Visualizing attitudes towards service levels

Kar Yin Lam, Michel Van de Velden, and Philip Hans Franses

ERIM REPORT SERIES *RESEARCH IN MANAGEMENT*	
ERIM Report Series reference number	ERS-2011-022-MKT
Publication	September 2011
Number of pages	25
Persistent paper URL	http://hdl.handle.net/1765/26471
Email address corresponding author	vandevelden@ese.eur.nl
Address	Erasmus Research Institute of Management (ERIM) RSM Erasmus University / Erasmus School of Economics Erasmus Universiteit Rotterdam P.O.Box 1738 3000 DR Rotterdam, The Netherlands Phone: + 31 10 408 1182 Fax: + 31 10 408 9640 Email: info@erim.eur.nl Internet: www.erim.eur.nl

ERASMUS **R**ESEARCH **I**NSTITUTE OF **M**ANAGEMENT

REPORT SERIES

RESEARCH IN MANAGEMENT

ABSTRACT AND KEYWORDS	
Abstract	To assess the attitudes with respect to the quality of banks' service levels, we use survey data amongst more than 250 Chief Financial Officers (CFOs) of a range of Netherlands-based companies. These companies range from small to very large (including multinationals as Philips and Shell) companies. The survey was conducted in five subsequent years. In this paper, we explore the evaluations of the service levels of banks where, for all attributes considered, the ratings were accompanied by an importance rating. We propose a visualization method that incorporates the importance weights into correspondence analysis. The resulting maps exhibit the correlation structure of the different service items as well as the variances for each item. Moreover, the results are linked to different banks over time, thus exposing the development of the attitudes over time.
Free Keywords	marketing, product differentiation, brand image, multiattribute models, perceptual mapping, correspondence analysis
Availability	The ERIM Report Series is distributed through the following platforms: Academic Repository at Erasmus University (DEAR), DEAR ERIM Series Portal Social Science Research Network (SSRN), SSRN ERIM Series Webpage Research Papers in Economics (REPEC), REPEC ERIM Series Webpage
Classifications	The electronic versions of the papers in the ERIM report Series contain bibliographic metadata by the following classification systems: Library of Congress Classification, (LCC) LCC Webpage Journal of Economic Literature, (JEL), JEL Webpage ACM Computing Classification System CCS Webpage Inspec Classification scheme (ICS), ICS Webpage

Visualizing attitudes towards service levels

Kar Yin Lam

Michel Van de Velden[1]

Philip Hans Franses

Econometric Institute

Erasmus School of Economics

Abstract

To assess the attitudes with respect to the quality of banks' service levels, we use survey data amongst more than 250 Chief Financial Officers (CFOs) of a range of Netherlands-based companies. These companies range from small to very large (including multinationals as Philips and Shell) companies. The survey was conducted in five subsequent years. In this paper, we explore the evaluations of the service levels of banks where, for all attributes considered, the ratings were accompanied by an importance rating. We propose a visualization method that incorporates the importance weights into correspondence analysis. The resulting maps exhibit the correlation structure of the different service items as well as the variances for each item. Moreover, the results are linked to different banks over time, thus exposing the development of the attitudes over time.

Key words: Marketing; Product differentiation; Brand image; Multiattribute models; Perceptual mapping; Correspondence analysis.

[1] Corresponding author: Econometric Institute, Erasmus School of Economics, PO Box 1738, NL-3000 DR Rotterdam, The Netherlands, vandevelden@ese.eur.nl

1. Introduction

The versatility and power of graphical representations of complex high dimensional data has long been acknowledged in marketing research (Frank and Green,1968, Stefflre, 1969, Green and Carmone, 1969, Green and Carmone, 1970) and practice (Doehlert, 1968, Huber, 2008). In a survey of 136 marketing managers, Cornelius, Wagner, and Natter (2010) found that the preferred format for communicating positioning decisions was a graphical format. In marketing, the resulting visualizations are often referred to as perceptual maps. Such perceptual maps typically capture customers' perceptions of competing products by displaying the products (and sometimes, the associated attributes) in a low-dimensional map. Although perceptual mapping originally only concerned multidimensional scaling techniques, the term is nowadays used in conjunction with any multivariate analysis method yielding a graphical representation of the data, e.g. canonical discrimination (Pankhania, Lee, & Hooley, 2007), principal component analysis (Monteiro, Dibb and Almeida, 2010), correspondence analysis (Torres and Bijmolt, 2009), and canonical correlation analysis (Taks & Scheerder, 2006). For an extensive literature review of perceptual mapping, in particular with respect to strategic marketing, see Monteiro et al. (2010). In this paper, we use perceptual mapping to visualize attitudes with respect to various attributes concerning the quality of service levels of banks.

The quality of service levels of banks, insurance companies and the like, is crucial in the development of competitive marketing strategies. To assess the attitudes with respect to quality of service levels, we use survey data amongst more than 250 Chief Financial Officers (CFOs) of a range of Netherlands-based companies. These companies range from small to very large (including multinationals as Philips and Shell) companies. The survey was conducted in five subsequent years and consisted of several statements concerning service quality related attributes to which respondents replied using a numbered scale, ranging from "fully disagree" to "fully agree". In addition, respondents were asked to indicate the importance of each individual statement on a three point scale. Using these data we want to visualize attitudes towards different banks over time. To accomplish this, we first need to define attitudes in this context. For this we turn to multiattribute attitude models used in marketing, in particular to the Importance/Adequacy model (Lutz and Bettman, 1977).

In the Importance/Adequacy model, which is closely related to Fishbein's (1963) attitude model, the attitude towards an object is defined as the sum, over all attributes, of weighted attribute evaluations where the weights are the indicated attribute importances. By taking the sum over all weighted attribute evaluations, the interrelatedness of the attributes is ignored. In our study, we would like to see how the attitudes with respect to the different attributes relate. Furthermore, we would like to see how the different banks correspond to the attitudes towards the different attributes. Certain banks may be better characterized by positive attitudes towards, for example, service quality related attributes whereas others are characterized by positive attitudes towards product documentation related attributes. In the Importance/Adequacy model, these questions cannot be addressed as the sum score measure aggregates over the attributes. To overcome this, we develop a weighted correspondence analysis approach that yields a visualization of the attributes' correlation structure and the positions of the banks. In our correspondence analysis approach, we visualize subjects and attributes in such a way that subjects with similar attitudes towards attributes are close to each other, whereas those exhibiting different attitudes are well separated. Our visualizations depict the relationships between the different attributes and the development of attitudes towards the different banks over time.

