Both tasty and healthy? Conveying healthiness and tastiness for vice food utilizing packaging design

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Abstract
This study explores the role of packaging design elements in shaping consumer perceptions and purchase intentions within the vice food category in order to facilitate healthier vice food choice. A 2 × 2 between-subject experiment was designed and conducted to test the hypotheses among Dutch consumers based on two product categories: chocolate cookies and yogurt dessert. The findings reveal that visual elements have a more substantial impact on consumer perceptions, particularly in the context of tastiness, highlighting their importance in vice food packaging. More specifically, visual cues that convey tastiness compared to healthiness are proved to be more effective in promoting higehr purchase intention. This study failed in confirm the hypothesis regarding the interplay between visual and textual elements but offers some insights for future research to build upon. Additionally, the study identifies aesthetic attractiveness as a significant driver of purchase intention, suggesting that consumers are more likely to be drawn to visually appealing packaging in vice food contexts. The research also explores the moderating role of General Health Interest (GHI), demonstrating that health-conscious consumers respond differently to packaging cues, even in indulgent product categories. These insights offer valuable implications for marketers and designers aiming to create effective packaging strategies in the vice food sector.

keywords: vice food, packaging design, perceived healthiness and tastiness, purchase intention, aesthetic attractiveness, general health interest

1. Introduction

1.1 Trends in vice food choice

There is a notable demand for what is often referred to as "vice food" or "indulgent food" in contemporary society. These foods typically include items high in sugar, fat, and salt, such as fast food, desserts, and snacks, providing immediate pleasurable experience but contributing to negative long-term outcomes (e.g. weight gain). Despite the growing awareness of the importance of healthy eating, individuals often seek out these foods due to their palatability, convenience and psychological associations with pleasure and comfort (Wansink & Chandon, 2014). Previous researches have pointed out that consumers approach vice and virtue food with different product attribute weights in mind (Fenko, 2019； Ketron, Naletelich & Migilorati, 2021). Virtue food helps to fulfill long-term utilitarian goal of healthiness whereas sensory, tasty and other short-term hedonic needs tend to be more effectively satisfied by vice foods.

Concerned about approximately 2.5 billion overweight people (World Health Organization 2022) and the rise of diet-related diseases, health organizations and policy makers are advocating for better access to healthier food options. Health-concerned consumers, at the same time, are becoming a critical market segment, seeking food that combines “the best of both worlds”: tasty food with a healthful twist that alleviates the guilt associated with choosing vice foods (Palmer 2008). This shift has spurred vice food brands to innovate so-called healthful indulgences (Belei et al., 2012), blending the hedonism with the healthiness.

Yet in the domain of vice food, simply incorporating excessive health-oriented elements may not necessarily enhance, but rather diminish, the appeal and sales of the product. A well-known principle in food choice was described as the "unhealthy = tasty intuition" (Raghunathan, Naylor&Hoyer, 2006), which indicated that higher healthiness brings about lower tastiness inference and consumption preference when a hedonic goal is more salient. Thus, achieving the balance between tastiness and healthiness is particularly challenging and may be filled with uncertainty, making this balance an area rich for further exploration.

1.2 Packing and consumer perception

Consumer's purchase decisions are influenced by multiple factors, such as product categories, brand reputation, packaging design, promotion events and so on. Packaging is considered to be influential in shaping consumer perception by rapidly attracting their attention and convincing them that it provided the product benefits that perfectly fulfil their needs (Gil-Pérez, Rebollar & Lidón, 2020), for example, aesthetic appreciation, price and quality expectations, taste impression and health perception.

