



Research Article

Textual Information on Food Packaging Addressing Several Sensory Modalities

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Abstract

Currently, product packaging is an important marketing tool and a substantial criterion in the consumer decision-making process. From a sensory marketing perspective, product packaging can be used to address consumers' senses and communicate the sensory characteristics of products. However, packaging does not necessarily possess special sensory properties that affect sensory perception. Verbal (i.e., amodal) sensory information may also shed light on the sensory properties of a product and can be influential in steering consumer responses. We examined the effects of verbal sensory information on nine categories of packaged food products in a large-scale quota sample experiment and found a sizeable positive effect of verbal sensory information on anticipated emotions, embodied mental simulation, and intention to purchase. Moreover, we identify highly significant effects of product category. Therefore, our results point to the critical role of category in determining the effectiveness of verbal cross-modal sensory information.

Keywords: Sensory Marketing; Verbal Sensory Information; Cross-Modal Correspondence; Single-Sense and Multiple-Sense Information

Textual information on food packaging addressing several sensory modalities

Problem description

Setting the scene

Food packaging refers to “all the ways food and beverages are boxed, wrapped, arranged, and presented to consumers in retail stores” [1]. Product packaging can be regarded as a highly important factor in consumer decision-making processes in contemporary market environments. This is particularly so when considering that a substantial number of purchasing decisions are made in-store [2] and that consequently, product packages serve as important extrinsic cues. However, they are also important cues for Internet shoppers when browsing webpages showing wrapped food. Product packaging affects consumer responses such as product selection, intention to purchase, and perception of

quality [3]. The concept of packaging design incorporates multiple elements such as verbal information, pictures, shape, size, colors, and graphic design. In particular, the information displayed on the front of the packaging, the so-called front-of-package information, is relevant in marketing, as this type of information can, in contrast to mandatory back-of-package information, be controlled by marketers [1]. In general, packaging often communicates the brand name and logo, price, or origin of a product but fails to provide any information about its sensory characteristics, although trying to take advantage of consumers' senses could positively affect buying behavior positively [4].

Krishna [5] defines sensory marketing as that which “engages consumers' senses and affects their perception, judgment, and behavior.” In recent literature, the concept of multisensory marketing has been used to describe marketing measures that appeal to multiple senses, as addressing multiple senses is acknowledged as being capable of evoking stronger and more favorable consumer responses (see, for instance, [6]).

Sensory modalities play a vital role in all the stages of consumption.

However, the relevance of separate senses varies between these stages. When consumers choose and buy products, the dominant sensory modality is vision, which enables them to gather relatively large amounts of information in a comparatively short time [7].

During the purchase of food products, consumers lack reliable information regarding the sensory experience of the product; thus, extrinsic cues are vital [8]. However, it is possible to code information regarding the sensory attributes of products in language, and thus communicate them as cognition [9]. Cognitively conveyed information about a product's sensory properties is also referred to as amodal sensory information [5]; that is, information lacking the typical stimulus and perception conditions for a sensory modality. In this study, we refer to verbally conveyed amodal sensory information as verbal sensory information.

The relevance of verbal sensory information arises from several factors, two of which are emphasized here. First, as previously mentioned, the dominance of sight over other sensory modalities during the product selection and purchase stages is acknowledged [7]. Cognitive neuroscience research provides a second explanation for the relevance of verbal sensory information, and current studies show connections between verbal information and the activation of certain parts of the brain, with these brain regions not just tied to the modality in which the information has been presented [10]. Indeed, sensory stimuli are not processed in isolation; rather, manifold associations (i.e., cross-modal correspondences) between sensory modalities may occur. Cross-modal correspondences constitute “nonarbitrary associations that appear to exist between different basic physical stimulus attributes, or features, in different sensory modalities” [11]. Several empirical studies have provided evidence of consistent cross-modal correspondence between verbal information and sensory attributes in non-synesthetic individuals, reporting, for example, the correspondence between verbal stimuli and tastes or flavors [12], as well as odors [13].

Moreover, empirical work gives reason to assume that our senses shape language: Studies demonstrate that sensory metaphors (such as describing a person as ‘cold’ instead of unfriendly) are more memorable, tend to be used more frequently than non-sensory (semantic) equivalents, and evoke more associative cues because they involve the senses [14]. Furthermore, recent research indicates that language can be used to construct synaesthetic metaphors (connections between concepts referring to different sensory modalities) in print advertisements. An example of a synaesthetic metaphor is a ‘sweet voice,’ in which a hearing-related concept is described through a taste-related attribute [15].

