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## A conjoint model for Internet shopping malls using customer's purchasing data

D.H. Lee<sup>a,\*</sup>, S.H. Kim<sup>a</sup>, B.S. Ahn<sup>b</sup>

<sup>a</sup>Graduate School of Management, Korea Advanced Institute of Science and Technology, 207-43 Cheongryangri Dongdaemun, Seoul 130-012, South Korea

<sup>b</sup>Division of Business Administration, Hansung University 389 Samsun 2, Sungbuk, Seoul, 136-792, South Korea

### Abstract

Lots of Internet shopping malls strive for obtaining a competitive advantage over others in an increasingly tighter electronic marketplace. To this end, understanding customer preference toward products (or services) and administering appropriate marketing strategy are essential for their continuous survival. However, only a few marketing researchers and practitioners focused on this issue in this changing business environments, compared with academic and industry efforts devoted to the traditional market segmentation. In this paper, we suggest a methodology of benefit segmentation for electronic shopping malls using conjoint analysis. Traditional market segmentation methodologies based on customer's profile sometimes fail to utilize the abundant information given while navigating around cyber shopping malls. In this methodology, we do not impose information overload to the customer for preference elicitation, but capture automatically generated surfing or buying data and analyze them to get useful market segmentation information. The methodology consists of four stages: (1) analyzing legacy homepages; (2) data preparation; (3) estimating and interpreting the result; and (4) developing marketing mix. Our methodology was to give useful guidelines for market segmentation to companies working in the electronic marketplace. © 2000 Elsevier Science Ltd. All rights reserved.

**Keywords:** Electronic commerce; Electronic markets; Market segmentation; Conjoint analysis; Customer relation management

### 1. Introduction

The rapid proliferation of the Internet and the World Wide Web (WWW) has created a fast growing electronic channel for marketing and the number of electronic stores has increased in an unprecedented speed (Liang & Huang, 1998). The ability of Internet marketplace to reduce search costs for product (or service) information is significantly affecting competition environments. Bakos (1997) shows that lower buyer search costs in electronic marketplaces promote price competition among sellers. This effect will be most dramatic in commodity markets, where intensive price competition can eliminate much of seller profits. In this increasingly tighter market, organizations continue to search for means to get a competitive advantage over others.

As an alternative to this end, lots of electronic shopping malls employ one-to-one marketing strategy by using advanced database technology. But, inadequate uses of this strategy sometimes force their customers into being dissatisfied. For instance, companies engaged in business to customer electronic commerce (EC) e-mail to their custo-

mers indiscriminately who have been dropping into their shopping malls. And, their customers have to struggle against enormous amount of junk mails every day and night, which are hardly of interest to them.

Market segmentation in view of the customer's benefits may be one of the good solutions for this problem. By market segmentation, markets who engage in shopping malls can find out what motivates customers to respond, how to communicate to each customer, and they are able to increase customer's lifetime value by increasing customer loyalty (Wells, Fuerst, & Choobinceh, 1999).

Market segmentation has long been considered one of the most fundamental concepts of modern marketing (Wind, 1978). Kotler and Armstrong (1989) suggested several variables for market segmentation which were geographic, demographic, psychographic and behavioral. Since there are too many consumers who have no membership to shopping malls in cyberspace, the prior three variables are not applicable to Internet shopping malls for the reason that they cannot be aware of the customers' profile for segmentation. Fortunately, electronic markets facilitate the storage and recall of each history of customer's footnotes (Arunkundram & Sundararajan, 1998), and these can be input data for behavior segmentation in their shopping mall. One of the

\* Corresponding author. Tel.: + 82-32-610-3465.

E-mail address: hunii@kgsma.kaist.ac.kr (D.H. Lee).

most popular approaches for assessing these benefits is through the use of conjoint analysis (Green & Desarbo, 1979; Green & Srinivasan, 1990; Vriens, Wedel, & Wilms, 1996). The conjoint analysis has been used extensively by marketing researchers and practitioners for understanding consumers' preferences toward products (Green & Srinivasan, 1978) and is especially helpful for the identification and understanding of benefit segments with preference data from the sample of consumers. The objective in benefit segmentation is to identify groups of consumers having similar preferences that might be targeted more efficiently by specific marketing mixes. The dual goals are (1) to form groups of consumers who share a common utility function and (2) to estimate the aggregate utility functions that would best explain the preferences stated by the number of each segment (Kamakura, 1998). Nonetheless, little research efforts are exerted to the explicit application of conjoint analysis to market segmentation of Internet shopping malls which is rapidly substituting or complementing traditional marketplaces.

