clusterwise Linear Regression", International Journal of Research in Marketing, **6**, pp. 45–59.

Wedel, Michel and Steenkamp, Jan-Benedict E. M. (1989), "Fuzzy Clusterwise Regression Approach to Benefit Segmentation", *International Journal of Research in Marketing*, **6**, pp. 241–258.

Wedel, Michel, Vriens, Marco and DeSarbo, Wayne (1991), "A Maximum Likelihood Methodolgy for Segmentation in Conjoint Models", Research Memorandum, Institute of Economic Research, Faculty of Economics, University of Groningen.

Willet, Ronald P. and Stephenson, Ronald P. (1969), "Determinants of Buyers Response to Physical Distribution Service", *Journal of Marketing Research*, August, pp. 279–283.

Wind, Yoram (1974), "Recent Approaches to the Study of Organizational Buying Behaviour. In: *Combined Proceedings of the 1973 American Marketing Association Conferences*. (Ed) Green, T. V. (Chicago), pp. 203–206.

Wind, Yoram, Grashof, J. F. and Goldhar, K. D. (1978), "Market-Based Guidelines for Design of Industrial Products", *Journal of Marketing*, July, pp. 27–37.

Wind, Yoram and Spitz, Lawrence (1976), "Analytical Approach to Marketing Decisions in Health-Care Organizations, *Operations Research*, **24**, No. 5, September/October, pp. 973–990.

Wittink, Dick R. and Cattin, Philippe (1989). "Commercial Use of Conjoint Analysis: An Update", *Journal of Marketing*, **53**, July, pp. 91–96.

Wittink, Dick R., Vriens, Marco and Burhenne, Wim (1993), "Commercial Use of Conjoint Analysis in Europe: Results and Critical Reflections", *International Journal of Research in Marketing*, forthcoming.

Wyner, Gordon, A., Benedetti, Lois H. and Trapp, Bart M. (1984), "Measuring The Quantity and Mix of Product Demand", *Journal of Marketing*, **48**, Winter, pp. 101–109.

Zufryden, Fred S. (1988), "Using Conjoint Analysis To Predict Trial and Repeat-Purchase Patterns of New Frequency Purchased Products", *Decision Sciences*, **19**, pp. 55–71.