ANDERS GUSTAFSSON
ANDREAS HERRMANN
FRANK HUBER
Editors

CONJOINT MEASUREMENT

Methods and Applications

Fourth Edition

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Anders Gustafsson · Andreas Herrmann
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With 39 Figures and 68 Tables

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Foreword

by
Paul E. Green

I am honored and pleased to respond to authors request to write a Foreword for this excellent collection of essays on conjoint analysis and related topics. While a number of survey articles and sporadic book chapters have appeared on the subject, to the best of my knowledge this book represents the first volume of contributed essays on conjoint analysis. The book reflects not only the geographical diversity of its contributors but also the variety and depth of their topics.

The development of conjoint analysis and its application to marketing and business research is noteworthy, both in its eclectic roots (psychometrics, statistics, operations research, economics) and the fact that its development reflects the efforts of a large variety of professionals - academics, marketing research consultants, industry practitioners, and software developers.

Reasons for the early success and diffusion of conjoint analysis are not hard to find. First, by the early sixties, precursory psychometric techniques (e.g., multidimensional scaling and correspondence analysis, cluster analysis, and general multivariate techniques) had already shown their value in practical business research and application. Second, conjoint analysis provided a new and powerful array of methods for tackling the important problem of representing and predicting buyer preference judgments and choice behavior - clearly a major problem area in marketing.

In addition, the fortuitous confluence of academic research, practictioner application, and easy-to-use software (distributed by Sawtooth Software and Bretton-Clark) provided the necessary mix for conjoint's rapid acceptance by both the private and public sectors. The rest (as they say) is history.

Recent Trends

Conjoint analysis continues to expand in terms of models, techniques, and applications. Examples include:

Prescriptive modeling: the development of normative models for finding the product/service or line of products/services that maximize the firm's return.

- Dynamic modeling: the development of normative conjoint models for representing competitive actions and reactions, based on game theoretic concepts.
- Extension of earlier models to choice-based conjoint situations, incorporating multinomial logit and probit modeling.
- Latent class, hierarchical Bayes modeling, and constrained choice modeling.
- Other new models, such as individual-level hybrid modeling, Sawtooth's ICE model, and empirical Bayes applications.
- Applications in diverse areas, including the design of lottery games, employee benefits packages, public works (such as the New Jersey E-Z Pass toll road

system), hotel and time share amenities, gasoline station layouts, and legal issues dealing with misleading advertising, antitrust violations, etc.
- New choice simulators that include sensitivity analysis, composing and evaluating selected segments, computation of monetary equivalents of part worths, share/return optimization, including Pareto frontier analysis.
- New developments in full-profile experimental designs, including d-optimal designs, randomized balance designs, and Plackett-Burman design extensions.
- The coupling of conjoint analysis with virtual-reality electronic displays that simulate product arrays, store interiors, house, and furniture layouts, etc.
- The coupling of conjoint analysis with the perceptual and preference mapping of choice simulator results.

The preceding points are only illustrative of the diversity and ingenuity of conjoint researchers/practitioners. And, clearly, more is yet to come.

The Validation Problem

Researchers and practitioners should have (and generally do have) a healthy skepticism about the "latest developments" in conjoint modeling. Fortunately, this book of essays contains a number of model comparisons and cross validation studies. New models and application areas have proliferated over the past 30 years; it is still highly important to evaluate the host of new "whizzbangs" that invariably accompany a rapidly growing research area.

Our Indebtedness

This new book of essays, Conjoint Measurement - Methods and Applications, is a welcome addition to the conjoint literature. Its publication attests to the international character associated with the growth and diffusion of interest and research in conjoint analysis. While conjoint has reached a level of popularity and maturity that few of us in its early stages would have imagined, the methodology is still far from becoming moribund. This book is a fitting testimonial to the sustained interest in conjoint methods and the vigor and acuity of this international gathering of researchers.

In closing, it seems to me that we should all express our gratitude to those early scholars -- Thurstone, Luce, Tukey, McFadden, Addelman, Kempthorne, Lazarsfeld, to name only a few -- who planted the seeds that have led to such a bountiful harvest for marketing researchers. And to go back even further, let's not forget the good reverend, Thomas Bayes. Were he here today, I'm confident that this book would merit his blessings.

