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Title Page

To look tasty, let's show the ingredients! Effects of ingredient images on implicit tasty–healthy associations for packaged products

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Abstract

This study investigates the effect of ingredient images on implicit tasty–healthy associations for packaged products. An implicit association test (IAT) with 106 respondents reveals the impact of repeating ingredient images on the implicit healthy = tasty intuition; fewer ingredient images are linked to a stronger intuition. This study also considers explicit product packaging preferences and the number of ingredient images depicted. The implicit intuitions affect explicit preferences, such that packages depicting few ingredient images are preferred over those depicting many ingredient images for healthy products, but no significant effects emerge for unhealthy products.

Keywords

Implicit association; front-of-pack display; taste, ingredient image; food perception; healthiness

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1. Introduction

Package designs influence consumers' food product expectations and their implicit associations with healthiness and attractiveness, which in turn inform product choice and purchase decisions (Tijssen et al., 2017). Because consumer expectations reflect both taste and health cues (Fischler and Masson, 2008), food product managers need designs that convey both cues. In this sense, packaging might meet both expectations, whether separately or jointly, and package designers rely on various strategies to depict food ingredients (see Figure 1). Noting that previous research has investigated healthy–tasty perceptions for unpackaged products (Werle et al., 2013) and healthy–untasty perceptions for packaged products (Tijssen et al., 2017, 2019), we seek to complement these findings by investigating the effect of ingredient images on implicit tasty–healthy associations for packaged products.

In so doing, we consider evidence of the positive impacts of transparent packages that allow consumers to view the product (Simmonds et al., 2018) or of adding product images to packaging (Underwood and Klein, 2002; Underwood et al., 2001). Product depictions on the front of packages (FOP) facilitate consumers' evaluations (Underwood and Klein, 2002; Underwood et al., 2001), and more product images tend to enhance perceived product quantities (Madzharov and Block, 2010). Ingredient images inform consumers about product composition (Machiels and Karnal, 2016; Piqueras-Fiszman et al., 2013; Rebollar et al., 2017; Smith et al., 2015; Thomas and Capelli, 2018); induce inferences about the product's healthiness (Ares et al., 2013; Bialkova and van Trijp, 2011; Rebollar et al., 2017), tastiness (Lancelot Miltgen et al., 2016; Machiels and Karnal, 2016; Pantin-Sohier and Lancelot Miltgen, 2012; Rebollar et al., 2017; Smith et al., 2015), attractiveness, and sensorial properties; and evoke greater willingness to try the product (Piqueras-Fizman et al., 2013). Other studies reveal that when consumers shop while under substantial cognitive loads, depictions of natural ingredients encourage them to predict the product will be tasty (Thomas and Capelli, 2018). Thus, the number and type of ingredient images on packaging clearly can influence tastiness and healthiness perceptions. We seek to go a step further to consider their potential impact on the healthy–tasty association too (Werle et al. 2013).

In an effort to contribute to packaging design research, we demonstrate how an extrinsic cue, the number of ingredient images on a package, affects consumers' implicit health and taste perceptions of the product. First, FOP cues are implicitly associated with semantic brand

attributes (e.g., packaging shapes evoke gentle vs. strong performance attribute associations; Parise and Spence, 2012). Consumers often rely on evaluative shortcuts, triggered by packaging cues, to inform their food purchases and perceptions of product healthiness (Bublitz et al., 2013). Previous studies assess the explicit product evaluations prompted by FOP ingredient images (e.g. Pantin-Sohier and Lancelot Miltgen, 2012; Thomas and Capelli, 2018), which might ignore automatic associations, such as the healthy–tasty association, that arise from implicit product evaluations (Werle et al., 2013). Implicit assessments are of particular interest to explain consumers' purchases and eating choices in routine or habitual consumption situations (Rothman et al., 2009), including food purchases in supermarkets. Second, studies of how depicting ingredients affects purchases mainly deal with hedonic products and the addition of one (Lancelot Miltgen et al., 2016; Pantin-Sohier and Lancelot Miltgen, 2012; Rebollar et al., 2017) or several (Thomas and Capelli, 2018) different ingredients. Instead, we seek to determine how replicating the same ingredient image affects consumers' healthy–tasty association and product preferences. Third, we explicitly acknowledge the strong evidence that food choices effectively determine consumers' health and well-being (Bublitz et al., 2013; Koenigstorfer et al. 2014), and to advance this relevant theoretical domain, we specify how FOP ingredient depictions might reinforce the healthy–tasty association, alter perceptions, and push consumers to embrace their health-related goals.

Few flavor ingredient images (lemon and mint)

Many flavor ingredient images (lemon and mint)

Figure 1. Example FOP designs with varying quantities of flavor ingredient images

To achieve these contributions, the experimental design manipulates the number of flavor ingredient images depicted on the FOP in two steps, such that we can assess the consistency

between implicit and explicit evaluations. First, with an implicit association test (IAT) we assess the impact of repeated ingredient images on implicit tastiness perceptions for both healthy and unhealthy packaged product categories (n = 106). Second, we investigate explicit product packaging preferences relative to the repetition of ingredient images. Of relevance for food product packaging design decisions, we find that fewer FOP ingredient images on healthy products prompt dual evaluations of healthiness and tastiness.

2. Theoretical background

Consumers' food choices are influenced by both intrinsic quality cues and extrinsic cues, such as FOP images (Piqueras-Fiszman and Spence, 2015; Skaczkowski et al., 2016). The FOP might feature both nutrition facts, which provide information about the product's composition, and depictions or images of the product itself or its implied flavoring.

2.1 Graphic FOP elements

Packaging largely shapes consumers' first impressions of products (Orth and Malkewitz, 2008), especially FOP elements (Clement, 2007). The designs thus seek to attract consumers' attention (Krishna, 2010), with product information, slogans and labels, or visual elements and graphics, such as colors, images, shapes, and sizes (Silayoi and Speece, 2007; Underwood, 2003). Those external cues can influence both liking and purchase intentions (Mueller and Szolnoki, 2010), and both text and images can increase attention (García-Madariaga et al., 2019). We focus on ingredient images, as visual elements of the FOP.

Visual elements rely on specific metaphors and known associations to convey meaning (Karnal et al. 2016; Mai et al. 2016; Rahinel and Nelson, 2016; Sundar and Noseworthy, 2014). They tend to be processed first and automatically, as well as memorized more easily than textual information, so visual cues have received significant research attention (Luna et al., 2003; Paivio, 1971; Piqueras-Fiszman et al., 2013; Rettie and Brewer, 2000; Schoormans and Robben, 1997; Townsend and Kahn, 2013; Unnava and Burnkrant, 1991). For food products, more positive attitudes toward the visual appearance of the packaging increase perceived product quality (Wang, 2013). Even peripheral graphical elements (colors, images) unrelated to intrinsic product quality can function as heuristics that influence consumers' beliefs (Bone and France, 2001).

Among the different visual elements, product images have received especially close attention in studies that demonstrate the potential positive impacts on product beliefs, including tastiness (Poor et al., 2013), a feeling of hunger and the desire to eat (Simmonds and Spence,

2017), brand evaluations (Underwood and Klein, 2002; Underwood et al., 2001), and the quantity of products in the package (Madzharov and Block, 2010). Studying many similar product images depicted on the FOP, Madzharov and Block (2010) show that the number of units of whole product images influences consumer perceptions and consumption, because consumers use these images as a visual anchor. This anchor serves as a heuristic, such that consumers rely on this arbitrary numerical value (anchor) to estimate an unknown quantity (Wegener et al., 2010). That is, they base their judgments on a quantity of information that may not be relevant (anchor) and adjust them according to the particularities of the focal object. If an anchor appears relevant, people use it as a standard of comparison to reduce their uncertainty, through a link to a known object.

