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Effect of the State of Consciousness on Consumer Clustering in the Cognitive Sensory Evaluation of Food

Sung-Woo Shine and Jae-Kun Chun

Department of Food Science and Technology, School of Agricultural Biotechnology, College of Agriculture and Life Sciences, Seoul National University

Abstract

A cluster analysis of various states of consciousness was conducted using data on the cognitive sensory evaluation of potato chips from three panel groups of university students (total $n = 148$). The state of consciousness in general was classified into the complete consciousness state (CCS) and incomplete consciousness states (ICCS), which were further classified into six states, according to the degree of elimination of layers of consciousness. The clustering dendrogram, using CCS as the original cluster, served as the reference for the comparative analysis. Clustering of the ICCS without a particular consciousness layer significantly affected the cluster pattern with respect to the translocation of the original cluster subjects. The ICCS without the 8^{th}-consciousness layer caused segregation of the original cluster subjects, while the ICCS without the 6^{th}-consciousness layer contributed to the aggregation of the subjects of the original cluster.

Keywords: Cognitive sensory evaluation, clustering analysis, effect of state of consciousness, potato chips

Introduction

In this era of internationalization and the global exchange of commodities, traditional boundaries between countries have become less important. However, regional purchasing patterns are particularly relevant for food products and the food product industry (Askegaard & Madsen 1998). For the food industry to overcome the invisible trade barriers constructed by regional food cultures, it is important to understand the underlying nature of cross-cultural food issues. The food industry needs to understand the differences between cultures in terms of food preferences (Prescott and Bell 1995, Prescott 1998). A sensorial approach using sensory analysis is inadequate for accessing deep-seated food habits related to particular cultures because it does not arise from food, but from people's lifestyles.

Lifestyle has been defined as an intervening system of cognitive structures that link situation-specific product perceptions to increasingly abstract cognitive categories and, finally, to personal values (Brunsø and Grunert 1998). These personal values are trans-situationally aggregated cognitive categories and are situated at the top level of their framework. Brunsø *et al.* (1995) have elaborated the basic theory in a dual-process framework that enables information processing via bottom-up and top-down routes. The bottom-up route is driven by external input (product perceptions), which is thought to trigger a hierarchical categorization process that finally results in the activation of the most abstract conceptual level. The top-down route is driven by stable individual differences in personal values (Gurnert and Gurnert 1995).

This approach strongly suggests that human consciousness plays an important role in the perception of food by individuals, and by groups, who possess different backgrounds with respect to consciousness. In this regard, differences in individual consciousness, constructed during exposure to food, affect the consumer's selection of food in terms of the consumer's expectations, arising, in turn, from the background level of consciousness (O'Sullivan *et al*. 2004). Therefore, food culture can be said to manifest itself in the

Corresponding author: Jae-Kun Chun, Professor San 56-1, Sinlim 9-dong, Kwanak-gu, Seoul, Republic of Korea
Phone: 02-880-4851, Fax: 02-873-5095
E-mail: chunjae@snu.ac.kr

consumption habits or food-related lifestyles that are dominant within certain groups of people or nations (Brunsø & Grunert 1998).

Personal variance is closely associated with personal behavior in the selection of food, and constitutes supporting evidence for the cognitive sensory evaluation concept developed by Chun (2000, 2001a), who hypothesized a multi-layer consciousness framework consisting of the five physical sensory organs (defined as the 5^{th}-consciousness layer, or the 5^{th}-CL) and three hidden layers (defined as the 6^{th}-, 7^{th}-, and 8^{th}-consciousness layers, or the 6^{th}-CL, 7^{th}-CL, and 8^{th}-CL, respectively (for details, see Chun 2001b, 2002). Clustering analysis showed that the distribution of subjects across clusters was closely associated with the background level of consciousness of panel groups (Chun and Shine 2003, Shine and Chun 2004b).

Chun's concept (Chun 2000, 2002) posits that stimuli sensed by the 5^{th}-CL are perceived by the 6^{th}-CL, and are then transformed into information carrying meaningful logic that leads to a decision on the taste of food by the 7^{th}-CL, as an internal assessor, via a bottom-up route. The 8^{th}-CL is the ultimate cognizer, controlling the processes of all the layers, and storing events that happen during the process through a top-down route.

Chun and his co-worker (Shine and Chun 2004a, 2004b) conducted a clustering and distribution analysis using cognitive sensory data for three different panel groups, and found that each group had a characteristic clustering nature with respect to the group size of the clustered subjects and the differences in their distributions. Brunsø and Grunert (1998) attempted a similar approach, which differed only with respect to the conceptual context and methodology. While there is evidence of a trend that leans toward different roles for different forms of consciousness, the influence of the state of consciousness, defined as a multi-layer concept (Chun 2001a, Anacker 1984), should be investigated to verify its validity.