Paul E. Green
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1 Conjoint Analysis as an Instrument of Market Research Practice

Anders Gustafsson, Andreas Herrmann and Frank Huber

1.1 Introduction

The essay by the psychologist Luce and the statistician Tukey (1964) can be viewed as the origin of conjoint analysis (Green and Srinivasan 1978; Carroll and Green 1995). Since its introduction into marketing literature by Green and Rao (1971) as well as by Johnson (1974) in the beginning of the 1970s, conjoint analysis has developed into a method of preference studies that receives much attention from both theoreticians and those who carry out field studies. For example, Cattin and Wittink (1982) report 698 conjoint projects that were carried out by 17 companies in their survey of the period from 1971 to 1980. For the period from 1981 to 1985, Wittink and Cattin (1989) found 66 companies in the United States that were in charge of a total of 1062 conjoint projects. Wittink, Vriens, and Burhenne counted a total of 956 projects in Europe carried out by 59 companies in the period from 1986 to 1991 (Wittink, Vriens, and Burhenne 1994; Baier and Gaul 1999). Based on a 2004 Sawtooth Software customer survey, the leading company in Conjoint Software, between 5,000 and 8,000 conjoint analysis projects were conducted by Sawtooth Software users during 2003. The validation of the conjoint method can be measured not only by the companies today that utilize conjoint methods for decision-making, but also by the 989,000 hits on www.google.com. The increasing acceptance of conjoint applications in market research relates to the many possible uses of this method in various fields of application such as the following:

- new product planning for determining the preference effect of innovations (for example Bauer, Huber, and Keller 1997; DeSarbo, Huff, Rolandelli, and Choi 1994; Green and Krieger 1987; 1992; 1993; Herrmann, Huber, and Braunstein 1997; Johnson, Herrmann, and Huber 1998; Kohli and Sukumar 1990; Page and Rosenbaum 1987; Sands and Warwick 1981; Yoo and Ohta 1995; Zufryden 1988) or to
- improve existing achievements (Green and Wind 1975; Green and Srinivasan 1978; Dellaert et al., 1995), the method can also be applied in the field of
- pricing policies (Bauer, Huber, and Adam 1998; Currim, Weinberg, and Wittink 1981; DeSarbo, Ramaswamy, and Cohen 1995; Goldberg, Green, and Wind 1984; Green and Krieger 1990; Kohli and Mahajan 1991; Mahajan, Green, and Goldberg 1982; Moore, Gray-Lee, and Louviere 1994; Pinnell 1994; Simon 1992; Wuebker and Mahajan 1998; Wyner, Benedetti, and Trapp 1984),

- advertising (Bekmeier 1989; Levy, Webster, and Kerin 1983; Darmon 1979; Louviere 1984; Perreault and Russ 1977; Stanton and Reese 1983; Neale and Bath 1997; Tscheulin and Helmig 1998; Huber and Fischer 1999), and
- distribution (Green and Savitz 1994; Herrmann and Huber 1997; Oppewal and Timmermans 1991; Oppewal 1995; Verhallen and DeNooij 1982).

In addition, this method is increasingly used as an instrument of

- controlling (Green and Srinivasan 1978; Herrmann et al., 1999).

Another field of application using basic strategic decisions such as

- Market segmentation (Hagerty 1985; Akaah 1988; De Soete and Winsberg 1994; DeSarbo, Olivier, and Rangaswamy 1989; DeSarbo, Ramaswamy, and Chaterjee 1992; DeSarbo, Wedel, Vriens, and Ramaswamy 1992; Diamantopoulos, Schlegelmilch, and DePreez 1995; Gaul and Aust 1994; Gaul, Lutz, and Aust 1994; Green and Helsen 1989; Green and Krieger 1991; Kamakura 1988; Ogawa 1987; Steenkamp and Wedel 1991; Steenkamp and Wedel 1993; Wedel and Kistemaker 1989; Wedel and Steenkamp 1989; Wedel and Steenkamp 1991). A good overview for the different segmentation approaches provides Vriens (1995) and Vriens, Wedel, and Wilms (1996). Conjoint analysis can be of great use here.
- The method is further applied to simulate purchasing decisions with a focus on competitors' responses (Mohn 1991).