2.2. Ingredients on the FOP

The ingredients that constitute packaged food products are legally mandated to appear on packages, usually on the back, so that concerned consumers can find it. When nutrition information appears on the FOP, it implies a goal to provide ingredient and health information more readily for all consumers (Bialkova et al. 2013, Bialkova and Van Trijp, 2011; Van Herpen and Van Trijp, 2011), not just health-conscious ones who already seek out and use nutrition information to make purchase decisions (Visschers et al. 2010; Vyth et al., 2009, 2010). That is, consumers oriented toward a health goal likely consider product pictures after the nutritional information (Bialkova and van Trijp, 2011), but other consumers, who adopt preference orientations, do not process the detailed nutritional information at all (Raghunathan et al., 2006) and instead use heuristics, triggered by FOP cues, to make decisions (Bublitz et al., 2013). These heuristics can systematically bias their judgments and have negative implications for consumer well-being. For example, according to studies that rely on consumer self-reports, ingredient images depicted on packaging increase mental imagery about the product, such that it appears more pleasant, innovative, healthier, and tastier (Lancelot Miltgen et al., 2016; Pantin-Sohier and Lancelot Miltgen, 2012; Rebollar et al., 2017; Thomas and Capelli, 2018). Eye-tracking studies also show that flavor images capture more attention (Piqueras-Fiszman et al., 2013), though their impact depends on the type of scan that a consumer uses when considering the FOP (Rebollar et al., 2015). Among health-conscious consumers, images of unprocessed foods (e.g., orange for packaged orange juice) evoke naturalness and tastiness, in both self-reported and eye-tracking studies, and these perceptions in turn influence product evaluations (Machiels and Karnal, 2016; Smith et al., 2015). Even images of ingredients that are not formally contained in the product recipe

can increase perceived healthiness (Ares et al., 2013).

2.3 Implicit attitude toward food products

Memory has a key role in consumer choice and decision making (Bettman, 1979). Concepts stored in memory can be activated and affect consumer responses (Sela and Shiv, 2009), and this memory activation also can spread through networks of associations to link seemingly unrelated concepts, such as extrinsic and intrinsic cues (e.g., green labels and healthy food; Temple et al., 2011). Package information that emphasizes healthy or hedonic aspects thus can affect taste or healthiness perceptions (Tijssen et al., 2017). We anticipate that consumers encode links between the number of ingredients depicted on the FOP and the healthiness and tastiness of the product, which they then store in their memory.

To investigate this association, we need to measure implicit attitudes, or the attitudes that consumers adopt before they engage in any form of mental correction—that is, evaluative judgments about a target (Samson and Voyer, 2012). Consumers sometimes exhibit seemingly irrational behavior, induced by automatic and non-conscious cognitive processes. Despite having no rational basis, these processes can exert strong effects on judgments, attitudes, and perceptions (Greenwald et al., 1998; Nosek et al., 2011). The resulting attitudes, defined as associations between an evaluation and an object that are stored in memory and automatically activated upon exposure to the attitude object, determine automatic consumption behaviors. However, the associations also vary in strength and accessibility (Fazio et al., 1982, 1986). Therefore, to assess non-conscious consumption behavior, we need to measure the difference between effortful evaluations (explicit attitudes), measured explicitly with questionnaires, and automatic evaluations that consumers might not even be consciously aware of (Greenwald and Banaji, 1995). Explicit measurements cannot access introspective beliefs (Nisbett and Wilson, 1977; Petty and Cacioppo, 1996), such that people often cannot explain their own cognitive mechanisms and processes and remain unaware of the possible relationship between a stimulus and their responses. Furthermore, such measures may evoke a strong bias toward socially acceptable responses (Reynolds, 1982), because survey respondents tend to want to project a positive image to others (Bernreuter, 1933).

Without necessarily understanding why, people often experience ambivalent attitudes toward food, such that the same food can evoke positive and negative associations, depending on whether consumers evaluate it according to taste (Grunert, 2005; Hoppert et al. 2012) or healthiness (Michaelidou et al. 2012; Vyth *et al*., 2010) dimensions. As Zimmerman et al.

(2011) reveal, evaluative conditioning that alters implicit brand attitudes seemingly evokes a corresponding shift in explicit brand attitudes. In general, people are not aware of the associations and processes taking place in their minds, and various social dispositions and internal mechanisms (conscious or unconscious) further hinder their access to that information. Therefore, studying implicit attitudes, or an automatically activated attitude that the person is not conscious of (Greenwald and Banaji, 1985), is necessary to understand consumer behaviors that reflect such automatic processes (Ackermann and Mathieu, 2015).

With regard to eating behaviors, previous research on implicit attitudes establishes that for unpackaged products (Becker et al., 2015), affective associations (e.g., taste) implicitly influence attitudes. Furthermore, disparate associations of taste perceptions, across healthy versus unhealthy products, often drive how consumers attend to packaging elements (Songa and Russo, 2018). In research dealing with packaged products, the findings show that extrinsic cues affect implicit attitudes, so package cues that signal hedonic (vs. healthy) properties are implicitly perceived as tastier, unhealthier (Tijssen et al., 2017), and more attractive, even after repeated in-home exposures (Tijssen et al., 2019). Consumers also perceive food in red-colored (Huang and Lu, 2016) or vivid-colored (Mead and Richerson, 2018; Tijssen et al. 2017) packaging as unhealthier than that contained in blue-colored or muted, less color-saturated packaging. When consumers need to make heuristic taste inferences (i.e., cannot taste the product), light-colored packages stimulate favorable health impressions and activate detrimental taste inferences (Mai et al., 2016). Darker colors, perceived as heavy, can lead consumers to assess the food items as heavier, such that they seem richer or higher in calories, and this assessment affects their healthiness and taste perceptions too (Mai et al., 2016). We anticipate a similar effect of FOP ingredient images, such that more depicted ingredients evoke the sense that the product is heavier or richer, leading to lower healthiness but enhanced taste perceptions. Overall, many ingredient images depicted on the FOP thus may induce perceptions that products are tastier, compared with FOP depictions of fewer ingredient images.

Yet conceptual fluency also might be reduced if the FOP presents many ingredient images. When an association is conceptually fluent, it fits with what consumers already know (Kidwell et al., 2013). Fluent concepts and associations feel familiar and accurate and are easy to process (Winkielman et al., 2003), inducing greater acceptance (Chae and Hoegg, 2013). Considering previous evidence of the healthy = tasty implicit intuition for unpackaged products in France (Werle et al., 2013), we propose an effect opposite the hedonic = tasty that

Tijssen and colleagues (2017) identify for packaged products. That is, we predict that in France, healthy packaged products are implicitly perceived as tastier than unhealthy ones. But when the FOP presents many ingredient images, making the food seem heavier, richer, and thus less healthy, it may reduce the conceptual fluency of this tasty–healthy association (Werle et al. 2013), such that

> **H1: "Healthy = tasty" is stronger when the FOP depicts fewer, compared with many, ingredient images.**

Consumers rely on implicit attitudes to make buying choices (Songa and Russo, 2018), and food choices often are influenced by product healthiness perceptions (Aschemann-Witzel and Hamm, 2010). Specifically, when consumers have access to sufficient cognitive resources, their food choices lean toward healthy products (Shiv and Fedorikhin, 1999; Zimmerman and Shimoga, 2014). If they must choose between a healthy and an unhealthy product, they are influenced by implicit cognitive attitudes (healthiness) if their cognitive resources are high, such that impulsive eating behaviors are less likely (Trendel and Werle, 2016). When a neutral product is labeled as healthy, consumers evaluate it as being of better quality and more enjoyable to consume than a product labeled as unhealthy (Werle et al., 2013). A congruent visual image, signaling the food product category, evokes intrinsic product information, so the processing requires minimal cognitive effort (Gil-Pérez et al., 2019). However, if information challenges their previous experiences or expectations, people tend to avoid the incongruent signal (Wittlesea et al., 1990). If the packaging does not align with existing implicit attitudes (e.g., healthy = tasty), consumers might reject the product, because of the lack of conceptual fluency. Therefore, reinforcing the healthy = tasty association with a FOP that features fewer ingredient images might increase preferences for a healthy product.

In contrast, for unhealthy products, extrinsic information conveyed by packaging may prompt a process of sensation transfer, as long as the expectations elicited by the packaging information and the sensory characteristics match (Skaczkowski et al., 2016). If the FOP depicts many ingredients, this information fails to match the unhealthy = untasty association, in that many ingredients evoke perceptions of tastiness. A FOP that features a sole, health-related ingredient similarly conflicts with the unhealthy–untasty association. In both cases, the sensation transfer likely gets inhibited. Consequently, we propose:

> **H2a:** When healthy products' FOP depict many ingredient images, they are chosen less than when they depict few ingredient images.

