

APPLICATION OF FACTOR ANALYSIS IN BEHAVIORAL SEGMENTATION ON THE BASE OF SEMIOMETRIC SCALE

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Abstract

The main aim of the paper is to present the methodological basis of market segmentation which uses not only demographic-social attributes and preferences but also variables defining values with important meaning in personal life of customers. The construction of a psychometric test is discussed on the basis of the example of a semiometric scale. This test uses principal components analysis in order to distinguish the main dimensions of cultural dichotomies. The example of measurement on the semiometric scale comes from the examination of preferences in the range of the life and medical insurances.

Key words: behavioral segmentation, semiometric scale, factor analysis.

JEL classification: C01, C51, C53.

1. Behavioral Segmentation

According to classical economics a consumer is an economic individual who always makes rational decisions in the world of perfect competition¹. The classical model does not take into account the limitations of cognitive potential of the man, their own skills, habits, experience, values, aims, knowledge and possibility of processing new information.

The theory of the determinants of buying attitudes uses the concept of *black box process*² in order to explain the decision-making concerning purchases in the financial, psychological and social context. In the psychology of economic behavior³ the typology of consumers'/clients' personalities is made. This typology helps sellers to support the most effectively the client's decision about purchase. Social theories of the buying decision determinants describe regularities in human behavior such as reciprocity, commitment, social prove of right, authority, unavailability and automatism. This kind of theoretical knowledge creates the fundament for relevant and effective advertising that makes potential consumer unable to analyze consciously the methods used in advertising.

The main criterion determining the target group of statement-advertisement is no longer a buyer profile determined by age, sex and education, but that determined by behavior.

People from the same demographic group can differ strongly and people who are theoretically different can have the same preferences. Therefore the behavioral segmentation is a natural continuation of demographic segmentation. Consequently the set of attributes on the base of which the target groups are defined has evolved (see Table 1). The classification of products is replaced by typology of behaviors/values that explain a purchasing attitude. In market research the classification of values should be crossed with the classification of attitudes/preferences.

Table 1. The evolution of the classification of attributes with a view to market segmentation

Segmentation	The range of classification	Measurement
According to the demographic-social attributes	Social group of clients	In a significant part it concerns the consumer's demographic attributes. The classification of consumers is often made according to their social status.
According to the way of providing for the needs by existing products	Products (supply segmentation)	The degree of satisfaction from specific aims is measured in reference to well-known products (usually an ordinal or an interval scale).
According to preferences	Classification of attitudes on potential market (demand segmentation)	No reference to the existing products; the measurement (usually an ordinal or an interval scale) of preferable attributes in an ideal product; it could be crossed

		with the classification of existing products by measuring the spontaneous and assisted knowledge of brands
According to behavioral attributes	Classification of values – media plans	Measurement on psychometric scales not connected with the existing and „ideal” products.

Source: own research.

2. Psychometric Scales

The psychometric tools such as standardized and objective measurements of human behavior have been supporting the diagnostic process in the clinical psychiatry since the beginning of the XXth century. The psychometric scales can serve for evaluating such factors as temperament, the type of activities, preferred work conditions and the kind of personality. The best-known psychometric studies are *European Values Study* (by J. Kerkhofs and R. De Moor) started in 1982. They are repeated regularly every 5 years all over the world⁴.

The measurements made in the World Value Survey are connected with the subjective evaluation (on the ordinal scale) of life-important things⁵ together with such elements as: membership in organizations, cooperation, social activity, the importance of environmental protection, the opinions on social exclusion and prejudice, the attitude to work, religion and state.

The most popular effect of the study are the analyses of the happiness of nations and Inglehart values map which illustrates strong correlation of values in different cultures⁶. In the construction of the two-dimensional map the factor analysis was applied, which reduced the set of the above mentioned variables to two dimensions explaining over 70% of variances among countries and including 10 indices. The first factor can be presented on the axis as a traditional attitude contra the secular-rational one, while the second factor as survival versus self-expression.

The traditional/secular-rational dimension points out the contrast between societies in which religion is very important and those where it is not. Some other orientations are strongly correlated with this dimension.

The societies situated close to the traditional pole emphasize the parent/child relationship, respect for authority, absolute standards and traditional family values while rejecting divorce, abortion, euthanasia and suicide. In such societies the levels of national pride and nationalism are high. The secular/rational societies demonstrate reverse preferences in all the above aspects.