This paper suggests an architecture and methodology of adapting the conjoint model to electronic shopping malls for benefit segmentation.

The rest of the paper is structured as follows. Section 2 gives an overview of the electronic market and market segmentation. Section 3 suggests a methodology and an architecture of adapting a conjoint model for benefit segmentation in Internet shopping malls. In Section 4, an example of a methodology suggested in chapter 3 is introduced for detailed comprehension. Finally, we conclude and highlight some directions for the future research in Section 5.

## 2. Market segmentation and electronic market

### 2.1. Market segmentation by customer's benefits

Ever since the pioneering article in Smith (1956), segmentation has become a dominant concept in marketing literature and practice. Market segmentation is the subdividing of a market into distinct subsets of customers, where any subset may conceivably be selected as a market target to be reached with a distinct marketing mix. Segmentation is essential for marketing success: most successful firms drive from their businesses based on the segmentation (Lilien & Rangaswamy, 1997). Differentiated markets are common place because buyers' preferences are heterogeneous for most types of product (Bakos, 1991). Customers differ in their values, needs, wants, constraints, beliefs, and incentives to act in a particular way. Products compete with one another in attempting to satisfy the needs and wants of those customers. By segmenting the market, firms can understand their customers' preferences and target of their marketing efforts efficiently and effectively.

Traditional approaches to market segmentation have emphasized two principal design strategies. In the prior segmentation, segments are formed on the basis of pre-specified behavior classification (e.g. who chooses what brand) and are then examined for possible correlates drawn from segment member's background characteristics identified by geographic, demographic, and psychographic variables. In post-hoc (or cluster-based) segmentation, segments are developed after observing respondents similarities in their responses to a battery of related variables that divide buyers into groups based on their knowledge, attitudes, uses, or responses to a product. Many marketers believe that behavior variables are the best starting point for building market segments. Especially, a powerful form of segmentation is to group buyers according to the different benefits that they seek from the product (Calantone & Sawyer, 1978; Haley, 1968; Moriarty & Reibstein, 1986; Wedel, Jan-Benedict & Steenkamp, 1991).

An approach to market segmentation whereby it is possible to identify market segments by causal factors rather than descriptive factors, might be called "benefit segmentation". The belief underlying this segmentation strategy is that the benefits which people are seeking in consuming a given product are the basic reasons for the existence of true market segments. Experience with this approach has shown that benefits sought by consumers determine their behavior much more accurately than do geographic, demographic and psychographic characteristics.

Benefit segmentation implies that product benefits sought by consumers are the underlying causes of both market structures and consumer segments. Brands may compete in a number of subsets of brands, because products provide different benefit bundles possibly sought in different usage situations. Consumers may belong to more than one segment, depending on multiple uses of brands or multiple usage situations, and the structure of the market depends on segments in which consumers have similar uses of products. Although the benefit segmentation technique is quite straightforward, some barriers may inhibit its use (Moriarty & Reibstein, 1986). The first is the data requirement. Data for the traditional segmentation approaches are usually readily available. Frequently, the marketer already has such data or can obtain the information through Bureau of Census or syndicated data sources. This is not true for benefit segmentation. In this case, special data must be collected in order to develop the segmentation strategy.

The second problem relates to the criterion that the segments must be identifiable and accessible. Once the market has been divided into benefit segments, identifying to which segment a potential customer belongs without measuring his or her derived benefits is difficult. Furthermore, although the segments may be homogeneous with respect to their desired benefits, they may not be with regard to their media exposure.

## 2.2. Benefit segmentation in the electronic marketplace

As the Internet is getting more and more popular as the backbone of the global information infrastructure, the Web is no longer only for information display. In particular, for Intranet applications, information systems over the Web will be playing a key role in business (Chou, 1998).

