MULTIDIMENSIONAL ANALYSIS OF CONSUMERS' STORE IMAGE

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Abstract Previous studies on consumers' store image have demonstrated that the image consists of a few fundamental dimensions. To examine the generality of image structure, MDS is applied to the dissimilarities between the stores estimated by 139 housewives in Kofu City. The extracted dimensions are interpreted by using PROFIT algorithm which makes it possible to objectively define the MDS configuration. The results of the analysis show that the housewives share a common image structure whose main components are 'price level', 'distance from home' and 'store size', while the importance of each component varied with locational environment of residence.

Key words: shopping behavior, store image, MDS, Kofu City

1. Introduction

Measurement of the consumers' store image has been an important theme in behavioral research of shopping behavior. Store image is merely a single phase of the decision-making process and cannot fully explain the actual store choice. Nonetheless, elucidating the nature of the image is essential to behavioral research which assumes that consumer behavior is not influenced directly by the objective attributes of shopping opportunities, but rather indirectly through the consumers' subjective images of them (Timmermans *et al.*, 1982). In modeling the consumers' spatial choice process, measurement of store image can contribute to identify the salient attributes of stores, which should be incorporated as independent variables into the causal model of shopping behavior.

After a brief review of the previous studies, the paper will compare some quantitative methods for extracting the underlying dimension of image. Then an integrated approach will be applied to an empirical study in Kofu City.

2. A Brief Review of the Previous Studies

The previous studies on store image are varied in type of shopping goods or sample group. Dimension of image commonly obtained can be regarded as a fundamental component of store choice process. In order to examine such an important dimension, the

findings obtained in major studies are summarized in Table 1.

Comparing the results of studies in Europe, it is indicated that dimensions related to 'price' and 'distance from home (*i.e.* accessibility)' appeared in most of them. The 'distance' dimension, related to the nearest center hypothesis in Christaller's central place theory, has been essential to explaining consumer spatial behavior. The 'size' dimension which has been incorporated together with the 'distance' in Huff's shopping probability

Table 1 Major studies of store and shopping center (SC) image[1)]

Study	Study area	Stimuli[2)]	Sample size	Method	Important dimensions
[Europe]					
Downs (1970)	Bristol (UK)	Downtown SC (1)	202	SD	(Retail establishment) Service quality, Price, Shopping hours, Shop range and quality: (Structure and function of the SC) Structure and design, Internal pedestrian movement, Visual appearance, Traffic conditions
Hudson (1974)	Bristol (UK)	Grocery stores (11)	26	RG	Price, Distance from home
Spencer (1978)	Lancashire (UK)	Grocery stores(7)	381	MDS	Price, Center size, Location
Blommestein *et al.* (1980)	Naaldwijk (Netherlands)	SC(1)	60	MDS	(Non-daily goods) Price, Product variety, Service quality: (Daily goods) Price, Product variety, Accessibility
Timmermans *et al.* (1982)	Eindhoven (Netherlands)	SC(13)	20	RG	Number of shops, Parking, Distance from home, Atmosphere
Coshall (1985)	Maidstone (UK)	Shoe shops (17)	50	RG	Price, Shop type, Product (shoe) characteristics, Choice of Merchandise
[Japan]					
Tokita(1977)	Maebashi	SC(14)	227	SD	Relaxed atmosphere, Ordinariness, Liveliness, High fashion, Poor merchandise
Kawashima (1979)	Hanno	Supermarket, other shop	426	SD	Security, Luxury, Friendly, Specialty store
Kawashima(1985)	Ginza (Tokyo)	Department store (6)	64 (40)	MDS SD	Freshness, Reputable
Yamanaka (1986)	Osaka	SC(10)	1000	MDS SD	Multipurpose, Specialty goods, Conversational-Attendant, Shopping around

1) Some parts of this table are based on Golledge and Stimson (1987) and Wakabayashi (1987).
2) Number in parentheses denotes the number of stimuli.

model or Rushton's revealed space preference model explicitly appears only in Spencer (1978), while some related dimensions appeared, such as 'structure and design' and 'appearance' (Downs, 1970), 'product variety' (Blommestein *et al.*, 1980) and 'number of shops' (Timmermans *et al.*, 1982). These results suggest that 'size' bears no substantial meaning at the individual decision-making level, even if it plays an important role in predicting aggregate shopping flow: because the 'size' is no more than a composite variable substituting for attractiveness of stores. In other words, it is likely that objective information of 'size' is transformed into other intervening variables in cognitive structure of consumers, whereas 'distance' constitutes a dimension of the store image as it is.