The outline of this paper is as follows. We introduce multiattribute models and formulate restrictions that facilitate the application of correspondence analysis of the attitude data. We then briefly summarize correspondence analysis (CA) and show how additional information can be projected in the CA map as supplementary points. Next we apply our methodology to survey data on the quality of banks in the Netherlands. Finally, we summarize our findings.

2. Multiattribute attitude models

The aim of multiattribute attitude models is to measure consumers' attitudes towards objects in the marketplace (Lindgren and Konopa, 1980). The most basic model commonly used in the field of marketing is Fishbein's (1963) attitude model. In Fishbein's attitude model, objects are evaluated on a set of attributes together with the so-called belief about an object's possession of the attribute. Attitudes are defined as the weighted sum of attribute evaluations where the beliefs are used as weights. Thus, subject *i*'s attitude towards object *o* becomes: $A_{io} = \sum_{j=1}^{p} b_{ij} e_{ij}$, where b_{ij} is subject *i*'s strength of belief about the object's possession of the *j*th attribute and e_{ij} is the evaluation of the attribute. The Importance/Adequacy model (Lutz and Bettman, 1977) is equivalent to Fishbein's attitude model with importance ratings playing the role of beliefs.

By defining the attitude as described above, intercorrelatedness of attributes is ignored and a straightforward assessment of the attitudes with respect to the individual attributes is not possible. An obvious solution to this would be to remove the summation and consider the attribute-specific products of item importances and item evaluations. Then, applying a visualization technique like correspondence analysis can be used to explore the correlation structure of the attributes. However, when applying correspondence analysis to such attributes attitudes, there are some restrictions that need to be taken into account.

2.1. Unipolar versus bipolar rating scales

To incorporate the item weights in correspondence analysis of ratings, we have to distinguish between unipolar and bipolar rating scales. For the unipolar case, there is no definite neutral option. The importance weights ranging from "not important" to "very important" are an example of a unipolar scale. For bipolar rating scales, the ratings indicate extremeness with respect to a neutral option. An example is a scale ranging from "completely disagree" to "completely agree". The distinction is important when applying weights. For bipolar scales it does not make sense to multiply ratings by importance weight as such a procedure would have obvious adverse affects. For example, a low rating, indicating the furthest distance from the neutral option, moves closer to the neutral position after receiving a high importance weight.

To avoid this problem, a translation of the bipolar rating scale is necessary. For example, the ratings may be recoded on a scale with the midpoint (corresponding to the neutral/middle option) set to zero. Note that, even if the original scale does not allow subjects to choose a neutral/middle option, subtracting the midpoint creates a midpoint at zero and the translated scale values indicate deviations from this midpoint. Multiplication of the translated ratings has the desired effect of amplifying the values. Note that, in the Fishbein attitude model, only bipolar scales are used for the attributes.

2.2. Maintaining the original order of the ratings

In our multivariate analysis of the attributes, the weighted ratings should not interfere with the original indicated order of the items. That is, for an individual, attributes that received a lower rating should, after weighting, not surpass higher rated attributes. Thus, if $f_{ij} \leq f_{ik}$ then

$w_{ij} f_{ij} \le w_{ik} f_{ik}$, where f_{ij} is the observed rating of individual *i* for object *j* (in deviation from the neutral option) and $w_{ij} > 0$, is individual *i*'s weight for object *j*.

Let r denote an integer-valued rating on a bipolar symmetrical scale, that is, $r \in [-k, k]$ where *k* denotes the highest possible rating. Writing $w_{\min}$ and $w_{\max}$ for the lowest and highest possible weights respectively, the restriction can be formulated as

$$w_{\max}(r-1) \le w_{\min} r, \text{ for all } r = 1 \ldots k.$$

Hence,

$$w_{\max} \le \frac{r}{r-1} w_{\min} \le \frac{k}{k-1} w_{\min}. \tag{1}$$

(Note that the same result holds for a unipolar scale with $r \in [0, k]$).

The importance weights are obtained from the individuals. However, the observed weights do not necessarily satisfy the restrictions formulated above. For example, consider the situation in which individuals were asked to indicate the importance of an item on an integer scale from 1 (not important) to 3 (very important). Using these weights, i.e. $w_1 = 1$, $w_2 = 2$ and $w_3 = 3$, would clearly not satisfy our restriction as $w_{\max} > 2w_{\min}$. To obtain weights that do satisfy the restrictions, we transform the observed values by setting the minimum weight, say w_1, equal to 1, the maximum w_k equal to $k/(k-1)$, and by assigning even spaced intermediate values. For the example situation we obtain: $w_1 = 1$, $w_2 = 1.5$ and $w_3 = 2$.

2.3. Relative importance and weighting the neutral option

On bipolar scales, the midpoint (that is, the neutral option) is coded as zero. Consequently, applying weights to items that received a neutral score has no effect. Furthermore, content irrelevant factors such as response styles (e.g., Baumgartner and Steenkamp, 2001) may complicate using the weighted ratings of different respondents. A response style may be defined as a respondent's tendency to respond to questionnaire items on some basis other than what the items were specifically designed to measure (Paulhus, 1991). Differences in response styles have received considerable attention from researchers in various disciplines such as marketing and psychology (Baumgartner and Steenkamp, 2001, Grimm and Church, 1999; Van Herk et al., 2004). Methods have been developed to detect response styles (e.g., Baumgartner and Steenkamp 2001, van Rosmalen et al, 2010, van de Velden, 2008) and to correct for them (Baumgartner and Steenkamp 2001, de Jong et al., 2010). However, to disentangle true variation in preferences from variation caused by a response style still remains cumbersome due to the non-observability of these two factors. The existence of response styles can lead to a reduction in observed variation in the answers and complicates aggregation of the respondents' ratings. To correct for this, we standardize the (order preserving) weights for an individual, by dividing them through the sum of all weights assigned by that individual. Hence,

$$w_{ij} = \frac{w_{ij}}{\sum_{j=1}^{p} w_{ij}}.$$

Standardizing the weights in this manner ensures that, if a respondent assigns maximum weight to all items, the results do not differ from someone giving the same ratings but with minimum weight to all items. Moreover, the standardization implicitly defines weights for the objects that received a neutral (zero) rating.

