

# PERCEPTUAL MAPPING OF CONSUMERS: A CORRESPONDENCE ANALYSIS APPROACH TOWARDS CONSUMERS OF LEATHER PRODUCTS IN CALCUTTA, INDIA

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## ABSTRACT

*Perceptual mapping is an important tool which the marketing managers or the product developers can use before taking up any major decisions in advertisements, brand positioning or even in case of new product development. The same tool can be effectively used for even market segmentation to identify the specific target audience or customers. In this paper, the focus has been kept on correspondence analysis for its ease of use and better understanding of different perceptual maps which are existing in the market of Calcutta, India on leather products. The maps will clearly show how different attributes are mapped in the minds of the customers and how the same information can be helpful for managers to take marketing decisions on leather products.*

Keywords: Perceptual mapping, correspondence analysis, MDS, customer segmentation, hierarchical cluster analysis

## INTRODUCTION

Perceptual mapping is one of the most important tools in marketing research. It refers to market research techniques for displaying consumer perception of brands in a category, companies in an industry and so forth. Perceptual maps are often used to investigate positioning issues to new or existing brands (Fox 1988) Dickson and Ginter 1987, Bijmolt and van derVelden 2012). If a broad categorization is done on various type of perceptual maps, there are two ways of building perceptual maps; compositional and decompositional methods. Decompositional method is a technique where consumers only give their overall preference or ratings and those overall evaluations are decomposed into a set of dimensions. The typical decompositional method for developing a perceptual map is Multidimensional Scaling (MDS). However, there are a few problems with this method. First, there should be more than four objects per dimension which means that for a two dimensional layout, at least nine objects are to be selected. For measuring similarities or preferences between two objects, a respondent is required to respond to 36 different combinations ( ${}^9C_2$ ) and for 3 dimensional layout, the number of comparison will be as high as 78 ( ${}^{13}C_2$ ). Thus, with the increase in

number of dimensions, the number of comparisons increases exponentially which will cause consumer wearout. Second, it is very difficult to identify the dimensions in a proper way. The dimensions are decided subjectively and many a times, it becomes very difficult to justify a dimension in a proper way. That is why compositional methods are more frequently used for building perceptual maps.

In a compositional approach, a set of different attributes are evaluated on the basis of preference or rating and afterward the results are combined (composed) together to get an overall evaluation. Compositional methods, particularly factor analysis is found to be superior to decompositional methods with respect to underlying theory, interpretability of dimensions ease of use and predictive validity (Hauser and Koppelman, 1979; Holbrook, 1981; Huber, Wittink Fiedler and Miller, 1993).

As a result, compositional method is used quite extensively in marketing research. But this method has at least two problems associated with it. First, compositional methods cannot identify perceptual dimensions that do not have at least one attribute to represent them. Second, the most important, presenting all consumers with same set of a priori attributes assumes that (1) all attributes in the study are relevant to all consumers, (2) no other attributes are relevant to certain group of consumers and (3) consumers attach the same meaning to an attribute (Steenkamp, Hans, and ten Berge, (1994). Traditionally discriminant analysis and factor analysis have been used to develop perceptual maps but in the recent developments, aspects of both the methods and MDS are combined to develop new tools for perceptual mapping (Hair, Black, Babin, Anderson, and Tatham, 2011). In this regard, Bendixen (1985) has shown how Chi-square test can be used to do perceptual mapping and Katahira (Katahira, 1990) tried to develop perceptual maps using ordered logit analysis. Chaturvedi and Douglas (2006) developed a three way hybrid model for doing perceptual mapping which incorporated overlapping clustering and MDS. But these models are mathematically intensive and the software is not readily available to apply these models. That is why correspondence analysis is used for its easy to use feature and relative advantages over MDS.

