



## Identifying ideal products using three different consumer profiling methodologies. Comparison with external preference mapping

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### ABSTRACT

The aim of the present work was to identify consumers' ideal product by three consumer profiling techniques and to compare the agreement among the three techniques. Two studies were carried out in which consumers evaluated seven samples of orange-flavoured powdered drinks. In the first study 108 consumers scored their overall liking, whereas in the second one three groups of 50 consumers evaluated the sensory characteristics of the samples using projective mapping, a check-all-that-apply question or intensity scales. After completing the task consumers were asked to identify their ideal product.

The different approaches yielded similar information regarding the sensory characteristics of the products and consumers' ideal product, providing similar recommendations for product improvement. However, they differed in the position of consumers' optimum product within the sensory space defined by the sensory characteristics of the evaluated samples. Projective mapping identified the consensus position of the ideal product within the range of sensory characteristics of the evaluated samples, providing similar results than external preference mapping. Differences and similarities between the methodologies are discussed, as well as potential applications.

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### 1. Introduction

Despite the fact that new food product innovation and development is necessary for food companies to survive in today's highly competitive market, the vast majority of new food products fail (Stewart-Knox & Mitchell, 2003). The low innovation and high failure rate of new food products suggests that the methodology used for new food product development is seriously flawed (Rudolph, 1995; Stewart-Knox & Mitchell, 2003). Thus, product development teams need more efficient product development techniques.

One of the most important steps of new product development process is product optimization. This step aims to identify ideal products, i.e. products that maximize consumers' acceptance, usually measured as liking (Lagrange & Norback, 1987). The most common approach to product optimization is to ask consumers to rate their overall liking of a large set of products and characterize the sensory properties of those products using a trained assessors' panel. Then, both data sets are combined using regression analysis to identify the sensory characteristics of the ideal product (van Trijp, Punter, Mickartz, & Kruihof, 2007). One of the most common methodologies during this step of product optimization is external

preference mapping (Arditti, 1997; Carroll, 1972; McEwan, 1996; Schlich, 1995).

External preference mapping refers to a series of approaches to relate consumers' overall liking scores to a configuration of products determined by their sensory characteristics, i.e. the products' configuration in a sensory space (Carroll, 1972; Meullenet, Lovely, Threlfall, Morris, & Striegler, 2008b). Individual consumer scores are fitted into the product configuration in the sensory space using a regression model (Danzart, 1998). After this, individual models are overlapped to create a density plot of consumer acceptance and the points of maximum density are considered the ideal products (Danzart, Sieffermann, & Delarue, 2004).

Another tool frequently used for the understanding of the descriptive sensory attributes that drive consumer preferences is internal preference mapping. In this methodology the sensory profile of the product is related to preference ratings from a representative sample of consumers, using only consumer data to determine consumer preference patterns. Afterwards, the sensory description is linked by regressing it onto the consumer map (Lawlor & Delahunty, 2000). Alternative internal preference mapping approaches were also developed, such as Landscape Segmentation Analysis (LSA), which unfolds an acceptance space and estimates individual ideal locations in that space; vectors of descriptive attributes (measured by a panel) are then overlaid on the acceptance

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space (Ennis, Palen, & Mullen, 1988; Ennis & Rousseau, 2004; Rousseau & Ennis, 2008; Thompson, Drake, Lopetcharat, & Yates, 2004).

In these approaches consumers are only asked about their liking, and therefore information about how they perceive the sensory characteristics of the products is not gathered. However, trained assessors could describe the product differently or take into account attributes that may be irrelevant for consumers (ten Kleij & Musters, 2003). Besides, since liking data is regressed onto principal components, it could be difficult to translate preference directions into product sensory attributes (Guinard, Uotani, & Schlich, 2001). Moreover, during food product development the application of quantitative descriptive analysis with trained assessors remains a very time-consuming approach since the vocabulary and associated training must be adapted to each product (Faye et al., 2006).

Another possible approach for product optimization would be asking consumers to describe the sensory characteristics of the products and also to identify their ideal product. According to Risvik, McEwan, and Rodbotten (1997) the best way to understand consumer preferences is consumer data. In particular, getting consumer feedback about sensory description of products has become of great interest in the last decade. In this context, several consumer profiling methodologies have increased popularity, among which intensity scales, check-all-that-apply questions and projective mapping have had a central role.

