"Eating with your eyes first": Cross-cultural evaluation of visual expectations generated by high-end pastry.

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Abstract: Chefs often say "You eat with your eyes first.". This means that, while taste, smell, and vision are distinct senses, visual stimuli generate expectations through learned associations, and these expectations exert cognitive top-down influences that can and sometimes do alter assessments of taste and flavour. This study investigates the intangible values associated with the visual assessment of high-end pastry cakes among individuals from diverse food cultures. Using word association, the study explored the emotions, sensations, and impressions evoked by the visual representation of five high-end pastry cakes. Thematic content analysis was conducted to interpret and group the evoked words into dimensions. Across all cultures, "Organoleptic properties" emerged as the most highly rated dimension, aligning with expectations for food product visual assessments.

1. Introduction

Chefs often say, "You eat with your eyes first," regarding the importance of visual impact on consumer food choices. Consumers are the last piece in the production chain from food companies to retail, including hospitality, so meeting their expectations is extremely important to avoid failed launches. It is, therefore, essential to understanding the factors that affect consumer choice and behaviour [1,2]. Food culture, framed by traditions, beliefs, and values, is a determining factor in food choice, affecting consumers' perceptions and attitudes toward food products [3]. Thus, cultural traditions, agricultural and commercial practices, food processing, purchasing, and consumption habits significantly affect food preference, preparation mode, portions, and nutritional status [4]. As culture is critical in consumers' food decisions and in guiding their preferences, cross-cultural studies play a key role in optimising the communication of sensory properties of foods. Knowledge of consumer perceptions and behaviour from different cultures has extreme value, as it allows the best product development and marketing strategies to be defined to penetrate different markets [5].

Projective techniques are among the different methodologies used to study consumer opinion [6]. One is free word association, which allows identifying and assessing feelings, perceptions, motivations, and attitudes that would be self-censored in a more structured approach, such as in individual questionnaires and interviews [7]. This tool assumes that free will is provided to the participant in associating the ideas that come to mind when evaluating an object of study, allowing access to their mental representations [8,9]. In this sense, the first impressions or words expressed have the greatest relationship and connection to the participant's behaviour with the stimulus [10].

The use of free word association methodology has been increasingly used in cross-cultural studies in order to assess the perception of consumers from different countries and cultures, such as the concepts of well-being [11,12], "feeling good" [13], and traditional food [7] and regarding specific food products like meat [14], or insects [15].

This study aimed to investigate the intangible values associated with the visual assessment of high-end pastry cakes among individuals from diverse food cultures.

2. Materials and Methods

A total of 822 participants, mainly from London (United Kingdom), Porto (Portugal), Valencia (Spain), Guadalajara (Mexico), and Bogotá (Colombia), were recruited through an online questionnaire using the REDJADE® Sensory Software, except for Portugal, where LimeSurvey® was used. Participants were recruited on a voluntary basis through the dissemination of an online questionnaire via email or social networks. Participation took place in an anonymous form, with informed consent, and data was retrieved, stored, and treated following the European General Data Protection Regulation [16]

Five high-end pastry cakes with different characteristics according to current trends were used in this study (Figure 1). All cakes were designed by "Casa La Curra" (Torrent, Valencia, Spain) and photographed using a Nikon D300 camera with a Nikkor 24-70mm f/2.8S lens (Nikon Corporation, Tokyo, Japan). A uniform white background and three Neewer LED lights (Shenzhen Neewer Technology Co., Shenzhen, China) were used to ensure constant lighting conditions. Representing the "Eatertainment" trend, the Leonor Cake (LC) was made from a coconut and almond dacquoise and lemon mousse on the base, filled with a creamy almond praline and Ivorie lemon mousse with white chocolate and decorated with candied orange pieces. Following the same trend, the Saffron Cake (SC) consisted of a butter biscuit base filled with saffron cream with granny smith apple, steamed with saffron, rosemary honey, and Manjari chocolate mousse. The Walnut Cake (WC) was guided by the "Fusion" trend, and it was made of a sable cake consisting of salted caramel cream, walnuts, and creamy milk chocolate. The Coulan Cake (CC) represented "Indulgence," and it was a Guanaja chocolate sponge cake with raspberry (Fig. 1d). Finally, to achieve "Tradition," the ChocoMuffin (CM) was a conventional muffin incorporated with a Guanaja chocolate filling.