3. Methodology

Correspondence analysis (Benzécri et al. 1973) is an exploratory multivariate statistical technique that visualizes a nonnegative data table into a map by depicting rows and columns of the data table as points. The coordinates for objects in a CA perceptual map are determined in such a way that they are close to each other when perceived as similar and far apart when perceived as dissimilar. Similarly, subjects are represented in such a way that differences in the evaluations are optimally represented. Although the geometry underlying correspondence analysis is based on contingency table data, the method can be applied to any nonnegative table. For the sake of completeness and to simplify our exposition of the new CA of weighted ratings approach, we briefly introduce the method below. For a more comprehensive treatment, see for example Greenacre (2007).

3.1. Correspondence analysis

Let **N** denote an $n \times p$ nonnegative matrix. Then, the correspondence matrix **P** is defined as

$$\mathbf{P} = \frac{1}{\mathbf{1}_n^{'}\mathbf{N}\mathbf{1}_p}\mathbf{N} \tag{2}$$

so that

$$\mathbf{1}_n^{'}\mathbf{P}\mathbf{1}_p = 1, \tag{3}$$

where, generically, $\mathbf{1}_q$ denotes a qx1 vector of ones. In addition, define diagonal matrices $\mathbf{D}_r$ and $\mathbf{D}_c$ such that $\mathbf{D}_r\mathbf{1}_n = \mathbf{P}\mathbf{1}_p$, and $\mathbf{D}_c\mathbf{1}_p = \mathbf{P}`\mathbf{1}_n$.

Correspondence analysis amounts to considering the following singular value decomposition:

$$\mathbf{D}_r^{-1/2}(\mathbf{P} - \mathbf{D}_r\mathbf{1}\mathbf{1}'\mathbf{D}_c)\mathbf{D}_c^{-1/2} = \mathbf{U}\boldsymbol{\Lambda}\mathbf{V}' \tag{4}$$

where

$$\mathbf{U}'\mathbf{U} = \mathbf{V}'\mathbf{V} = \mathbf{I}_\kappa, \tag{5}$$

with κ the rank of the matrix $(\mathbf{P} - \mathbf{D}_r\mathbf{1}\mathbf{1}'\mathbf{D}_c)$, and $\boldsymbol{\Lambda}$ the diagonal matrix of singular values in descending order. Coordinates for rows and columns can be obtained by

$$\mathbf{G} = \mathbf{D}_r^{-1/2}\mathbf{U}\boldsymbol{\Lambda}^\alpha \tag{6}$$

and

$$\mathbf{H} = \mathbf{D}_c^{-1/2}\mathbf{V}\boldsymbol{\Lambda}^\beta. \tag{7}$$

When $\beta = 1-\alpha$, the CA solution can be seen as a biplot (Gabriel, 1971). The advantage of such a solution is that it allows for the interpretation of projections of two sets of points on each other. In this paper we shall only consider CA solutions that satisfy this biplot property, that is, $\beta = 1-\alpha$. For more details of CA and its biplot interpretation we refer to Greenacre (1993).

The row and column coordinates are related by so-called transition formulae. For example, for $\alpha = 1$ and $\beta = 0$, we have

$$\mathbf{G} = \mathbf{D}_r^{-1}\mathbf{P}\mathbf{D}_c^{-1/2}\mathbf{V} = \mathbf{D}_r^{-1}\mathbf{P}\mathbf{H}. \tag{8}$$

Similarly, for $\alpha = 0$ and $\beta = 1$, we get

$$\mathbf{H} = \mathbf{D}_c^{-1}\mathbf{P}'\mathbf{D}_r^{-1/2}\mathbf{U} = \mathbf{D}_c^{-1}\mathbf{P}'\mathbf{G}. \tag{9}$$

These transition formulae are particularly useful when so-called supplementary points are to be plotted. Note that all equations above contain the full, κ-dimensional, coordinates. By selecting the first k columns of **G** and **H**, a k-dimensional least-squares approximation is obtained.

3.2. Correspondence analysis of ratings

Correspondence analysis can be applied to any nonnegative data table. However, the geometric rationale of the method depends on the concept of Chi-squared distances appropriate in the analysis of contingency tables (see, e.g., Greenacre and Hastie, 1987). Nevertheless, application to different data types is common. The most common extension of correspondence analysis is multiple correspondence analysis (MCA). In MCA the data are coded in the format of a so-called (super) indicator matrix. That is, the categories of each categorical variable in the analysis are recoded into dummy variables. Using zero-one coding it is indicated whether an observation corresponds to a certain category. Correspondence analysis is then applied to the resulting indicator matrix.

The analysis of ratings by MCA can be done by constructing dummy variables for each possible rating and applying correspondence analysis to the resulting indicator matrix. However, if the questionnaire consists of many items this procedure may soon lead to a large number of points that need to be plotted. For example, a questionnaire consisting of twenty items measured on a five-point rating scale will yield 5 x 20 = 100 dummy variables. Hence, plotting the results yields (too) many points. To overcome this problem, Benzécri (1973) proposed a CA adaptation that allows the direct analysis of the rating data. The proposed method involves a so-called "doubling" of the data. That is, for each individual we record the ratings on two scales: 1) the original scale, for example, from "disagree" to "agree", 2) the reversed scale, from "agree" to "disagree". The ratings are then coded on both scales (with zero for the lowest rating) and CA is applied to the doubled data matrix. Consequently, one obtains two points per item; one for each end of the rating scale. Van de Velden (2004) showed that Benzécri's doubled CA procedure, yields coordinates for the subjects in such a way that subjects with different weighted ratings are optimally separated. We will use CA of doubled ratings for our analysis of attitudes.

