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An alternative way to uncover drivers of coffee liking: Preference mapping based on consumers' preference ranking and open comments

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ABSTRACT

In classic consumer science, liking has generally been measured with the 9-point hedonic scale. In recent years, signal detection procedures where consumers rank products in terms of preference have been used, together with an *R*-index that measures the distance in preference. Ranking has been found to be friendlier for consumers, being a more "natural" exercise than scaling. However, scaling has the advantage of quantifying liking, resulting in data sets that can be treated further, for example through preference mapping, together with sensory data from a trained panel or from consumers. Preference mapping is very useful for product development and as a communication tool.

This study compared two preference mapping approaches, one using a data set from hedonic scaling plus intensity questions and the other using preference ranking data coupled with open comments.

Preference ranking tests plus open comments by consumers proved a very promising method as it produced very similar internal preference map results to "traditional" preference mapping from liking scales. This quicker and easier method in terms of practical implementation has the added advantage of eliciting drivers of liking and disliking directly from consumers, as these cannot be obtained through attribute intensity assessment or by using a trained panel.

1. Introduction

The increasing quantity and variety of food products appearing on the market is making consumers more demanding about their purchases (Clemons, 2008). It is not enough to find out how much consumers like a product, their opinions and the variety of their needs must be carefully studied (Chrea et al., 2011; Onwezen et al., 2012); there are no universally liked odors or tastes, one person may dislike what another person likes (Moskowitz & Bernstein, 2000). Consumers may present differentiated preference patterns for some products because of their different hedonic responses, forming groups with shared hedonic patterns. This is known as consumer segmentation. In some foods, considerable variations in taste, intensity of flavor or sensory profile can lead to a segmentation of consumers. These variations can be intrinsic to the product, such as sharp, crunchy apples versus sweet, mealy ones (Jaeger, Andani, Wakeling, & MacFie, 1998) or may be due to changes in formulation that modify the sensory properties, as in milk desserts that vary in flavor and texture (Ares, Giménez, Barreiro, & Gámbaro 2010) or low and high intensity chocolates (Januszewska & Viaene, 2001).

Coffee is a product that can be drunk on its own or mixed with others (milk, sugar, condensed milk, etc.), making it a typical segmented product for which groups with well differentiated consumption patterns can be identified. Bitterness is generally considered a negative attribute in food, yet many individuals enjoy a certain amount of bitterness in products such as coffee, beer, or dark chocolate (Harwood, Ziegler, & Hayes, 2012). Cristovam, Russell, Paterson, and Reid (2000) found differences between men's and women's preferences for six blends of different coffee bean varieties in cappucino coffees.

Internal or external preference mapping approaches can be applied to understanding these kinds of consumer preference pattern. Preference mapping is a group of methods for investigating consumers' hedonic responses to a set of products through multivariate statistical mapping methods (Næs, Brockhoff, & Tomic 2010). In internal preference mapping the sensory profile of the products is related to liking ratings from a representative sample of consumers, using only consumer data to determine consumer preference patterns, and to build a map representing the preference space. Afterwards, the sensory description is linked by regressing it onto the consumer map (Ares, Varela, Rado, & Giménez 2011). Internal preference mapping has been identified as advantageous for marketing actionability and new product creativity as the preference space is created on the basis of consumers' responses alone (MacFie, 2007; van Kleef, van Trijp, & Luning 2006).

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This technique reveals the main factors underlying the consumers' liking, providing the main preference directions that separate consumers with different liking patterns (consumer segments) and linking them to product characteristics (Ares, Gimenez, & Gambaro, 2006; Lê & Ledauphin, 2006; Parente, Manzoni, & Ares, 2011; Thompson, Drake, Lopetcharat, & Yates, 2004).

The most common way to collect data for preference maps is to measure consumer liking through acceptance tests, using 9-point hedonic scales and presenting the samples in a monadic sequence. This type of test makes it possible to apply parametric statistical analysis and directly compare data across studies. Although these scales make it possible to assess the degree of liking quantitatively, they are not very intuitive for consumers, as although the values on the scale are the same, the consumers may not all have the same values when they work out a scoring pattern. This will vary internally with the previous experience of each panelist, who will intuitively tend to compare samples, and the distance between the points will respond to each consumer's "internal scale" (Lawless & Heyman, 2010). The multidimensional representation of products and consumers in an internal preference map is generally obtained via PCA of a matrix of products *x* consumers, the data being the hedonic score derived of the scaling exercise. The obtained map allows the visualization of the samples that received the highest hedonic scores together with the consumers that preferred them: the vectors indicate liking directions for each consumer. Afterwards, the sensory description is linked by regressing it onto the consumer map (Varela, in press).