Varied packaging elements will be participating in the process and leaving positive or negative impact on the consumer perception individually and mutually. An overview of the main elements involved is structured in Fig.1. The elements are categorized into textual and visual groups (Silayoi and Speece, 2007), organized according to the extent of regulation and explicitness dimension (Schifferstein, Boer & Lemke, 2021). Implicit

and explicit elements typically appear jointly as crucial parts of the packaging to convey relevant meaning to consumers, influence consumer responses and and ultimately contribute to the purchase decision (van Ooijen et al., 2017). Explicit elements, such as textual claims and images, convey meanings to consumers primarily through a deliberate, cognitive, and informational belief formation process (Steenkamp, 1990). In contrast, implicit elements, such as color and typeface, suggest symbolic, abstract, and implicit meanings through an associative inferential process, resulting in a more automatic and unconsious processing mechanism (Lindh et al., 2016; Steenis et al., 2017).

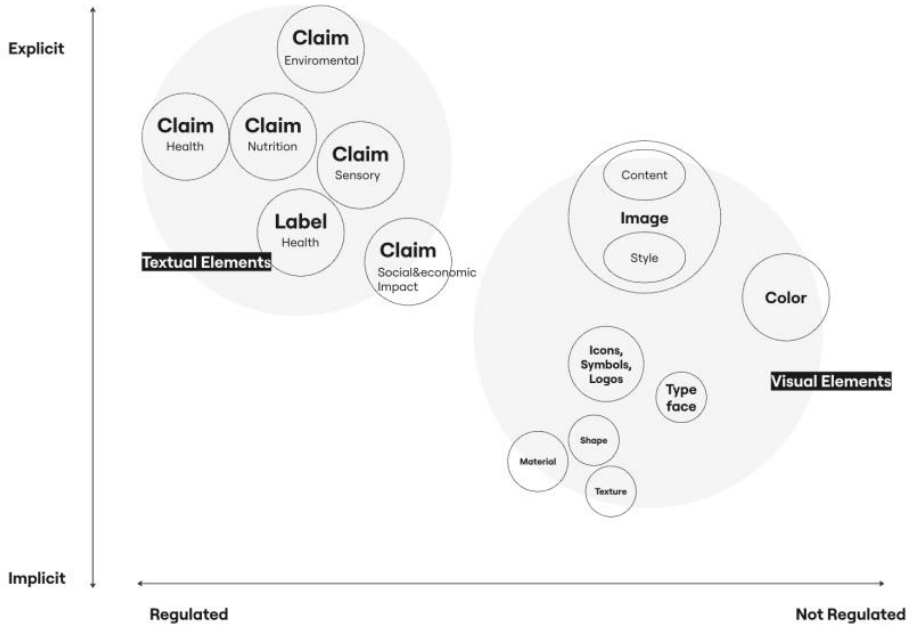

Fig.1. Overview of food packaging elements

2. Packaging elements and their impact

For packaging designers, when designing packages, specific style or content of different elements will be determined and integrated into a coherent and appealing whole, while these elements exert their impact on communicating certain product benefits. The goal of this research is to promote healthier choices in vice foods. As discussed earlier, consumers approach vice foods with high expectations of indulgence, making tastiness a key benefit that they value. At the same time, we aim to highlight the healthiness of these healthier vice food products, aligning with the growing trend towards healthier eating habits in the market. Therefore, our objective is to identify the optimal packaging design strategy that effectively conveys both tastiness and healthiness simultaneously. In the following section, we will review and summarize the different impacts of the key packaging design elements.

2.1 Textual elements

Textual elements on food packages will significantly affect consumer perceptions of healthiness and tastiness. One advantage of using text can be that its meaning appears clear and unequivocal. However, Schifferstein et al. (2021) noted that when expressing advanced, abstract concepts such as "health" or "nature," text can also become ambiguous. The interpretation of text is often influenced by context, cultural background, and personal experience, which can as well lead to ambiguity or vagueness. This duality makes textual cues both a powerful tool and a potential source of challenges in conveying information. Below, we summarize several classic textual elements that have been widely researched.

Descriptive product names, as well as ***flavour and sensory claims***, have been shown to enhance perceived tastiness (Wansink et al., 2005; López-Galán & de-Magistris, 2020). In vice food categories, it's indicated that consumers can develop poorer taste expectations and lower perceived quality as a consequence of the negative impact ***organic claims*** would leave when conveying sensory attributes, leading to a decrease on the overall attraction evaluation and the willingness-to-pay of the product (Van Doorn & Verhoef, 2011).

