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Clustering Consumer Characteristics in a Cognitive Sensory Evaluation of Food

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Abstract

To characterize the cognitive evaluation of a food, a sensory test was conducted with three groups of university students (n=38, 34, and 76) with the use of a questionnaire consisting of 53 objective and 105 subjective elements for potato chips. Each group had a characteristic clustering with respect to the sizes of the clustered elements and the differences in their distributions. The clustered normal distribution curve was a tool used to characterize the cognition of food and should prove useful for investigating the background level of consciousness of panel groups.

Key words: Cognitive sensory evaluation, consciousness, clustering analysis, distribution curve, potato chip

Introduction

Conventional sensory science finds it difficult to explain the inherent variance in the sensory evaluation of individuals. To resolve the variance problem, Chun (2000, 2002) developed a new concept for cognitive sensory evaluation based on human consciousness. He proposed a multi-layer consciousness system consisting of several consciousness layers that play roles in the sensory evaluation process. On the basis of Vasubandhus theory (Anacker, 1984), Chun (2000, 2003) hypothesized that stimuli sensed by the 5th consciousness layer (5th-CL) were perceived by the 6th-CL and then transformed into information carrying meaningful logic that led to a decision on the taste of food by the 7th-CL, which was the internal assessor. The 8th-CL is the ultimate cognizer that controls all of the layers and stores events that happen during the process. A schematic of the cognitive structure of human consciousness is shown in Fig. 1.

To find evidence of the role of these consciousness layers, new methods of sensory evaluation using sensory bar codes and frequency curves were devised and tested in 12 persons with the use of cooked rice. The results showed that individual sensory properties could be expressed using the sensory bar code or frequency-curve patterns, and there were remarkable differences in the patterns (Chun, 2000, 2003). Because the cognitive stage of consciousness was regarded as more important stage than the sensing stage in the human sensory system, he renamed this cognitive sensory evaluation.

To understand the role of the background level of consciousness of panelists, a clustering and normal distribution analysis was carried out in three consumer groups with the use of potato chips.

Materials and Methods

Potato chips (200 g) packaged in laminated aluminum bags were used (NongShim Co., Korea), and the packages were opened just before the sensory test began. The panelists consisted of 148 subjects in three groups: groups S and T consisted of food science students from two different universities, and group H consisted of students majoring in food nutrition at a women's college. The tests were conducted in lecture rooms at the respective institutes without conditional environment. The questionnaire developed by Chun (2001) was modified to test the subjects response to potato chips. It consisted

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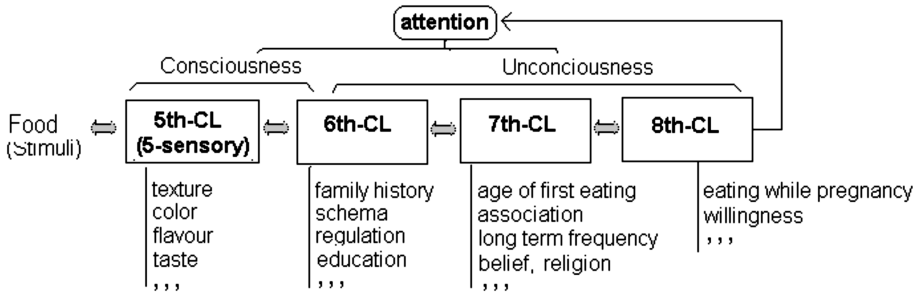


Fig. 1. Multi-layer consciousness model for the cognition of food.

of 158 questions that included 105 subjective and 53 objective elements (Chun and Shine, 2003). The Statistic Analysis System (SAS) clustering analysis was used to classify the results on the basis of similarities in the cognitive sensory bar code patterns developed by Chun and Shine (2003).

Results and Discussion

Clustering of the three consumer groups

On the basis of the similarity in the cognitive bar code patterns, the three groups were subjected to clustering analysis. The resulting dendrograms are presented in Fig. 2. In each group, eight clusters were generated. The differences in the clustering trees suggest that the subjective or conscious elements of the panelists play roles in the assessment stage in the cognition process.

The sizes of the clusters for each group differed, and this difference might be valuable information indicating that each group has its own common background level of consciousness.