3.3. Correspondence analysis of attitudes

Let f_{ij} denote the original preference rating of respondent *i* on item *j*, and let c_j denote the midpoint (neutral) value of the original scale of item *j*. The attitude f_{ij}^{*} for respondent *i* regarding item *j* is then calculated as:

$$f_{ij}^{*} = \frac{w_{ij}(f_{ij} - c_j)}{\sum_{j=1}^{p} w_{ij}}, \tag{10}$$

where *p* is the number of items. If all items are measured on the same scale, that is, $c = c_j$ for $j = 1...p$, we can write

$$\mathbf{F}^{*} = \mathbf{D}_w^{-1}\mathbf{W} \circ (\mathbf{F} - c\mathbf{1}_n\mathbf{1}_p') \tag{11}$$

where $\circ$ denotes the element-wise or Hadamard product, $\mathbf{W}$ is the *n* x *p* matrix of importance weights and $\mathbf{D}_w$ is a diagonal matrix with as its elements the sums of weights per individual, that is, $\mathbf{D}_w \mathbf{1}_p = \mathbf{W1}_p$.

Correspondence analysis requires a matrix of nonnegative entries. For a contingency table these entries are counts. In the case of rating data, with integer rating values, the ratings can be seen as counts of the number of times that an object was preferred over a rating boundary. More generally, for non-integer ratings the entries can be seen as distances with respect to the lowest possible rating. To apply CA to the attitudes we must transform them back to nonnegative entries. This can be achieved by adding the lowest possible value(s) on the reweighted scale(s). For a bipolar symmetrical scale with k_j as its maximum, we get, using the restriction for the weights as described in the previous section,

$$m_j = \max_i \frac{w_i (f_{ij} - c_j)}{\sum_{j=1}^{p} w_{ij}} = \frac{w_{\max} (f_{\max} - c_j)}{w_{\max} + (p-1) w_{\min}} = \frac{k_j^{\,2}}{k_j + (k_j - 1)(p-1)}. \tag{12}$$

Adding these to $\mathbf{F}^*$ yields a nonnegative matrix of attitudes: $\mathbf{T} = \mathbf{F}^* + \mathbf{1m}'$, where $\mathbf{m}$ is the *p x 1* vector with as its elements m_j.

The matrix $\mathbf{T}$ is nonnegative and has as its entries the differences with respect to the lowest possible attitude value. Alternatively, we could have opted for considering the differences with respect to the highest possible attitude value. Clearly, such an arbitrary choice should not affect our results. To correct for this indeterminacy, we apply the doubling procedure proposed by Benzécri (1973).

Let $\mathbf{S} = \mathbf{1m}' - \mathbf{F}^*$, then a doubled matrix of attitudes can be defined as $\mathbf{F}^*_d = [\mathbf{T} \;\; \mathbf{S}]$. Applying CA to this matrix explicitly yields coordinates for the end-points of the scale. These end-points are situated on a line through the origin and projections of points on the line are approximations of the observed attitudes. It should be noted that, instead of using the doubled matrix, the coordinates for the subjects can also be obtained by applying PCA to a matrix of centered and reweighted ratings (e.g. Van de Velden, 2004). An important advantage of the doubled CA approach, however, is its explicit depiction of the end-points of the scales. In addition, the length of the line can be interpreted as a measure of within-object variation.

If $\mathbf{W}$ is known, we can calculate $\mathbf{F}_d^*$ and insert this into the usual CA formulas obtaining coordinates for subjects (rows) and the doubled attributes (columns). The banks cannot be plotted directly using CA of rating data. To depict the banks and attributes jointly, we plot the banks as supplementary points.

3.4. Supplementary points in correspondence analysis of rating data

It frequently happens that a dataset contains additional variables which are not of primary interest in the analysis, but which are useful in interpreting results discovered in the data. These additional variables can also be positioned in the CA map. In CA the force of attraction of each point on the principal axes depends both on the position of the point and its mass. Profiles further from the average contribute more to the orientation of the map, and higher mass profiles have a greater pull on the map. However, there are situations where we wish to cancel out the effect of certain points on the principle axes, while we are still able to examine the projection of these points onto the map. In other words, such points have a position but no mass, so that their contribution is zero. These points are called supplementary points.

In a marketing context, the additional variables are often background characteristics coded by means of an indicator matrix. The aim is to plot these characteristics in the map in such a way that their positions correspond to the most preferred (or, agreed upon) items. That is, a background characteristic is close to the attribute for which individuals have indicated a positive attitude. To achieve this, we follow Torres & Van de Velden (2007) to plot supplementary points in the CA map. Their method can be summarized as follows: Let **Z** denote an $n \times q$ matrix of additional, categorical, variables. Hence, the columns correspond to the categories of the additional variables. If respondent *i* corresponds to category *j*, z_{ij} takes the value of the highest rating that was used by an individual in the evaluation of the attributes, otherwise it takes the value of the respondent's mean rating. This is to minimize the influence of individuals who do not correspond to a category of the variable.

Using the transition formula (9) with $\alpha=0$ and $\beta=1$, the profiles of the categories of the additional variables can be obtained by

$$\mathbf{G}^{*} = \mathbf{D}_n \mathbf{D}_z^{-1} \mathbf{Z}' \mathbf{G} \tag{13}$$

where $\mathbf{D}_z^{-1}$ is a diagonal matrix with as elements the column sums of **Z** and $\mathbf{D}_n$ is a diagonal matrix, with $\sqrt{\frac{n}{n_j}}$ as its nonzero elements. The matrix $\mathbf{D}_n$ corrects for the underestimation of the variance for individuals who do not corresponds to the *j*th category.