### Correspondence Analysis

Correspondence analysis is a compositional approach in building perceptual maps. It is based on the association between an object and a set of descriptive characteristics specified by the researcher (Hair et al, 2011). It is particularly useful in developing a correspondence between variables which are measured in nominal scale. The most attractive feature of correspondence analysis lies in its ability to develop the perceptual map in a single step with much lesser mathematical computations. Basically correspondence analysis use cross tabulation of data which it uses to measure similarities or dissimilarities between attributes. Typically, an  $N \times P$  cross-tab matrix with N rows and P columns will have NP cells in it. Each cell contains the observed frequency count of occurrence of an outcome ( $O_{ij}$ ). Correspondence analysis calculates the expected cell value ( $E_{ij}$ ) using the formula

$$\text{Expected Cell Value } (n_{ij}) = \frac{\text{Sum total of Row } i \times \text{Sum total of Column } j}{\text{Grand total of all frequencies}} = E_{ij} \quad [1]$$

Based on expected cell value, it calculates Chi-square ( $\chi^2$ ) value for individual cells using the formula

$$\chi^2 \text{ value for a cell } (i, j) = \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \quad [2]$$

Chi-square value denotes the degree of similarity or association between two attribute levels. But what happens in the calculation is that the direction of association is removed because of squaring the difference. That is why, to restore the direction, the original sign of difference is

put back into the chi-square value. A negative sign is introduced if the expected value is found more than the observed value. Thus, a positive value indicates a positive association whereas the negative value shows a negative association. The chi-square value gives a standardized measure of association or similarities and the same values can be used for developing a similarity matrix which is, afterward, used in the same way how a similarity matrix is use by MDS. Thus, correspondence analysis is a hybrid method incorporating both MDS as well as cross-tabulated non-metric data. Correspondence analysis is now considered to be a very popular method for developing perceptual map in a very cost effective way. However, the further mathematical part is intentionally not included in this paper. Readers can refer to Hoffman and Franke (1986); Doey and Kurta (2011) for the mathematical part of Correspondence Analysis.

### **An application**

Correspondence analysis can be easily used for understanding how leather products and leather brands are mapped in the perceptual levels of consumers. Leather items which are found in Calcutta vary from key rings to shoes to weather jackets. Each item has its own attribute, own utility and market value. For men, leather office bags are available which are costly but ladies bags are available in different range of prices. The reason behind such a wide variation in prices can be explained by the fact that the market for leather items is highly fragmented. Leather bags can be found in Gariahat Market, New Market and also in malls like Forum, City Center and South City Mall. In Gariahat Market or in New Market, mostly unbranded items or local brands are found which are sold on the pavements of Calcutta because of which they can be sold at a much cheaper price. But malls usually keep famous brands like Da Milano, Grant's Leather, Gucci, Millie, Rene, Duckback etc. That is why in this paper the focus has been kept on how

- different brands are positioned in the minds of consumers with respect to price category
- different brands are positioned in the mind of consumers with respect to importance of different attributes (color of product, fashion, price, smoothness, toughness, ethnicity and brand name)
- different brands are positioned in the mind of consumers with respect to preferred product category
- Different leather products are positioned in the minds of consumers with respect to their preferred price category.

Not only is this, even the reasons for choosing different brand plotted in a perceptual map to get a better picture of consumer behavior in buying of leather products.

## **METHODOLOGY**

A self-administered questionnaire was prepared for this study because the study deals with mainly categorical data. Through qualitative study, total seven attributes were found to be important for leather products. These attributes (Colour, Smoothness, Fashion, Price, Toughness, Ethnicity and Brand Name) are incorporated in the questionnaire to understand the importance level of these attributes against each brand. The importance was measured using a 10 point rating scale where 1 was indicating least important and 10 was indicating most important. Responses were collected from four different parts of Calcutta, India, i.e. north, south, east and west, so that they accord with the population of Calcutta as a whole.

Mall and street intercept techniques were employed for collecting the data. From each region 50 responses were collected through convenience sampling technique. However, to maintain a systematic methodology, every fifth (5<sup>th</sup>) person was targeted for getting the responses. In this way, a total 150 responses were collected based on convenience sampling through mall intercept and street intercept. Respondents were asked to mention their preferred brands, their preferred price category, preferred product category and rate the above mentioned attributes on a 10 point scale. Instead of binary responses (important/not important), a rating scale was used because an attempt was also made to see how these attributes formed clusters based on a hierarchical clustering method using Euclidian Distance measure.