Building on these considerations, scholars have shown that verbal sensory information, as an extrinsic cue, is highly relevant to sensory and hedonic consumer responses [16]. Support for this assumption stems, *inter alia*, from neuroimaging studies indicating

that verbal sensory information may affect brain responses. For instance, such information may modulate cortical representations of taste [17] and activate the olfactory brain regions [10]. However, the effects of verbal sensory information on consumer responses have not received much academic attention in the field of consumer research. To date, studies have examined the effects of descriptive sensory food names on the evaluation and choice of food [18], as well as the effects of verbal sensory information on the choice of product [4], and food acceptance [19]. However, the research on the influence of verbal sensory information is limited.

Responses to verbal sensory information

Extrinsic information is capable of stimulating the anticipation of a product's attributes, and thus generates sensory and hedonic expectations [3]. These preconceived beliefs about product attributes are highly relevant as they may create bias in the sensory perception of products [20] and evoke expectations regarding future pleasure when consuming the product. This may, in turn, affect decisions about consumption and make the consumption experience more enjoyable [21].

The imagination of emotions, which “are expected to be experienced in the future if certain events do or do not occur” [22], is referred to as the construct of anticipated emotions. These are “spontaneous reactions to an external stimulus” that describe consumers' expected feelings in the future [23]. The extant literature suggests that the tendency of consumers to anticipate the experience of consumption and the emotions associated with it becomes more relevant and likely, the more products possess experiential qualities [24]. Thus, anticipated emotions seem particularly relevant to food products.

Moreover, research provides reason to assume that consumers will not only anticipate emotions, but also simulate prior perceptions associated with products when confronted with relevant information; that is, viewing visual or verbal information about a product may induce similar behaviors to interact with the product. Scholars conclude that “our initial perceptions of objects, both conscious and nonconscious, are stored in memory and are simulated or played back on subsequent encounters with not only the object itself but also representations of that object, such as verbal and visual depictions” [25].

The concept of embodied mental simulation suggests that when interacting with a product, our brains encode and integrate all sensory perceptions (e.g., how it feels, looks, or smells) related to the product. When we are subsequently confronted with (verbal or visual) information regarding a product, we are likely to mentally simulate perceptions previously associated with the product. This process of embodied mental simulation results in neural activation of the same sensory brain regions that are active during sensory perception [26]. These assumptions are based on

embodiment theory, which aims to explain the linkage between 'low' cognitive processes as perception and 'high' cognition as language processing and comprehension [27].

Embodied approaches to language comprehension suggest that verbal descriptions of our perceptual (sensory) world—that is, descriptions of what we see, feel, hear, taste, or smell—are mentally simulated within the brain's perception and action systems [28]. In other words, understanding verbal sensory information may initiate processes used to perceive the real-world referent of a word. However, there is no conclusive empirical evidence of such mental simulation processes for all human senses. While the literature indicates that sound words are mentally simulated, there is no clear evidence for the mental simulation of olfactory information [29], which highlights the importance of gaining a more profound understanding of the potential effects of verbal sensory information on embodied mental simulation.

In addition to anticipated emotions and embodied mental simulation, extrinsic cues may affect buying behavior [30], particularly the intention to purchase [31].

Research agenda

Regarding the composition of verbal sensory information, the number of senses addressed by sensory information may affect consumer responses in the same way that multiple-sense information (compared to information stimulating only a single sense) enhances perceptions of taste [32]. This has been confirmed and extended by work reporting the positive effects of (verbally presented) multiple-sense information on the valence and number of sensory associations of a product [33]. However, owing to the lack of studies that systematically approach this topic, more comprehensive insights into the effects of the number of senses addressed are lacking.

Given the findings above, we put forward the following research question:

RQ 1: In which way does verbal sensory information displayed on product packaging addressing either a single sensory modality or more than one modality affect consumer responses?

Drawing on previously reported findings, we hypothesize that:

H1 to RQ 1: Verbal sensory information will favorably affect a) anticipated emotions, b) embodied mental simulation, c) intention to purchase, and that, d) this effect will be stronger for multiple-sense information than for single-sense information.

Sensory information does not always operate in the same manner. Although the literature points to the effectiveness of extrinsic food cues [34], several empirical studies report surprising results, which

provide a reason to assume that the effects of extrinsic cues could be biased by numerous factors. Bialkova et al. [35] assume that the effects of verbal sensory information depend on the product category for which sensory information is employed. One possible explanation for the relevance of the product category may be found in the fact that knowledge of the product category can affect consumers' use of extrinsic cues such as verbal sensory information [36]. Moreover, considering that hedonic expectations can affect sensory perceptions [37], as well as behavioral intentions [38], the sensory appeal associated with the product category could also be decisive in modulating the effects of verbal sensory information on consumer responses.

However, the effects of product categories have not been subject to systematic investigation; thus, it remains unclear whether and in what way different product categories may cause heterogeneous responses to verbal sensory information. Therefore, we propose the following research question:

RQ 2: Does sensory information have a different effect on consumer responses across different categories of packaged food products which vary regarding their sensory appeal?