H2b: When unhealthy products' FOP depict many ingredient images, they are chosen as often as when they depict few ingredient images.

To test these predictions, we investigate the impact of the number of FOP ingredient images on the healthy–tasty implicit association and explicit product choice, using IAT procedures together with self-reported choices (Greenwald and Nosek, 2008). As we noted previously, the IAT helps reduce the influence of social desirability biases in self-reports, which are pertinent in our study setting because the consumption of healthy or unhealthy food gives people a means to affirm their social identity (Reynolds, 1982). Implicit associations accordingly offer good predictors of self-reported choices (Greenwald and Nosek, 2008). Food product choices also tend to be made under high cognitive loads, so consumers may lack sufficient cognitive resources and rely on heuristics and automatic attitudes. Previous studies reveal correlations of positive implicit associations of healthy food with the actual choice, purchase, and intake of healthy (vs. unhealthy) foods (Ayres et al., 2011; Conner et al., 2007; Prestwich et al., 2011; Songa and Russo, 2018). Because food choices often are automatic and outside conscious awareness, implicit measures that account for habitual, automatic processing modes should improve understanding of the effects of FOP designs on product evaluations and associations (Tijssen et al., 2019).

3. Step 1: Impact of number of ingredient images on healthy = tasty association

We designed a study to investigate the role of the number of ingredient images depicted on the FOP of packaged food on French consumers' implicit healthy = tasty intuition. Similar to previous research (Werle et al., 2013), we used the IAT (Greenwald et al., 1998, 2003).

3.1 Method

The IAT we use assesses the strength of associations between healthiness and tastiness concepts by determining response latencies in computer-administered categorization tasks. The initial block of trials investigates healthiness perceptions (attribute dimension, hereafter). Specifically, the computer screens featured examples of two contrasting healthiness concepts, depicted as packages of healthy or unhealthy products, and participants had to classify them rapidly by pressing keys (e.g., e key for healthy, i key for unhealthy). The next block of trials investigates tastiness perceptions, using two target concepts. Presented pairs of contrasted concepts related to tastiness (i.e., words representing tasty and untasty valences) had to be classified using the same two keys. Then, in a first combined task, participants had to classify examples of all four categories, assigned to the same keys as in the initial two blocks (e.g., e

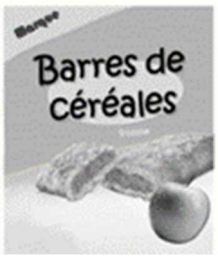
for healthy or untasty, i for unhealthy or tasty). The second combined task featured a complementary pairing (e.g., e for healthy or tasty, i for unhealthy or untasty). Respondents had to correct any errors before proceeding, and the latencies thus measure the occurrence of correct responses. The difference in average latencies between the two combined tasks provides the basis for the IAT measure. For example, faster responses for the {healthy-tasty/unhealthy-untasty} task than for the {healthy-untasty/unhealthy-tasty} task indicate a stronger association of healthy products than of unhealthy products with tastiness.

We introduce two FOP versions (few vs. many ingredient images) for the same product in a healthy/unhealthy category. Previous research underlines the risk of confounding effects when implementing a second distinction within a category (Bluemke and Friese, 2006; Govan and Williams, 2004; Mitchell et al., 2003; Steffens and Plewe, 2001); a recommended solution is to run and compare the same IAT twice, switching the variable used to represent the category. Yet De Houwer (2001) also establishes that the IAT tolerates substantial variance in an irrelevant attribute, and we posit that the variation in the number of ingredient images within the category is not a relevant attribute. Thus, we proceed with a single IAT procedure, because replicating the same image does not provide any additional information or alter the complexity of FOP processing (Pieters et al., 2010).

3.2 Stimuli

This study features two healthy (apple cereal bar, hazelnut cereal bar) and two unhealthy (cheese crackers, peanut snack cookies) packaged products, with unknown brands, to establish anchors of the healthiness attribute ("healthy" and "unhealthy"). Eight products were pretested using a within-subject questionnaire administered to 68 consumers (64% women, M_{age} = 22.6 years, SD = 8.12), who categorized products according to the level of perceived healthiness on 7-point Likert scales (e.g., "Do you agree or disagree with the following statement: the product is healthy"; 1 = strongly disagree, 7 = strongly agree). We also measured healthiness according to fat content perceptions, using a 7-point Likert scale (e.g., "In your opinion, this product is fatty"; 1 = strongly disagree, 7 = strongly agree) (Drewnowski and Darmon, 2005). Healthy products were perceived as healthier ($M_{healthy}$ = 4.31, SD = 1.7; $M_{unhealthy}$ = 2.90, SD = 1.3; t(66) = -3.297, $p < 0.01$) and less fatty ($M_{healthy}$ = 3.57, SD = 1.15; $M_{unhealthy}$ = 5.87, SD = 0.931, t(66) = -8.954, $p < 0.01$) than unhealthy products (see Appendix A). In addition, the two product FOP designs depicted either few or many ingredient images (Table 1). In a second pretest with 164 participants (58.5% women, M_{age} = 27.5 years, SD = 9.8), we confirmed that they perceived the multiplication of images,

by measuring perceived element numbers with a 7-point semantic differential scale (e.g., “In your opinion, the number of visual elements of this packaging is: large/small”; Pieters et al., 2010). For each pair of FOP designs, the one depicting fewer ingredient images appeared as containing fewer elements than the one depicting many ingredient images (see Appendix B). These two pretests validated our manipulation of healthy/unhealthy packaged products and the number of ingredient images. Finally, both target concepts (tasty/untasty) were represented by a list of 14 French words that previous research has categorized as “tasty” or “not tasty” (Werle et al., 2013).

ATTRIBUTES			
Healthy products		**Unhealthy products**	
Few flavor ingredients	Many flavor ingredients	Few flavor ingredients	Many flavor ingredients
			

TARGET CONCEPTS	
Tasty *	**Not tasty**
Tasty	Disliked
Delicious	Less tasty
Yummy	Unappealing
Appetizing	Bland
Flavorful	Flavorless
Appealing	Unappetizing
Mouthwatering	Unpalatable

*These terms were listed in French in the IAT but are translated here into English.

Table 1. Stimuli for the IAT

3.3 Data collection

One hundred six undergraduate management science students (69% women, M_{age} = 21 years; SD = 1.4) at a French university participated voluntarily in the laboratory experiment. The sample size reflects recommendations that the IAT should include about 81 respondents (Greenwald et al., 2009). The data collection used Dell computers, with 17-inch screens, equipped with Inquisit 3.0 software provided by Millisecond using JavaScript language. Each experiment lasted 10 minutes. The participants were told that their task was to categorize the stimuli shown in the middle of their screens by pressing the i or e key on the keyboard. The selected stimuli spanned four categories: (1) pictures of healthy foods, (2) pictures of unhealthy foods, (3) words associated with tastiness (e.g., tasty, delicious), and (4) words associated with a lack of taste (e.g., flavorless, unpalatable). In line with established protocols (Greenwald et al., 1998), the participants completed seven blocks of trials, three of which were practice blocks designed to familiarize them with the target stimuli and the categorization labels. They classified products according to their estimation of whether they belonged to a "healthy" or "unhealthy" product category (target concept) and their taste association as "tasty" or "not tasty" (attribute). Furthermore, the test included three learning task blocks (blocks 1, 2, and 5) and four combined test task blocks (blocks 3, 4, 6, and 7), as Table 2 outlines. The combined test task blocks provide the relevant input for this analysis (e.g., blocks 3 and 4, "healthy-tasty" and "unhealthy-not tasty"; blocks 6 and 7, "unhealthy-tasty" and "healthy–not tasty").