Participants were then asked to write down the first four words, ideas, sensations, or emotions that came to mind when looking at the images of each of the (randomly presented) pastries. For each cake, they were also asked to indicate how they rated the cake presented on a 9-point scale (1 = Dislike very much, 5 = Neither like it nor dislike it, 9 = Like very much). Finally, the participants answered a sociodemographic questionnaire that aimed to provide information on gender, age, nationality, marital status, and consumption of products in the category "sweets, cakes, and biscuits."

All valid words were considered for data analysis. The words mentioned by the participants from each country were initially spell-checked and translated into English. The free word association data was qualitatively analysed through a thematic analysis and, according to similarity, grouped into different dimensions. This classification was obtained through triangulation [12,17]. For all countries, three researchers first conducted a semantic analysis of the terms according to their interpretation and individually defined their categories. Categories were merged into different dimensions using the same procedure.

For each country, the frequency of mention of each word was calculated. Terms mentioned by at least 5% of the participants were considered for quantitative analysis to avoid loss of information [10,18]. The existence of statistical differences between countries in the frequency of mention of dimensions was tested using a Chi-square statistic. Finally, correspondence analyses (CA) were performed to assess the association between the different significant. Statistical significance was set at $p < 0.05$. All data analyses were performed employing the software XLSTAT® 2022, v.2.1 [19].

3. Results and Discussion

Table 1 presents the socio-demographic characteristics of the participants. A total of 822 surveys were collected, of which 242 corresponded to residents in Spain, 84 to Colombia, 137 to Mexico, 108 in the United Kingdom, and 251 to Portugal. The percentage of female respondents to the survey was higher across all five populations. The majority of participants were living with a partner or with family, regardless of their place of residence. The population with the lowest average age was the Mexican population (24±10 years), while the Colombian population was the oldest (44±12).

Table 1. Participants profile.

	CO[1]	UK	SP	MX	PO
Age ± SD	44±12	36 ±11	36 ±14	24±10	42±13
Participant's percentaje	10	13	29	17	31
Gender (%)					
Male	24	18	40	26	35
Female	75	82	59	74	63
N/D	1	0	1	0	2
Marital status (%)					
Single	63	42	49	63	35
Married or in a couple	31	48	43	31	55
Widow	1	0	1	1	10
Divorced	2	4	1	2	1
Other	2	6	7	2	0
Where do you live?(%)					
Alone	13	16	11	2	19
With a partner	24	35	24	1	33
With family	58	44	56	85	57
In a shared apartment	0	3	7	11	1
Other	5	3	2	1	0

Note: (1) CO: Colombia; ES: Spain; RU: United Kingdom; MX: Mexico; PO: Portugal.

All participants provided 16399 validated words for the visual evaluation of five cakes. The participants from Portugal (5020 elicited words) and Spain (4819 elicited words) demonstrated a broad range of adjectives and phrases when eliciting words associated with the visual stimuli. Their vocabulary was rich and descriptive, providing detailed and nuanced assessments of the stimuli. However, in contrast, the participants from Colombia (1660 words) used fewer descriptors and were less expressive in their evaluations. These words were grouped into 16 dimensions. Applying the chi-square test for the terms elicited by the participants ($\chi2=1367.766$, df= 15, $p < 0.0001$) reveals significant differences among the association dimensions based on different participant's countries. Table 2 shows the word-associated dimensions, citation frequency, and total Chi-square test results based on participants' country of residence. The most frequently elicited dimension for all participants corresponds to "organoleptic properties," including positive and neutral connotations, as expected for a food product's visual evaluation. Although the product cannot be tasted, it is undeniable that the assessment of visual appearance contributes to the consumer's appreciation of flavors or textures that the consumer can experience [20]. The "hedonic properties" dimension, in a positive connotation, follows in importance according to the frequency of appeared terms associated with words like "good,

tasty, sweet, and appetizing." On the opposite side, the dimensions "organoleptic proper-
ties (negative)" and "others," which include a miscenanic group of words associated with
the stimulus, have a lower frequency of emerged terms.

Table 2. Description of Dimensions for each country, total citations in each dimension, and total Chi-
square test results.