According to the latter half of Table 1 showing the results of store image studies in Japan mainly by marketing researchers, few dimensions are related to distance or location. From such a result, a conclusion cannot be immediately drawn that the 'distance' is not important to the store image formation of Japanese consumers, since the dimensions were sometimes labeled arbitrarily or given a contextual interpretation. We should consider that this reflects a different point of view between marketing researchers mainly interested in store management and geographers whose main concerns are spatial aspects. In the present research, the generality of components of store image will be examined focusing on the importance of 'distance'.

3. Methodology

As a result of the imagery debate in cognitive psychology, environmental image is assumed to be stored in man's long-term memory either as a visual code or as a propositional one (Lloyd, 1982). Based on this conceptualization, most of the previous studies of store image have considered image as a set of conceptual propositions. As indicated in Table 1, three kinds of methods—SD (Semantic Differential), RG (Repertory Grid), and MDS (Multidimensional Scaling)—to capture the image have been employed in geography. According to Spencer (1980) and Wakabayashi (1987), characteristics of these methods can be summarized as shown in Table 2.

SD method, devised by C.E. Osgood (1952), consists of rating scale technique and factor analysis. Theoretical background of SD method assumes a representational mediation process containing self-stimulation between acceptance of stimuli and reaction. The method was developed to measure the meaning of the sign produced through this process. Such a framework reveals a neo-behavioristic feature and can be applicable to the conceptual framework of behavioral geography. After some empirical studies, Osgood demonstrated that semantic space, obtained by using factor analysis, consists of major three dimensions—evaluation, potency, and activity. However, it is likely that choice of scales by researchers will bring a bias to the obtained dimensions, since the combination of scales can affect the result of factor analysis. In order to improve this deficiency, much attention has been paid to RG method.

RG method is based on the role construct repertory test, developed by G. Kelly (1955), whose theoretical background resided in PCT (Personal Construct Theory). PCT regards a person's construct not only as being essentially unique to him but also as being subject

Table 2 Comparison of the features of Semantic Differential, Repertory Grid and Multidimensional Scaling Methods

	Semantic Differential	Repertory Grid	Multidimensional Scaling
Theoretical background	Osgood's representational mediation process model	G. Kelly's personal construct theory	—
Stimulus	Concept	Element	Stimulus
Attribute	Scale	Construct	—
Specification of attributes	prespecified by researchers	specified by respondents	not necessary
Advantages	applicable to questionnaire	free from biases caused by researcher	flexible to various types of data
Disadvantages	biases caused by the chioce of scales	difficulty of data collection	exhausting for respondent

to change over time as his environment and beliefs alter (Spencer, 1980). Due to this idiographic nature of PCT, it offers a more useful basis for humanistic studies rather than behavioral studies in geography. In behavioral studies RG method ought to be used apart from PCT, whereby SD method may be regarded as a version of RG method prespecifying both constructs and elements.

In contrast to these two methods, MDS has developed as a data-management technique in experimental psychology. Hence it has no theoretical background of the formation of image. In applying MDS to the analysis of store image, two types of data can be used. One is the dissimilarity matrix indirectly produced from profile data matrix of stimuli variables, such as SD and RG data. The other is the dissimilarity matrix directly estimated by subjects. In this paper, MDS method means the technique using the latter type of data. According to Takane (1980) and Spencer (1980), advantages of MDS method can be summarized as follows:

(1) It necessitates neither a prespecification of the related attributes nor a verbal definition of them.

(2) The data are relatively free from the biases affected by the tendency of evaluation.

Comparing the three methods in terms of the flexibility of the data collection and the possibility of causing biased data, MDS method seems to be superior to the others. But the dimensions obtained by MDS have been likely to be interpreted subjectively, due to the lack of information concerning the characteristics of stimuli. MDS method ought to be supplemented by other types of data concerning the attributes of stimuli. In the present study, two methods—MDS and SD—were jointly employed, in order to interpret the dimensions of MDS by means of SD data in the similar way as Kawashima (1985) and Yamanaka (1986).