This brief overview may give the impression that the success of this method comes from the application to new areas, in the sense of a broadening of the concept. But this is only one side of the coin. Simultaneously, research has been initiated to deepen the knowledge in certain areas. We have particularly seen many contributions for finding the optimal price for a certain product. In this context, an important distinction in analyzing the price attribute is made by Rao and Sattler in Chapter 2. They differentiate between two functions of the price. Consumers use the price of a product both as a signal of product quality (informational role) and as a monetary constraint in choosing it (allocative role). In their paper, Rao and Sattler implement a conjoint based research approach to separately estimate these two effects of price. While in practice only the net effect of the two roles of price are usually estimated in any conjoint measurement approach or brand choice model, our methodology is able to separate the two price effects.

It is the goal of conjoint analysis to explain and predict preferences that result in an assessment of achievements. Various achievement profiles are created (both real as well as hypothetical ones) by varying specific attributes, and these profiles are to be evaluated by the test persons. The contributions (partial benefits) that the various attributes make to overall preference (overall benefit) are estimated on the basis of overall preference judgments as expressed by the test persons. Accordingly each product concept is assigned with a specific overall benefit value. Thus no attribute-specific single judgments are summarized to yield an overall judgment (compositional approach) but vice versa; the contributions of the various attributes or their manifestations are filtered out of the overall judgments (decompositional approach).

Although many people speak of 'the conjoint analysis', the number of methods understood by this term and their variants is considerable. What all these approaches have in common, however, is a flow diagram developed by Green and Srinivasan (1978) which is shown in an updated form in Figure 1; the order of typical variants has been approximately selected based on their decreasing importance for practical applications (Cattin and Wittink 1982; Wittink and Cattin 1989; Wittink, Vriens, and Burhenne 1994).