### ANALYSIS

The responses were taken from various categories of Calcutta respondents in terms of gender, age and income group. 58.7 per cent of the respondents were male while 41.3 per cent of the respondents were female. In terms of age category, 12 per cent of the respondents were in 20-25 years age, 34% of the respondents in the 26-30 years age, 25.3 per cent of the respondents were in the 31-40 years of age, 19.3 per cent were in the 41-50 years of age and 9.3 per cent were in the above 50 years category.

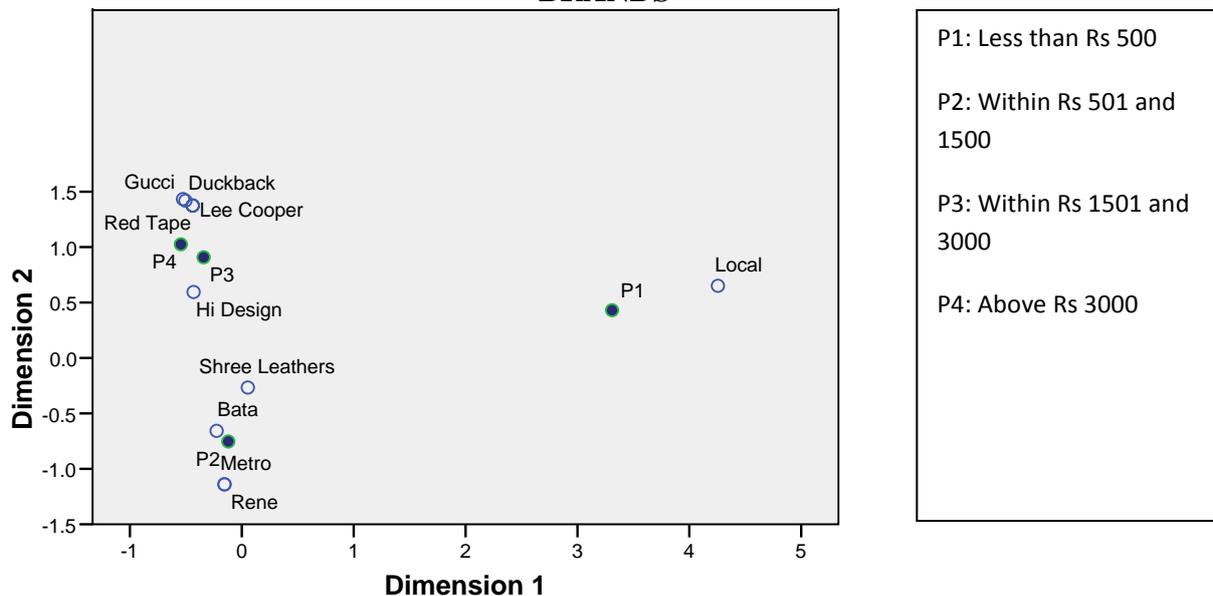
Correspondence analysis is more like an exploratory analysis which does not consider any hypothesis testing. In fact it is just a way of putting things in a pictorial manner so that better understanding about the aspects can be viewed and further analysis can be done based on the output. Hence, in the first place, correspondence analysis was done on two variables, i.e. preferred price category and brands. The summary table as well as the perceptual map is shown below in Table 1 and Figure 1 respectively.

**TABLE 1**  
**SUMMARY TABLE OF CORRESPONDENCE ANALYSIS BETWEEN**  
**PREFERRED PRICE CATEGORY AND BRANDS**

Dimension	Singular Value	Inertia	Chi Square	Sg.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation
1	.778	.605			.499	.499	.126	.119
2	.661	.436			.360	.859	.062	
3	.413	.170			.141	1.000		
Total		1.212	93.316	.000 <sup>a</sup>	1.000	1.000		