To understand the role played by the background consciousness of the panelists, clustering and normal distribution analyses were carried out for three consumer groups using data on potato chips (Chun 2004b). This study investigated the influence of states of consciousness on the clustering and distribution across clusters.

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. The questionnaire developed by Chun (2001b) was modified to test the subjects' responses to the potato chips. It consisted of 158 questions that included 105 subjective and 53 objective elements (Shine and Chun 2004a). The data on the cognitive sensory test were subjected to statistical analysis.

The Statistic Analysis System (SAS 1999) clustering analysis was used to classify the results, based on similarities in the cognitive sensory bar code patterns developed by Chun and Shine (2004).

Results and Discussion

Definition of the state of consciousness in the cognitive sensory process

Consciousness layers were classified into eight layers, according to Vasuvandhus classification (Anacker 1984). The 5^{th}-consciousness layer represents the consciousness of the five senses, and the 6^{th}-, 7^{th}-, and 8^{th}-consciousness layers (6^{th}-CL, 7^{th}-CL, and 8^{th}-CL, respectively) are the conscious structures associated with mental and intellectual activities in humans (Chun 2000, Chun and Shine 2003, Shine and Chun 2004). The state of consciousness, in general, was classified into two states: the complete consciousness state (CCS) and the incomplete consciousness state (ICCS). The CCS was defined as a state involving the participation of all the consciousness layers, whereas in the ICCS, one or two consciousness layers were eliminated, as described in Table 1.

Table 1. Definition of state of consciousness*.

States of Consciousness	Consciousness layers participating*
Complete Consciousness States (CCS)	6th-CL, 7th-CL, and 8th -CL, (6th +7th + 8th)
Incomplete Consciousness States (ICCS)	
Less incomplete states of consciousness (One layer eliminated)	without the 8th-CL (6th + 7th 8th) without the 6th-CL (6th + 7th + 8th) without the 7th-CL (6th + 8th 7th)
More incomplete states of consciousness (Two layers eliminated)	without the 7th-CL and 8th-CL (6th 7th 8th) without the 6th-CL and 8th-CL (6th + 7th 8th) without the 6th-CL and 7th-CL (6th 7th + 8th)

*Composite elements of each layer are included in the questionnaire (for details see Shine and Chun 2004).

Comparison of clustering in the complete and incomplete states of consciousness

Based on a similarity in the cognitive bar code patterns, the three groups were subjected to clustering analysis. The resulting dendrograms are presented in Fig. 1.

To investigate the role of a particular layer of consciousness in the clustering process, dendrograms obtained under the CCS and ICCS were compared using the data from group S (n = 38). To facilitate the comparison, the dendrogram for group S under CCS is shown for reference (Fig. 1).

The dendrogram for group S in the ICCS, from which the elements of the 6th-CL or 8th-CL were eliminated, differed significantly with respect to cluster size and the alignment of the clustered subjects, as shown in Fig. 2a. As readily seen in the dendrogram, translocation of the original subjects was observed, with subjects from the original clusters migrating across clusters. For example, subject 85, who originally belonged to cluster 8, migrated to cluster 1 under the ICCS that eliminated the 8th-CL.

For example, subjects in the original cluster 7 (subjects 71, 73, and 74 in Fig. 1) in the dendrogram for group S at ICCS (–6th+7th–8th) migrated to a subcluster in cluster 3 (see the numbers in the rectangular box in Fig. 2a), while the subjects in original cluster 5 (subjects 51, 52, 53, 54, 55, and 56 in Fig. 1) were translocated broadly across clusters 4, 5, 6, and 7 (see the numbers in the rectangular boxes in Fig. 2a). When the clustering was conducted for the ICCS without the 6th-CL (–6th+7th +8th), similar trends were found, as seen in Figure 2b. In particular, there were more aggregated migrations of the original subjects than occurred in the previous case.

These results in the ICCS lead to two observations. First, clustering was significantly affected by the state of consciousness at the moment of food perception and, second, different translocation patterns occurred in the ICCS, as the aggregation and segregation of the original subjects were affected by the particular consciousness layers eliminated.