4. Research Design

The study area was Kofu City situated from about one hundred kilometers west of Tokyo. It has about 202,000 inhabitants as of 1985, the greatest city in the Kofu Basin. The nine sample districts, shown in Fig. 1, were chosen so that each of the three represented the northern, western and southern parts of the city, respectively. Previous studies (Potter, 1977; Wakabayashi, 1982) reported that the range of consumers' information field within a city were confined to wedge-shaped sectors centered on the place of residence and focused on the CBD. Based on this finding, a total of seven stimuli were chosen, which were assumed to be known by the consumers in each district; comprised of four stores located close to the residence and the three large ones located in the CBD. Table 3 shows the stores used as stimuli in the present analysis.

A total of 450 households—50 in each district—were randomly sampled and of these 139 housewives completed the questionnaire. The survey was conducted in December 1987. Most of the respondents were in the 30-60 age range and have resided in the city for more than ten years.

MDS data were obtained by means of conditional rank ordering method; respondents

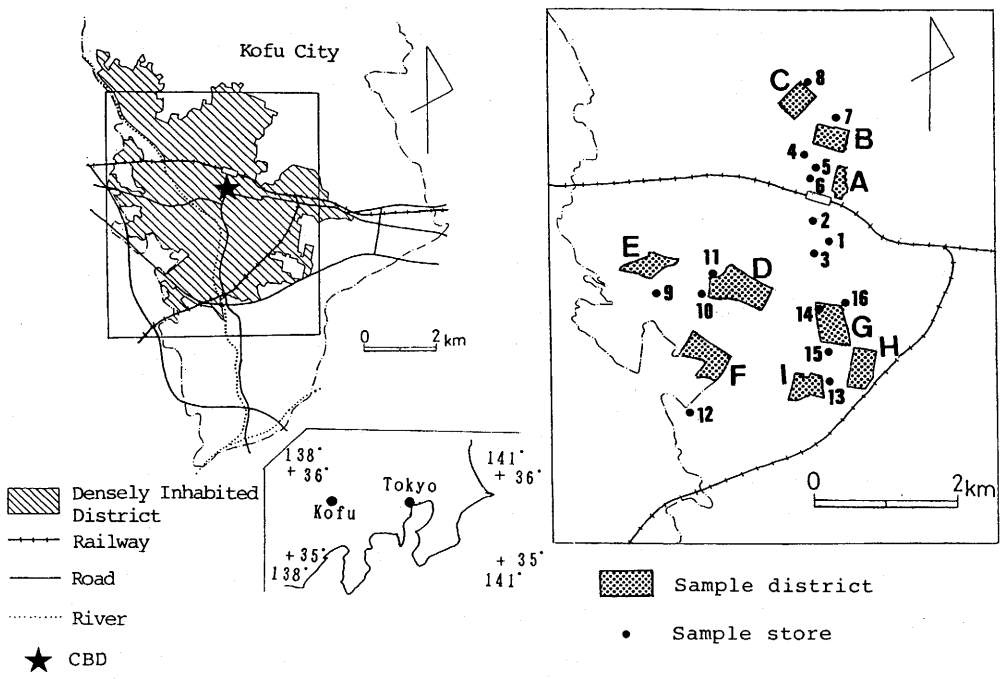

Fig. 1 Study area and location of stores
A: Kitaguchi; B: Takeda; C: Kitashin; D: Kamiishida; E: Tomitake;
F: Shimoishida; G: Ohta; H: Yuda; I: Ise
Numbers in this figure correspond with the one shown in Table 3

Table 3 Stores used as stimuli for the respondents in each district[1)]

Store	Floor space (m^2)	Store type[2)]	Study district[3)] A	B	C	D	E	F	G	H	I
1	20,044	a	○	○	○	○	○	○	○	○	○
2	8,744	a	○	○	○	○	○	○	○	○	○
3	10,577	b	○	○	○	○	○	○	○	○	○
4	4,708	b	○	○	○						
5	583	b	○	○	○						
6	999	c	○	○							
7	299	b	○	○	○						
8	288	b			○						
9	3,390	b				○	○	○			
10	950	b				○	○	○			
11	297	b				○	○	○			
12	2,447	c				○	○	○			
13	4,677	b							○	○	○
14	475	b							○	○	○
15	994	b							○	○	○
16	298	b							○	○	○

1) Abbreviations of the store and district name are the same as Fig. 1.
2) a: Department store, b: Supermarket, c: Discount store
3) "○" denotes that the store is used as a stimulus for the respondents in the district.

were required to rank similarities between the reference stimulus and the remaining ones, replacing the reference stimulus by turns. For convenience sake, the obtained data were treated as ratio scale, then converted into dissimilarity matrix in the following manner (Saito, 1980):

$$S'_{jk}=S_{jk}[\sum_{k=1}^{m}(S_{kj}/S_{jk})]/m$$

where S'_{jk} is the standardized dissimilarity between reference stimulus j and compared stimulus k; S_{jk} is the rank order of similarity between j and k; m is the number of stimuli.

