

# Emotional Response to Different Types of Cakes through Visual Assessment †

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† Presented at the 2nd International Electronic Conference on Foods, 15–30 October 2021; Available online: <https://foods2021.sciforum.net/>.

**Abstract:** Thinking of present gastronomic trends is inevitable when talking about innovation in Haute Pastry. Despite the rising demand for new creations, launching a successful product that meets the high expectations of consumers is increasingly complex. For this reason, sensory analysis studies are more and more interested in studying the emotions generated by these products to understand and improve user experiences. The main goal of this work was to conduct a study to analyze the emotional arousal of consumers after the visualization of 5 special cakes. For data collection, an online questionnaire with EsSense Profile® scale and CATA methodology has been used. EsSense Profile® is a predefined and validated scale that measures emotions generated by food that includes 39 terms. When analyzing the emotions expressed by all the participants 22 are statistically significant, of which 14 are classified as positive, 6 as neutral, and only 2 are negative. The results obtained support the importance of the emotional profile to understand consumer's expectations and behavior.

**Keywords:** visual assessment; check-all-that-apply; emotions; EsSense Profile®

**Citation:** Alba-Martínez, J.; Bononad-Olmo, A.; Cunha, L.M.; Martínez-Monzó, J. Emotional Response to Different Types of Cakes through Visual Assessment. *2021*, *1*, x.

<https://doi.org/10.3390/xxxxx>

Academic Editor(s):

Published: date

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## 1. Introduction

The current concept of gastronomic innovation is experiencing growing public and professional interest [1]. Although culinary creativity has always existed, today that creativity focuses mainly on haute cuisine. Inevitably, due to similar intuitive product development traditional bakeries have also been affected by this 'modernist cuisine' phenomenon. Thus, its transformation into what is known as haute pastry has turned it into a technical, rigorous, and multidisciplinary area. This high-quality pastry could be considered like an "ephemeral art", which in addition to technique has an aesthetic and emotional sensitivity in the reconciliation of flavors, colors, textures, and shapes of the different ingredients that are part of each composition [2–4]. Therefore, when it comes to perceiving a haute patisserie cake, visually speaking, the consumer is exposed to a variety of emotional experiences, often unconsciously. It has been proved that food selection depends mainly on sensory attributes that are based on visual perception [5]. This visual sense provides the most references to the client since 80% of the information in commercial spaces is obtained through sight [6]. When evaluating emotional responses of consumers to food products, distinguished information is obtained that contributes to the understanding of consumer behavior and expectations, and the acceptance of new products [7]. These emotional responses that arise from the visual signals caused by the perception of a relevant stimulus [8], play an essential role in adding value to the product

and directly controlling the expectations and perception of the consumer [9]. Indeed, consumers are very often carried out by the unconscious emotional evocation of a product to decide to satisfy their desire to purchase [10].

The main goal of this work was to study the emotional response of consumers after visual evaluation of five cakes, using online questionnaire.

## 2. Materials and Methods

### 2.1. Stimuli

Five cakes with different characteristics designed by “Casa La Curra” (Torrent, Valencia, Spain) were used in this study (Figure 1). A “Coulan cake” (CC) with molten chocolate heart of Guanaja 70% and raspberries (Figure 1a) was created. The “Leonor cake” (LC) was made of a dacquoise base of coconut and almonds, filled with creamy almond praline and 34% Ivory lemon mousse with white chocolate, and decorated with candied orange pieces (Figure 1b). “Saffron cake” (SC) consisted of a base of butter biscuit filled with a saffron cream with Granny Smith apple, steamed with saffron, rosemary honey, and mousse of Manjari chocolate 64% (Figure 1c). “Walnut cake” (WC), is made of a sablée breton topped with salted caramel cream, nuts, and creamy milk chocolate (Figure 1d). Finally, the “Chocomuffin” (CM) is a conventional muffin incorporated with a filling of 70% Guanaja chocolate (Figure 1e).



**Figure 1.** Stimuli designed by “Casa La Curra”: (a) Coulan (CC), (b) Leonor cake (LC), (c) Saffron cake (SC), (d) Walnut cake (WC), (e) Chocomuffin (CM).