Regarding elements that influence perceived healthiness, it has been extensively studied and proven that ***health-related claims*** (e.g., nutrition labels) can enhance the perceived healthiness of food (Schifferstein, Lemke & Boer, 2022). More specifically, Egnell et al. (2018) and Feunekes et al. (2008) pointed out that ***interpretative*** health-related textual labels, such as "low in calories", outperform ***informative*** labels, which are nutrient-specific, in helping consumers make healthier food choices. Interpretative labels reduce the cognitive burden required to understand health information, enhancing both comprehension and credibility. In contrast, informative labels that provide only numerical data are often poorly understood by consumers, resulting in lower perceived healthiness of the product.

Other research has also explored the effects of different types of health claims on perceived healthiness while simultaneously examining their influence on tastiness. The use of ***nutrition claims*** such as "low fat" and "sugar free" (Wansink and Chandon, 2006) along with ***organic claims*** like "bio" (Hallez et al., 2023) is effective in enhancing the perceived healthiness of beverages and snacks without diminishing their taste appeal. This phenomenon can be explained by the hypothesis that health claims emphasizing ***hedonic food attributes***, which are closely linked to the palatability of the food (such as low fat and low sugar), may enhance the pleasurable aspects of the food experience. This emphasis diminishes the conflict between healthy and tasty goals, thereby facilitating greater consumption compared to the claims featuring ***functional attributes*** that have a strong connotation of "health" (e.g., low cholesterol, vitamins, antioxidants) which trigger high levels of health-goal accessibility (Belei et al., 2012). Another explanation might be that the organic claim ("bio") also succeeded in making products seem more sustainable, resulting in a halo effect, where one positive benefit like sustainability of the product is depicted and induce other favorable product features (Chandon, 2013).

On the contrary, the negative halo effects seems to as well happen in certain types of claims. Lähteenmäki et al. (2010) suggested that the enhancement in perceived

healthiness is, at most, moderate, and that the effect may also be detrimental when consumers are presented with claims regarding ingredients and benefits that are unfamiliar to them. As a result, perceived naturalness and tastiness also came down in their research after applying health claim regarding either omega-3 or bioactive peptides.

All kinds of impact aside, consumers are actually often skeptical about the information presented on food labels made by manufacturers vis-à-vis the standardized Nutrition Facts Panel (Mitra, Hastak, Ringold &Levy, 2019; Chan, Patch & Williams, 2005). A social media poll conducted by Lockyer, Ryder, Jaworska, Benelam, and Jones (2020) revealed that only merely 21% of participants expressed a strong conviction that the assertions made on food labels were grounded in robust scientific evidence, whereas a substantial 79% regarded these claims as primarily marketing strategies. This skepticism may partly stem from insufficient awareness of consumers toward food ingredient: other studies suggest that only 30-40% of consumers maintain sufficient understanding to interpret packaging information correctly (Dutch Ministry of Health, Welfare and Sport, 2005). As for those more knowledgeable and involved consumers, they might be more aware of the proliferation of questionable health claims, making them more skeptical. This skepticism, however, can be mitigated through multi-sensory experiences, such as providing consumers with product samples and opportunities to taste the products (Fenko, 2019).

2.2 Visual elements

Imagery on packaging has been found to have a vital role in various aspects of consumer perceptions. Compared with text, conveying information through images is more engaging and vivid (Underwood, Klein, & Burke, 2001) and has been suggested to generate expectations more quickly (Smith, Barratt, & Sørensen, 2015), since images as visual cues are processed predominantly at an unconscious and automatic level, requiring less cognitive resources from consumers and bringing less burden.