Scientific work suggests that various demographic, psychographic, and socioeconomic predictors may influence the use of information provided in food packaging [39]. In particular, the gender and age of respondents are acknowledged to affect the processing of sensory cues, and extant research indicates that women tend to use information provided on food labels more frequently and conscientiously than men [40]. Additionally, scholars point to the fact that thresholds for elaborative processing of sensory stimuli differ by gender [41].

Younger and older consumers differ in their perceptions and interpretations of food labels [42]. Research suggests that older consumers are more vigilant about sensory attributes and consider more characteristics when evaluating foods [43]. Consistent with this finding, age has been found to be a significant predictor of food label use in some studies. However, while some scholars conclude that older consumers tend to use food labels more intensively [40], others argue that younger consumers are more influenced by information on labels than middle-aged or older consumers [44].

The current state of hunger during participation in a study may bias consumer responses because it relates to sensory sensitivity [45] and may affect brain responses to food cues [46], thus potentially influencing consumers' reactions to the stimuli. Finally, sensory and hedonic expectations, such as the expected liking for a product, may shape the effects of extrinsic cues on perceptions of a product [47]. Using these considerations, we employed gender, age, feelings of hunger, and liking a product as covariates. Figure 1 illustrates this conceptual model.

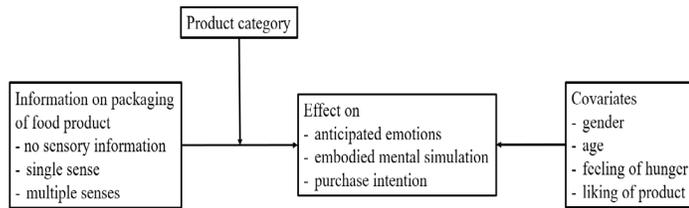


Figure 1: Conceptual model.

Empirical study

Method

We employed a mixed 3-9 two-factor experimental design, with the number of sensory modalities addressed by sensory information serving as a between-subjects factor, resulting in three experimental conditions (CG: control group, no sensory information; EG1: Single-Sense Information; EG2: Multiple-Sense Information). In the single-sense condition, amodal sensory information targets only one sensory modality at a time (taste, texture, or smell), whereas in the multiple-sense condition, two different sensory modalities are stimulated simultaneously (e.g., taste and smell). Nine different products (cereal bars, chocolate, cookies, crisps, honey, ketchup, raisins, rice cakes, and smoothies) served as the within-subjects factor which varied with respect to their sensory appeal (e.g., crisps vs. rice cakes). The selection of these products is based on several considerations. First, recent literature suggests that the strength of the association between food products and sensory modalities depends on the perceived health of the food. Speed [48] showed that unhealthy foods are more strongly associated with all perceptual modalities (particularly taste, smell, and interoception) than are healthy food products. As unhealthy food is believed to be more attractive than healthy food, investigating products that differ in sensory appeal could be enlightening in this context. Second, all products can be classified as snacks or snack-related (ketchup and honey) rather than as full meals. Third, all the products were presumably familiar to and affordable for our respondents (regarding honey, the product used in our study was a standard honey and not an exclusive variety). Moreover, the use of verbal sensory information seems meaningful for different products as all of them contain different flavors/types. Finally, our selection of products is pragmatic as they are all packaged with labels that can be manipulated.

Images of real product packaging were manipulated using the graphics software package Adobe Photoshop to design single-sense, multiple-sense, and control conditions for each product. The stimuli varied only regarding the manipulated factor (i.e., the sensory information provided) but were kept identical across the groups in all other respects (e.g., color, shape, or size). To ensure the same length (word count) for all stimuli, we employed two sensory attributes referring to the same sensory modality in the single-

sense conditions and combined two sensory attributes referring to different sensory modalities in the multiple-sense conditions. For example, ketchup was described as “*Mild* ketchup. Delicate *taste* of sun-ripened tomatoes” (a single sense: flavor) or as “*Mild* ketchup. Delicate *smell* of sun-ripened tomatoes” (multiple senses: smell and flavor) (Figure A1 of Appendix A). For chocolate, either the information “*Pleasantly bitter*. Balanced cocoa and mint *flavor*” (a single sense: flavor) or “*Pleasantly smooth*. Balanced cocoa and mint *flavor*” (multiple senses: texture and flavor) were provided. Sensory attributes were selected based on an online pretest ($n = 100$ consumers in a Central European country), in which we asked respondents to list all sensory attributes associated with the different categories. After checking for plausibility and valence (only attributes that could be regarded as positive/desirable for the respective category were included), the most frequently mentioned attributes per sensory modality were used to develop the stimuli. The stimuli of the control condition included the product name (e.g. “Ketchup”), but no sensory or other information in order not to confound responses. Appendix A provides the exact wording (in German with a translation into English) of the sensory information used for data collection under the two experimental conditions for each product. Appendix B presents all labels.