Firms communicate with their customers through various media. Traditionally, these media follow a passive one-to-many communication model, whereby a firm reaches many current and potential customers, segmented or not. For several years, a revolution has been developing that is dramatically altering this traditional view of advertising and communication media. This revolution is the Internet which as a new marketing medium has the potential to radically change the way firms do business with their customers (Hoffman & Novac, 1996). In marketing area, the Internet is considered as an opportunity for reaching new consumer groups and an alternative way to offer low-price and value-added products or services. The Internet can help perform value-added marketing by using the technology to gain market share with low cost and timely performance (Angelides, 1997). Marketing on the Internet is achieved through electronic mail and the WWW. Especially, Internet's WWW provides two of the most important aspects of modern marketing philosophies such as the ability to target selected groups of buyer and to open interactive dialog (Herbig & Hale, 1997). The Web is not a one-way communication between a vendor and a buyer unlike traditional marketing channels. The Web provides a means of communication that facilitates more intimate relationship between buyer and seller. Added to this, the Web supports hypermedia technology through which a customer walks on the Web for himself and a marketer can trace the customer's footsteps on his homepage. This trace, a behavior of customer on the Web can be considered a valuable source of information for benefit segmentation. For example, we can infer the customer's preferences through the information about which homepages the customer visits and finally on what homepage the customer purchases products among some competing homepages built for products to be sold. And the preference data on competing products are fed into the conjoint model to estimate model parameters such as relative importance of attributes of products or group of customers who have similar preference tendency, which is dealt in detail in the following section.

## 3. Conjoint model in the cyber mall

### 3.1. Some considerations in conjoint analysis

Conjoint analysis has been used extensively by marketing researchers for understanding consumer's preferences (Green & Srinivasan, 1978). A comprehensive survey of its use in commercial research is presented by Cattin and

Wittink (1982), who identify market segmentation as one of its major applications. Conjoint analysis is a multivariate technique used specifically to understand how respondents develop preferences for products or service. It is based on the simple premise that consumers evaluate the value or utility of a product or service by combining the separate amounts of utility provided by each attribute. Conjoint analysis is unique among multivariate methods in that the researcher first constructs a set of real or hypothetical products or services by combining the selected levels of each attribute (Hair, Anderson, Tatham, & Black, 1995).

Several alternate means exist for identifying the attributes which are relevant to consumers in forming their preferences. Preliminary data collection effort, questioning consumers about attributes considered important to them, usually helps in identifying those attributes that are most frequently regarded as relevant. Focus group interview or judgments of product managers, retailers and others knowledgeable about the product/service and its uses can be used for this purpose. The more difficult and often subjective task is to reduce the number of attributes to a manageable size so that the estimation procedures are reliable while accounting for consumer preference sufficiently well.

Hair et al. (1995) suggests seven steps of conjoint analysis as follows: (1) determining the objectives of conjoint analysis; (2) design of a conjoint analysis; (3) assumptions of conjoint analysis; (4) estimating the conjoint model and assessing overall fit; (5) interpreting the results; (6) validating the conjoint results; (7) applying conjoint analysis results. Different from traditional benefit segmentation, a new procedure adapted to cyber mall environment has to be developed to execute conjoint analysis. We describe general considerations in market segmentation, compared with those in electronic market situation.

In the design phase of conjoint model, marketer identifies attributes by analyzing customer's preference. These attributes are called the independent variables or factors. The possible value of an attribute is called factor levels. For conjoint analysis to explain a respondent's preference structure only from overall evaluations of a set of stimuli (alternatives), the analyst must make two key decisions regarding the underlying conjoint model: relationship between attributes (additive or interactive) and relationship between levels within an attribute (linear, quadratic, or part-worth). In this paper, we assume most common and basic additive model, with which the respondent simply add up the values for each attribute to get the total value for a combination of attributes and the assumption can be attained with well-organized attributes. Furthermore, the part-worth function model provides the greatest flexibility in allowing different shapes for the preference function along each level of the attribute. In the cyber mall environment, the part-worth function model can be used effectively due to the fact that the number of homepages considered in a shopping mall is finite and the characteristics of homepages for conjoint analysis can be described as multi-attribute categorical