Similar alterations in the dendrograms of other subject groups (T and H) were observed, regardless of the difference in the number of subjects in the group. The

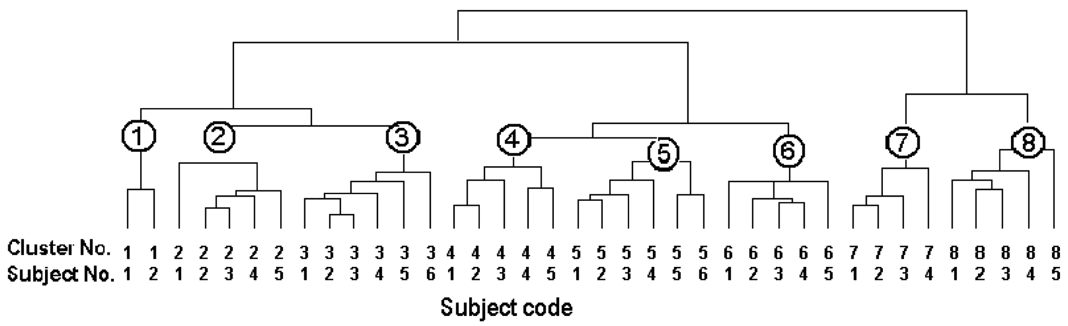
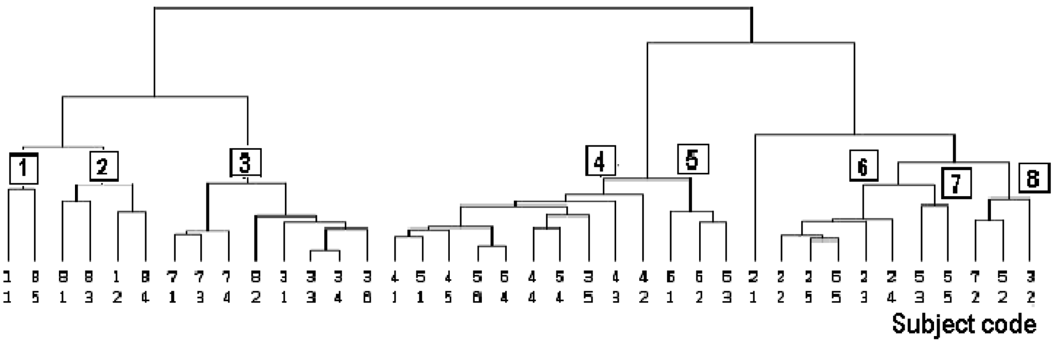
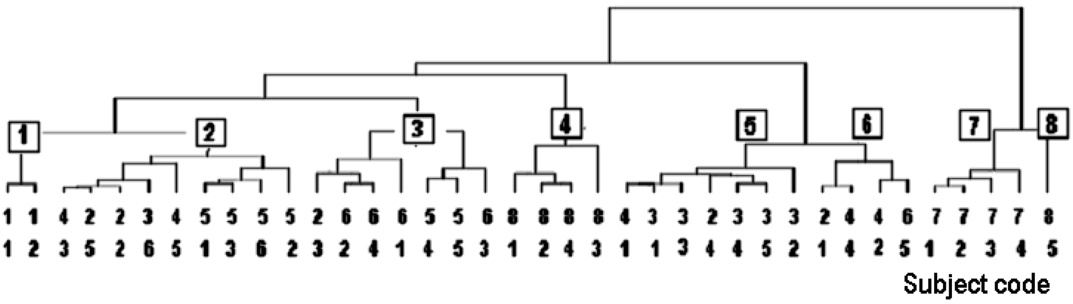


Fig. 1. Clustering of group S (n = 38) for potato chips in the complete consciousness state. The subjects are coded using vertical pairs of numbers consisting of the original cluster number in the circle and the subject's number.



a. Clusters in the ICCS without elements of the 8th-CL, *i.e.*, (6th + 7th 8th).



b. Clusters in the ICCS without elements of the 6th-CL, *i.e.*, (6th +7th +8th)

Fig. 2. Clustering of group S with various combinations of the consciousness layers.

aggregation and separation of the original subjects in the panelist clustering indicate that the subjects in each original cluster shared a strong conscious binding force, a force comparable to that constituted by the food habits of immigrants who preserve their native food preference or culture in their new cultural environment.

Effect of various states of consciousness in the ICCS on the aggregation of the original subjects on clustering

In the ICCS condition, the original subject clusters were disrupted and the subjects were translocated to new clusters, with the movement of aggregated subgroups consisting of 2 to 6 subjects. In order to understand the cause underlying the translocation of the subjects in the original cluster, the degree of aggregation of the original subjects was analyzed for the three subject groups, as illustrated in Table 2.

The frequencies of occurrence of subject aggregates are indicated with asterisks (*) and the population size of each aggregate is shown in parentheses.

As indicated in Table 2, the original subjects were translocated into different clusters in the ICCS clusters. In the CCS (6th+7th+8th), large aggregates with at least five subjects were dominant (83%) over small aggregates (5%). By contrast, in the ICCS, clustering with small aggregates consisting of 2 or 3 subjects increased to 49-52%.

As in group S, the clustering patterns of groups T and H were also affected by the states of consciousness, as shown in Table 3. In the CCS, group T was composed of 37% large aggregates and 21% small aggregates. By contrast, in the ICCS, the proportion of small aggregates increased to 29-52%, whereas the proportion of large subgroups decreased.