The study was conducted in a laboratory located at a Central European university to ensure that all participants encountered the same sensory and environmental conditions (e.g., lighting, setting, sounds, and room temperature). The data collection form was a paper-and-pencil questionnaire. A team of trained research assistants supported the data collection. They recruited respondents in this Central European country based on a predefined quota for age and gender who were invited to participate in a study on ‘packaging design.’ The subjects were randomly assigned to the single-sense condition, multiple-sense condition, or control group. In each condition, participants received photo albums with images of the packaging of nine products and were asked to answer questions regarding each product based on their packaging. To avoid sequence bias, the order of products was manipulated systematically. Respondents’ anonymity was protected, and they could terminate responding at any time. After completing the questionnaire, they were debriefed, dismissed, and did not receive compensation for their participation.

Anticipated emotions, embodied mental simulation, and intention to purchase were response variables. Self-assessment was performed using well-established scales. For embodied mental simulation, although this construct is related to bodily reactions (i.e., mental simulation may lead to neural activation of many of the same sensory regions of the brain that are active during perception), the aim of our study was not to measure and substantiate the activation of brain regions, but rather to investigate whether verbal sensory information is likely to evoke or enhance mental simulation.

Operationalization as self-assessment is a common practice in the literature (see, for instance, [25] and is based on the understanding of mental simulation as “product-related imagery or imaginary product experiences that consumers project in their minds based on relevant marketing information they receive” [49]. Therefore, we considered self-assessment as an appropriate measure in this context. Appendix C presents the measurement details (also for the covariates) and psychometric properties, which were highly satisfactory.

Altogether, 421 respondents (quota sample), 51% female and 49% male, participated in this study. Respondents’ ages ranged from 15 to 91 years, with an average of 44 years. Participants indicated that they were moderately hungry (a mean of 3.15 on a 7-point scale, increasing with feelings of hunger) at the beginning of the study. The average liking for the products ranged from 3.52 (for rice cakes) to 5.69 (for chocolate). Group sizes for the experimental conditions were balanced (approximately 140 per group). Appendix D displays the averages for all the variables used in this study.

Results

Tables 1–3 present the results provided by a mixed design ANCOVA for each response variable; being product specific,

the covariate liking could not be included in this analysis. The marginals of response variables have been estimated by a series of univariate ANCOVAs, also including the liking of the product as a covariate. We note that the differences between these marginals and the marginals based on the mixed design ANCOVA (ignoring liking) are negligible, i.e. the significant influence of liking affected all the experimental groups to about the same extent.

Anticipated emotions. Table 1 shows the significant main effects of both, experimental condition and product category. Moreover, hunger, as a covariate, significantly enhanced anticipated emotions. The influence of gender and age is product-specific (right column of Table 1) and the results have face validity. Regarding the number of senses stimulated, sensual information (i.e., information stimulating one or two senses simultaneously) is advantageous over a stimulus without any verbal sensory information. Evaluations of anticipated emotions in general, and the effects of verbal sensory information in particular, differ across different products. Consistently, marginals are smaller for the CG than for the EGs; addressing the two sensory modalities is preferable in most but not all (e.g., smoothies) cases. Rice cakes had the lowest anticipated emotions. Raisins, smoothies, honey, and rice cakes deserve particular mention, as marginal anticipated emotions were significantly different across the experimental groups.

Response Variable: Anticipated Emotions (AE)			
Effect Variable	F	p-level	Report on more detailed (statistically significant, type I error of 5%) results
EG	4.97	<0.01	<p>EG: overall, AE are higher for EG1 and EG2 than for CG (pairwise comparisons)</p> <p>Product⁽¹⁾: in particular, for raisins, smoothies, honey, and rice cakes AE differ over experimental conditions</p> <p>Gender: honey, rice cakes, and smoothies induce higher AE emotions for female (than for male) participants</p> <p>Age: cereal bars, crisps, ketchup, and smoothies induce higher AE for younger, but raisins for older respondents</p> <p>Hunger: AE increase with hunger (not for honey, raisins, and rice cakes)</p> <p>Liking⁽²⁾: AE increase with the liking of a product consistently</p>
Product	14.34	<0.01	
Gender	1.88	0.17	
Age	0.87	0.35	
Hunger	20.29	<0.01	
Product × EG	0.92	0.54	
Product × Gender	5.74	<0.01	
Product × Age	12.87	<0.01	
Product × Hunger	1.23	0.28	
<p>Notes: Mixed design ANCOVA: between factor - experimental group EG (3 levels); within factor – product (9 levels); covariates: gender, age, hunger</p> <p>⁽¹⁾based on a series of univariate ANCOVA <i>F</i>-tests (for each product category) with gender, age, hunger, and liking as covariates</p> <p>⁽²⁾results for liking according to a series of separate univariate ANCOVAs</p>			

Table 1: Anticipated emotions, results of mixed design ANCOVA.