Overall trend in the clustering phenomena

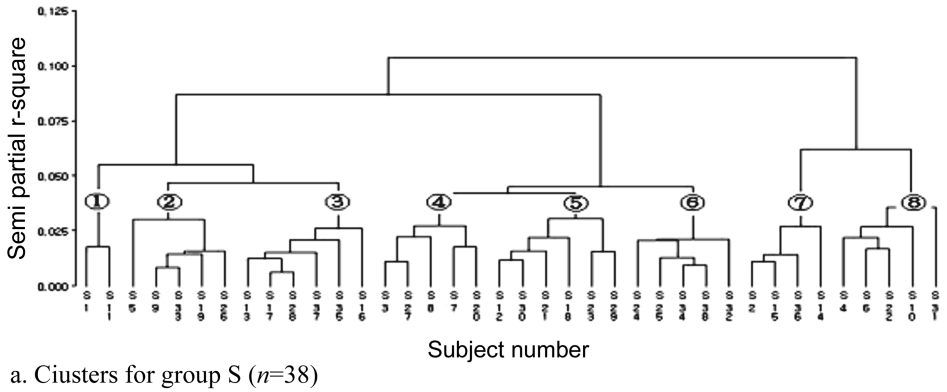
The results shown in Fig. 2 were obtained in three separate tests conducted in different environments with different numbers of subjects. Therefore, the consistency of the test is questionable. To resolve this, clustering analysis was conducted after combining the data for the three groups (n=148). This resulted in eight clusters at the 0.02 semi-partial r^2 level, as shown in Fig. 3.

As evident from the first row of the x axis in Fig. 3, the subjects from each particular group were aggregated in subclusters in the dendrograms, as shown by patterns such as “SSS” or “HH.” In particular, clusters 5 and 6 consisted mainly of subjects from group S. This suggests that each group has a characteristic background level of consciousness related to food evaluation.

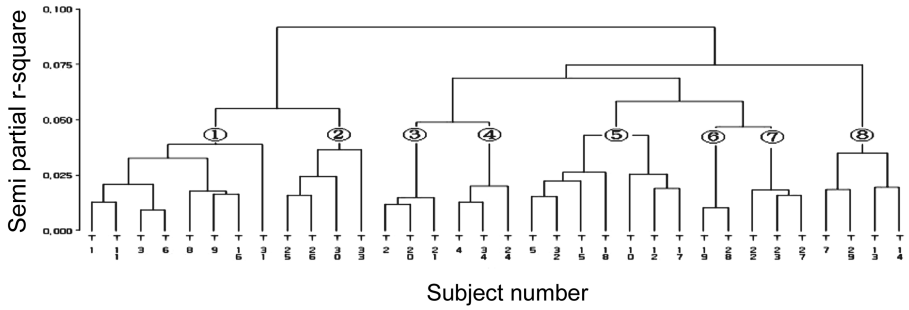
Distribution of the subjects from different groups in the dendrogram

To determine the potential effect of the consciousness layer, the clustering characteristics of the subjects (n=148) were investigated with an analysis of normal distribution. The distribution of the number of clustered subjects (n= 148, *see* the x axis of Fig. 3) is plotted in Fig. 4. There were tangible differences among the three groups, and the Z value and curve pattern of group S differed markedly from those of the other two groups. The relative narrowness of the distribution suggests that group S possesses common characteristics in terms of consciousness or in some of its layers.

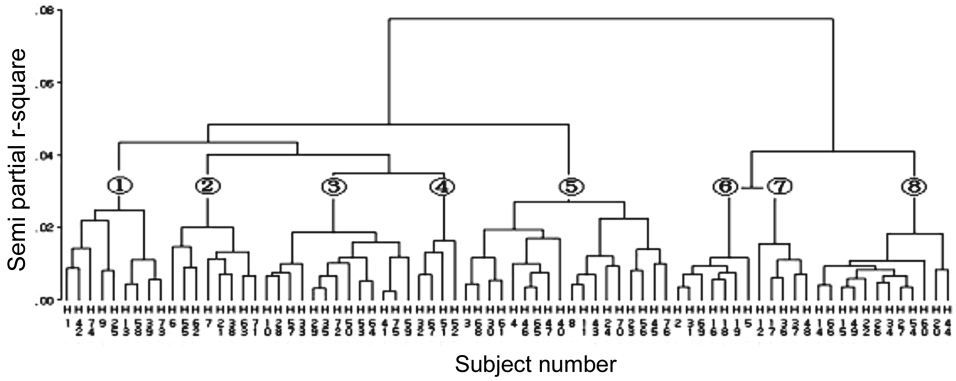
One reason for the differences between groups may have been the education level in each group. Although all three groups consisted of university students majoring in food science, groups S and T were from lecture courses that consisted of 10% and 22% female students, respectively. Group H consisted of students at a junior womens college who were one to two years younger than the students in the other two groups. The similarities in education level did not affect the distribution curves because there was a big difference between groups S and T. By contrast, groups T and H, which consisted of students with different education levels and ages, had similar curves, which indicated that differences in sex and education level have negligible effects on the clustered



a. Ciusters for group S (*n*=38)



b. Ciusters for group T (*n*=34)



c. Ciusters for group H (*n*=76)