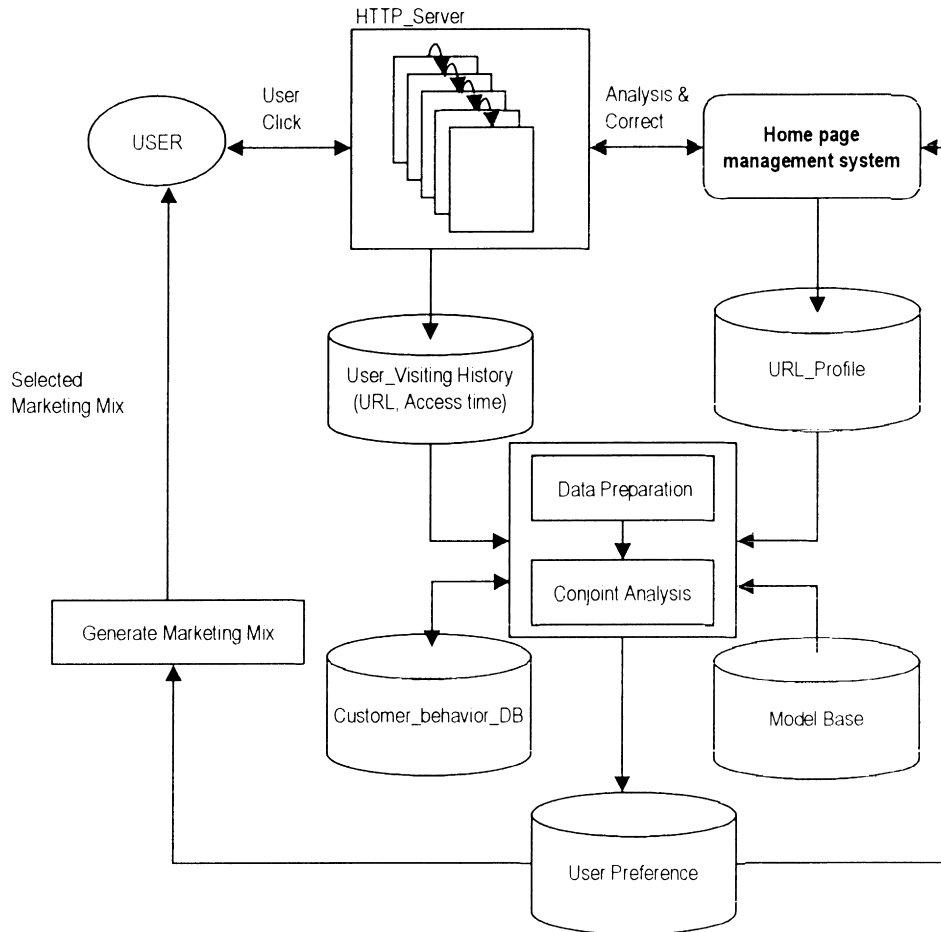


Fig. 1. An architecture for benefit segmentation in cyber mall environment.

values, where we are forced to use the part-worth function model if the attribute is categorical.

Data collection procedures in conjoint analysis are the most basic of choices (Reibstein, Bateson, & Boulding, 1988), and have largely involved variations on two basic methods: the two-factor-at-a-time procedure, and the full-profile approach. The two-factor-at-a-time procedure (i.e. trade-off procedure) considers factors on a two-at-a-time basis. The respondent is asked to rank the various combinations of each pair of factor levels from the most preferred to the least. The full-profile approach is the method of presenting stimuli to the respondent for evaluation that consists of a complete description of the stimuli across all attributes. Full-profile approach gives a more practical description of stimuli by defining the levels of each factor and possibly taking into account the potential environmental correlation between factors in real stimuli (Green & Srinivasan, 1978). An additional advantage of the full-profile method is its ability to measure overall preference judgments directly using behaviorally oriented constructs such as intentions to buy, likelihood of trial, chances of switching to a new brand, and so on. In cyber mall environment, the full-profile method might be appropriate for data collection because we utilize customer's buying data on a certain homepage

representing a complete description of a product. And that implies that a certain homepage (e.g. a brand of product) is preferred to other homepages (e.g. other brands of products).