Response variable: Embodied Mental Simulation (EMS)			
Effect Variable	F	p-level	Report on more detailed (statistically significant, type I error of 5%) results
EG	2.24	0.11	<p>EG: overall, EMS is higher for EG1 and EG2 than for CG (but at a 10% level only, pairwise comparisons)</p> <p>Product⁽¹⁾: in particular, for raisins and honey EMS differ over experimental conditions</p> <p>Gender: rice cakes and smoothies induce higher EMS for female (than for male) participants</p> <p>Age: cereal bars, crisps, ketchup, and smoothies induce higher EMS for younger, but raisins and chocolate for older respondents</p> <p>Hunger: EMS increases with hunger (not for honey, ketchup, raisins, and rice cakes)</p> <p>Liking⁽²⁾: EMS increases with the liking of a product consistently</p>
Product	11.02	<0.01	
Gender	0.41	0.52	
Age	2.53	0.11	
Hunger	15.50	<0.01	
Product × EG	1.15	0.31	
Product × Gender	4.37	<0.01	
Product × Age	13.47	<0.01	
Product × Hunger	1.05	0.39	
<p>Notes: Mixed design ANCOVA: between factor – experimental group EG (3 levels); within factor – product (9 levels); covariates: gender, age, hunger</p> <p>⁽¹⁾based on a series of univariate ANCOVA <i>F</i>-tests (for each product category) with gender, age, hunger, and liking as covariates</p> <p>⁽²⁾results for liking according to a series of separate univariate ANCOVAs</p>			

Table 2: Embodied mental simulation, results of mixed design ANCOVA.

Embodied mental simulation. Table 2 presents results similar to those for anticipated emotions; however, the effect of the experimental manipulation was weaker. We consider similar patterns of results remarkable, as both variables represent different constructs. While anticipated emotions refer to predictions of the emotional consequences of a behavior [50], the concept of mental simulation relates to cognition, particularly the theory of grounded cognition [49], postulating that cognition is based on sensorimotor processing. Mental simulation is the mechanism for grounding cognition and is understood as a type of mental imagery that reinforces modal processing. The mechanism of mental imagery can be described as “the ability to reactivate and manipulate

modality-specific mental representations when current sensory stimulation or overt motor action is absent, and this ability can be associated with the subjective experience of perceiving or acting within one’s mental world” [51]. The concept of embodied mental simulation proposes that based on a link between language and the sensorimotor system, our bodies interact with their environment [52] and simulate their perceptions of objects [25]. However, both anticipated emotions and mental simulation may be understood as prefactuals, which “capture the idea of something that is not yet a fact but could well become a fact” [53]. This common base may account for the similar patterns in the results.

Response variable: Purchase intention (PI)			
Effect Variable	F	p-level	Report on more detailed (statistically significant, type I error of 5%) results
EG	2.21	0.11	<p>EG: overall, PI is higher for EG2 than for CG (pairwise comparisons)</p> <p>Product⁽¹⁾: in particular, for raisins and honey PI differ over experimental conditions</p> <p>Gender: females are more inclined than males to purchase honey, rice cakes, and smoothies</p> <p>Age: younger respondents prefer crisps, ketchup, and smoothies; older respondents prefer chocolate, honey, and raisins</p> <p>Hunger: PI increases with hunger (not for honey, ketchup, and rice cakes)</p> <p>Liking⁽²⁾: PI increases with the liking of a product consistently</p>
Product	15.36	<0.01	
Gender	7.42	<0.01	
Age	0.05	0.82	
Hunger	20.34	<0.01	
Product × EG	1.11	0.34	
Product × Gender	3.94	<0.01	
Product × Age	14.43	<0.01	
Product × Hunger	1.77	0.08	
<p>Notes: Mixed design ANCOVA: between factor - experimental group EG (3 levels); within factor – product (9 levels); covariates: gender, age, hunger</p> <p>⁽¹⁾based on a series of univariate ANCOVA <i>F</i>-tests (for each product category) with gender, age, hunger, and liking as covariates</p> <p>⁽²⁾results for liking according to a series of separate univariate ANCOVAs</p>			

Table 3: Intention to purchase, results of mixed design ANCOVA.

Purchase intention: Table 3 reveals the highly significant within-subject effects of product, hunger, and gender as covariates on purchase intention. However, the effect of the number of senses was not statistically significant. A closer investigation of the marginals reveals a similar (but somewhat weaker) pattern of results as for anticipated emotions. Overall, the simulation of multiple senses is (directionally) advantageous compared to addressing a single sense, which is, again, more favorable than the absence of verbal sensory information.