4. Application: CFOs attitudes concerning services of banks

We conducted a survey amongst CFOs of a range of Netherlands-based companies. These companies range from small to very large (including multinationals as Philips and Shell) companies with sales over €10 million. The CFOs give scores on a scale of 1 to 5 on various attributes concerning their satisfaction with respect to several aspects of the banks' services. The attributes are statements concerning service quality, credit loan, relationship manager, tariff and documentation, and products and services. Additionally, the CFOs indicated the importance of each attribute. The CFOs are familiar with one or more banks and they assess the statements for all banks that they are familiar with. The information linking the banks to the statements is also collected. We use this individual specific information to link attitudes to the different banks. A detail of the survey is given in Table 1. The attributes are listed in Table 2 together with the corresponding numbers as they appear in the CA plots. Due to property rights we cannot publish the full list of questions.

Table 1: The survey (some example questions and answers)

	Importance 1 – 3	Applies to my bank (fill in name of bank, can be more than 1)				
		(no) 1	2	3	4	5 (yes)
		☐	☐	☐	☐	☐
If things go wrong, the bank solves it adequately	2		ING		VL	
The bank is helpful to give credit if we show good figures	2			VL	ING	
My bank is willing to compete with price	3		VL	ING		

Notes: ING and VL (Van Lanschot) are just two of the banks involved. The others are DB, ABNAMRO, Rabobank and Fortis.

We have data from 2006 to 2009 inclusive, but we first present the empirical results for 2009 only. Figure 1 gives the CA plot based on the attitudes. The lines in this figure correspond to the statements in the questionnaire. The end-points represent the negative and positive end-points of the scales. By observing the positions of the end-points (and lines), we see whether attitudes with respect to certain statements (attributes) were similar (or dissimilar). In addition, the length of the lines gives a graphical depiction of the variance within the statements. If the attitudes of the respondents showed considerable agreement on a statement, the line will be short. If the indicated attitudes were more diverse, the line becomes longer.

Furthermore, as the origin in CA corresponds to the so-called centroid, the mean attitude to a statement can be inferred by considering the relative distance from both end-points to the origin. If, for example, the positive endpoint is closer to the origin than the negative one, the average attitude is positive, and vice versa. Using these simple properties, we immediately see, in Figure 1, that variation in the attitudes with respect to the first three (service quality related) statements was larger than the variation in the attitudes with respect to, for example, statements 15-17 (products and services related statements). Furthermore, we see that for many statements, the mean attitude (the origin) approximately corresponds to the middle of the scale. That is, the mean attitude with respect to such attributes is neutral.

Table 2: The attributes and corresponding statements in questionnaire

Attributes	Correspondings statements in questionaire
service quality	1-4
credit loan	5-7
relationship manager	8-11
tariff and documentation	12-14
products and services	15-17

In Figure 1, two clusters of attributes may be distinguished. The first cluster contains the first three statements of the questionnaire. These statements concern the quality of service of a CFO's bank. In particular, they are concerned with things going wrong and the banks' response if things go wrong. A second cluster contains all other attributes: credit loan and bank tariffs, the relationship manager, and products and services. Except for statement 4, which appears to be more associated with statements 11 than with statements 1 through 3, associations between attitudes towards the statements are in accordance with the grouping suggested in Table 2.

To see how the banks fit within this framework, we plotted them, as supplementary points, in Figure 1. Whereas attitudes of CFO's familiar with the Rabobank were generally positive, CFO's familiar with ING tended to be more negative, in particular, with respect to the first three statements. Attitudes for the Rabobank, Lanschot and DB bank with respect to the first three statements tended to be quite positive. For ABNAmro, attitudes with respect to the first three statements were average and relatively low for the remaining statements. Lanschot bank performed well on the first three attributes and relatively poorly on the other statements. For Fortis bank, the opposite holds as it performs relatively well on the last statements and poorly on the first three statements.

To evaluate the development of attitudes towards service level performance of the banks over the years, we constructed dummy variables to indicate banks and years. Collecting all CFOs ratings over the years in one data matrix we obtain a 1069×9 respondents–by-attributes matrix. Figure 2 gives the corresponding CA plot. We see that the positive endpoints of the statements are closer to the origin than the negative ones. That is, on average the attitudes towards the statements are positive. Again two clusters of attributes can be distinguished. Moreover, concerning the second cluster, consisting of statements 4 through 17, we identify three subclusters which appear to coincide more strongly with certain statements of the questionnaire. To see this, we observe that the lines corresponding to statements 5, 6, 7, 12, 13 are very similar. The corresponding statements concern credit loan and bank tariffs. Similarly, the lines corresponding to statements 8, 9, 10, all concerning the "relationship manager" may also be identified as a sub-cluster with near identical distributions of attitudes over all respondents. Finally, we see a sub-cluster containing the statements 11, 14, 15, 16, 17 and 4. These statements concern the products and services of a bank. Note that the variances of these last attributes appear to be smaller than the variances of the statements in the other sub-clusters.