Regarding imagery content, one that aligns with the product's health benefits can reinforce consumers' inferences about healthiness (Underwood & Klein, 2002). However in Schifferstein, Boer and Lemke (2021), the health images seem to lower the perception of healthiness, especially for the orange juice packages. The variation in conclusions might due to the reason that the packagings in this research with these health images are considered comparatively less attractiveness, resulting the negative influence in conveying other product benefits. Additionally, the effectiveness of using imagery to signify health benefits seems to vary across different food categories. For vice food, imagery showing the product can trigger sensory appeal and cravings, potentially overshadowing health concerns (Scott, Nowlis, Mandel, & Morales, 2008). Another imagery category used frequently by packaging designer is natural. Consumers may perceive products featuring natural imagery as being healthier, safer, and more environmentally friendly. For vice food brands, natural imagery could mitigate feelings of guilt associated with vice food choices for arousing the association with environment, leading to increased purchase intention (van Rompay et al., 2016). Furthermore, visual imagery of other consumers enjoying the product may enhance the perceived palatability

of unhealthy product categories, since such image serves as a social proof of the appropriateness of such a consumption (Poor, Duhachek, & Krishnan, 2013).

Other features of the imagery are also proved to enhance consumer perception in positive ways. For example, food products imagery depicted in motion (as opposed to static) will generate better evaluations in terms of perceived food freshness, food acceptance, and taste expectations (Gvili et al., 2015). Amar, Gvili & Tal (2021) found out that presenting food in motion increased judgment of food healthiness, with not a decrease, but rather an increase, in perceived tastiness. Furthermore, the perception of healthiness is significantly improved when the image is a photograph rather than a drawing (Smith, Barratt, & Sørensen, 2015), and when the imagery is representational as opposed to abstract (Ketron, Naletelich, & Migilorati, 2021). Moreover, research on specific imagery features, the overall packaging imagery style is suggested to as well have an influence. According to Schnurr (2019), cute package designs may favour the choice of indulgent products for higher perceived tastiness, but it will also decrease the perceptions of product healthiness, ultimately leading to lower purchase intentions for relatively virtuous products.

Color is another pivotal element in packaging design that influences consumer perception. The choice of colour is is vital within the context of both the product and its packaging, necessitating careful consideration of how to incorporate color into the overall design to facilitate the demonstration of the imagery. Colors can indicate the flavour of the food (e.g., pink for strawberry juice, yellow for mango or passion fruit) as well as the quality (e.g., white for low-cost, black and gold for high-end or premium) (Schifferstein, Boer & Lemke, 2021). Furthermore, the connotations of a particular color can differ based on both physical and cultural contexts. Gofman, Moskowitz, and Mets (2009) found out that certain colors such as green are strongly associated with specific tastes and health perceptions. Festila & Chrysochou (2018) indicated that lighter (as opposed to heavier) colors would promote perceived healthiness but at the same time activate detrimental taste inferences (Mai, Symmank & Seeberg-Elverfeldt, 2016). Conversely, highly saturated, bright and vibrant colors suggest intense product taste and therefore can enhance taste appeal (Singh, 2006). The influence of packaging color on consumer expectations and perceptions is complicated and may vary according to product categories. For instance, the impact of brightness on the perceived flavor intensity is evident in sausage products, but not in dairy beverages (Tijssen et al., 2017). Consequently, there is a need for continued exploration regarding color selection in relation to specific categories of indulgent foods.

Besides imagery and color, there are also several visual elements that are playing significant role in food packaging. For instance, the amount of food ***icons, symbols, and logos*** introduced has been increasing steadily, differentiating products by their various categories, including health and quality labels, organic and fair trade logos, as well as natural and animal welfare, etc (e.g., Grunert & Wills, 2007; Sirieix, Delanchy, Remaud, Zepeda, & Gurviez, 2013). In 2023, the Nutri-Score logo was legally designated as a voluntary food choice logo in the Netherlands. This logo assigns products a score based on their nutritional value, using colors and letters ranging from dark green (A) to dark orange (E) (Dutch Government, 2023). The Nutri-Score enabled consumers to evaluate

the healthiness of products better and therefore increase the perceived healthiness of the products; furthermore, it has the potential to enhance the appeal of healthy products without reducing the demand for less healthy ones (De Temmerman et al, 2021). Shapes of the icons can as well have a strong symbolic meaning, which could potentially emphasize food-related claims and arouse healthy association. Nonetheless, consumers may interpret such shapes differently from the designers' original intentions, and the introduction of new symbols can be challenging. For instance, Sanders (2013) found that while a majority of consumers within the European Union comprehended the principles of organic farming, they were largely unfamiliar with the EU organic logo that was introduced in 2010.