Conclusions

Results concerning RQ1 – verbal sensory information on product packaging

Effects of verbal sensory information in general. Our results demonstrate the positive effects of verbal sensory information on consumer response. Interestingly, as regards the strength of the effects of verbal sensory information on the response variables investigated here, these effects are the stronger, the more ‘sensory-related’ (i.e. the closer to the visualization of the sensory experience of the product) the response variables are. While highly significant effects of the number of senses stimulated by verbal sensory information on anticipated emotions emerge, this effect is only marginally significant for embodied mental simulation and intention to purchase. Thus, our findings provide (directional) support for H1a, b, and c.

Effects of number of senses addressed by sensory information.

As hypothesized, our results clearly demonstrate that the number of senses addressed by the sensory information does affect consumer responses. This is because the stimulation of multiple senses generates more positive consumer responses than single-sense information, which again proves more advantageous than the absence of verbal sensory information (EG2 > EG1 > CG). However, while the effects are admittedly weak, surprising deviations for certain products can be observed (i.e., partial support for H1d).

Results concerning RQ2 – Effects of product category

Unambiguous product effects exist across all the categories. The highly significant within-subject effect of the product across all the response variables investigated leaves no doubt that the product category might bias the effects of verbal sensory information. As the interpretation of these biasing effects is complex, a closer look at certain categories that reveals surprising response patterns seems worthwhile.

Verbal sensory information is particularly useful for raisins, rice cakes, and honey. Remarkably, an inspection of the product categories reveals certain commonalities, as all these categories represent polarizing products with, at least to some extent, a lower sensory appeal inherent to the product (raisins, rice cakes), or can be regarded as challenging depending on their ambiguous

classification as healthy or unhealthy, with the resulting implications (honey, raisins). Hence, our results indicate that the use of verbal sensory information may be particularly effective for polarizing product categories. This finding is particularly remarkable as recent literature provides valid arguments supporting the opposite by showing stronger associations for unhealthy (hence sensorially appealing) food than for healthy (and less appealing) food for all perceptual modalities [48]. It is possible that the provision of sensory information might have helped establish stronger sensory associations, especially for products that could not be clearly classified as sensorially appealing. Importantly, it should be emphasized that the use of verbal sensory information might be intricate and demanding in such cases. Therefore, particular attention should be paid to the careful development and testing of this information (the next subsection describes such targeting in more detail).

Results Concerning Covariates

Responses to certain products differed by gender; honey, rice cakes, and smoothies induced stronger anticipated emotions for female than male participants. Moreover, rice cakes and smoothies elicited higher embodied mental simulation for female respondents. These findings may, to some extent, be explained by the fact that according to the extant literature, women are more likely than men to purchase these products (which is in line with our results). This might point to a more extensive knowledge of these products for women than for men, possibly accounting for the more favorable responses of the female participants regarding these (see, for example, [54] for the gender effects regarding honey consumption, and [55] for a discussion of the role of gender with respect to chocolate). Remarkably, studies have also revealed a more critical attitude of women (compared to men) towards sugar, gluten, dairy, red meat, white flour, alcohol, and food additives [56] and indicating that women tend to prefer healthier food.

Regarding age, certain products caused different responses, depending on the respondents' age. Overall, chocolate, honey, and raisins prompt more favorable responses from older consumers. Raisins evoke stronger anticipated emotions, a higher degree of embodied mental simulation, and higher purchase intentions for older respondents than for younger consumers. Chocolate induces a stronger degree of embodied mental simulation and a higher intention to purchase, while honey causes a higher intention to purchase for older consumers.

A review of the literature in the fields of nutrition and eating behavior may account for these findings. Honey may be regarded as an extraordinary and highly complex product that differs remarkably in terms of consumers' appearance, composition, and sensory perception by consumers [57]. Literature suggests that the intention to purchase honey increases with increasing consumer age. According to some authors, one explanation for this effect

might be found in the fact that older consumers tend to pay more attention to their health, and honey is a traditional health food [54]. Thus, the health benefits of honey seem to be of vital importance regarding consumer responses, with the propensity to consume honey for health purposes being influenced by consumer characteristics such as age and gender [58].

Interestingly, in addition to behavioral intentions, the relevance and quality of the sensory perceptions of honey seem to depend on age. Older consumers are better at describing and perceiving the sensory properties of honey [59], whereas younger consumers consider price a more relevant criterion than sensory characteristics when purchasing honey [60] (this remark is based on further results not presented in detail in this paper). We consider this a noteworthy finding that might account for the positive responses of older respondents towards honey in our study.

Raisins represent a similarly polarizing category, being frequently referred to in everyday discourse as a controversial snack or 'love or hate product.' Although raisins have traditionally been suspected of being cariogenic (i.e., promoting dental caries), recent studies have proposed the opposite and showed that raisins have antibacterial properties that may reduce oral pathogens, which could even make them beneficial for oral health [61].