The scale measuring attitudes is a semiometric scale, a licensed Taylor Nelson Sofres network tool. The founders of *Semiometrie*® built a semantic space model determining the coefficients of space among words being the attributes of objects and phenomena. The semantic space is a multidimensional structure, its individual axes relate to classical cultural dichotomies and archetypes. During a survey the respondent is asked to express their attitude to the list of 210 words by marking them from -3 to +3. The pool of words in the semiometric survey is a representative sample of all the terms available to a human being⁷. The words are unambiguous and semantically stable, can provoke contradictory reactions and are emotionally intensive enough to play the role of a stimulator [Szczurowska, 2002]. This tool can be used to predict opinions and behaviour as well as for segmentation. The emotional response triggered by the words makes it possible to identify the respondents' values. These values have been classified in 13 groups of fields (see Table 2). A group of consumers is characterised by the terms that are significantly over or undervalued.

Table 2. Definition of value field of respondents in semiometric scale

Lp.	A respondent's value field	Explanation
1.	Family oriented	Family as the base of human coexistence, seeking for safety, stability and peace
2.	Social	Aiming at community, mutual trust, harmonious cooperation with other people
3.	Religious	Orientation to the Christian view and faith; Christian community as a fundamental world view
4.	Materialistic	Orientation to consumption and financial security, demonstration of assets, prestige and status
5.	Idyllic	Idealistic posture, dreams on better world, contact with nature
6.	Desirous	Pursuit of sensual sensations, positive attitude to a human body and sexuality
7.	Bold	Search for adventure and challenge as well as for life full of highly emotional experiences
8.	Cultural	Intellectual posture expressed by the interest in literature, theatre, art. And music
9.	Rational	Pragmatism and nearly scientific precision, orientation to the palpable, perceptible and measurable
10.	Critical	Inquisitiveness about the nature of relations, the perceived reality is critically investigated
11.	Dominant	Pursuit of power and influence, but also readiness to obey to and accept social hierarchy
12.	Combative	Dynamic, offensive posture, acceptance of conflicts, aiming to changes
13.	Traditional	Orientation to tradition, patriotism, honour and morality

Source: TNS OBOP.

3. Application of Factor Analysis in Psychometric Research

Factor analysis is used to make the decomposition of information from the set of random variables. It is based on seeking factors which are meaningful in describing a problem. Those factors are unobservable but they illustrate very important dimensions of the problem⁸. Each of the observed variables is a linear combination of m common factors and specific error terms – see formula 1. Usually the number of common factors is smaller than the number of the original observed variables.

$$\begin{aligned} X_1 &= b_{11}F_1 + b_{12}F_2 + \dots + b_{1m}F_m + U_1, \\ X_2 &= b_{21}F_1 + b_{22}F_2 + \dots + b_{2m}F_m + U_2, \\ &\vdots \\ X_k &= b_{k1}F_1 + b_{k2}F_2 + \dots + b_{km}F_m + U_k, \end{aligned} \quad (1)$$

where:

F_j ($j = 1, \dots, m$) – common factors,

U_i ($i = 1, \dots, k$) – error term for variable X_i ,

b_{ij} – factor loadings.

In psychometric measurements the rightness of theoretical assumptions is verified by means of the factor analysis conducted for particular variables/scales with the use of the principal component method. The psychometric measurement is defined as right if particular variables are strongly correlated with the first principal component found in the factor analysis⁹.

The factor analysis was always conducted in a representative sample of people of a certain nationality/citizenship so the semantic space for each European country was pre-defined differently. When constructing value fields defined in Table 2 the words were assigned to one of 13 factors by means of the principal components analysis with a *varimax* rotation.

In order to present the method we are going to use such a pre-population previously examined in Poland by TNS OBOP. The application of the semiometric scale will be illustrated with the data collected in a series of surveys of 500 respondents, the heads of the family, in August 2006¹⁰. The survey was designed by the authors and conducted by TNS OBOP who had developed an integral semiometric questionnaire. The part of the survey that was to be the basis for the typology of consumers of knowledge-based services and included

the family members responsible for financial decisions concerned the respondents' preferences measured on the ordinal scale.

4. Application of the Semiometric Scale in the Behavioral Segmentation

The semiometric tool allows for comparing a target group to a reference group through examining the differences in an average rating of a given word. The final effect of the analysis is the selection of the words with the higher and lower average score. Table 3 presents an example of a word distance map constructed in the above mentioned way.