Another option for building a preference map is to use a different preference test, as a preference ranking to measure hedonic appreciation. These tests present all the samples together and the consumers rank them by preference. The data obtained are ordinal. The disadvantage of this is that the preference ranking of the samples is not comparable from one experiment to another. The advantage is that they are simpler and more natural for consumers (Hein, Jaeger, Carr, & Delahunty, 2008; Lawless & Heymann, 2010). Conceptually, ranking samples by preference has been recognized as a very simple task (Meilgaard, Civille, & Carr, 2006). However, some authors have identified it as a complicated one if there are many samples and many parameters to be assessed, as this leads to tiredness and to not rating the last samples in the same way as the first ones (Moskowitz, 2005). Apart from being more natural and in general easier for consumers, another advantage of the ranking procedure is from a practical point of view, the shorter time of the test; setting up a ranking procedure is definitely shorter and easier than rating the same number of samples, where only one tray with all the samples is given to the consumers, instead of having to follow a design and changing trays between tastings. The limitation of this technique is that it gives no indication of the size of the differences. This can be solved in part by analyzing the data with the *R*-index, which explains the probability of choosing one sample rather than another (Brown, 1974; Hye Seong & van Hout, 2009). Ordinal data could be analyzed via multifactorial analysis (MFA) to obtain a preference map. (MFA) permits analyzing several tables of variables, obtaining maps that allow studying the relationship between the observations, the variables and tables, which can be of different types (Escofier & Pagès, 1984).

Generally, for preference mapping purposes, consumers are only asked about their liking for the products and the description of these is obtained with a trained panel (Parente et al., 2011). However, some authors have realized that confining the consumers to assessing acceptibility without allowing them to describe and express what they feel about the product is a waste of information that could mean not having to use a trained panel. One of the options most often used for product description by consumers is to measure the intensity of attributes, defined by using structured or unstructured scales labeled from "low" to "high". This method has been much criticized. Kim and O'Mahony (1998) and Meilgaard et al. (2006) have described various scaling effect and lack of discrimination issues. Other ways to measure consumer perception include that suggested by Parente et al. (2011), who proposed building a preference map based on consumers' responses to a check-all-that-apply (CATA) question on commercial antiaging cosmetic creams. Ten Kleij and Musters (2003) proposed analyzing open-ended questions to complement preference mapping in a study of mayonnaises, asking the consumers to volunteer words about the sensations the product aroused in them. Ares et al. (2010) conducted a similar study with milk-based desserts. However, none of these studies asked whether the terms employed were related to liking or disliking, thus losing relevant information that can give important clues to buying decisions. Symoneaux, Galmarini, and Mehinagic (2012) conducted a study in which the untrained consumer panelists, after rating apples on a 7-point hedonic scale, were allowed to write words freely to indicate their "likes" or "dislikes". Further discussion on the use of open ended questions or word association techniques for product profiling purposes could be found in Varela and Ares (2012).

The objectives of the present work were to study consumers' liking patterns for a segmented product (coffee, varying the intensity of the coffee in the samples by adding different amounts of milk and sugar) through internal preference mapping, comparing two methods. The study proposes a quick, simple approach, collecting data through preference ranking coupled with open comments, compared with a more classic approach using a 9-point hedonic scale coupled with intensity questions.

2. Materials and methods

2.1. Sample preparation

Six samples were prepared with different proportions of instant coffee (Nescafé®, Nestlé España S.A., Barcelona, Spain), white sugar (Azucarera Ebro S.L., Valladolid, Spain), whole milk (UHT Cremosita®, Leite Rio S.L., Lugo, Spain) and tap water (Table 1).

The quantity of instant coffee remained constant at 3.5 g (2 spoonfulls) per 0.20 L cup, the quantity recommended by the manufacturer. The quantities varied were those of the sugar, water and milk. The concentrations of the six samples finally used were chosen so that they would be quite different from each other, covering a wide range from "little milky flavor and not very sweet" to "strong milky flavor and very sweet". Samples were selected in a bench top tasting between the researchers and members of a descriptive panel (not trained in coffee evaluation, but with sensory training), in order to get samples different enough ranging in coffee intensity, milky/creaminess and sweetness.

A consumption temperature of around 60 °C was chosen (Lee & O'Mahony, 2002). Thermos flasks for 1.9 L of liquids (Valira, Reus, Spain) were used to keep the samples at this temperature until the test. Water was heated with an electric kettle and milk in a microwave oven. Previous to the consumer test the preparation was optimized in order to obtain the final sample mix at 60 °C

Table 1
Sample formulation.

Sample	Soluble coffee (g/L)	Sugar (g/L)	Water: whole milk
A	14	0	10:1
B	14	24	10:1
C	14	24	2:1
D	14	64	2:1
E	14	24	1:2
F	14	64	1:2