The stimulus descriptions can be constructed in either of two ways. The more popular method is defining a number of levels for each of the attributes over the range of attribute variation. If a full factorial design is used, the number of possible stimuli quickly becomes very large. Green (1974) has suggested the use of various types of fractional factorial designs to reduce the number of combination to a manageable size while maintaining orthogonality. An alternate procedure for creating the stimulus descriptions is that of random sampling from a multivariate distribution. Random sampling procedure is likely to be better if the attribute correlation are high or if most of the attribute part-worth functions are monotone with changes in attribute levels and ordinal overall preference judgments are obtained. In cyber mall environment, the fractional-factorial design for conjoint analysis can be used because part-worth functions are applied to the multi-attribute categorical values and the fractional-factorial design is considerably easier to develop.

The presentation of the stimuli in the full profile approach has involved variations and combinations of three basic

Table 1  
Homepage structure

	Homepage address	Quality level	Product type	Product design	Profile
1	www.anymall.??/a1	High price and high quality	Shopping product	Monotonic	1
2	www.anymall.??/a2	High price and high quality	Shopping product	Fashionable	2
3	www.anymall.??/a3	N/A	N/A	N/A	
4	www.anymall.??/a4	High price and high quality	Convenience product	Monotonic	3
5	www.anymall.??/a5	High price and high quality	Convenience product	Fashionable	4
6	www.anymall.??/a6	Low price and low quality	Shopping product	Monotonic	5
7	www.anymall.??/a7	Low price and low quality	Shopping product	Fashionable	6
8	www.anymall.??/a8	Low price and low quality	Convenience product	Monotonic	7
9	www.anymall.??/a9	N/A	N/A	N/A	
10	Www.anymall.??/a10	Low price and low quality	Convenience product	Fashionable	8

approaches: verbal description (multiple cue stimulus cards), paragraph description, and pictorial representation. In cyber mall environment, all of three approaches are applicable. Especially pictorial presentation approach is natural due to the characteristics of current multimedia web.

The various alternatives for defining a measurement scale for the dependent variable can be roughly classified as metric (cardinal) or non-metric (ordinal or nominal). In cyber mall environment, metric or non-metric variable is available depending on the type of conjoint model considered, but metric requires additional information elicitation from the customer such that how the customer evaluates a product (homepage) in a rating scale. In our case, we only use rank order information derived on the basis of customer's footnotes in the cyber mall.

Rank order evaluations requires a modified form of analysis of variance specifically designed for ordinal data. Among the most popular and best known computer programs are MONANOVA (MONotonic ANalysis Of VAriance) and LINMAP. These programs give estimates of attribute part-worths, so that the rank order of their sum for each treatment is correlated as closely as possible to the observed rank order. If a metric measure of preference is obtained, many methods, even multiple regression can estimate the part-worths for each level.

### 3.2. A decision support system for benefit segmentation

The overall system flow can be outlined as follows: a certain customer navigates through homepages for buying some products and his or her surfing or buying data are recorded automatically in the User\_Visiting history database by homepage management system. The attributes and their levels of the homepages are already analyzed in URL\_Profile database which will be used as source data for analysis along with customer's buying data. Further, one of various combinations of models assumed in the analysis can be selected from model base according to the situation considered. Finally, user preferences toward the attributes of products are derived and the results can be used for enhancing customer relationship in further trans-

actions. The general architecture of conjoint analysis in electronic shopping malls is depicted in Fig. 1.