Pictures were taken with a Nikon D200 camera with Nikkor 24–70 mm f/2.8S objective (Nikon Corporation Tokyo, Japan). A white uniform background and three led panel light Neewer (Shenzhen Neewer Technology Co, China) were used to ensure constant lighting conditions in the room.

### 2.2. Participants

Participants were invited to complete the online survey by email and by social networks. The contact list included students, staff, and lecturers of the Universitat Politècnica de Valencia, and other contacts. It is important to notice that, as is usual in qualitative research, this study did not intend to be representative of the entire Spanish population, but rather to test the results of questionnaires online to obtain inferences about emotional response to visual evaluation. A total of 381 answers were obtained and analyzed.

### 2.3. Questionnaire

The electronic questionnaire implemented for this task was designed with RedJade® Online Survey Tool (Redjade Sensory Solutions, LLC, Martinez, CA, USA). The questionnaire included: (i) food frequency questionnaire of sweet products and subjective hunger,

(ii) visual evaluation using EsSense Profile® (39 emotions) [11] in a CATA list, (iii) socio-demographic questions. Each survey lasted approximately 10 min. The online questionnaire was available for 2 weeks.

#### 2.4. Statistical Analysis

Cochran's Q test was performed on each of the CATA list emotions to detect differences in consumer perception of cakes ( $p < 0.05$ ). Correspondence analysis (CA) was used to investigate the association between the cakes and the expected emotions. A principal component analysis (PCA) was performed with the emotions and visual acceptance, and willingness to buy. All analyses were performed using XLSTAT statistical software (version 2021 Addinsoft®, New York, NY, USA).

### 3. Results and discussion

#### 3.1. Emotional Profile after Visual Evaluation

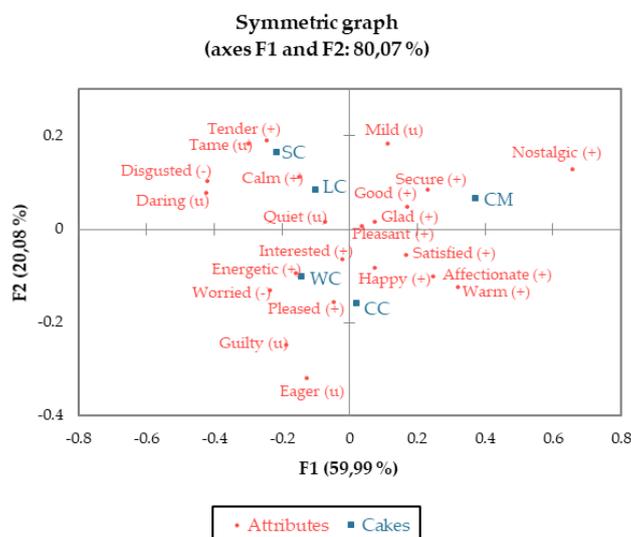
The CATA data analysis was done initially with all attributes. Cochran's Q test allowed to choose only those that show significant differences between the different cakes ( $p < 0.05$ ). Consequently, 22 significant emotions are selected from the EsSense Profile® with which the emotional profile of each of the five cakes can be studied (Table 1). Of which 14 are positive, 6 are neutral, and 2 are negative.

**Table 1.** Cochran's Q test for each emotion.

Emotion	<i>p</i> -Values	Emotion	<i>p</i> -Values	Emotion	<i>p</i> -Values
Bored (-)	0.420	Happy (+)	<0.0001	Good (+)	<0.0001
Joyful/Merry (+)	0.281	Nostalgic (+)	<0.0001	Guilty (u)	<0.0001
Daring (u)	0.000	Mild (u)	0.004	Energetic (+)	0.011
Warm (+)	0.000	Affectionate (+)	0.008	Whole (+)	0.057
Wild (u)	0.071	Loving (+)	0.466	Worried (-)	0.009
Steady (u)	0.214	Good-natured (+)	0.310	Aggressive (u)	0.066
Free (+)	0.753	Glad (+)	0.008	Disgusted (-)	<0.0001
Secure (+)	0.007	Pleased (+)	0.001	Calm (+)	0.014
Active (+)	0.690	Tame (u)	0.002	Tender (+)	0.003
Friendly (+)	0.127	Peaceful (+)	0.108	Enthusiastic (+)	0.054
Adventurous (+)	0.765	Quiet (u)	0.002	Interested (+)	0.028
Understanding (u)	0.617	Pleasant (+)	0.018	Satisfied (+)	<0.0001
Polite (u)	0.883	Eager (u)	<0.0001		