Block	**Number of trials**	**Function**	**Items assigned to left-side key (e)**	**Items assigned to right-side key (i)**
1	20	Single task-Practice	FOP picture of healthy food	FOP picture of unhealthy food
2	20	Single task-Practice	Good taste words	Bad taste words
3	20	Combined task-Practice	FOP picture of healthy food + Good taste words	FOP picture of unhealthy food + Bad taste words
4	40	Combined task-Test		
5	20	Single task-Practice	FOP picture of unhealthy food	FOP picture of healthy food
6	20	Combined task-Practice	FOP picture of unhealthy food + Good taste words	FOP picture of healthy food + Bad taste words
7	40	Combined task-Test		

Notes: Each FOP picture may feature few or many ingredient images.

Table 2. Order of blocks and procedure in the IAT

Stimuli from all four categories (FOP picture of healthy food, FOP picture of unhealthy food, words associated with good taste, words associated with bad taste) were presented for classification in the combined tasks blocks for 60 trials across blocks 3 and 4 and blocks 6 and 7 (see Table 2). An implicit belief that healthy foods are tastier (and unhealthier foods are less tasty) would be reflected in faster responses when the stimuli must be categorized in a condition in which the classification task is congruent with this intuition (i.e., participants paired healthy foods with words associated with tastiness), rather than incongruent (i.e., participants paired healthy foods with words associated with bad taste).

We also imposed several control measures. Specifically, we measured participants' diet restrictions on a 7-point Likert scale ("You pay a lot of attention to your diet"; 1 = strongly disagree, 7 = strongly agree) (Werle et al., 2013). We controlled for product liking, using a binary item (e.g., "Do you like apple cereal bars?" yes/no); all participants liked at least one product from each category. To control for food allergies, we used an open question, "Please state any food allergies you have," then excluded three participants who suffered from allergies to an ingredient that the product contains (e.g., gluten).

Notes: The left side represents the "healthy-tasty"/"unhealthy-not tasty" step (blocks 3 and 4), and the right side indicates the "healthy-not tasty"/"unhealthy-tasty" step (blocks 6 and 7).

Figure 2. Example IAT

3.4 Data preparation

Consistent with the current IAT scoring algorithm, we calculated a *D* score that includes all correct response latencies (Greenwald et al., 2003). We excluded two participants whose response times were faster than 300 milliseconds on more than 10% of the critical trials (resulting in a final sample of 101 participants). We also eliminated trial response latencies greater than 10,000 milliseconds and less than 400 milliseconds from the 5,146 trials in the combined task blocks, resulting in 4,972 trials for analysis. The IAT D score reflects the

difference between the two combined task blocks of trials ([congruent: healthy foods + tasty and unhealthy foods + not tasty] – [incongruent: healthy foods + not tasty and unhealthy foods + tasty], divided by the pooled standard deviation of response latencies across both blocks). A positive value indicates that healthy products are perceived as tastier than unhealthy products, and a negative value indicates that unhealthy products are perceived as tastier than healthy products.

3.5 Results

As a preliminary test, we calculated differences in response time and identified a positive and significant D score ($M_{IAT\ D} = 0.24$, SD = 0.03, t(101[1]) = 8.58, $p < 0.001$). That is, participants performed the categorization task faster for congruent associations, such as when healthy and tasty or unhealthy and not tasty were associated ($M_{Latency_congruent} = 989.54$ ms, SD = 803.30), than for incongruent associations, such as when healthy and not tasty or unhealthy and tasty were associated ($M_{Latency_incongruent} = 1205.24$ ms, SD = 968.01). These results confirm the associations observed in French consumption contexts (Werle et al., 2013), which conflict with those for U.S. consumers (Raghunathan et al., 2006) for packaged products.

In analyses of variance, we also added age, gender, and diet restrictions as covariates. Age and gender might influence people's propensity to accept products with non-traditional designs (de Bont et al., 1992). Dietary restrictions likely lead consumers to focus on objective nutritive information, more than other FOP elements (Skaczkowski et al., 2016). However, none of the covariates had a significant effect on latency ($p > 0.05$).

We also considered whether the number of FOP ingredient images influenced congruent or incongruent tasty/healthy associations. First, in a congruent categorization task, with healthy and tasty associated, we investigated whether the number of FOP ingredient images reinforced this healthy = tasty intuition by including the number of FOP ingredient images as a covariate. For designs with fewer ingredient images, participants made significantly faster associations in the congruent blocks ("healthy–tasty" and "unhealthy–not tasty"; $M_{Latency_few_ingredients} = 952.64$ ms, SD = 674,20) than they did when the FOP depicted more ingredient images ($M_{Latency_many_ingredients} = 1022.33$ ms, SD = 889.34; F(1.2201) = 4.15 p = 0.04). Second, in the incongruent categorization task, in which healthy and not tasty were associated, the FOP with fewer ingredient images did not evoke quicker associations in the congruent blocks ("unhealthy–tasty" and "healthy–not tasty"; $M_{Latency_few_ingredients} = 1164.97$ ms, SD = 938.80) than the FOP with more ingredient images ($M_{Latency_many_ingredients} = 1161.69$

[1] Or 4,970 trials.

ms, SD = 915.07; $p = 0.88$).

Because increasing the number of ingredient images does not provide any supplementary information or increase processing complexity, the significant impact of FOP images in congruent situations, compared with the insignificant impact in incongruent situations, provides a test of H1. The healthy = tasty intuition is stronger for FOP depictions of fewer versus many ingredient images, and this effect holds for congruent associations, excluding any information load effect. These findings support H1.

4. Step 2: Impact of the number of ingredient images on product choice

We also examine package preferences, according to the number of ingredient images and product healthiness perceptions. That is, we test whether consumers' implicit attitudes toward packaging, formed through repeated exposures to the FOP, influence their explicit preference for the product, with the prediction that implicit attitudes toward healthy and unhealthy products can influence food choices and consumer behaviors (Friese et al., 2008). With the same respondents from step 1, we gathered an exploratory, behavioral choice measure related to the product category (healthy vs. unhealthy) and packaging preferences, according to the number of ingredient images on the FOP (few vs. many). The stimuli were the same as those in step 1 as well (see Table 1).

4.1 Data collection

4.1.1. Procedure. Following the IAT, these participants had to choose which of two products they would prefer: healthy (cereal bar) or unhealthy (crackers and snack cookies). Then they indicated their preferred FOP design for the selected product category, between two options (few versus many ingredient images).

4.1.2. Measures. As covariates, we used gender, diet restriction, and age. We measured which product the respondents prefer ("Which of the products that you just viewed would you prefer to consume?"), using a randomized choice among four options: apple cereal bar (coded 0), peanut snack cookies (coded 1), hazelnut cereal bar (coded 2), and cheese crackers (coded 3). Healthy products were grouped and coded 0, and unhealthy products were coded 1. Then, we measured product preference ("Which product packaging do you prefer?"), according to the number of FOP ingredient images, with two binary measures: FOP with few ingredient images, coded 0, or FOP with many ingredient images, coded 1. That is, the FOP designs with few ingredient images were grouped and coded 0, and those with many ingredient images were grouped and coded 1.

4.2 Results

To assess the influence of the number of ingredient images on food choice, we used logit regressions with product category choice between healthy products (coded 0) and unhealthy products (coded 1) as the dependent variable. We performed all logistic regressions with and without covariates. The presence of covariates does not affect the significance of the results, so we present the results obtained without covariates (Simonsohn et al., 2015).

4.2.1. Product category and FOP preferences. Healthy products were chosen twice as often (67 respondents) as unhealthy products (34 respondents). The implicit attitude that healthy packaged products are tastier than unhealthy packaged products induces more frequent choices of the healthy packaged products (β = -0.69, Wald $\chi^2(1)$ = 462.25, p < 0.01, exp(B) = 0.50). To test whether the number of FOP ingredient images influences product choice, we used a logit regression, with FOP choice between few (0) and many (1) ingredient images depicted as the dependent variable. When the FOP design depicts few ingredient images, it prompts 20% more choices than the one with many ingredient images (β = -0.22, Wald $\chi^2(1)$ = 31.98, p < 0.01, exp(B) = 0.80).