In terms of ***typefaces***, in Henderson, Giese & Cote, 2004, six underlying design dimensions of typeface (elaborate, harmony, natural, flourish, weight, and compressed) were proposed, offering a framework for designers when selecting typefaces that align with desired consumer impressions. By utilizing the typeface that matches the product's health-related attributes, brands can enhance consumer perceptions and potentially influence purchase decisions. Karnal et al. (2016) indicated that more delicate typefaces would symbolically convey the concept of light and thin, arousing the association of lightness. Bolder typefaces, on the contrary, would convey a image of heavy and fat. Besides, using round typefaces (high curvature) in vice products would triggers pleasant feelings which eventually enhance preferences (Wang, Yu & Li, 2019). Additional studies have shown that individuals tend to align their taste expectations with typefaces characterized by either roundness or angularity. Angular shapes are commonly associated with words like "bitter," "salty," or "sour," whereas round shapes are more closely linked to the word "sweet." (Salgado-Montejo et al., 2015; Velasco et al., 2014).

Other elements operate on a more structural dimension and subtly influence consumers. For example, ***shape*** is one of the most well researched structural elements of package design. Research indicates that food items presented in elongated or concave packaging are perceived as having fewer calories and being healthier compared to those in wider or convex packaging, likely due to associations with a slim body shape that serve as symbolic indicators of product healthiness (Van Ooijen, Fransen, Verlegh & Smit, 2017). Moreover, more angular shapes tend to suggest more intense flavors (Becker et al., 2011) and would be perceived as healthier (Fenko, Lotterman, & Galetzka, 2016). On the contrary, rounded shapes and textured surfaces are useful in terms of enhancing the perception of sweetness in food products without necessitating an increase in actual sugar contentt (Spence & Ngo, 2012).

Research indicates that food packaged in more sustainable ***materials*** is often perceived as more natural and of superior quality, which can enhance consumer perceptions of healthiness (Magnier, Schoormans, & Mugge, 2016). Fenko et al. (2015) found that the use of rough paper for packaging crisp bread and chocolate increased perceptions of healthiness and naturalness; however, it negatively impacted taste evaluations for crisp bread when compared to plastic packaging while exerting no negative effect on the taste evaluation of chocolate. Apart from that, many consumers have formed an association between glossy packaging and unhealthy food products, while matte packaging tends to be connected with natural food instead (Ye et al., 2019).

In terms of ***transparency***, food in transparent packages in contrast to opaque packages are perceived to be of higher quality, more attractive, fresher, and also healthier (Simmonds & Spence, 2016). However, Riley, da Silva, and Behr (2015) found the opposite effect, as transparent windows were linked to the perception of lower healthiness for coffee, carrot soup, and carrot baby food. Additionally, Simmonds and Spence (2017) argued that aesthetically unpleasing products were viewed as less healthy when presented in transparent packaging. These findings suggest that the choice for materials and transparency in conveying healthiness may vary across different product categories.

