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Influence of consumers' cognitive style on results from projective mapping

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ABSTRACT

Projective mapping (PM), one of the most holistic product profiling methods in approach, is increasingly being used to uncover consumers' perception of products and packages. Assessors rely on a process of synthesis for evaluating product information, which would determine the relative importance of the perceived characteristics they use for mapping them. Individual differences are expected, as participants are not instructed on the characteristics to consider for evaluating the degree of difference among samples, generating different perceptual spaces. Individual differences in cognitive style can affect synthesis processes and thus their perception of similarities and differences among samples. In this study, the influence of the cognitive style in the results of PM was explored. Two consumer studies were performed, one aimed at describing intrinsic sensory characteristics of chocolate flavoured milk and the other one looking into extrinsic (package only) of blueberry yogurts. Consumers completed the wholistic-analytic module of the extended Verbal Imagery Cognitive Styles Test & Extended Cognitive Style Analysis-Wholistic Analytic Test, to characterize their cognitive style. Differences between wholistic and analytic consumers in how they evaluated samples using projective mapping were found in both studies. Analytics separated the samples more in the PM perceptual space than wholistic consumers, showing more discriminating abilities. This may come from a deeper analysis of the samples, both from intrinsic and extrinsic point of views. From a sensory perspective (intrinsic), analytic consumers relied on more sensory characteristics, while wholistic mainly discriminated samples according to sweetness and bitterness/chocolate flavour. In the extrinsic study however, even if analytic consumers discriminated more between packs, they described the products using similar words in the descriptive step.

One important recommendation coming from this study is the need to consider higher dimensions in the interpretation of projective mapping tasks, as the first dimensions could underestimate the complexity of the perceptual space; currently, most applications of PM consider two dimensions only, which may not uncover the perception of specific groups of consumers.

1. Introduction

Holistic methodologies are increasingly used for uncovering consumers' perception of food products (Valentin, Chollet, Lelievre, & Abdi, 2012; Varela & Ares, 2012). These methodologies are based on the evaluation of global similarities and differences among samples, providing a synthetic representation of the products (Ares & Varela, 2014).

Among consumer-based descriptive methods, projective mapping can be considered as one of the most holistic in approach (Dehlholm, Brockhoff, Meinert, Aaslyng, & Bredie, 2012). In projective mapping assessors are asked to position samples on a bi-dimensional space according to their global similarities and differences (Risvik, McEvan, Colwill, Rogers, & Lyon, 1994). This methodology allows assessors to evaluate similarities and differences among samples by considering more than one characteristic at the same time (bi-dimensional) and without the use of words, although a descriptive step can be added later on. Projective mapping has been applied to identify similarities and differences among products, as well as the sensory characteristics responsible for perceived similarity in a wide range of product categories (Albert, Varela, Salvador, Hough, & Fiszman, 2011; Bárcenas, Pérez Elortondo, & Albisu, 2004; Hopfer & Heymann, 2013; Nestrud & Lawless, 2008; Pagès, 2005; Risvik et al., 1994; Vidal et al., 2014).

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Projective mapping data consist of the X and Y coordinates of the samples on each of the assessors' individual maps. Considering that assessors can use different criteria to estimate similarities and differences among samples Generalized Procrustes Analysis (GPA) or Multiple Factor Analysis (MFA) are used to obtain a consensus sample configuration in 2 to 4 dimensions (Dehlholm, 2014). However, representation of the sensory characteristics of samples in a limited number of dimensions may not reflect the cognitive representation of all consumers (Summers & McKay, 1976). In this sense, Vidal et al. (2016) reported that the consensus representation of samples in the first and second dimensions did not correlate with the configuration of at least one consumer segment.

In a projective mapping task, assessors should form an overall representation of the similarities and differences among samples by relying on a process of synthesis for analyzing and processing sensory information (Jaeger, Wakeling, & MacFie, 2000). This process of synthesis determines the relative importance of the perceived sensory characteristics for estimating the similarities and differences among samples. For this reason, individual differences in the criteria used by assessors to evaluate samples and complete the task are expected (Næs, Berget, Liland, Ares, & Varela, 2017). These individual differences have been reported by several authors (Kennedy, 2010; Dehlholm, Brockhoff, Meinert, et al., 2012; Hopfer & Heymann, 2013; Nestrud & Lawless, 2011; Vidal et al., 2016).