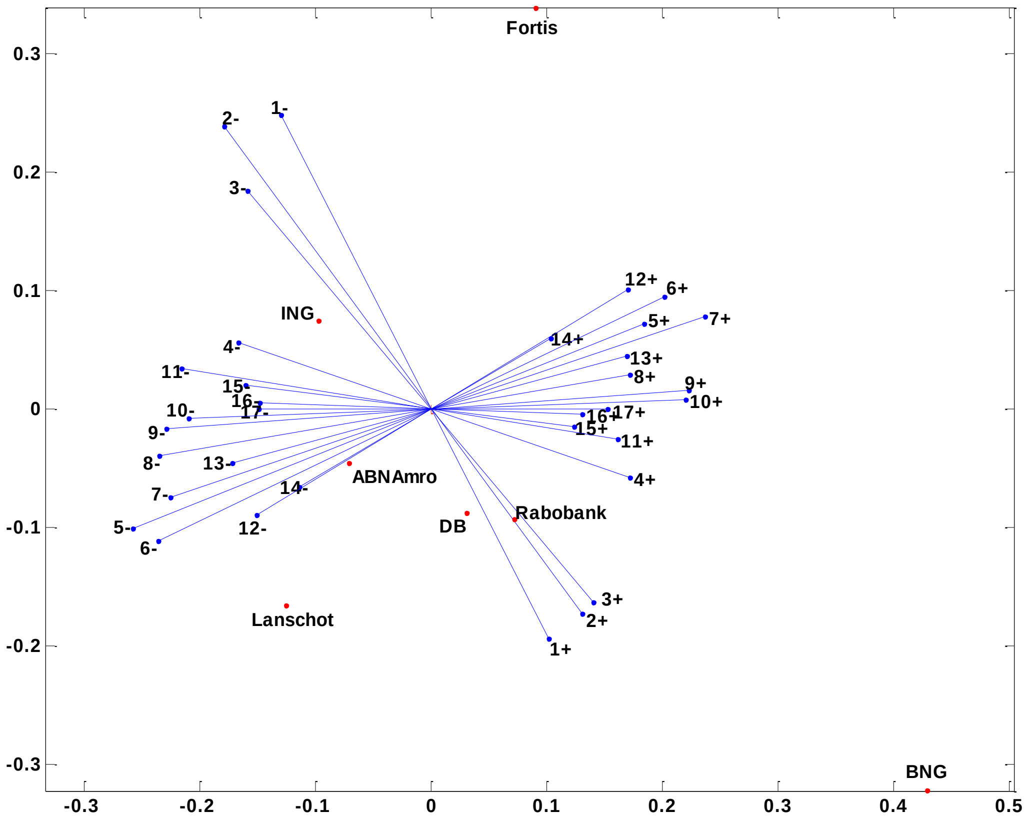

Figure 1: Correspondence analysis of 2009 attitudes. All statements are in principal coordinates (β=*1*). The lines correspond to questions in the survey. The endpoints of the lines are labeled with the question numbers and indicators for the negative (-) and positive (+) endpoints. Points corresponding to banks are supplementary points.

The positions of the banks over the years 2006-2009 are also plotted in Figure 2. Comparing the positions of the banks with regard to the statements we can say something about the attitudes towards the banks and the development of these attitudes over time. For example, following the positions of the points corresponding to ABNAmro for 2006 through 2009, we see that attitudes were generally negative. However, it appears that with respect to the first three, service quality related statements, attitudes became more positive over the years. On the other hand, attitudes relating to credit loan statements (5-7) and tariffs and loans (12 and 13) deteriorated. For ING the development until 2008 is very positive, in 2009, however, the positive attitudes rather brusquely change into distinctly negative attitudes, especially with respect to product and services attributes in 2009. A possible explanation for the sudden change could be related to the 2009 merger of the Postbank and ING. If we follow Rabobank over the years we see that attitudes gradually become less favorable. While in 2006 this bank performs very well on all attributes, in 2009 attitudes are more negative except for the first three statements on the quality of service. Attitudes for this bank in 2007 and 2008 were very similar as these points are located very close to each other. In the same way we can evaluate the performance of other banks over the years. By observing these trajectories, managers are able to identify areas that require measures to improve quality of service.

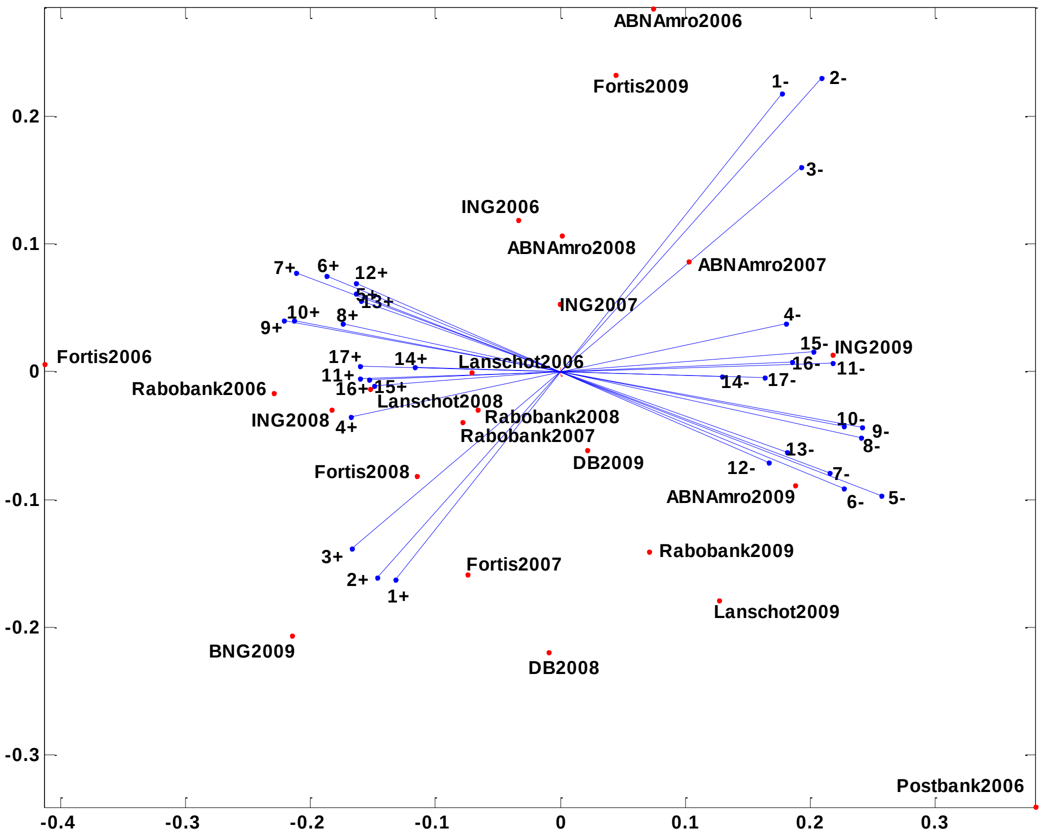

Figure 2: Correspondence analysis when the weights are included for 2006-2009 data. All points are in principal coordinates ($\beta=1$). The lines correspond to questions in the survey. The endpoints of the lines are labeled with the question numbers and indicators for the negative (-) and positive (+) endpoints. Points corresponding to banks and years are supplementary points.