4.2.2. Packaging preferences for healthy and unhealthy products. Next, we tested whether the number of FOP ingredient images influences product choices linked to product healthiness. In line with H2a, we find that healthy products with many FOP ingredient images are chosen less often, in just 18% of cases, compared with FOP depicting fewer ingredient images (β = -0.20, Wald $\chi^2(1)$ = 22.15, p < 0.01, exp(B) = 0.82). Healthy products appear preferred when their FOP design depicts fewer ingredient images. For unhealthy products, we find no significant effect of the number of FOP ingredient images on packaging preference (β = -0.01, Wald $\chi^2(1)$ = 0.01, p > 0.05), in support of H2b. Therefore, the number of ingredient images on the FOP does not influence unhealthy product preferences, and the results match those from step 1. An additional chi-square test confirms these results ($\chi^2(1)$ = 10.76, p < 0.01), as depicted in Figure 3.

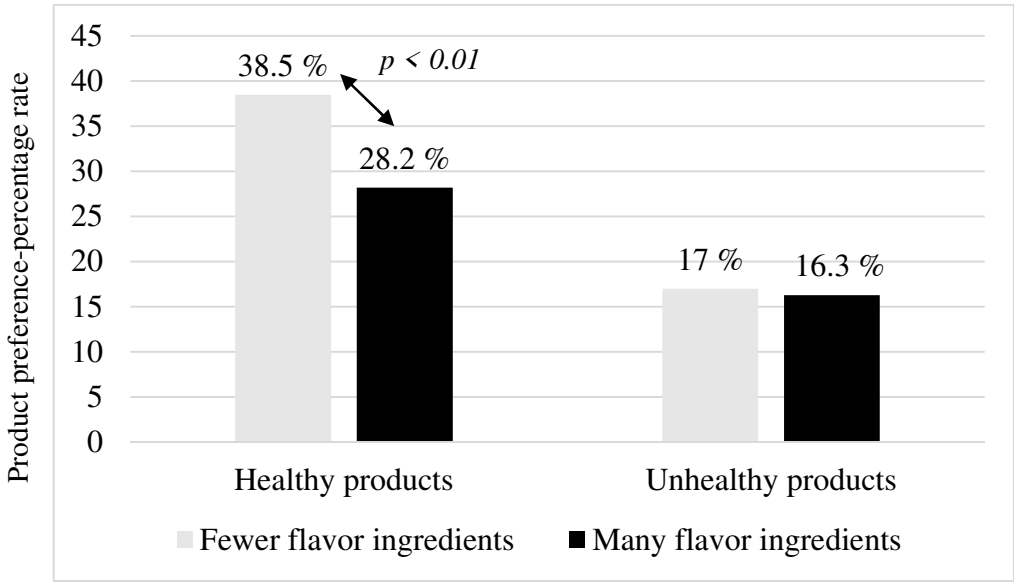


Figure 3. Distribution of participant preference for packaging, according to the number of FOP ingredient images and product healthiness

5. Discussion and conclusion

5.1. Theoretical contributions

By specifying how food product ingredient image depictions on the FOP affect consumers' implicit evaluations and explicit preferences, we offer several contributions to marketing and packaging design research. First, understanding the cognitive heuristics that consumers use to assess food product healthiness is critical, especially as a means to deal with increasing obesity rates in Western countries. A healthy = tasty heuristic favors the choice of healthy products (Mai et al. 2015), and reinforcing this association with packaging that depicts ingredient images represents a controllable, inexpensive means to help stimulate healthy food consumption: The fewer times the ingredient image is represented, the stronger the healthy = tasty intuition.

Second, previous research into the impact of extrinsic cues on packages on consumers' perception of food product usually focus on healthy (Festila and Chrysochou, 2018; Mai et al., 2016; Piqueras-Fiszman and Spence, 2015; Tijssen et al., 2017, 2019) or unhealthy (Skaczkowski et al., 2016) products, addressing the effect of a specific packaging cue on healthiness or tastiness perceptions. In contrast, we consider the association between healthiness and tastiness perceptions, which some consumers may perceive as conflicting attributes. The influence of packaging cues, such as the number of ingredient images, for reconciling these perceptions can effectively explain some consumer behaviors. In addition, this consideration refines existing evidence of positive outcomes in contexts in which the

healthy = tasty association exists (Mai et al., 2016; Werle et al., 2013), by specifying how extrinsic packaging cues can reinforce or mitigate this association.

Third, we extend literature dealing with the impact of extrinsic packaging cues on food product perceptions. For healthy products, we confirm that consumers intuit that healthy = few and unhealthy = many, reflecting the association of healthiness and diet restrictions in many developed countries (Rozin et al., 1999). These results support the generalization of saturation effects (Tijssen et al., 2017), such that fewer ingredient images issue a signal of healthiness similar to that evoked by pale package colors. Repeating the same image appears to exert an effect similar to that of the repetition of color pixels in saturating the packaging, which signals a heavier product. For unhealthy products though, our results do not confirm an anchoring effect of product images (Madzharov and Block, 2010), because we do not find that more ingredient images induce tastier product perceptions.

Fourth, to establish that the effects of FOP ingredient images do not depend solely on the implicit method, we present implicit results that are congruent with explicit preferences for particular product packages. Healthy products depicting few FOP ingredient images are preferred over healthy products that depict many images. In contrast, the number of FOP ingredient images for unhealthy products does not alter product preferences. Our results thus confirm that implicit evaluations inform explicit choices (Trendel and Werle, 2016). For hedonic, unhealthy products, our results contrast with the explicit positive impact of the number of FOP ingredient images on perceived taste (Thomas and Capelli, 2018). That is, explicit perceptions of tastiness are stronger for packaging with many (vs. few) ingredient images, but we do not find the same positive effect for implicit associations with healthiness or observed choices.

5.2. Managerial implications

At a time when public authorities in many countries are trying to fight obesity, we recommend promoting healthy product consumption through package design. To encourage consumers to choose healthier foods and clarify their offerings, marketers should exploit the quantity of FOP ingredient images to enhance perceived product taste and trigger choice. In particular, managers of healthy food brands should actively seek to benefit from the healthy–tasty intuition that arises in certain contexts, such as in France. Rather than mimicking the FOP designs of unhealthy products and giving consumers the illusion that they are eating a healthy but high-fat product, managers should consider developing their own package designs to benefit from consumers' positive intuitions about healthy products. In particular, they should

depict few ingredient images on healthy product FOP, to convey the idea that taste is compatible with health. For managers of brands that sell hedonic, unhealthy products, our results do not offer a clear strategy for benefiting from the healthy–tasty association according to the number of ingredient images, so this choice should not direct their strategy, because it will not enhance product choice.

Combining our finding that few ingredient images improve implicit healthy–tasty associations and previous research that shows how ingredient images (cf. text information) improve perceived product healthiness (Rebollar et al., 2017) after people are exposed to nutritional information (Ares et al., 2013; Biakolva and van Trijp, 2011), we propose using ingredient images as signals to encourage product composition. That is, when nutritional information is not available on the FOP or when consumers function under high cognitive loads, they will use the FOP ingredient image to assess product healthiness and tastiness. Ackermann et al. (2018) show that when consumers categorize new products, a single exposure to category-related cues shapes their implicit and explicit attitudes, though it requires some minimum level of attention to form implicit attitudes, before explicit attitudes develop fully. In our study, the depiction of few ingredient images requires minimal cognitive effort, and the healthy–tasty association becomes more fluent, to the benefit of the product, compared with a design that features many ingredient images on the FOP. Therefore, the use of few ingredient images represents an efficient means to inform consumers about product healthiness and determine their evaluations, compared with nutrition facts that necessitate more in-depth cognitive processing.

5.3. Limitations and research avenues

Our use of unknown brands limits the effects of the number of ingredient images, because when they lack experience with the product, consumers use the image more intensively as an extrinsic signal to form product beliefs (Underwood et al., 2001; Zeithaml, 1988). Once they know the brand, consumers reduce their reliance on extrinsic signals, because the brand alone can induce vivid images (Burns et al., 1993). Therefore, reducing the quantity of ingredient images might be beneficial to known brands, but we cannot confirm that prediction without further research.

