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Short Communication

Utilizing hedonic frame for projective mapping: A case study with Korean fermented soybean paste soup

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ABSTRACT

Projective mapping (PM) based techniques are frequently used to develop consumer perception maps holistically for identifying and characterizing samples with similar characteristics. In the present study, the criteria for locating samples in projective mapping are narrowed from the original projective mapping methodology. This study proposes the use of a hedonic frame (i.e. reasons for liking similarity), H_PM, and comparing it using a sensory frame (i.e. sensory similarity), S_PM, with the aim of understanding how consumers perceive soups made with various Korean fermented soybean pastes. The participants comprised a total of 69 consumers. Fifteen fermented soybean paste products from different regions of Korea were selected. All consumers evaluated samples using both S_PM and H_PM, which were conducted in separate sessions. The order of the two mapping sessions was balanced between the subjects. In the S_PM method, subjects grouped samples with similar sensory characteristics. In the H_PM method, subjects grouped samples which had similar reasons for liking or disliking on a mapping sheet. Ultra flash profiling was conducted in both S_PM and H_PM after the mapping tasks. Multiple factor analysis was used for statistical analysis. S_PM and H_PM resulted in different product positions. Although some samples shared very similar sensory characteristics with each other in S_PM, distinct differences appeared in the reasons for (dis)liking in H_PM. Critical attributes that affected sample positioning differed when using different criteria for mapping the samples which resulted in discrete perceptual maps of S_PM and H_PM. H_PM can identify important hedonic drivers of samples that may not be caught by a sensory based approach.

1. Introduction

Free sorting and projective mapping (a.k.a. napping) related techniques are popular methods for product characterization due to their simplicity as well as effectiveness in holistically discriminating samples (Risvik, McEwan, & Rødbotten, 1997; Tuorila & Monteleone, 2009; Cadoret & Lê, 2010). These methods basically identify and characterize samples with (dis)similar characteristics (Faye et al., 2004; Abdi, Valentin, Chollet, & Chrea, 2007; Lelièvre, Chollet, Abdi, & Valentin, 2008). In global projective mapping techniques, subjects use holistic similarity criteria, which include a broad spectrum of similarity in sensory, hedonic or other aspects of food, to position samples on a sheet. More recently, researchers conducted projective mapping using a narrower criteria (i.e. partial projective mapping), specific reference sample (i.e. polarized projective mapping), or specific attribute (i.e. freshness). Table 1 lists various projective mapping/napping techniques which utilize different evaluation frame of similarity for positioning the samples on a sheet.

Projective mapping has often been proposed as an alternative quick method for descriptive analysis (Valentin, Chollet, Lelièvre, & Abdi, 2012). Previous studies have investigated the reproducibility, validity, and reliability of projective mapping techniques by comparing methods with descriptive analysis (Kennedy & Heymann, 2009; Heymann, Hopfer & Bershaw, 2014). The effectiveness of the projective mapping/napping methodology as a sensory analysis tool has also been compared with rapid descriptive analysis methods such as free multiple sorting, flash profiling, ultraflash profiling, conventional profiling, and the CATA method (Perrin et al., 2008; Nestrud & Lawless, 2010; Dehlholm, Brockhoff, Meinert, Aaslyng, & Bredie, 2012; Santos et al., 2013; Liu, Grønbeck, Di Monaco, Giacalone, & Bredie, 2016). The usage of projective mapping as an alternative for descriptive analysis implies that the sensory based similarity between samples are one of the main implicit frames adapted to determine the sample position on a map, although subjects evaluate the samples holistically.

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Table 1
List of projective mapping/napping techniques utilizing diverse evaluation frame for positioning the samples.