To compare our analysis of attitudes with an analysis of the evaluations, we performed CA on the ratings without including the importance weights. The resulting map is presented in Figure 3. The most striking difference in this map concerns the positioning of the banks. In Figure 3 we see that all banks are extremely close to the origin, inappropriately suggesting that the CFOs perceive the service level of the banks under scrutiny as about equal with little differentiation with respect to the different statements.

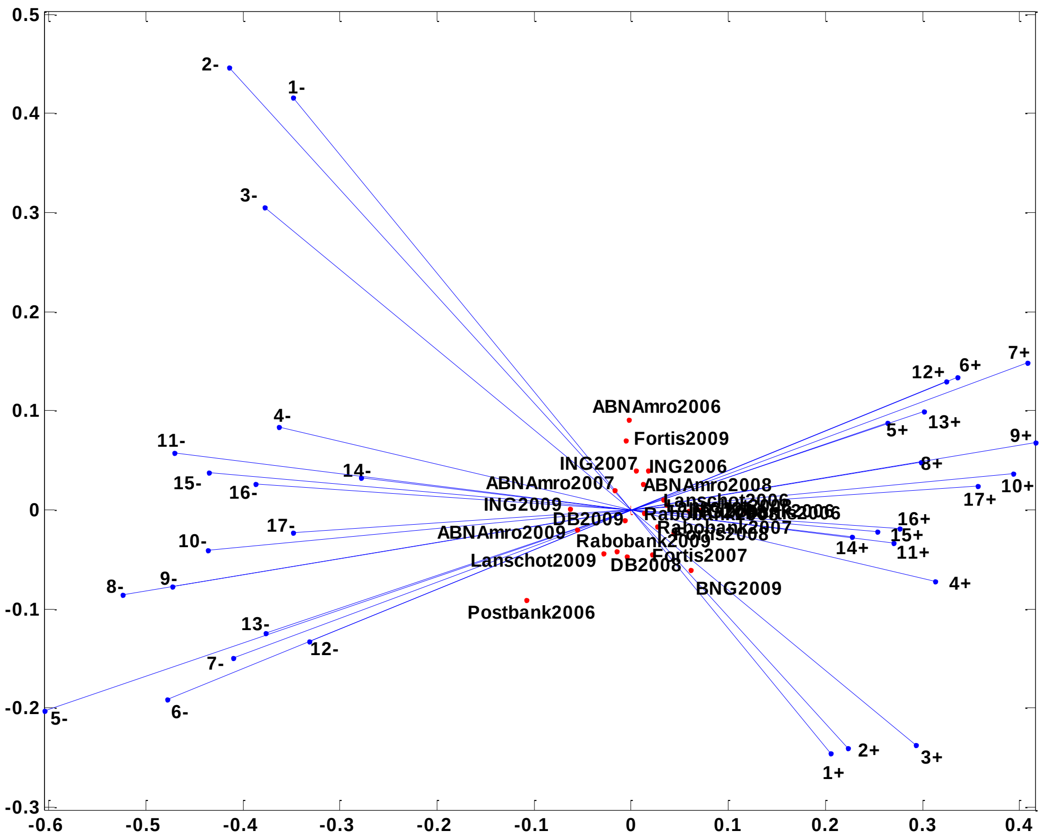

Figure 3: Correspondence analysis when the weights are NOT included for 2006-2009 data. All points are in principal coordinates ($\beta=1$). The lines correspond to questions in the survey. The endpoints of the lines are labeled with the question numbers and indicators for the negative (-) and positive (+) endpoints. Points corresponding to banks and years are supplementary points.

5. Conclusion

The quality of service levels of companies is crucial in the development of competitive marketing strategies. In this paper, we introduced a methodology that facilitates visualization of attitudes with respect to different service related attributes. Following Fishbein's attitude model we defined attitudes with respect to individual attributes. Next, instead of aggregating over all attributes, as done in Fishbein's model, we use the attribute specific attitudes and visualize the correlation structure among the attributes. Moreover, we proposed a methodology that allows the visualization of individual banks as well as the development of attitudes towards banks over time.

By using attitudes, importance weights of separate attributes are incorporated in the analysis. Importance weights are often added to questionnaires as they allow discrimination of the different statements. In practice, however, it appears that importance weights are not incorporated in the analysis. Typically, only the average importance weights are reported or, following Fishbein's model, an aggregate attitude is calculated for each bank. In this paper, we showed that incorporating the weights into the visualization method results in a map with better dispersed banks. Comparing Figures 2 (attitudes) and 3 (unweighted ratings) we see that the inclusion of item weights amplifies observed variation.

In our analysis of a data set comprising five years, we observed changes of attitudes for the different banks. Using the attitude maps, managers are able to identify service related areas that underperform and/or areas that perform satisfactory. As our data contains evaluations of several banks, it is also possible to see how the banks perform with respect to each other. It may be therefore be possible to develop specific actions employing the relative positions of the banks.

Finally, although we focused on the analysis of attitudes with respect to banks' service levels, it is evident that the proposed methodology can be applied much more generally. In particular, the proposed attitude visualization method may be useful in brand/product positioning related studies in which attribute ratings for several brands/products are accompanied by measures of item importances.

References

Baumgartner, H. and J -B. E. M. Steenkamp (2001). Response Styles in marketing Research: A Cross-National Investigation. *Journal of Marketing Research*, 38 (May), 143-56.

Benzécri, J. P. et al. (1973). *L'Analyse des Données. Tome (vol. 1): La Taxinomie. Tome 2: L'Analyse des Correspondances*. Dunod, Paris.

Cornelius, B., Wagner, U. and M. Natter (2010). Managerial applicability of graphical formats to support positioning decisions. *Journal für Betriebswirtshaft* 55, 167-201.

De Jong, M. G., J -B. E. M. Steenkamp, J -P. Fox, and H. Baumgartner (2008). Using Item Response Theory to Measure Extreme Response Style in Marketing Research: A Global Investigation. *Journal of Marketing Research*, 45 (February), 104–115.