	CO(1)	SP	UK	MX	PO	χ^{-2}
Food & beverages	155	**517 (+)**	200	**299 (+)**	**413 (-)**	21.35
Context	**147 (+)**	**451 (+)**	**134 (-)**	204	**263 (-)**	66.22
Body & Health	53	146	**42 (-)**	**64 (-)**	**217 (+)**	37.43
Body & Health (negative)	102	**455 (+)**	135	**140 (-)**	**202 (-)**	122.92
Emotional (neutral)	**49 (+)**	**129 (+)**	39	71	**81 (-)**	19.89
Emotional (negative)	**67 (+)**	**82 (-)**	36	**89 (+)**	**65 (-)**	68.90
Emotional (positive)	**137 (+)**	**218 (-)**	**58 (-)**	**281 (+)**	313	150.20
Gastronomy	138	**334 (-)**	**376 (+)**	**319 (+)**	**343 (-)**	234.68
Other	19	**100 (+)**	27	36	**16 (-)**	63.23
Hedonic properties (negative)	14	49	21	25	**73 (+)**	8.13
Hedonic properties (positive)	199	498	**175 (-)**	**226 (-)**	**682 (+)**	69.89
No sensory properties	**47 (-)**	**178 (-)**	**130 (+)**	125	**282 (+)**	40.16
Organoleptic properties (neutral)	**212 (-)**	**603 (-)**	**488 (+)**	434	823	107.71
Organoleptic properties (negative)	**40 (+)**	80	**7 (-)**	50	**112 (+)**	35.91
Organoleptic properties (positive)	271	798	**206 (-)**	**328 (-)**	**1090 (+)**	181.06
Tradition & innovation	**10 (-)**	**181 (+)**	**86 (+)**	49	**45 (-)**	140.08
Total word number	1660	4819	2160	2740	5020	

Note: (1) CO: Colombia; ES: Spain; RU: United Kingdom; MX: Mexico; PO: Portugal. According to Fisher's
exact test, the values in bold are significant at the alpha=0.05 level. (+) or (−) indicates that the observed value
is higher or lower than the expected theoretical value.

The correspondence analysis (CA) of these dimensions enabled the identification of
the profile of each country according to participants' associations. Figure 1 shows the sim-
ple correspondence analysis of the dimensions classified from the visual evaluation of the
five stimuli for participants from five countries. The two first factors explained 84.18% of
the variance observed. F1 accounted for 53.96% of this variance and was positively corre-
lated with tradition & innovation, body & health (negative), context, or gastronomy. F2,
accounting for 30.22% of the variance, separated PO and SP participants of the MX and
UK mainly because of these associations with gastronomy terms. Participants from SP
elicited more words related to tradition and innovation, body and health with negative
connotations, while PO participants elicited more terms about hedonic properties. In ac-
cordance with cross-cultural studies [12,13], the perception of cakes can be considered a
complex, multi-dimensional construct including emotional, organoleptic, and hedonic
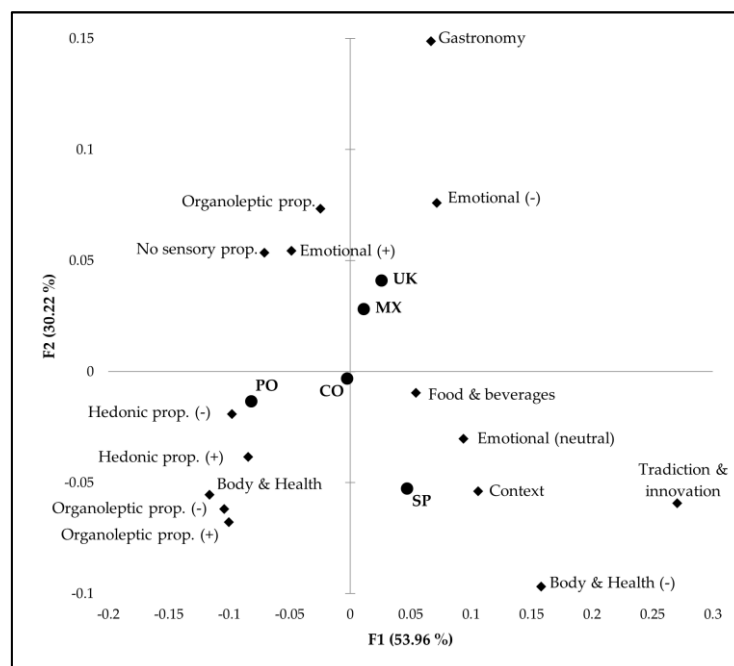properties.

Figure 1. Correspondence analysis of the dimensions classified from the terms elicited for all participants. CO(Colombia); SP(Spain); MX(Mexico); UK(United Kindom); PO (Portugal).

4. Conclusions

This study underscores the importance of understanding consumer motivations and perceptions in food product selection and highlights the significance of sensory and hedonic properties in high-end pastry cakes.

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