Table 3. Words from semiometric map taking into account statistically significant differences between a population of Polish people and a subset of stomatological, prosthetic and orthodontic patients using mostly or exclusively the services of the National Health Fund

Overscored words		
Pleasure	To dream (20), Magic (33), To conquer (21), Huge (16)	90
Duty	Law (16)	16
Community		0
Autonomy	Maze (51), Magic (37), Absolute (20), Meditation (25), Mountain (19), Headstrong (26), Detachment (34), Audacity (42), To attack (46), Storm (44), Material (33), Different (17), Fire (35), Huge (28), To climb (32)	489
Sublimation	To dream (38), Logic (70), Dynamic (47), Absolute (16), Meditation (41), Mountain (43), Theatre (70), Book (65), Detachment (18), Animal (18), Art (84), Storm (56), Fire (28), Law (18), To climb (47)	659
Materialism	To conquer (16), Audacity (32), Material (81), Huge (20)	149
Idealization	Different (24), Huge (18), To climb (22)	64
Pragmatism	Logic (16)	16
Humility	To conquer (26), Audacity (16), To attack (15)	57
Sovereignty	Magic (15), Meditation (18), Mountain (34), Theatre (16), Huge (21)	104
Underscored words		
Pleasure		0
Duty	Humble (35), To obey (26), To punish (28), Faith (32)	121
Community	Faith (22), Politeness (19)	41
Autonomy	To punish (41)	41
Sublimation	Politeness (23)	23
Materialism	Humble (28), To obey (43), Faith (18)	89
Idealization	Faith (15)	15
Pragmatism	To punish (30), Politeness (16)	15
Humility		0
Sovereignty		0

Source: own study on the basis of *Semiometrie*.

In a semiometric structure of semantic space 5 polar axes¹¹ were derived by means of the principal components method by reference to such cultural dichotomies as: pleasure vs.

duty, community vs. autonomy, sublimation vs. materialism, idealization vs. pragmatism, humility vs. sovereignty.

On the map the word distances were attributed to the fields of 13 discussed above values. In market research or political support survey a target group of customers/voters with specific preferences is defined and then the frequency of particular word ratings in a target group and in a group pre-defined in panel studies is compared by means of a test for two parameters of the structure.

Figure 1 shows the results of the comparison of the selected subgroup of respondents who prefer specialist medical care offered by private outpatient clinics¹² with the pre-defined group. Cultural dichotomies (axes) in this group that are distinctive in comparison with the predefined group are autonomy vs. community and sublimation vs. materialism. Therefore we can attribute this group of consumers with autonomy and sublimation. At the same time the group of respondents selected hereby does not differ from a group of average Poles as far as their level of materialism is concerned, which can mean that their decision to pay for medical care was not influenced by financial matters (neither in a case of the rich nor the poor respondents).