We used two product categories, sweet and salty, which may create some bias; sweet products purportedly induce more fluent information processing and reduce cognitive efforts (Berridge, 2003). Although we selected “natural” ingredients, we did not use the same flavors for the products presented in this research (nut or apple for healthy products, peanut or cheese for

unhealthy products). Yet product healthiness perceptions likely correlate with primary flavors, such that nuts and apples could be more associated with health, and peanuts and cheese could evoke fat associations. Perceptions of the healthiness of flavor ingredients thus should be investigated further, according to the nature of the product; peanuts may be perceived as healthy in a cereal bar but unhealthy in snack cookies. Further research also could reproduce our study design by integrating artificial flavor ingredients, such as those used for candy. Including more ingredient images on the FOP for these unhealthy products could be beneficial.

Moreover, the representation of ingredient images appeared alongside the overall product image in this study. Other ingredient depiction designs could influence the results, such as a representation of the ingredients alone (see Figure 1) or of a key ingredient together with the whole product image (e.g., chocolate chips in a cookie). Beyond these extensions based on the type of image, further research could test the validity of our findings in another product category. For example, a recent consumer survey (Nielsen, 2018) cited increased interest in personal care products that feature natural, healthier compositions. The number of natural ingredient images depicted on the FOP of beauty products accordingly might influence these product evaluations too.

Finally, it would be pertinent to replicate our studies among non-student consumers in various shopping contexts and across cultures, especially considering how food associations vary by culture (Fischler and Masson, 2008). Such efforts could increase the external validity of the results. Another replication might include unique consumer traits; for example, Zimmerman et al. (2011) assert that people's need for cognition moderates the relationship between their implicit and explicit attitudes, as well as their product choices. Therefore, the effect of the number of FOP ingredient images might vary with the level of cognitive resources available (Thomas and Capelli, 2018). Further research could include need for cognition as a moderator of the implicit attitude formation that results from the number of FOP ingredient images.

Appendix A. Product categories in the IAT, according to healthiness and fat content perceptions

Healthy products	Means		Unhealthy products	Means	
	Healthiness	Fat content		Healthiness	Fat content
Apple cereal bar	5.00 SD=1.3	3.47 SD=1.25	Cheese crackers	3.16 SD=1.4	5.50 SD=1.24
Hazelnut cereal bar	4.78 SD=1.3	3.62 SD=1.15	Peanut snack cookies	2.56 SD=1.1	6.24 SD=1.05

Appendix B. Stimuli pretest of the number of elements perceived, according to the number of FOP ingredient images

Many ingredient images	Quantity	Few ingredient images	Quantity	*p*
Apple cereal bar	2.57 SD= 1.61	Apple cereal bar	4.75 SD=2.01	$p<0.01$
Hazelnut cereal bar	3.59 SD=1.61	Hazelnut cereal bar	4.63 SD=1.95	$p<0.01$
Cheese crackers	3.22 SD=1.62	Cheese crackers	4.75 SD=2.04	$p<0.05$
Peanut snack cookies	2.41 SD=0.96	Peanut snack cookies	4.26 SD=1.97	$p<0.01$

Notes: Quantity is categorized as few or many.

References

Ackermann, C. L., Mathieu, J. P. (2015). Implicit attitudes and their measurement: Theoretical foundations and use in consumer behavior research. *Recherche et Applications en Marketing* (English Edition), 30(2), 55-77.

Ackermann, C. L., Teichert, T., Truong, Y. (2018). 'So, what is it? And do I like it?' New product categorization and the formation of consumer implicit attitude. *Journal of Marketing Management*, 34(9-10), 796-818.

Ares, G., Giménez, A., Bruzzone, F., Vidal, L., Antúnez, L., Maiche, A. (2013). Consumer visual processing of food labels: results from an eye-tracking study. *Journal of Sensory Studies*, 28(2), 138-153.

Aschemann-Witzel, J., Hamm, U. (2010). Do consumers prefer foods with nutrition and

health claims? Results of a purchase simulation. *Journal of Marketing Communications*, 16(1-2), 47-58.
Ayres, K., Prestwich, A., Conner, M., Smith, P. (2011). Emotional eating moderates the relationship between implicit measures of attitudes and chocolate consumption. *European Journal of Personality*, 25(5), 317-325.
Becker, D., Jostmann, N. B., Wiers, R. W., Holland, R. W. (2015). Approach avoidance training in the eating domain: Testing the effectiveness across three single session studies. *Appetite*, 85, 58-65. https://doi.org/10.1016/j.appet.2014.11.017
Bernreuter, R. G. (1933). The theory and construction of the personality inventory. *Journal of Social Psychology*, 4(4), 387-405.
Berridge, K. C. (2003). Pleasures of the brain. *Brain and Cognition*, 52(1), 106-128. https://doi.org/10.1016/S0278-2626(03)00014-9
Bettman, J. R. (1979). *An Information Processing Theory of Consumer Choice*. Reading M.A : Addison-Wesley Publishing company.
Bialkova, S., Grunert, K. G., van Trijp, H. (2013). Standing out in the crowd: The effect of information clutter on consumer attention for front-of-pack nutrition labels. *Food Policy*, 41, 65-74.
Bialkova, S., van Trijp, H. C. (2011). An efficient methodology for assessing attention to and effect of nutrition information displayed front-of-pack. *Food Quality and Preference*, 22(6), 592-601.
Bluemke, M., Friese, M. (2006). Do features of stimuli influence IAT effects?. *Journal of Experimental Social Psychology*, 42(2), 163-176.
Bone, P. F., France, K. R. (2001). Package graphics and consumer product beliefs. *Journal of Business and Psychology*, 15(3), 467-489. https://doi.org/10.1023/A:1007826818206
Bublitz M.G., Peracchio L.A., Andreasen A.R., Kees J., Kidwell B., Miller E.G., Motley C.M., Peter P.C., Rajagopal P., Scott M.L. et Vallen B. (2013), Promoting positive change: advancing the food well-being paradigm. *Journal of Business Research*, 66(8), 1211-1218.
Burns, A. C., Biswas, A., Babin, L. A. (1993). The operation of visual imagery as a mediator of advertising effects. *Journal of Advertising*, 22(2), 71-85.
Chae, B., Hoegg, J. (2013). The future looks “right”: Effects of the horizontal location of advertising images on product attitude. *Journal of Consumer Research*, 40(2), 223-238.
Clement, J. (2007). Visual influence on in-store buying decisions: an eye-track experiment on the visual influence of packaging design. *Journal of Marketing Management*, 23(9-10), 917-928.

Conner, M. T., Perugini, M., O'Gorman, R., Ayres, K., Prestwich, A. (2007). Relations between implicit and explicit measures of attitudes and measures of behavior: Evidence of moderation by individual difference variables. *Personality and Social Psychology Bulletin*, 33(12), 1727-1740.

De Bont, C. J., Schoormans, J. P., Wessel, M. T. (1992). Consumer personality and the acceptance of product design. *Design Studies*, 13(2), 200-208.

De Houwer, J. (2001). A structural and process analysis of the Implicit Association Test. *Journal of Experimental Social Psychology*, 37(6), 443-451.

Drewnowski, A., Darmon, N. (2005). Food choices and diet costs: an economic analysis. *Journal of Nutrition*, 135(4), 900-904.

Fazio, R. H., Chen, J. M., McDonel, E. C., Sherman, S. J. (1982). Attitude accessibility, attitude-behavior consistency, and the strength of the object-evaluation association. *Journal of Experimental Social Psychology,* 18(4), 339-357.

Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology*, 50(2), 229.

Festila, A., Chrysochou, P. (2018). Implicit communication of food product healthfulness through package design: A content analysis. *Journal of Consumer Behaviour*, *17*(5), 461-476.

Fischler, C., Masson, E. (2008). *Manger: Français, Européens et Américains face à l'alimentation*, Paris : Odile Jacob.

Friese, M., Hofmann, W., Wänke, M. (2008). When impulses take over: Moderated predictive validity of explicit and implicit attitude measures in predicting food choice and consumption behaviour. *British Journal of Social Psychology*, 47(3), 397-419.

García-Madariaga, J., López, M. F. B., Burgos, I. M., Virto, N. R. (2019). Do isolated packaging variables influence consumers' attention and preferences? *Physiology and Behavior*, 200, 96-103.