a. 30 degrees of freedom

**FIGURE 1  
PERCEPTUAL MAP OF PREFERRED PRICE CATEGORY AND LEATHER BRANDS**



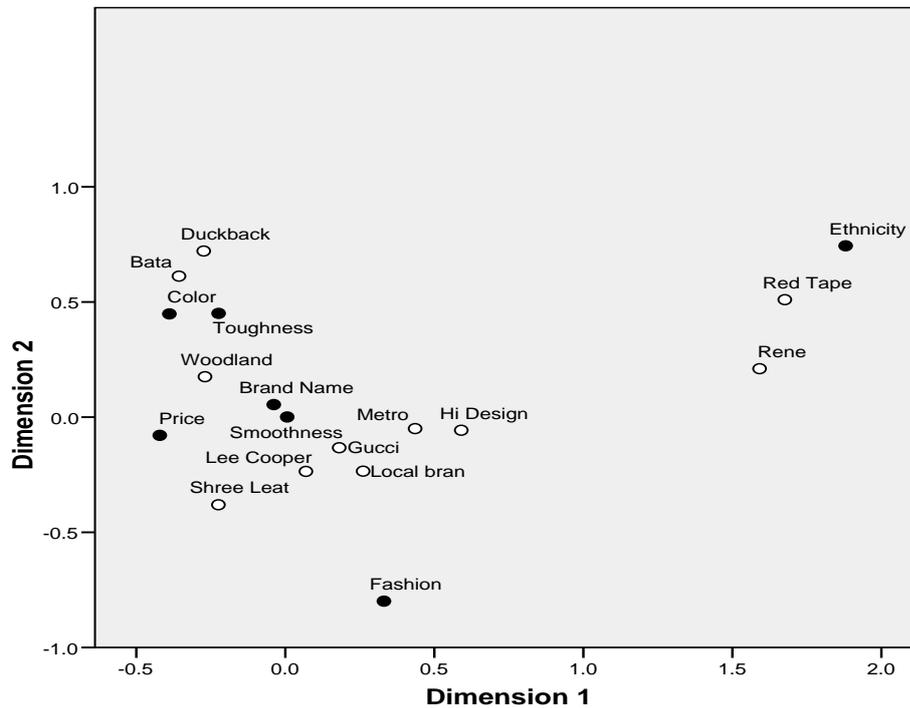
The summary table, based on Chi-square significance value, clearly shows that there exists a relationship between preferred price category and brands. The perceptual map also shows which brands are lying close to which preferred price category. Moreover, the two dimensions explain almost 85 per cent variances which is a good representation of the perception. The second perceptual map is drawn using importance of attributes and brands. However, to calculate the frequency, importance score of above or equal to 5 was considered to be important and below 5 was considered not important. Thus, from the rating scores, a binary response was generated for each respondent and then the correspondence analysis was done. The summary table is shown in Table 2. The table clearly shows that there exists no relationship among attributes and brands in the perceptual levels of consumers (Chi-square significance value is much above 5 per cent significance level). And the perceptual map also gives a pictorial representation of the same.

**TABLE 2  
SUMMARY OF CORRESPONDENCE ANALYSIS OF IMPORTANCE OF  
VARIOUS ATTRIBUTES AND BRANDS**

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation
1	.233	.054			.499	.499	.066	.012
2	.177	.031			.286	.786	.044	
3	.098	.010			.088	.874		
4	.092	.008			.078	.952		
5	.072	.005			.048	1.000		
6	.007	.000			.000	1.000		
Total		.109	41.950	.963 <sup>a</sup>	1.000	1.000		