MDS algorithm, INDSCAL, was applied to the symmetric matrices given by $(S'_{jk}+S'_{kj})/2$. INDSCAL has two advantages over ordinary two-way MDS: it performs a reasonable aggregation of data without simply averaging them, and yields a group stimulus space whose dimensions are common to all respondents; the positions of the unrotated coordinate axes are uniquely determined, allowing direct interpretations of dimensions.

As an aid in interpreting the MDS solution, SD data were collected with regard to the store attributes. A five-point scale was used for six attributes of store: 'distance from home', 'price level', 'range of goods', 'quality of goods', 'atmosphere' and 'parking'. These attributes have been most commonly used in the previous studies on store image (Kojima, 1977).

MDS and SD data were subsequently combined through property fitting algorithm (PROFIT) that allows for an objective interpretation of MDS solution. This procedure performs linear multiple regression using SD scores as the dependent variable and the coordinates of the MDS solution as the independent variable.

5. Results of the Analysis

By submitting a set of matrices of dissimilarity between the stores to INDSCAL algorithm, a configuration of stores can be obtained for each district. Calculation was performed for up to three possible dimensional solutions. One dimensional solution can account for only as much as 50% of variance in the data. Negative weights of subjects inconsistent with the assumptions of INDSCAL appeared in three dimensional subject space. In the two dimensional solution more than 70% of variance in the data was accounted for and every weight of subject was positive. Hence, the two dimensional solution was adopted (see Fig. 2).

The configurations presented in Fig. 2 are commonly characterized by a contrast between the large-scale stores located in the CBD and the small-scale stores close to the residence. In addition, among the stores in the CBD, a contrast also appears between the department stores (stores 1 and 2) and the supermarket (store 3). These results suggest that the type of stores, as well as their size and location, can be discriminated by the consumers.

In order to grasp the meaning of the configuration, vectors of store attributes fitted to the MDS configuration by means of PROFIT algorithm were added to Figure 2. These vectors suggest that the two department stores are perceived to be remote from home, with wide range and better quality of goods, and attractive atmosphere, opposed to the small-scale local stores. Additionally, the discount stores (stores 6 and 12) can be discriminated from the other stores with respect to price level, quality of goods and atmosphere.

To label the dimensions in terms of these attributes, two measures can be used: the multiple correlation for the attribute indicating the degree of fit of attribute to the overall configuration; standardized regression weights on the given dimensions indicating the directional cosine between the dimension and the vector of the attribute (Takane, 1980). Using these measures, dimensions were interpreted as shown in Table 4. One of the two dimensions was commonly related to 'price' having correlation with 'quality of goods' and 'atmosphere' in most of the districts, the other shows a different nature among districts. That is to say, in the newly urbanized area remote from the CBD, such as B to F, the dimension was related to 'distance', while in the densely inhabited districts relatively close to the CBD (A, G and I), the dimension was related to the size characterized by 'range of goods'. This implies that consumers residing in the district in which many stores are easily accessible, discriminate them according to size rather than to the distance.

Thus it turns out that the dimensions, such as 'distance', 'size' and 'price' commonly obtained in previous studies in Europe, are equally important to the store image forma-