Type of method	Evaluation Frame	Publications
Global Projective Mapping/Napping Projective Mapping	Holistic_ Similarity/dissimilarity	Risvik et al. (1994) Risvik et al. (1997) Pagès (2005) Perrin et al. (2008) Dehlholm et al. (2012) Kim et al. (2013) Vidal, Cadena, Antunez, Gimenez, and Varela, Ares (2014) Marcano et al. (2015) Varela et al. (2017) Moelich et al. (2017) Esmerino et al. (2017)
Projective Mapping/Napping with Sorting	Holistic_Similarity/dissimilarity	Pagès, Cadoret, and Le (2010) Hopfer and Heymann (2013)
Partial Mapping/napping	- Single attribute (Usage, Freshness)_similarity - Single modality (appearance, aroma, taste, or texture)_Similarity - Multi modalities (aroma & taste, palate or flavor & texture) _Similarity/ dissimilarity	King et al. (1998) Zhang, Lusk, Mirosa, and Oey (2016) Dehlholm et al. (2012) Reinbach, Giacalone, Ribeiro, Bredie, and Frøst (2014) Marcano et al. (2015) Louw et al. (2015) Moelich et al. (2017)
Partial Mapping/napping with Sorting	- Single modality (appearance, aroma, taste, or texture)_Similarity - Multi modalities (aroma & taste, palate: flavor & texture) _Similarity/ dissimilarity	Blancher, Clavier, Egoroff, Duineveld, and Parcon (2012)
Polarized projective mapping	3 Reference samples_ Similarity/dissimilarity	Ares et al. (2013) Horita et al. (2017)
Projective Mapping on Choice/Preference	Preference_Similarity/dissimilarity	Lezaeta et al. (2017) Varela et al. (2017)
Structured/directed mapping	Usage & liking Healthy & Liking	King et al. (1998) Varela and Salvador (2014)

When evaluating samples for projective mapping, subjects will use their own holistic criteria, and as mentioned earlier, the types of criteria involved and the weight of these criteria (if there are more than 2) will vary among subjects but will probably be consistent within a subject. For example, foods that taste similar to each other should elicit similar hedonic responses. However, since the components that build similarity perception of food are multifaceted, similar sample properties may not necessarily mean similar sensory property nor similar hedonic properties of food. That is, the importance (or weight) of sample attributes affecting the perceived similarity of samples from sensory aspects and hedonic aspects may well be different. Thus, similar sensory characteristics of samples will not always correspond to similar acceptance ratings. And partly due to these reasons, researchers attempt to narrow the frame for evaluating similarity among samples.

A few researchers have attempted to incorporate hedonic aspects of food evaluation into mapping/napping techniques. King, Cliff, and Hall (1998) proposed a structured projective mapping method that defined the *x* and *y* axes as liking and usage, respectively, and asked the subjects to position the samples in this two-dimensional space based on their individual liking and usage. Varela and Salvador (2014) applied a similar approach to children. Very recently, projective mapping based on preference was introduced and compared with classical projective mapping resulting in a different perceptual map of the product (Varela et al., 2017). The present study proposes a projective mapping method which utilizes hedonic frame (H_PM), and compared this with a projective mapping utilizing a sensory based similarity strategy (S_PM) using soups made with fermented soybean paste samples as products of interest. S_PM was conducted using previously described protocols (Risvik, McEwan, Colwill, Rogers, & Lyon, 1994; Pagès, 2005; Park, Lê, Hong, & Kim, 2014). For the H_PM method, consumers were required to sort the samples based on similarity of reasons for liking and disliking the samples.

Fermented soybean paste soup was selected as a product category of interest in this experiment since Korean fermented soybean paste (called doenjang) is a very important culinary ingredient in Korean foods and the flavors of fermented soybean pastes can vary widely depending on the raw materials, fermentation methods, aging periods, and other factors (Kim & Rhee, 1988; Lee, 2004; Ahn et al., 2012; Jeon, Lee, Kim, & Kim, 2016).

2. Material and methods

2.1. Sample and sample preparation

Fifteen Korean fermented soybean paste (doenjang) products were chosen as samples of interest (Table 2). A large set of samples was obtained from major and local producers located in various regions of Korea. Two products were national brands with the largest market shares in Republic of Korea. Nine products were produced by various small-scale local producers in five different provinces. Four products were obtained from a single local producer and these were produced by similar methods but used different starter cultures to ferment the soybean paste.

Since fermented soybean paste is a seasoning ingredient that is rarely consumed on its own, samples were evaluated as soup preparations (Kim, Hong, Song, Shin, & Kim, 2010; Kim & Lee, 2014). In the first step, stock for fermented soybean paste soup was made by boiling 160 g of dried anchovy and dried kelp at a ratio of 3:7 (Seokha, Busan, Korea) in 4 L of water (Jeju Sam Da Soo, Kwangdong Pharmaceutical, Jeju, Korea) for 40 min. The salinity of the stock was approximately 0.09%. The fermented soybean paste sample was added to the stock at a concentration of 10%. The soup was then boiled for 5 min, and soup samples were kept in a heating cabinet (LH-1041G, Daeyeong E&B, Changwon, Korea) at 70 °C until being evaluated. Fifty milliliters of each sample was poured into a disposable cup (diameter 7 cm, height 4 cm; Samboopack, Incheon, Korea) just before the sample evaluation, and each sample was labeled with a three-digit random code.