Doehlert, D. H. (1968). Similarity and preference mapping: A color example. In "*Proceedings of the Denver conference of the American marketing association",* ed. R. King. American Marketing Association, Chicago, pp. 250-258.

Frank, R. E. and Green, P. E. (1968). Numerical taxonomy in marketing analysis: A review article. *Journal of Marketing Research*, 5 (1): 83 - 94.

Fishbein, M. (1967). A behavior theory approach to the relations between beliefs about an object and the attitude toward the object. In "*Readings in Attitude Theory and Measurement"*, ed. M. Fishbein. Wiley, New York, pp. 389-399.

Gabriel, K. R. (1971). The biplot graphic display of matrices with application to principal component analysis. *Biometrika,* 58, 453-467.

Green, P. E. and Carmone, F. J. (1969). Multidimensional scaling: An introduction and comparison of nonmetric unfolding techniques. *Journal of Marketing Research*, 6(3):330 - 341.

Green, P. E. and Carmone, F. J. (1970). *Multidimensional scaling and related techniques in marketing analysis*. Allyn & Bacon, Boston.

Greenacre, M. J. (1993). Biplots in correspondence analysis. *Journal of Applied Statistics*, 20, 251-269.

Greenacre, M. J. (2007). *Correspondence Analysis in Practice, Second Edition,*,Chapman & Hall / CRC, London.

Greenacre, M. J. and T. Hastie (1987). The geometric interpretation of correspondence analysis. *Journal of the American Statistical Association*, 82, 437-447.

Grimm, S. D. and Church, A. T. (1999). A cross-cultural study of response biases in personality measures. *Journal of Research in Personality, 33,* 415-441.

Huber, J. (2008). The value of sticky articles. *Journal of Marketing Research (JMR), 3*, 257 - 260.

Lindgren, J.H. and L.J. Konopa (1980). A comparative analysis of multiattribute attitude models. *Journal of the Academy of Marketing Science, 8, 374-389.*

Lutz, R.J. and J.R. Bettman (1977). Multiattribute models in marketing: A bicentennial review. In *"Foundations of Consumer and Industrial Buying Behavior"*, eds. Woodside, A., Sheth, J.N. and P.D. Bennett. American Elsevier, New York, p. 137.

Monteiro, C.M.F., Dibb, S. and L.T. Almeida (2010). Revealing doctors' prescribing choice dimensions with multivariate tools: A perceptual mapping approach. *European Journal of Operational Research*, 201, 909-920.

Pankhania, A., Lee, N. and Hooley, G. (2007). Within-country ethnic difference and product positioning: a comparision of the perceptions of two British sub-cultures. *Journal of Strategic Marketing*, *15*, 121–138.

Paulhus, Delroy L. (1991). Measurement and Control of Response Bias. In "*Measures of Personality and Social Psychological Attitudes"*, eds. J. P. Robinson, P. R. Shaver and L. S. Wrightman. San Diego: Academic Press, pp. 17–59.

Stefflre, V. (1969). *Market structure studies: New products for old markets and new markets (foreign) for old products*, pp. 251-268. John Wiley & Sons, New York.

Taks, M. and Scheerder, J. (2006). Youth sports participation styles and market segmentation profiles: evidence and applications. *European Sport Management Quarterly*, *6*, 85–121.

Torres, A. and T. H. A. Bijmolt (2009). Assessing brand image thorugh communalities and assymetries in brand-to-attribute and attribute-to-brand associations. *European Journal of Operational Research*, 195, 628-640.

Torres, A. and M. van de Velden (2007). Perceptual mapping of multiple variable batteries by plotting supplementary variables in correspondence analysis of rating data, *Food Quality and Preference*, 18 (January), 121-129.

Van de Velden, M. (2004). Optimal scaling of paired comparison data, 2004. *Journal of Classification* 21, 89-109**.**

Van de Velden, M. (2008). Detecting response styles by using dual scaling of successive categories. In "*New Trends in Psychometrics",* eds. Shigemasu, K., Okada, A., Imaizumi, T. and T. Hoshino. Universal Academy Press, pp. 517-525

Van Herk, H., Poortinga, Y. H., and Verhallen, T. M. (2004). Response styles in rating scales: evidence of method bias in data from six EU countries. *Journal of Cross Cultural Psychology*, *35,* 346-360.

Van Rosmalen, Joost, Hester van Herk, and Patrick Groenen (2010). Identifying Response Styles: A Latent-Class Bilinear Multinomial Logit Model, *Journal of Marketing Research*, 47 (February), 157–172.

Publications in the Report Series Research* in Management

ERIM Research Program: "Marketing"

2011

Nonmetric Unfolding of Marketing Data: Degeneracy and Stability
Michel van de Velden, Alain De Beuckelaer, Patrick J.F. Groenen, and Frank M.T.A. Busing
ERS-2011-006-MKT
http://hdl.handle.net/1765/22725

The Bright Side and Dark Side of Embedded Ties In Business-to-Business Innovation
Corine S. Noordhoff, Kyriakos Kyriakopoulos, Christine Moorman, Pieter Pauwels, and Benedict G.C. Dellaert
ERS-2011-008-MKT
http://hdl.handle.net/1765/22813

The Global Entry of New Pharmaceuticals: A Joint Investigation of Launch Window and Price
Isabel Verniers, Stefan Stremersch, and Christophe Croux
ERS-2011-010-MKT
http://hdl.handle.net/1765/23488

Visualizing attitudes towards service levels
Kar Yin Lam, Michel Van de Velden, and Philip Hans Franses
ERS-2011-022-MKT
http://hdl.handle.net/1765/26471

---

* A complete overview of the ERIM Report Series Research in Management:
https://ep.eur.nl/handle/1765/1

ERIM Research Programs:
LIS Business Processes, Logistics and Information Systems
ORG Organizing for Performance
MKT Marketing
F&A Finance and Accounting
STR Strategy and Entrepreneurship