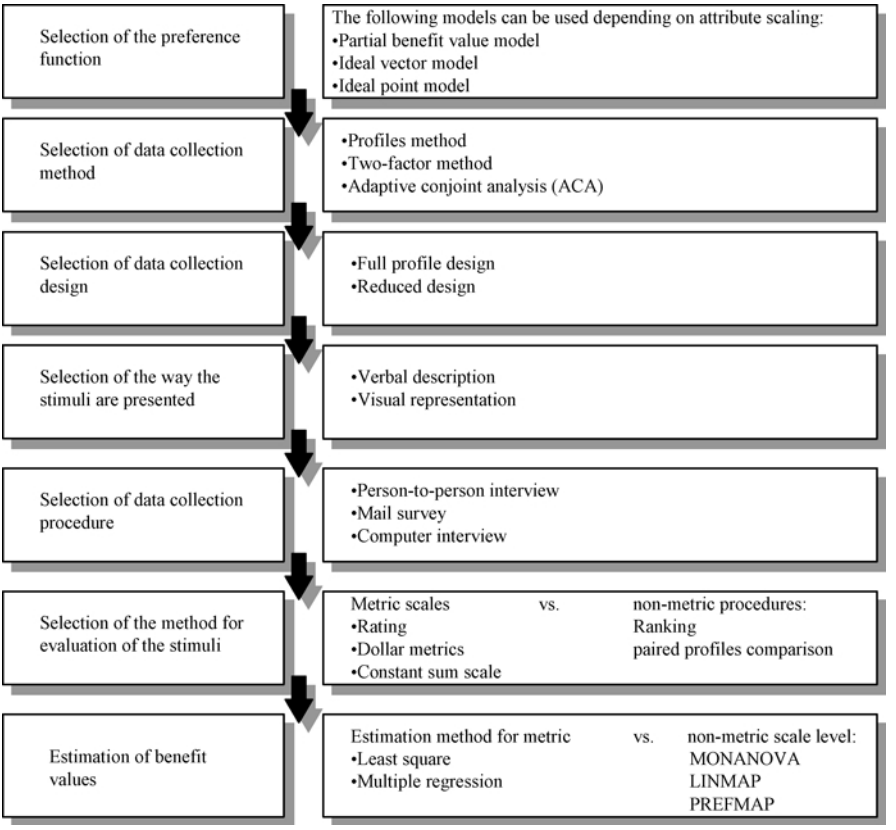


Figure 1: Flow diagram of conjoint analysis

1.2 Research areas and future development trends of conjoint analysis

1.2.1 A flow diagram of conjoint analysis

The various options regarding the flow diagram (see figure 1) of the process of analysis should be determined before carrying out a practical conjoint analysis (Green and Srinivasan 1978; Green and Srinivasan 1990; Vriens 1995). Although each step is suitable to reveal findings and future developments of the research areas, the individual steps are not carried out one after the other and decisions are not made independently. Furthermore, good conjoint research most likely occurs if the process is hypothesis driven. Each stage of the process should be used to approve or reject potential solutions to decision problems.

1.2.2 Data collection

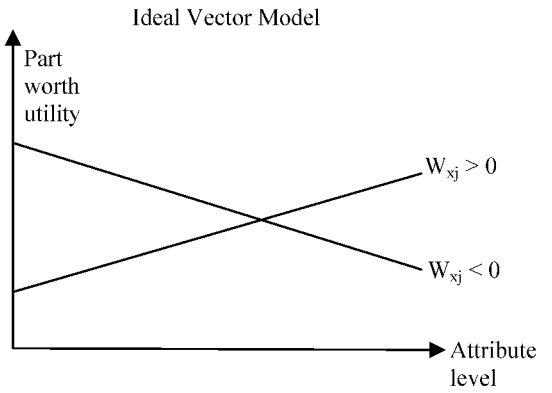
Selection of the preference function

The first step is the selection of the preference function based on which influence the defined attributes have on the respondents' preferences (other authors accentuate the relevance of the selection of the attributes and their levels in the first step, see Vriens 1995). This preference function therefore is the basis for determining partial benefit values for the respective attributes that reflect the preferences of the persons interviewed (Green and Srinivasan 1978; Schweikl 1985). The models that are most frequently used are the ideal vector model, the ideal point model, and the partial benefit model (See also Green and Srinivasan 1978; Vriens 1995).

When using the ideal vector model (see Figure 2) a proportional relationship is assumed between a partial benefit value and the manifestation of an attribute. This means that benefit increases ($w_{xj} > 0$) or decreases ($w_{xj} < 0$) with an increasing or decreasing manifestation of the attribute (Vriens 1995; Srinivasan, Jain and Malhotra 1983; Kamakura and Srivastava 1986; Allenby, Arora, and Ginter 1995).

If the ideal point model (see Figure 3) is used, the researcher assumes the existence of an ideal manifestation. The benefit value of a manifestation drops as soon as it falls below or exceeds the ideal point (Green and Tull 1982).

The partial benefit model (see Figure 4) is the most flexible of all three models and includes the ideal vector and the ideal point models as special cases (Green and Srinivasan 1978; Cattin and Wittink 1982; Louviere 1984; Wittink and Cattin 1989; Krishnamurthi and Wittink 1991; Green and Srinivasan 1990). This model does not assume a specific functional process and manifestations of attributes can only be interpolated if the scale level is metric.



Wxj: individual weighting of attribute x by respondent j

Figure 2: Preference value for various manifestations of attribute x while keeping the values of the other attributes constant

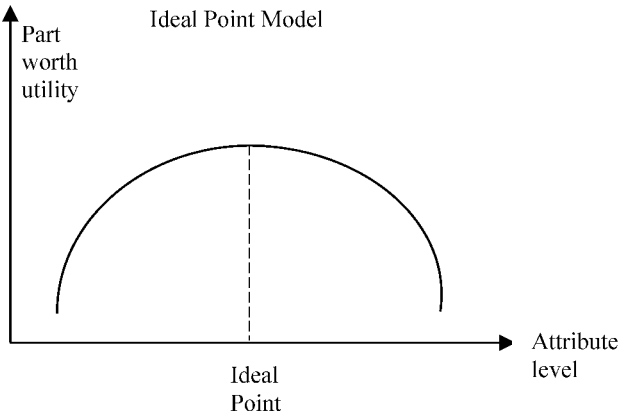


Figure 3: Preference value for various manifestations of attribute x while keeping the values of the other attributes constant