Asking consumers to rate the intensity of different sensory attributes using scales has been reported to be a good alternative to the classical sensory profile provided by trained assessors (Husson, Le Dien, & Pagès, 2001; Worch, Lê, & Punter, 2010). Husson et al. (2001) and Worch et al. (2010) reported that sensory profiles obtained with consumers using intensity scales meet discrimination and reproducibility requirements, being an interesting alternative when companies face difficulties to use trained assessors' panels. Moskowitz (1996) also concluded that consumers are able to assess the sensory characteristics of products using this type of methodology.

Check-all-that-apply questions (CATA) consist of a list of words or phrases from which respondents should select all the words they consider appropriate to describe a product. This type of question has been used in consumer studies to determine which sensory attributes consumers perceive in different food products (Adams, Williams, Lancaster, & Foley, 2007; Ares, Deliza, Barreiro, Giménez, & Gámbaro, 2010; Meullenet, Lee, & Dooley, 2008a). Compared to just-about-right or intensity questions, CATA questions seem easier and more natural for consumers (Adams et al., 2007).

Another alternative for consumer profiling is the application of projective mapping to quantify individual perception of overall similarity and dissimilarity between products (Risvik, McEwan, Colwill, Rogers, & Lyon, 1994). In this methodology consumers are asked to provide a two dimensional projection of a group of samples, according to their own criteria (Risvik et al., 1997). This technique might be a useful and simple way to evaluate consumer perception of food products.

Few studies have been published reporting the identification of ideal products based on consumers' perception of the sensory characteristics of food products. Epkong, Ngarmasak, and Winger (2006) reported that consumers and trained assessors provided similar and suitable information for the optimization of mango gel snacks. Furthermore, van Trijp et al. (2007) used intensity and just-about-right scales to optimize the sensory characteristics of natural yogurts, reporting that both methodologies yielded valid and similar results.

In this context, the aims of the present work were to: (a) study the ability of three consumer profiling techniques (intensity scales, check-all-that-apply questions and projective mapping) to identify

consumers' ideal product, and (b) to compare the results among the three techniques to those obtained using external preference mapping.

## 2. Materials and methods

### 2.1. Powdered juice samples

The powdered drinks market in Latin America is currently one of the most dynamics in terms of new flavor developments and new launches. In 2008, more than 62 million liters of powdered beverages were drunk in Uruguay, a country with a population just above 3 million. Regarded somehow as healthier than carbonated beverages, and costing a fraction of their natural counterparts, powdered drinks are chosen as an 'economic and healthier soft drink' (Varela, Ares, Giménez, & Gámbaro, 2010). Therefore, it is interesting to gather information about consumers' perception of the sensory characteristics of this type of product.

Seven samples of orange-flavoured powdered juice drinks (named samples 1–7), corresponding to different brands available in the Uruguayan market were evaluated in the present study. Samples were prepared by diluting the powders with tap water, as recommended in the packages, adding 25% extra water (e.g. samples for dilution in 1 L were diluted to 1.25 L), based on usage and attitude data from previous consumer studies in the region. Twenty-five milliliters of each drink were served to consumers at 20 °C in plastic containers. The seven samples were presented to consumers coded with 3-digit random numbers, following a balanced rotation (multiple orthogonal Latin square). Mineral water was available for rinsing between samples.

### 2.2. Consumer sample

Two-hundred and fifty-eight people, all regular consumers of the category participated in the present study. Participants ranged in age from 18 to 60 and were 63% females and 37% males. They all consumed orange-flavoured non-carbonated drinks at least once a week. Consumers were recruited from University campuses and public places, based on their interest and availability to participate in the study. Consumer tests were carried out in a sensory laboratory that was designed in accordance with ISO 8589 (ISO, 1988). Evaluations were performed under artificial daylight type illumination, temperature control (between 22 and 24 °C) and air circulation. Data were collected in paper ballots, through self administered questionnaires previously explained to each consumer in a 1:1 basis.

Two consumer studies were carried out on two consecutive days. In the first one, 108 consumers evaluated the overall liking of the seven drinks. In the second study 150 consumers were randomly divided into 3 groups of 50 people, each of which evaluated the samples using a different consumer profiling methodology: projective mapping, check-all-that-apply questions and intensity scales.

#### 2.2.1. Overall liking

In the first study consumers were asked to try each of the drinks and to evaluate their overall liking using a 9-point hedonic scale.

#### 2.2.2. Projective mapping

For the projective mapping task, also known as Napping® (Pagès, 2005), consumers were first asked to try each of the drinks and to provide up to four words they consider appropriate to describe each of them. After this, consumers were asked to place the samples on an A3 white sheet (60 × 40 cm), according to the similarities or dissimilarities between them. Consumers were explained

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