Fig. 2. Clustering of the subjects in the three groups for potato chips.

normal distribution curve or clustering phenomena. The cause of the unique difference in group S could not be determined definitively, but the difference suggests that common consciousness parameters exist related to the food evaluation stage.

Conclusions

Chun (2000) proposed that multi-layered consciousness exists in any judgment of food and reported a method that uses bar codes and frequency curves to visualize the consciousness factors on which sensory judgment is based. To provide material evidence of the roles of invisible consciousness parameters, empirical approaches were attempted by applying clustering analysis and a study of the normal distribution. The segmentation of each group into eight clusters implies that human thought branches in different directions when using

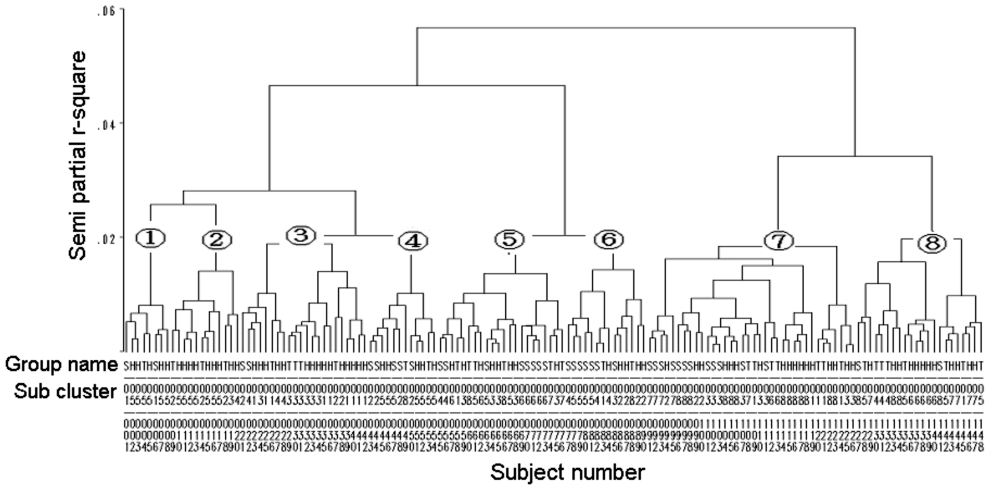


Fig. 3. Clustering of all the subjects (*n*=148) from the three different groups. The first row of the *x* axis is the group name (S, T, and H), the second row is the number of the subjects original cluster, and the third row aligns the clustered subjects after combining all three groups.

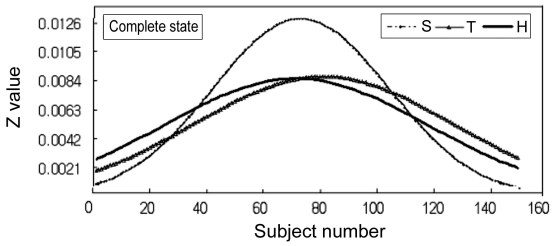


Fig. 4. Distribution of the number of clustered subjects in groups S, T, and H. The *x* axis is the same as in the dendrogram of Fig. 3.

branching rules, such as the logic of the 3-way branch transformation (Chun, 2000). The transformation might occur in a direction in which stimuli related to food consumption are cognized as a favorable consequence for each individual subject. Any consciousness parameter may be considered a sequential step through which the direction of stimuli flow can be altered. The pattern changes in the clustering phenomena of the subjects may be understood in terms of the transformation process of consciousness related to food assessment. The difference in clustered normal distribution curves between the subject groups suggests that distinct differences in the consciousness parameters of each group are present and may play important roles in the clustering or transformation processes. The clustered normal distribution curve may be another way to visualize the consciousness background of subject groups. To better understand the roles of consciousness state, further analysis of various states of consciousness is needed.

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