The results for the two groups showed that the ICCS enhanced segregation, although 5-subject subgroups were rarely found at the –6th–7th+8th and 6th+7th–8th.

These phenomena suggest that interactions between the consciousness layers play an important role in the

Table 2. Effect of the state of consciousness on the aggregation of subjects in group S

Consciousness Layer	Occurrence frequency (*) of subject-aggregates				
	6-subject	5-subject	4-subject	3-subject	2-subject
$6^{th}-7^{th}-8^{th}$			**(20)	*(8)	****(21)
$-6^{th}+7^{th}-8^{th}$			**(20)	**(15.7)	****(21.6)
$-6^{th}-7^{th}+8^{th}$				**(15.7)	*****(26)
$6^{th}+7^{th}-8^{th}$			*(10)	****(31)	**(11)
$6^{th}-7^{th}+8^{th}$			**(20)	***(24)	*****(26)
$-6^{th}+7^{th}+8^{th}$			**(20)	***(24)	****(22)
$6^{th}+7^{th}+8^{th}$	**(31)	****(52)	*(10)		*(5)

*The number of asterisks refers to the number of occurrences; the figure in parentheses is the occurrence rate (%).

food preference that comes from a conscious attachment to, or liking of, a particular food.

In group H, the trend was more obvious than in the other two groups; large aggregates with 7-18 subjects were dominant in the CCS, involving 85% of the population, and no aggregates with less than three subjects were observed. Although direct comparison of group H to groups S and T was impossible, owing to the difference in group size, the segregating trend in the ICCS was obvious. From these results, we conclude that there is a distinct difference in clustering pattern and translocation between the complete and incomplete

Table 3. Effect of states of consciousness on the aggregation of subjects in groups T and H
a. Case of group T

Consciousness Layer	Occurrence frequency (*) of subject aggregates					
	7-subject	6-subject	5-subject	4-subject	3-subject	2-subject
$6^{th}-7^{th}-8^{th}$					*(9)	*****(29)
$-6^{th}+7^{th}-8^{th}$					***(26)	*****(29)
$6^{th}-7^{th+}8^{th}$			*(14)	*(11)		*****(29)
$6^{th}+7^{th}-8^{th}$			*(14)		****(35)	***(17)
$6^{th}-7^{th}+8^{th}$					**(6)	******(35)
$-6^{th}+7^{th}+8^{th}$				**(17)	***(26)	**(11)
$6^{th}+7^{th}+8^{th}$	*(20)	*(17)		**(17)	***16	*5

b.. Case of group H.

Consciousness Layer	Occurrence frequency (*) of subject aggregates										
	18-s	13-s	12-s	9-s	8-s	7-s	6-s	5-s	4-s	3-s	2-subject
6^{th} 7^{th} 8^{th}										**(8)	*****(17)
$6^{th}+7^{th}$ 8^{th}							*(8)		**(10)	****(16)	***********(29)
6^{th} $7^{th}+8^{th}$							*(8)	*(7)	***(16)	**(8)	******(16)
$6^{th}+7^{th}$ 8^{th}							*(8)	*(7)	*(5)	****(16)	************(31)
6^{th} $7^{th}+8^{th}$								*(7)		*****(20)	***(18)
$6^{th}+7^{th}+8^{th}$				*	*(10)	*(9)	**(16)	***(20)	***(16)	**(8)	*(2)
$6^{th}+7^{th}+8^{th}$	*(23)	*(17)	*(15)	*(11)	*(10)	*(9)		*(7)	*(5)		

*The number of asterisks refers to the number of occurrences; the number in parentheses is the occurrence rate (%).

states of consciousness.

Conclusion

A series of clustering analyses for three subject groups, using potato chips, clearly demonstrated that the consciousness background of the respective consumer group affected the clustering format. I would suggest that each consciousness layer plays a particular role during the cognitive response to food consumption. In the ICCS, in which one or two consciousness layers were eliminated, the original clustering format of the CCS was altered considerably. Translocation of the original clusters was observed for every ICCS, through segregation and aggregation processes. One tangible finding is that some subjects in the original clusters translocated to other clusters by forming original subject aggregates. Different effects of the consciousness layers on the aggregates were observed among the three groups. This indicates that cognitive responses to food consumption are closely associated with particular consciousness layers and their characteristics. When the 7^{th}-CL or 8^{th}-CL participated in the cognitive process, the size of the subject aggregates increased, although some exceptions were found for the groups tested. The segregation and aggregation of subjects in the original cluster might have been caused by a transformation of the consciousness pathway, as reported by Chun and his coworker (Chun 2000, Chun and Shine 2003). Cross-culture differences in food consumption can be understood in relation to different states of consciousness evinced by people in different regions; a similar approach could be extended to the cross-cultural problem with respect to food that arises in the global market.

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