Regarding chocolate, socio-demographic factors are acknowledged to play a vital role, with the literature proposing more favorable responses towards chocolate for older and female respondents [55]. While we did not find any gender effects for chocolate, our results confirmed the favorable effect of increasing age on responses to chocolate.

Younger respondents tended to rate cereal bars, crisps, ketchup, and smoothies the most favorably. As these categories tend to represent "snack products," our findings may be indicative of the recognition that the food preferences of younger consumers are often for "fast food" [62]. Additionally, scholars emphasize the tendency of younger cohorts to consume more industrial and semi-industrial food products, which are characterized by their often intensive and sweet taste [59]. This may have biased the sensory perceptions of younger consumers. Moreover, younger cohorts consider other criteria such as price, which is more relevant than the sensory characteristics of products [60]. We consider both findings worthy of remark, as they might account for age differences in the processing and perception of the verbal sensory information. This could be a promising avenue for future research to investigate how sensory information should be designed to enhance the attractiveness of healthier products to younger consumers.

Moreover, as put forward in our conceptual model, feelings of hunger significantly affected anticipated emotions, embodied mental simulation, and the intention to purchase, in particular, for food edible on its own (i.e., snacks rather than honey or ketchup).

Naturally, liking a product had a positive impact on the response variables, but we did not observe any product-specific patterns.

Implications

This study has scientific and practical implications because it investigates the effects of verbal sensory information, particularly the impact of the number of senses addressed by verbal sensory information. Moreover, this research sheds light on the effects of product category, which remains largely ignored in the academic literature. Our empirical work provides the first argument for why the provision of verbal sensory information might be particularly promising for product categories characterized by either low sensory appeal or polarizing associations regarding their benefits. We consider this a noteworthy finding, as, against this background, verbal sensory information might contribute to the reduction of barriers to the consumption of sustainable/climate-friendly products (which share the prejudice of being less sensorially appealing than their conventional counterparts), or novel foods.

Moreover, our research highlights the role of socio-demographically induced particularities in consumers' perceptions of different products, with important implications for the development of appropriate sensory information for different categories and target groups. Our results can be easily applied to packaging design and marketing for food products and contribute to a general understanding of the potential range of use of verbal sensory information.

Limitations and further research

In this study, the participants responded to pictures of food packaging. We report the responses before the product was tasted. Bearing in mind that extrinsic cues might be capable of altering sensory perception and responses after tasting, empirical work employing real products, incorporating the opportunity to taste these products, and assessing responses after tasting would be an interesting expansion of this experiment. Beyond that, and against the background that we find significant effects of product category, the inclusion of further categories and the systematic investigation of the potential causes for these effects, possibly including real and fictitious brands, offers a promising avenue for future research. Although we distinguished between single- and multiple-sense information, our results did not provide reliable insights into the effectiveness of separate sensory modalities. Thus, there is a strong need for future research on the effects of the stimulation of different senses.

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Appendix A – stimuli used in the experimental conditions



Figure A1: Single-sense and multiple-sense stimuli for ketchup.

Note: This figure presents the actual stimuli used in the empirical study conducted in German language. Please refer to Table A2 for the translation of verbal cues.

To avoid potential fuzziness resulting from translation, Table A1 provides the original stimuli used for data collection (in German), Table A2 provides their English translations, and Appendix B presents the original labels.

Product	EG 1: single sense	EG 2: multiple senses
Cereal bars	Mit feinem Bananengeschmack , aus honigsüßem Getreide	Mit feinem Bananengeschmack , aus knusprigem Getreide
Crisps	Gesalzene Chips, natürlicher Geschmack	Gesalzene Chips, knuspriger Genuss
Chocolate	Zart bitter . Ausgewogener Kakao- und Minzgeschmack	Zart schmelzend . Ausgewogener Kakao- und Minzgeschmack
Cookies	Knackige Schokolade, knuspriger Keks	Feiner Schokoladengeschmack , knuspriger Keks
Honey	Fein süß Wiesenhonig. Naturbelassener voller Geschmack	Zart duftender Wiesenhonig. Naturbelassener voller Geschmack
Ketchup	Mildes Ketchup. Feiner Geschmack von sonnengereiften Tomaten	Mildes Ketchup. Feiner Duft von sonnengereiften Tomaten
Raisins	Geschmack sonnengereifter Trauben. Besonders süß	Geschmack sonnengereifter Trauben. Besonders zart
Rice cakes	Knusprige Textur , locker gepuffte Reiswaffeln	Voller Geschmack , locker gepuffte Reiswaffeln
Smoothies	Fruchtig-frischer Smoothie, aus süßen Früchten	Fruchtig-cremiger Smoothie, aus saftigen Früchten

Table A1: Single-sense and multiple-sense stimuli employed in the study.