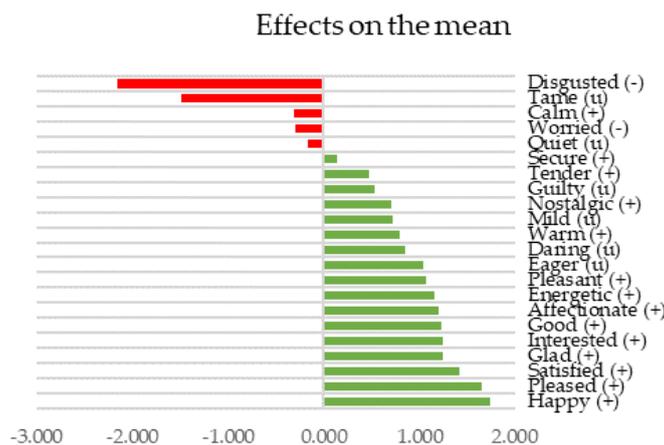
In green the significant attributes ( $p < 0.05$ ). Note: (+) positive emotion; (-) negative emotion; (u) neutral emotion.

Figure 2 shows the correspondence analysis of the significant emotions. The two cakes Leonor Cake and Saffron Cake are associated with calm and delicate emotions, due to their careful design. On the other hand, Chocomuffin is linked to the attributes "secure" and "nostalgic", because of its widespread and frequent consumption, which is associated with positive emotions that bring back good memories. Walnut Cake and Coulan Cake are relatively close on the emotional map although Coulan Cake is more related to "happy" and "pleased"; perhaps because it is made of chocolate, an appreciated comfort ingredient commonly associated with pleasure [12]. Walnut Cake makes you feel "energetic" and "worried" because of its attractive but caloric ingredients that generate a feeling of concern, but it is also perceived as a source of energy.



**Figure 2.** Symmetric graph of the correspondence analysis of the significant emotional responses obtained with CATA EsSense Profile®. Note: (+) positive emotion; (-) negative emotion; (u) neutral emotion, and WC (Walnut cake); LC (Leonor cake); SC (Saffron cake); CC (Coulan cake); CM (Chocomuffin).

When analyzing the effects that each attribute has on the mean (Figure 3), it is observed that only 5 have a negative effect. The two emotions that provoke consumers’ rejection are “disgusted” and “tame”. It is suggestive to point out that the adjective “disgusted” is the most common when the respondent evaluates a product that he considers unpleasant [13,14]. The rest of the words have positive effects, highlighting “happy”, “pleased” and “satisfied” as the ones that have the best impact. This analysis allows us to consider which emotions must be evoked, and which must not if we want a new cake to be successful in the market, based on our consumers’ profile.

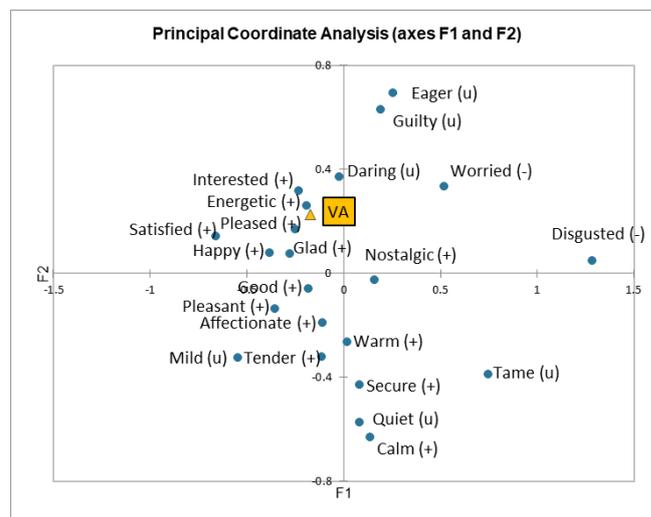


**Figure 3.** Graph of the effects on the mean for each significant attribute. Note: (+) positive emotion; (-) negative emotion; (u) neutral emotion.