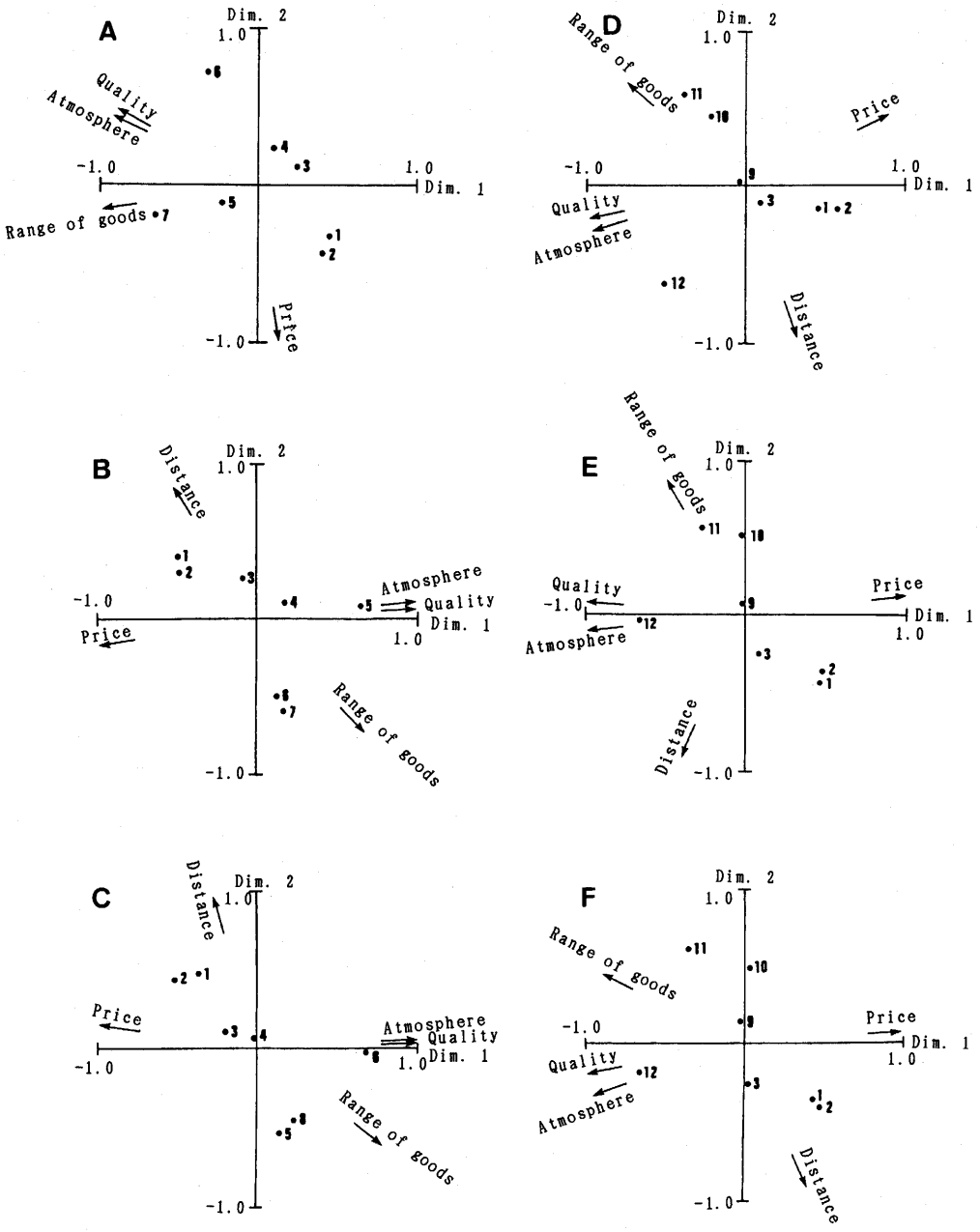

Fig. 2 Stimulus space obtained by INDSCAL
A: Kitaguchi; B: Takeda; C: Kitashin; D: Kamiishida; E: Tomitake; F: Shimoishida
Numbers in this figure correspond with the store code in Table 3
Only attributes whose multiple correlations are greater than 0.7 are shown