a. 60 degrees of freedom

**FIGURE 2  
PERCEPTUAL MAP OF IMPORTANCE OF ATTRIBUTES WITH RESPECT TO  
BRANDS**



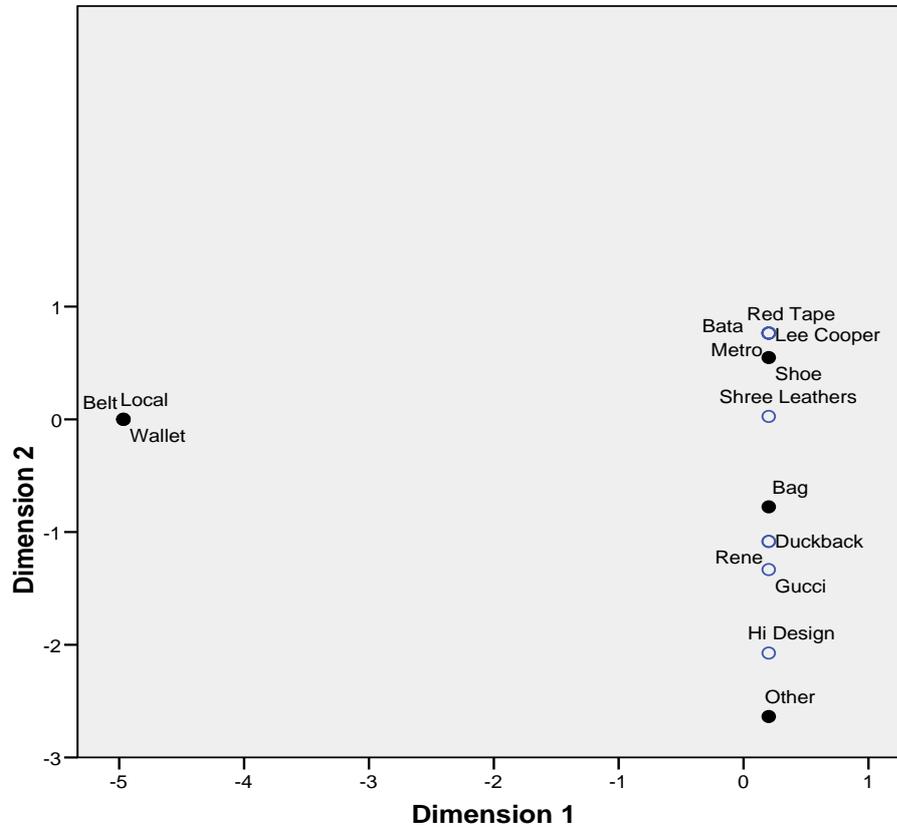
Interestingly, Rene and Red Tape were closer to Ethnicity and when the importance of color and toughness comes into the picture, people perceive Bata, Duckback and Woodland are more appropriate brands. However, these observations are just indicative and cannot be said with full confidence. The same analysis can be done with a larger sample to establish any relationship among the brands and attributes, if any such relationship exists. The third analysis was done on how different brands are attached with the preferred leather products. The summary tables as shown in Table 3 indicate that there is a significant relationship among preferred product category and the preferred brand. The perceptual map is also shown in Figure 3. The map clearly shows how the products and brands are perceived to be associated. It is understood that for belts and wallets consumers, usually, don't go for established brands whereas for bags, Duckback, Gucci and Rene are more preferred. Sree Leather is almost evenly spaced between bags and shoes which mean it is having similar preferences towards these products. Lee Cooper, Red Tape, Bata etc are predominantly dealing with footwear and hence the association is also clearly visible in the perceptual map.

**TABLE 3  
SUMMARY TABLE OF CORRESPONDENCE ANALYSIS OF PREFERRED  
PRODUCT WITH RESPECT TO PREFERRED BRANDS**

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation
1	1.000	1.000			.543	.543	.000	.000
2	.716	.513			.278	.821	.076	
3	.574	.330			.179	1.000		
Total		1.843	141.887	.000 <sup>a</sup>	1.000	1.000		