Product	EG 1: single sense	EG 2: multiple senses
Cereal bars	With a delicate banana flavor , made of honey-sweet cereals	With a delicate banana flavor , made of crunchy cereals
Crisps	Salted potato chips, with a natural taste	Salted potato chips, crisp delight
Chocolate	Pleasantly bitter . Balanced cocoa and mint flavor	Pleasantly smooth . Balanced cocoa and mint flavor
Cookies	Crisp chocolate, crunchy cookie	Chocolate taste , crunchy cookie
Honey	Delicate sweet meadow honey. Natural full taste	Delicate aromatic meadow honey. Natural full taste
Ketchup	Mild ketchup. Delicate taste of sun-ripened tomatoes	Mild ketchup. Delicate smell of sun-ripened tomatoes
Raisins	Taste of sun-ripened grapes. Especially sweet .	Taste of sun-ripened grapes. Especially tender .

Rice cakes	Crisply textured, lightly puffed rice cakes	Full-taste, lightly puffed rice cakes
Smoothies	Fruity-fresh smoothie, made of sweet fruits	Fruity-creamy smoothie, made of juicy fruits

Table A2: Single-sense and multiple-sense stimuli employed in the study (translations).

Appendix B – labels used in the experiment

Product	EG 1: single sense	EG 2: multiple senses	CG: no sensory information
Cereal bars			
Crisps			
Chocolate			

Cookies			
Honey			
Ketchup			
Raisins			



Appendix C – Measurements

Anticipated emotions. Following [9] and [40] three items framed as a semantic differential scale (7-point response format) measured anticipated emotions: Having read the product description, I imagine that eating [product] will be (1) “not exciting” ... “exciting,” (2) “not fun” ... “a lot of fun,” (3) “not enjoyable” ... “enjoyable.”

	α	VE1	CR	AVE
Cereal bars	0.94	0.90	0.94	0.85
Chocolate	0.96	0.93	0.97	0.90
Cookies	0.95	0.91	0.95	0.87
Crisps	0.94	0.90	0.94	0.85
Honey	0.91	0.85	0.92	0.78
Ketchup	0.94	0.89	0.94	0.83
Raisins	0.95	0.91	0.95	0.86
Rice cakes	0.95	0.91	0.95	0.87
Smoothies	0.96	0.93	0.96	0.89

α : Cronbach alpha reliability

VE1: variance explained by a single factor solution (exploratory factor analysis)

CR: Construct reliability

AVE: Average variance explained (confirmatory factor analysis)

Table C1: Psychometric properties – anticipated emotions.

Embodied mental simulation. Following [26] three items framed as an itemized rating scale (7-point response format) measured embodied mental simulation: (1) Please rate the extent to which images of eating [product] come to your mind? (“not at all” ... “to a great extent”); (2) To what extent could you imagine eating [product]? (“not at all” ... “to a great extent”); (3) How many images of eating [product] came to your mind? (“few or no images” ... “lots of images”).

	α	VE1	CR	AVE
Cereal bars	0.89	0.82	0.89	0.73
Chocolate	0.91	0.85	0.92	0.78
Cookies	0.90	0.84	0.90	0.76
Crisps	0.90	0.84	0.90	0.76
Honey	0.89	0.82	0.90	0.74
Ketchup	0.87	0.80	0.88	0.70
Raisins	0.91	0.85	0.91	0.78
Rice cakes	0.91	0.85	0.92	0.78
Smoothies	0.90	0.83	0.90	0.75

α : Cronbach alpha reliability
VE1: variance explained by a single factor solution (exploratory factor analysis)
CR: Construct reliability
AVE: Average variance explained (confirmatory factor analysis)

Intention to purchase. Respondents were asked to indicate how likely they were to purchase each product on a 7-point rating scale [26]. Furthermore, direct questions were asked regarding *liking* [product] (7-point rating scale), *hunger* (7-point rating scale), *age* (in years), and *gender*.

Appendix D – Descriptives

	Cereal bars	Chocolate	Cookies	Crisps	Honey	Ketchup	Raisins	Rice cakes	Smoothies
AE ^(1,4)	4.73	4.05	4.52	4.46	4.90	4.45	3.98	3.62	4.55
EMS ^(2,4)	3.99	3.57	3.90	3.82	4.04	3.63	3.44	3.18	3.93
PI ^(3,4)	4.63	3.88	4.48	4.22	4.83	4.87	3.96	3.87	4.30
Liking ⁽⁴⁾	4.60	5.60	5.01	4.33	4.89	4.23	3.88	3.52	4.48
Hunger ⁽⁴⁾	3.15								
Age ⁽⁵⁾	44								

Notes:
⁽¹⁾Anticipated emotions ⁽⁴⁾7-point scale
⁽²⁾Embodied mental simulation ⁽⁵⁾Domain [15 years; 91 years]
⁽³⁾Intention to purchase

Table D: Averages of all variables used in the study.