Gil-Pérez, I., Rebollar, R., Lidón, I., Martín, J., van Trijp, H. C., Piqueras-Fiszman, B. (2019). Hot or not? Conveying sensory information on food packaging through the spiciness-shape correspondence. *Food Quality and Preference*, 71, 197-208.

Govan, C. L., Williams, K. D. (2004). Changing the affective valence of the stimulus items influences the IAT by re-defining the category labels. *Journal of Experimental Social Psychology*, 40(3), 357-365.

Greenwald, A. G., Banaji, M. R. (1995). Implicit social cognition: attitudes, self-esteem, and stereotypes. *Journal of Personality and Social Psychology*, 102(1), 4-21.

Greenwald, A. G., McGhee, D. E., Schwartz, J. L. (1998). Measuring individual differences in

implicit cognition: the implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464-1480.

Greenwald, A. G., & Nosek, B. A. (2008). Attitudinal dissociation: What does it mean? In R. E. Petty, R. H. Fazio, & P. Brin˜ol (Eds.), *Attitudes: Insights from the new implicit measures* (pp. 65–82). Hillsdale, NJ: Erlbaum.

Greenwald, A. G., Nosek, B. A., Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197-207.

Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology*, 97(1), 17-41.

Grunert, K. G. (2005). Food quality and safety: consumer perception and demand. *European Review of Agricultural Economics*, 32(3), 369-391.

Hoppert, K., Mai, R., Zahn, S., Hoffmann, S., Rohm, H. (2012). Integrating sensory evaluation in adaptive conjoint analysis to elaborate the conflicting influence of intrinsic and extrinsic attributes on food choice. *Appetite*, 59(3), 949-955.

Huang, L., Lu, J. (2016). The impact of package color and the nutrition content labels on the perception of food healthiness and purchase intention. *Journal of Food Products Marketing*, 22(2), 191-218.

Karnal, N., Machiels, C. J., Orth, U. R., Mai, R. (2016). Healthy by design, but only when in focus: Communicating non-verbal health cues through symbolic meaning in packaging. *Food Quality and Preference*, 52, 106-119.

Kidwell, B., Farmer, A., Hardesty, D. M. (2013). Getting liberals and conservatives to go green: Political ideology and congruent appeals. *Journal of Consumer Research*, 40(2), 350-367.

Koenigstorfer, J., Groeppel-Klein, A., Kamm, F. (2014). Healthful food decision making in response to traffic light color-coded nutrition labeling. *Journal of Public Policy & Marketing*, 33(1), 65-77.

Krishna, A. (Ed.). (2010). *Sensory Marketing: Research on the Sensuality of Products*. New York: Routledge.

Lancelot Miltgen, C., Pantin-Sohier, G., Grohmann, B. (2016). Communicating sensory attributes and innovation through food product labeling. *Journal of Food Products Marketing*, 22(2), 219-239. https://doi.org/10.1080/10454446.2014.1000435

Luna, D., Peracchio, L. A., de Juan, M. D. (2003). The impact of language and congruity on

persuasion in multicultural e-marketing. *Journal of Consumer Psychology*, 13(1-2), 41-50.
Machiels, C. J. A., Karnal, N. (2016). See how tasty it is? Effects of symbolic cues on product evaluation and taste. *Food Quality and Preference*, 52, 195-202. https://doi.org/10.1016/j.foodqual.2016.04.014
Madzharov, A. V., Block, L. G. (2010). Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology*, 20(4), 398-409. https://doi.org/10.1016/j.jcps.2010.06.007
Mai, R., Hoffmann, S., Hoppert, K., Schwarz, P., Rohm, H. (2015). The spirit is willing, but the flesh is weak: The moderating effect of implicit associations on healthy eating behaviors. *Food Quality and Preference*, 39, 62-72.
Mai, R., Symmank, C., Seeberg-Elverfeldt, B. (2016). Light and pale colors in food packaging: When does this package cue signal superior healthiness or inferior tastiness? *Journal of Retailing*, 92(4), 426-444.
Mead, J. A., Richerson, R. (2018). Package color saturation and food healthfulness perceptions. *Journal of Business Research*, *82*, 10-18.
Michaelidou, N., Christodoulides, G., Torova, K. (2012). Determinants of healthy eating: a cross-national study on motives and barriers. *International Journal of Consumer Studies*, 36(1), 17-22.
Mitchell, J. P., Nosek, B. A., Banaji, M. R. (2003). Contextual variations in implicit evaluation. *Journal of Experimental Psychology: General*, 132(3), 455-469.
Mueller, S., Szolnoki, G. (2010). The relative influence of packaging, labelling, branding and sensory attributes on liking and purchase intent: Consumers differ in their responsiveness. *Food Quality and Preference*, 21(7), 774-783.
Nisbett, R. E., Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, 84(3), 231.
Nosek, B. A., Hawkins, C. B., Frazier, R. S. (2011). Implicit social cognition: From measures to mechanisms. *Trends in Cognitive Sciences*, 15(4), 152-159.
Orth, U. R., Malkewitz, K. (2008). Holistic package design and consumer brand impressions. *Journal of Marketing*, 72(3), 64-81.
Paivio, A. (1971). Imagery and language. In S. J. Segal (Ed.), *Imagery: Current cognitive approaches* (pp. 7–32). New York, NY: Academic Press. https://doi.org/10.1016/B978-0-12-635450-8.50008-X
Pantin-Sohier, G., Lancelot Miltgen, C. (2012). The impact of informational stimuli from a new drink product on consumers' affective and cognitive reactions. *Recherche et Applications*

en Marketing (English Edition), 27(1), 3-32. https://doi.org/10.1177/076737011202700101
Parise, C. V., Spence, C. (2012). Assessing the associations between brand packaging and brand attributes using an indirect performance measure. *Food Quality and Preference*, 24(1), 17-23.
Petty, R. E., Cacioppo, J. T. (1996). Addressing disturbing and disturbed consumer behavior: Is it necessary to change the way we conduct behavioral science*? Journal of Marketing Research*, 33(1), 1-8.
Pieters, R., Wedel, M., Batra, R. (2010). The stopping power of advertising: Measures and effects of visual complexity. *Journal of Marketing*, 74(5), 48-60. https://doi.org/10.1509/jmkg.74.5.48
Piqueras-Fiszman, B., Spence, C. (2015). Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Quality and Preference*, 40(A), 165-179.
Piqueras-Fiszman, B., Velasco, C., Salgado-Montejo, A., Spence, C. (2013). Using combined eye tracking and word association in order to assess novel packaging solutions: A case study involving jam jars. *Food Quality and Preference*, 28(1), 328-338. https://doi.org/10.1016/j.foodqual.2012.10.006
Poor, M., Duhachek, A., Krishnan, H. S. (2013). How images of other consumers influence subsequent taste perceptions. *Journal of Marketing*, 77(6), 124-139. https://doi.org/10.1509/jm.12.0021
Prestwich, A., Hurling, R., Baker, S. (2011). Implicit shopping attitudinal determinants of the purchasing of healthy and unhealthy foods. *Psychology and Health*, 26(7), 875–885. http://dx.doi.org/10.1080/08870446.2010.509797
Raghunathan, R., Naylor, R. W., Hoyer, W. D. (2006). The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, 70(4), 170-184.
Rahinel, R., Nelson, N. M. (2016). When brand logos describe the environment: design instability and the utility of safety-oriented products. *Journal of Consumer Research*, 43(3), 478-496.
Rebollar, R., Gil, I., Lidón, I., Martín, J., Fernández, M. J., Rivera, S. (2017). How material, visual and verbal cues on packaging influence consumer expectations and willingness to buy: The case of crisps (potato chips) in Spain. *Food Research International*, 99(1), 239-246. https://doi.org/10.1016/j.foodres.2017.05.024
Rebollar, R., Lidón, I., Martín, J., Puebla, M. (2015). The identification of viewing patterns of