In the stage of analyzing legacy homepage, a marketer analyzes the structure of Internet shopping mall homepages and then identifies the attributes and their levels of product or service. After creating attributes and attribute levels by analyzing legacy homepages, we construct full profile and put it to URL\_Profile database in Fig. 1. In data preparation, a marketer prepares data set for conjoint analysis by using information of customer's footnotes on the cyber mall, which is different method from traditional market conjoint analysis usually conducted by survey data. The method suggested in this paper requires two assumptions. The one is that a homepage in the cyber mall implies one profile for full profile method among data collection methods in conjoint analysis. The other is that the homepage on some product the customer finally bought is preferred to any other competing homepages a customer dropped by. The latter assumption implies that user holistically considers multi-attribute leveled homepages and decide product in his want when user enters into the selecting business. In a chosen time span, we can finally rank the competing homepages from the most and to the least and the rank order information is fed into conjoint model as values of dependent variables in estimation stage.

## 4. An illustrative example of benefit segmentation in cyber mall environment

This section offers simple example to explain the methodology suggested in Section 3. We assume that there is a certain Internet shopping mall whose marketer will investigate customer's behavior and segment market.

In the stage of analyzing legacy homepage, a marketer has to analyze the structure of his Internet shopping mall and then identify the attributes and their levels of product/service displayed on it. We presume that he has identified three common attributes in homogeneous products as follows:

- *quality level*—high price and high quality/low price and low quality;

Table 2  
Footnotes of a customer

Count	Access time	Full history	Purchase	Before purchase	Ordered pairs
1	99/9/1 13:34	(5,4,5,8,1)*	1	(4,5,8)	(1,4),(1,5), (1,8)
2	99/9/3 14:39	(1,2,5,3,4,1,2,1,1,3,2,2,5,1,2)	2	(1,3,4,5)	(2,1),(2,3),(2,4),(2,5)
3	99/9/7 06:37	(1,2,6,3,8,1,2,3)	3	(1,2,6,8)	(3,1),(3,2),(3,6),(3,8)
4	99/9/11 13:54	(3,5,7,5)	5	(3,7)	(5,3), (5,7)
5	99/9/15 19:23	(1,4,7,4,1,6,4,7,1)	1	(4,6,7,8)	(1,4),(1,6),(1,7),(1,8)
6	99/9/19 17:24	(1,8)	8	(1)	(8,1)
7	99/9/20 13:39	(4,5,6,8,4,5)	5	(4,6,8)	(5,4),(5,6),(5,8)
8	99/9/21 14:14	(7,2,3,4,2,7)	7	(2,3,4)	(7,2),(7,3),(7,4)
9	99/9/24 16:10	(5,7,1,8,5,1)	1	(5,7,8)	(1,5),(1,7),(1,8)
10	99/9/27 17:00	(6,2,7,6,2)	2	(6,7)	(2,6),(2,7)
11	99/9/29 17:00	(5,3,5,2,6,3)	3	(2,5,6)	(3,2),(3,5),(3,6)

- *type of product*—shopping product/convenience product;
- *product design*—monotonic fashionable.

If three attributes with two values are selected, then eight combinations of stimuli can be formed. Subsequently, they make a table of homepage profile as shown in Table 1. Not all homepages have attributes and is denoted as N/A.

In the stage of data preparation, marketers prepare data set for analysis using customer's surfing and buying history. The key role of this step is to derive the ranking of profiles of product homepages from customer's surfing and buying history. A customer usually clicks several pages before buying some product. During browsing, he or she may click the same page several times. "Before purchase" column tells the sequence of web pages the customer clicked before buying. The order of pages in "Before purchase" is consistent with that of "Full history" except deleting recurrent numbers. Table 2 tells that a customer visited a shopping mall eleven times during September 1999 and at each visit, he or she clicked web pages listed in "Full history" column, and he or she bought a product displayed on the page listed in "Purchase" column. Before deriving the ranking of profiles, we need to derive ordered pairs of preferences as shown in "Ordered pairs" column in Table 2.

We assume that a customer prefers the product he or she purchased to other products only considered. An ordered

pair ( $a_1, a_2$ ) means that product  $a_1$  is preferable to product  $a_2$ . To make full ranking of profiles, we use the basic outranking concept. The number of a product being preferred to other products except itself is denoted in "Column total" column. Similarly, the number of other products being preferred to a product except itself is denoted in "Row total" row. The difference between "Column total" and "Row total" in each profile is denoted in "Net" column. According to the magnitude of "Net" value, we can give ranks with higher rank in larger net number. It is thought that if the user buy the same product more frequently than other competing products in a given time span, the product should be evaluated as high rank and thus the outranking concept directs to majority of dominance although exact dominance relationship does not hold. The calculation process is described in Table 3.