One of the most important factors that could largely contribute to heterogeneity in responses to projective mapping tasks is individual differences in preferred ways of processing information (Allport, 1937). Differences in consumers' cognitive structure and decision making can influence the number of characteristics that are involved in sample categorization (Malhotra, Pinson, & Jain, 2010). Cognitive styles can be defined as characteristic and stable ways in which people process and organize information (Messick, 1984). They determine how people process information, as well as how they use it for solving problems and making decisions (Hayes & Allinson, 1998). Cognitive styles refer more to a preferred mode of reasoning than to cognitive ability, cognitive complexity or creativity level (Guildford, 1980; Leek, 1997). One of the most studied cognitive styles is wholistic-analytic dimension, which separates people who have tendency to process information at the global level to get a general overview (wholistic), and those who have tendency to process information in detail and separate it in specific characteristics (analytic) (Peterson & Deary, 2006).

In this context, the aim of the present work was to assess the influence of cognitive style on results from projective mapping by evaluating differences between perceptual maps and sample descriptions from wholistic and analytic consumers.

2. Materials and methods

Two studies were conducted, one involving the evaluation of intrinsic product attributes and the other involving packages. In both studies consumers performed a Projective Mapping test and completed the wholistic-analytic module of the extended Verbal Imagery Cognitive Styles Test & Extended Cognitive Style Analysis-Wholistic Analytic Test (Extended CSA-WA) (Peterson, Deary, & Austin, 2003a, 2003b, 2005a, 2005b). The Extended CSA-WA is a higher-level, complex cognitive task comparing how long the participant takes to perform a wholistic task with how long they take to perform an analytic task (Peterson & Deary, 2006). More concretely, it involves a matching figures task and an embedded figures task. The matching figures task contains 40 pairs of geometrical figures and requires participants to indicate whether they are identical or different, involving a wholistic cognitive strategy. The embedded figures test contains 40 simple geometrical figures embedded in complex figures and requires respondents to indicate if the simple figure is contained within the complex one, involving an analytic cognitive approach. The position of an individual along the wholistic-analytic dimension can be determined by the relative speed of processing matching figures and embedded figures (Davies & Graff, 2006). Details of the studies are provided in the next sections.

2.1. Study 1 – evaluation of intrinsic characteristics of chocolate flavoured milk

In this test, consumers performed a projective mapping to describe the sensory characteristics of chocolate flavoured milk samples, basing their mapping on the evaluation of the intrinsic product properties only via blind tasting.

2.1.1. Participants

The study was carried out with 92 consumers, recruited from the consumer database of the Sensometrics & consumer science research group (Universidad de la República, Montevideo, Uruguay) based on their consumption of chocolate milk and their availability and interest to participate. Participants ranged in age from 18 to 34 (average 22.8 years old) and were 80% female. They signed an informed consent form and received a small gift for their participation. The high proportion of women participants in the study is not expected to have an influence in the results, as gender have not been shown to have a significant influence on cognitive styles (Riding & Watts, 1997; Peterson et al., 2005a, 2005b).

2.1.2. Samples

Eight samples of chocolate flavoured milk samples were formulated following a fractional factorial design (2^{4-1}) with the following variables: alkaline cocoa powder (2.5 vs. 1.5%), sugar (9.0 vs. 4.5%), vanilla (0.05 vs. 0%) and milk fat (3.2 vs. 1.6%). Sample formulation, presented in Table 1, was determined by pilot testing with trained assessors in order to have samples with perceivable differences in their sensory characteristics. Carrageenan (Ticaloid® 780 Stabilizer — Texture Innovation Center, TIC GUMS, Philadelphia, USA) at a concentration of 0.08% was used as thickener.

Samples were prepared using a Thermomix TM 31 (Vorwerk Mexico S. de R.L. de C.V., Mexico D.F. Mexico). The solid ingredients were mixed with the milk, previously heated to 70 °C for 3 min. The dispersion was mixed for 1 min under gentle agitation (100 rpm), heated to 70 °C for 4 min and cooled to 20 °C. Then, samples were placed in glass containers, closed, and maintained under refrigeration temperatures (4 °C ± 1 °C). They were removed from the refrigerator as needed immediately prior to sensory evaluation, and dispensed into plastic serving cups. Samples were coded using three-digit blinding codes.

2.1.3. Data collection

The study took place in standard sensory booths, under white lighting, controlled temperature (22–24 °C) and airflow conditions. Data collection was carried out using *Compusense Cloud* (Compusense Inc., Guelph, Canada) in laptops. Consumers were asked to evaluate the samples and to place them on a rectangle presented on the screen, according to their similarities and differences, in a way that two samples

Table 1
Concentration (%) of cocoa, sugar, vanilla and fat of eight samples of chocolate flavoured milk samples, formulated following a 2^{4-1} fractional factorial design.

Sample	Cocoa	Sugar	Vanilla	Milk fat
1	1.5	9.0	0	3.2
2	1.5	4.5	0.05	3.2
3	1.5	9.0	0.05	1.6
4	2.5	4.5	0.05	1.6
5	2.5	9.0	0	1.6
6	2.5	4.5	0	3.2
7	2.5	9.0	0.05	3.2
8	1.5	4.5	0	1.6