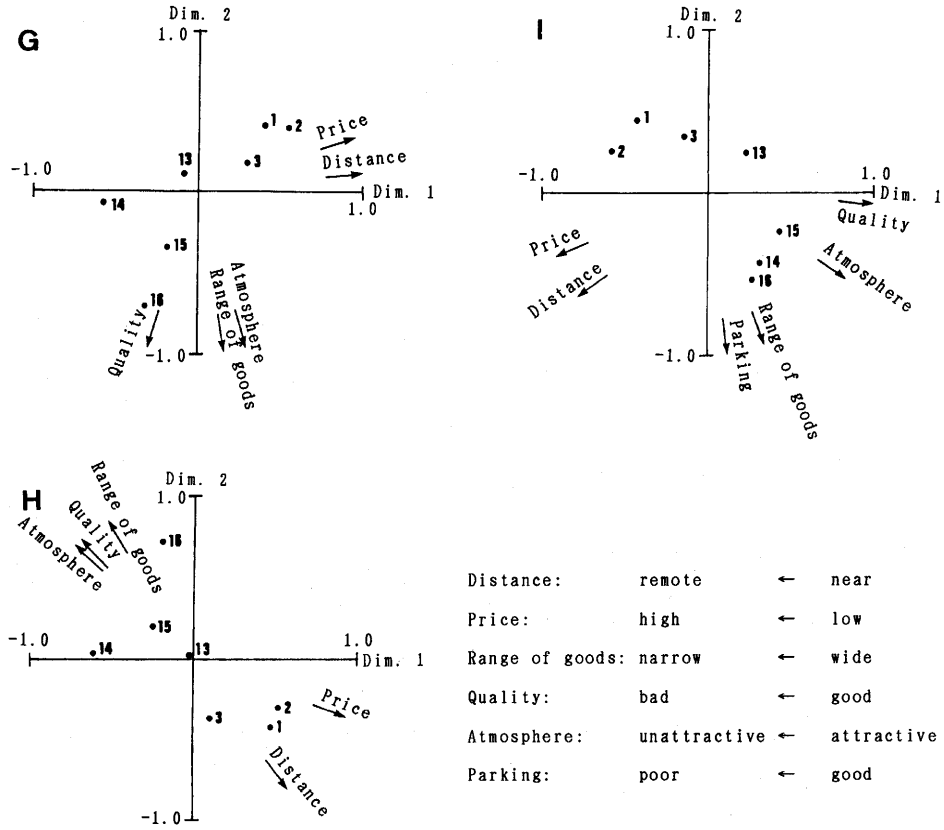

Fig. 2 (Continued)
G: Ohta; H: Yuda; I: Ise
Numbers in this figure correspond with the store code in Table 3
Only attributes whose multiple correlations are greater than 0.7 are shown

Table 4 Summary of attributes related to each MDS dimension

District	Dimension 1	Dimension 2	Number of samples
A : Kitaguchi	Range of goods, Quality, Atmosphere	Price	12
B : Takeda	Price, Quality, Atmosphere	Distance	22
C : Kitashin	Price, Quality, Atmosphere, Parking	Distance	11
D : Kamiishida	Price, Quality, Atmosphere	Distance	19
E : Tomitake	Price, Quality, Atmosphere	Distance	15
F : Shimoishida	Price, Quality, Atmosphere	Distance	18
G : Ohta	Price, Distance	Range of goods, Quality, Atmosphere	15
H : Yuda	Price	—	16
I : Ise	Price, Quality	Range of goods, Parking	11

Only attributes are shown whose directional cosine to the dimension is greater than 0.866 (=cos 30°=|cos 150°|) and multiple correlation greater than 0.7.

tion in Japan.

6. Concluding Remarks

The results presented in this paper confirmed the consistency of the underlying dimension of store image, whose main components are price level, size of store and distance from home. These attributes of stores have also been important in the existing shopping models in geography. On the other hand, the results obtained in the analysis indicate that the 'size' and 'distance' dimensions have a different level of importance depending on the district. Such an areal difference may be due not only to the locational conditions of district, but also to the socio-demographic characteristics of residents. The sample size used in this study was too small to disaggregate with regard to socio-demographic attributes, so that it is necessary to use a larger sample size to examine the problem of aggregation.

Regarding the dimensions extracted in this analysis as scales for discriminating the stores, it is likely that different set of stimuli should yield different dimensions of image. For instance, if all stores have equal levels of price and size, the 'distance' dimension would become a dominant one. Moreover, if the location of stores in physical space was correlated with the size distribution of stores, 'distance' and 'size' may be combined into a single dimension. The extracted dimensions cannot therefore be independent of the spatial pattern of stimuli, in so far as the location of stores has some relationship with the other attributes. To examine such issues, further investigation in various retail environments is required.

In terms of modeling spatial choice process, this study is only concerned with a single phase of the process. The next step to be undertaken is to elucidate the functional relationships among cognition, preference and choice behavior. As stated by Timmermans (1984), decompositional multiattribute preference model (*e.g.* conjoint measurement model) or discrete choice model (*e.g.* logit model) may provide useful techniques to tackle this problem.

Acknowledgments

The author wishes to Associate Professor Yoshio Sugiura of Department of Geography, Tokyo Metropolitan University for permission to use computer algorithms of MDS. This study was financially supported by the Grant-in-Aid for Encouragement of Young Scientists (No. 62780272) by The Ministry of Education, Science and Culture, Japan.

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(*: in Japanese, **: in Japanese with English abstract)