### 3.2. Visual Acceptance and Willing to Buy

Subsequently, the variables “visual acceptance” (VA) and “willing to buy” (WTB) were analyzed to identify the emotions with which they are related to. Figure 4 represents the principal coordinate analysis in the form of an emotional map that places VA among the different significant attributes. It can be said that a cake with greater visual acceptance

is mainly associated with the emotions “energetic” and “interested”. On the other hand, the one that is mainly related to “disgusted” produces a certain visual rejection. Again, it is striking that when a cake is related to the neutral adjectives “daring” and “guilty”, more visual tolerance is generated than with the adjectives “secure” and “calm”, classified as positive. These types of emotions, related to trust, are common when evaluating a product that is widely accepted [15,16]. Therefore, given the importance of visual acceptance in consumer expectations, this analysis shows important aspects to be considered.



**Figure 4.** Symmetric graph of the principal coordinates analysis with the variable “Visual acceptance” (VA), of the significant emotional responses obtained with CATA EsSense Profile®. Note: (+) positive emotion; (-) negative emotion; (u) neutral emotion.

Tukey’s HSD multiple comparison analysis was performed to compare each group of cakes according to the variables VA and WTB (Table 3). Saffron Cake has a significantly lower value of VA than the rest, which makes it the least visually appreciated by the participants. Leonor Cake and Walnut Cake present significant differences with Saffron Cake and with Chocomuffin and Coulan Cake. And the last group without significant differences is Chocomuffin and Coulan Cake, the most visually accepted. These last two cakes are the best known and most familiar to the respondents; so, the fact of being used to them directly influences their general acceptance in a positive way [15].

As to WTB variable, the results do not follow the exact same distribution. The two cakes that inspire the most desire to buy are Chocomuffin and Coulan Cake, with a slight non-significant preference over the first one. In this case, no statistically significant differences were found in the WTB of Leonor Cake and Saffron Cake, which did appear with Chocomuffin and Coulan Cake and only Leonor Cake presented differences with Walnut Cake. Finally, Walnut Cake and Saffron Cake form a homogeneous group with statistical differences from the one formed by Chocomuffin and Coulan Cake. It should be noted that despite being the worst valued visually, Saffron Cake shows a greater willingness to buy than the Walnut Cake, which had a greater VA.

**Table 3.** Means of the answers obtained according to Visual Acceptance (VA) and Willing to Buy (WTB) for each cake.

	WC	LC	SC	CC	CM
VA	4.13 (B)	4.15 (B)	3.78 (A)	4.75 (C)	4.81 (C)
WTB	3.17 (Z)	3.54 (Y)	3.31 (YZ)	4.40 (X)	4.63 (X)

The different superscripts indicate the significantly different groups according to tukey’s and fisher’s tests. Note: WC (Walnut cake); LC (Leonor cake); SC (Saffron cake); CC (Coulan cake); CM (Chocomuffin).

#### 4. Conclusions

The results obtained support the importance of the emotional profile to understand consumer's expectations and behavior. This work opens to the authors future areas of study to understand effects of emotions on eating behavior for Haute Pastry products.

**Author Contributions:** Conceptualization, J.A.-M., J.M.-M. and P.G.-S.; methodology, A.B.-O. and J.A.-M.; formal analysis, A.B.-O.; investigation, A.B.-O., J.A.-M. and P.G.-S.; resources, J.M.-M. and P.G.-S.; data curation, A.B.-O. and P.G.-S.; writing—original draft preparation and editing, A.B.-O., J.A.-M.; writing—review, L.M.C., P.G.-S. and J.M.-M.; supervision, L.M.C. and P.G.-S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Ethical review and approval were waived for this study, due to all data are anonymized and this kind of studies don't need approval by IRB at UPV.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:**

**Acknowledgments:** Pastry team in "Casa La Curra" that designed all cakes to this project.

**Conflicts of Interest:** The authors declare no conflict of interest.

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