Finally, in order to estimate the degree of consumer preference of each attribute, we use multiple regression with dummy variables instead of part-worth function model, where ordinary least square regression applied to integer ranks produces solutions that are very close, in terms of predictive validity (Green & Srinivasan, 1978).

$$Y = b_0 + b_1 \text{QUALITY} + b_2 \text{TYPE} + b_3 \text{DESIGN}$$

where  $Y$  = rank order of profiles,  $b_0$  = intercept, QUALITY = (1: high price and high quality, 0: low price and low quality), TYPE = (1: shopping product, 0:

Table 3  
Ranking of profiles

Profiles	1	2	3	4	5	6	7	8	Row total	Net (Row-Col.)	Rank
1				2	2	1	2	3	10	7	1
2	1		1	1	1				4	1	4
3	1	1				2	1	1	6	3	2
4		1			1	1			3	-2	6
5			1	1		2	1	1	6	2	3
6									0	-6	8
7		1	1	1					3	-1	5
8	1								1	-4	7
Column Total	3	3	3	5	4	6	4	5			

Table 4  
Results of multiple regression

Variable	B	SE B	Beta	t-test	p-value
DESIGN	– 3.50	0.612372	– 0.763763	– 5.715	0.0046
QUALITY	– 2.50	0.612372	– 0.545545	– 4.082	0.0151
TYPE	– 1.00	0.612372	– 0.218218	– 1.633	0.01778
(Constant)	8.00	0.612372		13.064	0.0002
Multiple R = 0.96362, R Square = 0.92857, Adjusted R Square = 0.87500					
Standard Error = 0.86603, F test = 17.33333, Signif F = 0.0093					
Observations = 8, DF of regression = 3, DF of residual = 4.					

convenience product), DESIGN = (1: monotonic design, 0: fashionable design).

Table 4 shows that the variable of DESIGN is the first in importance, followed by QUALITY, and TYPE. We consider this result is only for one customer in private level.

A marketer has to identify market segments on the basis of above result. Each attribute can be a segment. In this example, the consumer analyzed prefer monotonic design most of all and dislike a fashionable design of product. The marketer can e-mail to the customer an electronic handbill which will have a monotonic design of the product or shopping product or shopping product or high price and high quality product. The marketer should not e-mail to the customer an electronic leaflet which was a fashionable design of the product or convenience product or low price and low quality product.

## 5. Concluding remarks

Lots of shopping malls continue to search for a competitive advantage in an increasingly tighter marketplace. Further, electronic market changes traditional market environment fundamentally and radically. To this end, marketers are trying to searching for intimate customer relationship for further transaction. One of those instruments for improved customer relationship may be e-mail. E-mailing to the customer indiscriminately without any consideration of customer's preferences sometimes frustrates his or her own real customers. So identifying customer's preferences and administering appropriate strategies are essential for continuous and favorable relationship with their customers. This paper suggests how to identify user's preferences in newly rising electronic markets. In detail, this paper focuses on market segmentation in Internet shopping malls. Different from traditional market segmentation, electronic market segmentation requires new data preparation procedure, where customer's footnotes through competing homepages are key data input for conjoint analysis in market segmentation. Combining appropriate conjoint model and input data automatically gathered from the web server produces the customer's preference toward the product or service represented by Internet homepages. Finally the derived preferences are utilized for better understanding of the customer's

behavior and further transactions such as e-mailing or advanced design of homepages.

The limitation of the paper to be mentioned is that customer's preferences toward products vary depending on the time span used to derive ordinal ranking of profiles. However, it is conceived that long term investigation of a customer's footnotes on a shopping mall will reveal any tendency or convergence toward products. Otherwise, we conclude that his or her preferences are diversified and almost equal importance value should be given to the attributes.

Beyond individual evaluation, it is possible to extend a single customer's attribute estimation into a representative multiple customer's case. Thus, various statistical analyses can be utilized to infer group attitude toward products, which is left as a further research.

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