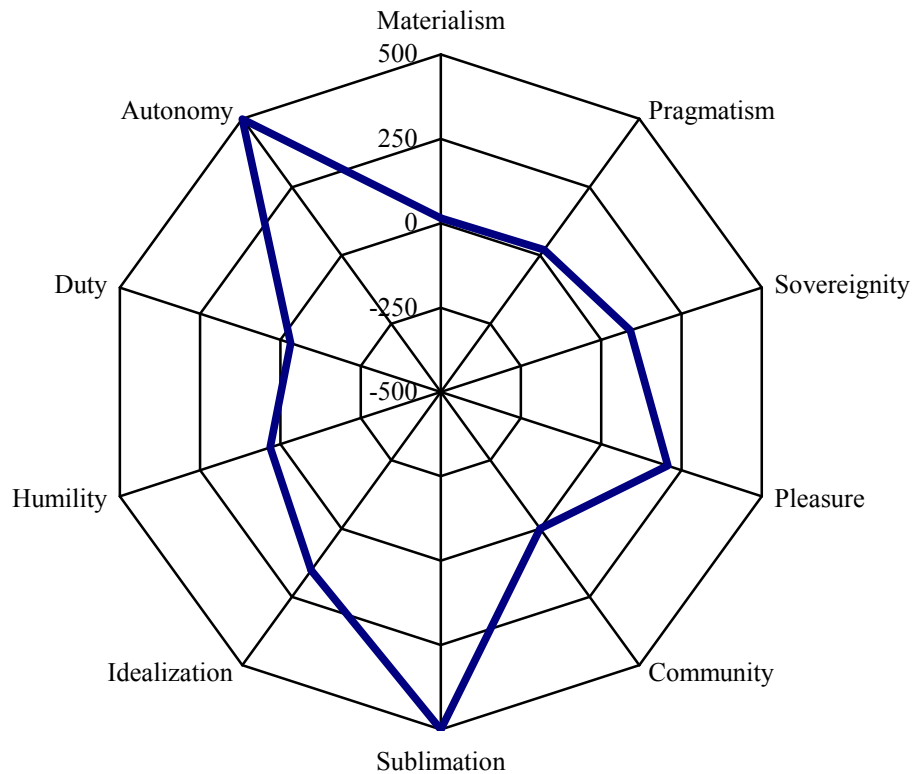


Fig. 1. Polar typology of people who prefer to use specialist medical care offered by private outpatient clinics

Source: own study on the basis of *Semiometrie*.

Table 4 presents the results of the typology of consumers of a specific group of knowledge-based services in a sample of family members who are responsible for financial decisions. It shows average ratings distinguishing the groups with particular preferences. The results of the value fields examination confirm the results of cultural dichotomies study to be found in Figure 1. Additionally, it seems that the decision about financing the above mentioned treatment depends neither positively nor negatively on the preference of family values, nor is it the effect of a rational attitude.

The above conclusions confirm the supremacy of the behavioral segmentation over the traditional segmentation based on socio-demographic features. Its results can be used in the development of media plans and brand adjustment.

Table 4. The differences in the value fields for consumers from pre-defined sample and with given preferences

Type of consumer	Preferences in the range of:				
	On joining personal pension plan bases on their own knowledge (manages household investments themselves)	elementary medical care	hospital treatment	stomatological and orthodontic care	specialist medical consultation
		I almost exclusively use private medical services			
Family oriented	0	0	-10	0	0
Social	3	-1	-6	1	1
Religious	-1	0	-4	-19	-4
Materialistic	0	1	-1	-1	0
Idyllic	1	32	10	17	22
Desirous	19	35	32	6	9
Bold	19	31	53	33	50
Cultural	0	8	3	11	15
Rational	0	-1	0	1	0
Critical	6	14	58	4	17
Dominant	-3	1	19	-2	1
Combative	6	25	35	5	9
Traditional	-1	-4	-11	-1	-2

Source: own research.

It should be stressed however that not every consumer type (among the set 13) can demonstrate strong relation with brand loyalty, but media plans and politicians' image building are usually more effective when the behavioral segmentation is applied.

Conclusions

The application of the ordinal scale in the European Value Survey has provided the foundations for using cultural extremities to position preferences that are average in an individual nation. It has made it possible to show the distances among the citizens all over the world as measured in relation to the values defined exclusively by semiotics. The above described semiometric scale has built semantic space within every examined country and has allowed for statistical discrimination of individual respondents or their groups in the study of values they follow. The presented examples of studies on preferences concerning the choice of medical care services offered by private specialist outpatient clinics confirm that the behavioral attitude in segmentation is recommended. But the above mentioned method requires the results obtained in a pre-defined reference group which becomes the basis for the analysis of significant differences between a target group in market research and a group of average consumers.

Notes

¹ See Tyszka (1997), Kotler (2002).

² O'Shaughnessy (1994), Cialdini (2003), Tyszka (1997).

³ Tyszka (1997), Aronson, Wilson, Akert (1995).

⁴ This survey (*World Values Survey*) was conducted in Poland three times – in 1989 by OBOP, in 1997 and 1999 by CBOS.

⁵ Classified as occupation, family, friends, free time, politics and religion.

⁶ <http://www.worldvaluessurvey.org>

⁷ In fact, it is representative for Europe because the choice of words in the research comes from the studies on the European culture and the European societies.

⁸ Aczel (2000).

⁹ In psychological tests the limit point of a correlation coefficient is usually equal to 0.7.

¹⁰ Project financed by KBN: *Statistical methods in segmentation of the insurance market in Poland*, No. 1H02B02827.

¹¹ Excluding the first factor.

¹² The survey contained the questions about preferences in the range of medical, property and life insurances. The adequate group of respondents consisted of people who declared seeking professional advice of medical specialist very often and regardless of the price.

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