chocolate snack packages using eye-tracking techniques. *Food Quality and Preference*, 39, 251-258.
Rettie, R., Brewer, C. (2000). The verbal and visual components of package design. *Journal of Product and Brand Management*, 9(1), 56-70.
Reynolds, W. M. (1982). Development of reliable and valid short forms of the Marlowe-Crowne Social Desirability Scale. *Journal of Clinical Psychology*, 38(1), 119-125.
Rothman, A. J., Sheeran, P., Wood, W. (2009). Reflective and automatic processes in the initiation and maintenance of dietary change. *Annals of Behavioral Medicine*, 38(1), s4-s17.
Rozin, P., Fischler, C., Imada, S., Sarubin, A., Wrzesniewski, A. (1999). Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: Possible implications for the diet–health debate. *Appetite,* 33(2), 163-180. https://doi.org/10.1006/appe.1999.0244
Samson, A., Voyer, B. G. (2012). Two minds, three ways: dual system and dual process models in consumer psychology. *AMS Review*, 2(2-4), 48-71.
Schoormans, J. P., Robben, H. S. (1997). The effect of new package design on product attention, categorization and evaluation. *Journal of Economic Psychology*, 18(2-3), 271-287.
Sela, A., Shiv, B. (2009). Unraveling priming: When does the same prime activate a goal versus a trait? *Journal of Consumer Research*, 36(3), 418-433.
Shiv, B., Fedorikhin, A. (1999). Heart and mind in conflict: The interplay of affect and cognition in consumer decision making. *Journal of consumer Research*, 26(3), 278-292.
Silayoi, P., Speece, M. (2007). The importance of packaging attributes: a conjoint analysis approach. *European Journal of Marketing*, 41(11/12), 1495-1517.
Simmonds, G., Spence, C. (2017). Thinking inside the box: How seeing products on, or through, the packaging influences consumer perceptions and purchase behaviour. *Food Quality and Preference*, 62, 340-351. https://doi.org/10.1016/j.foodqual.2016.11.010
Simmonds, G., Woods, A. T., Spence, C. (2018). 'Show me the goods': Assessing the effectiveness of transparent packaging vs. product imagery on product evaluation. *Food Quality and Preference*, 63, 18-27.
Simonsohn, U., Simmons, J. P., Nelson, L. D. (2015). Better P-curves: Making P-curve analysis more robust to errors, fraud, and ambitious P-hacking, a reply to Ulrich and Miller (2015). *Journal of Experimental Psychology: General*, 144(6), 1146-1152. https://doi.org/10.1037/xge0000104
Skaczkowski, G., Durkin, S., Kashima, Y., Wakefield, M. (2016). The effect of packaging, branding and labeling on the experience of unhealthy food and drink: A review. *Appetite*, 99,

219-234.
Smith, V., Barratt, D., Selsøe Sørensen, H. (2015). Do natural pictures mean natural tastes? Assessing visual semantics experimentally. *Cognitive Semiotics*, 8(1), 53-86. https://doi.org/10.1515/cogsem-2015-0001
Songa, G., Russo, V. (2018). IAT, consumer behaviour and the moderating role of decision-making style: An empirical study on food products. *Food Quality and Preference*, 64, 205-220.
Steffens, M. C., Plewe, I. (2001). Items' cross-category associations as a confounding factor in the Implicit Association Test. *Zeitschrift für Experimentelle Psychologie*, 48(2), 123-134.
Sundar, A., Noseworthy, T. J. (2014). Place the logo high or low? Using conceptual metaphors of power in packaging design. *Journal of Marketing*, 78(5), 138-151.
Temple, J. L., Johnson, K. M., Archer, K., LaCarte, A., Yi, C., Epstein, L. H. (2011). Influence of simplified nutrition labeling and taxation on laboratory energy intake in adults. *Appetite*, 57(1), 184-192.
Thomas, F., Capelli, S. (2018). The effect of the number of ingredient images on package evaluation and product choice. *Recherche et Applications En Marketing* (English Edition), 33(3), 6-30. https://doi.org/10.1177/2051570718769201
Tijssen, I., Zandstra, E. H., de Graaf, C., Jager, G. (2017). Why a 'light' product package should not be light blue: Effects of package colour on perceived healthiness and attractiveness of sugar-and fat-reduced products. *Food Quality and Preference*, 59, 46-58.
Tijssen, I. O., Zandstra, E. H., den Boer, A., Jager, G. (2019). Taste matters most: Effects of package design on the dynamics of implicit and explicit product evaluations over repeated in-home consumption. *Food Quality and Preference*, 72, 126-135.
Townsend, C., Kahn, B. E. (2013). The "visual preference heuristic": The influence of visual versus verbal depiction on assortment processing, perceived variety, and choice overload. *Journal of Consumer Research*, 40(5), 993-1015.
Trendel, O., Werle, C. O. C. (2016). Distinguishing the affective and cognitive bases of implicit attitudes to improve prediction of food choices. *Appetite*, 104, 33-43. https://doi.org/10.1016/j.appet.2015.10.005
Underwood, R. L. (2003). The communicative power of product packaging: creating brand identity via lived and mediated experience. *Journal of Marketing Theory and Practice*, 11(1), 62-76.
Underwood, R. L., Klein, N. M. (2002). Packaging as brand communication: Effects of product pictures on consumer responses to the package and brand. *Journal of Marketing*

Theory and Practice, 10(4), 58-68. https://doi.org/10.1080/10696679.2002.11501926
Underwood, R. L., Klein, N. M., Burke, R. R. (2001). Packaging communication: Attentional effects of product imagery. *Journal of Product and Brand Management*, 10(7), 403-422.
Unnava, H. R., Burnkrant, R. E. (1991). An imagery-processing view of the role of pictures in print advertisements. *Journal of Marketing Research*, 28(2), 226-231.
Van Herpen, E., Van Trijp, H. C. (2011). Front-of-pack nutrition labels. Their effect on attention and choices when consumers have varying goals and time constraints. *Appetite*, 57(1), 148-160.
Visschers, V. H., Hess, R., Siegrist, M. (2010). Health motivation and product design determine consumers' visual attention to nutrition information on food products. *Public Health Nutrition*, 13(7), 1099-1106.
Vyth, E. L., Steenhuis, I. H., Mallant, S. F., Mol, Z. L., Brug, J., Temminghoff, M., Feunekes G.I., Jansen L., Verhagen H., Seidell, J. C. (2009). A front-of-pack nutrition logo: a quantitative and qualitative process evaluation in the Netherlands. *Journal of Health Communication*, 14(7), 631-645.
Vyth, E. L., Steenhuis, I. H., Roodenburg, A. J., Brug, J., Seidell, J. C. (2010). Front-of-pack nutrition label stimulates healthier product development: a quantitative analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *7*(1), 65-72.
Wang, E. (2013). The influence of visual packaging design on perceived food product quality, value, and brand preference. *International Journal of Retail and Distribution Management*, 41(10), 805-816.
Wegener, D. T., Petty, R. E., Blankenship, K. L., Detweiler-Bedell, B. (2010). Elaboration and numerical anchoring: Implications of attitude theories for consumer judgment and decision making. *Journal of Consumer Psychology*, 20(1), 5-16.
Werle, C. O. C., Trendel, O., Ardito, G. (2013). Unhealthy food is not tastier for everybody: The "healthy=tasty" French intuition. *Food Quality and Preference*, 28(1), 116-121. https://doi.org/10.1016/j.foodqual.2012.07.007
Winkielman, P., Schwarz, N., Fazendeiro, T., Reber, R. (2003). The hedonic marking of processing fluency: Implications for evaluative judgment. In J.Musch & K.C.Klauer (Eds.)*The Psychology of Evaluation: Affective Processes in Cognition and Emotion*, (pp189-217). Mahwah, NJ: Lawrence Erlbaum.
Whittlesea, B. W., Jacoby, L. L., Girard, K. (1990). Illusions of immediate memory: Evidence of an attributional basis for feelings of familiarity and perceptual quality. *Journal of Memory and Language*, 29(6), 716-732.

Zeithaml, V. A. (1988). Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. *Journal of Marketing*, 52(3), 2-22.
Zimmerman, I., Redker, C., Gibson, B. (2011). The role of faith in intuition, need for cognition and method of attitude formation in implicit–explicit brand attitude relationship strength. *Journal of Consumer Psychology*, 21(3), 290-301.
Zimmerman, F. J., Shimoga, S. V. (2014). The effects of food advertising and cognitive load on food choices. *BMC Public Health*, 14(1), 342-351.