a. 40 degrees of freedom

**FIGURE 3  
PERCEPTUAL MAP OF PREFERRED PRODUCT WITH RESPECT TO  
PREFERRED BRAND**



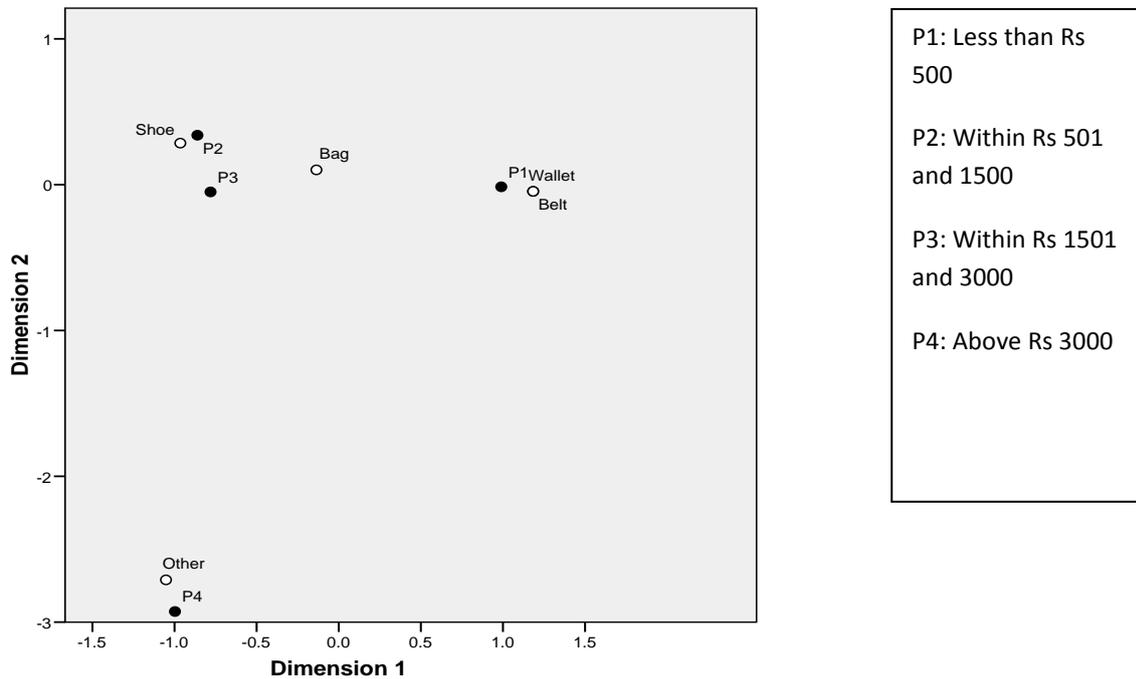
Another perceptual map is drawn between preferred products and preferred price range. This is important because price plays a critical role in product design. Consumers may develop their own inherent understanding of how a product should be priced and how much they are willing to pay for a particular type of product. That is why a perceptual map in this regard will throw light on how different leather products could be priced from consumers' point of view. The summary table is shown in Table 4. And the corresponding perceptual map is also shown in Figure 4.

**TABLE 4  
SUMMARY TABLE FOR THE CORRESPONDENCE ANALYSIS OF PREFERRED  
PRODUCT WITH RESPECT TO PREFERRED PRICE CATEGORY**

Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation
								2
1	.836	.699			.863	.863	.027	.035
2	.324	.105			.130	.993	.186	
3	.077	.006			.007	1.000		
Total		.810	121.537	.000 <sup>a</sup>	1.000	1.000		

a. 12 degrees of freedom

**FIGURE 4**  
**PERCEPTUAL MAP FOR PREFERRED PRODUCT WITH RESPECT TO**  
**PREFERRED PRICE CATEGORY**



The map indicates that leather bags are more preferred in P3 price category than P2. Other high valued items are falling in P4 category. The interesting thing in this map is that even though many branded shoes are actually falling in P3 and P4 category, the preferences are shown in P2 category. This shows that there could be a reasonable influence of brand in shoe category which is also evident from Figure 1.

These maps give key insight to product managers or brand managers in terms of product design or brand positioning/repositioning. Apart from the perceptual maps developed through correspondence analysis, hierarchical cluster analysis can also be used to see which attributes are perceived to be nearer to each other. In this analysis, seven attributes were rated by the respondents on a scale of 10 on the basis of importance. A hierarchical clustering algorithm was run using nearest neighborhood method to see which are the attributes seem to be closer in terms of importance. The dendrogram is shown in Figure 5.



constructs were used for the first time in the consumer non-durable sector, item reduction was solely done on statistical basis. Therefore, future researchers may replicate this study in other consumer non-durable sector to ascertain the validity of the analysis. Furthermore, since the study has only been conducted in n Calcutta, India, due to convenience sampling, the sample might not be a true representation of the population of Calcutta, India. Researchers can conduct similar studies in other industries (with experiential or utilitarian goods or services) and regions and compare the results before arriving at any generalization of these results. Further descriptive researches can also be carried out on buying behavior of leather goods based on the findings of this research.

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