2.3 Consumer factors

In addition to the diverse packaging elements that play a significant role in food choice, concerns about health and body image also influence food intake and healthy dietary behavior, as demonstrated in many studies. Roininen, Lähteenmäki & Tuorila (1999) developed a questionnaire assessing people's General Health Interest (GHI) to evaluate consumers' orientations toward the health and hedonic characteristics of foods. When people have a higher score on GHI, indicating greater interest in health, their health goals influence their food choices by directing more attention to nutrition labels (Bublitz et al., 2010; Van Herpen & Van Trijp, 2011). This increased attention ultimately facilitates the purchase of healthy food products due to their health benefits rather than their hedonic benefits (Lähteenmäki, 2013). This finding is also supported by Ares et al. (2010). Their research revealed that consumers' choices regarding functional yogurts were heavily influenced by their attitudes towards health-related concerns. Consumers with a greater interest in maintaining their health were more likely to choose healthier functional yogurts. For this group, brand and price were less influential in their decision-making process. On the other hand, consumers with lower health concern are more influenced by hedonic aspects such as taste and appearance, as Ares et al. (2010) found that these consumers prioritize sensory attributes over health benefits. Hence, in subsequent research, GHI as a moderating variable should as well be included as a factor influencing the consumer perception process.

2.4 Conclusion

The literature indicates that various packaging design elements have diverse impacts on consumer perceptions during food choice. They work in concert to influence perceptions of healthiness and tastiness, each carrying its own weight and potential for perception towards certain product benefits. However, contradictions among these elements underscore the complexity of consumer psychology and the need for a more nuanced understanding of how to harmonize these signals to convey accurate and appealing product information. We have summarized a comprehensive overview of all the packaging design elements that impact perceived healthiness, tastiness, and purchase intention as identified in the reviewed literature. This table will serve as a guide in our following experimental design, enabling us to create packaging combinations that more effectively convey our focused product benefits.

Table 1 Overview of the packaging elements and their effects on product benefits

	Tastiness	Healthiness	Purchase intention
Textual			
descriptive product names	↑		
health claims		↑	↓
- health claims featuring functional attributes		↑	↓
- health claims featuring hedonic attributes	↑	↑	↑
flavour claims	↑		
health label		↑	
Visual			
Imagery content			
health or sustainability		↑	
natural		↑	↑
product itself	↑		
non-food imagery: (e.g other consumers tasting and enjoying the product)	↑		
Imagery style			
motion (compared to static)	↑	↑	
photograph (compared to drawing)		↑	
representational (compared to abstract)		↑	
cute designs	↑	↓	
Color			
highly saturated colors	↑		
lighter vs heavier	↓	↑	
Typeface			
delicate		↑	
bold			
round			↑
Shape			
elongated or concave packages		↑	
wider or convex packages		↓	
angular shapes	↑	↑	
Texture			
matte (compared to glossy)		↑	
Materiel			
sustainable materials		↑	
Transparency			
transparent packages (compared to opaque)	↑	↑↓	

3 Research model and hypotheses

Concluded from the overview, it is evident that, in most cases, a single element cannot simultaneously convey both healthiness and tastiness effectively, making it

challenging for a packaging element to enhance both the perceived health benefits and the tastiness of a product at the same time. This suggests that consumers often perceive a trade-off between these two benefits, which aligns with the earlier discussion regarding the subconscious conflict between healthiness and tastiness, which stems from the widely held “unhealthy = tasty” intuition.

For packaging designers during packaging design process, they need to determine the specific product benefits each element is supposed convey and to clarify the role each element plays within the overall design. The collective perceptions generated by these individual elements combine to form the holistic perception of the entire package. For consumers standing in front of a store shelf filled with a dazzling array of products, the overall impact of packaging arises not from any single element but from the gestalt—the integration of all elements working together. These elements combine into more complex cognitive components or design factors that collectively shape perception and convey specific characteristics to consumers (Orth & Malkewitz, 2008).

Therefore, the aim of this research is to identify the optimal combinations of elements that effectively convey both healthiness and tastiness, ultimately appealing to a broader range of consumers and promoting more healthy vice food choices. By leveraging their varying levels of health concern, we seek to maximize overall purchase intention for more healthier products. Based on the findings, the research question is proposed as:

How do aggregated packaging elements as a whole improve consumers' perception of healthiness while minimizing the decrease in perceived tastiness, achieving the optimal combination performance in terms of purchase intention?

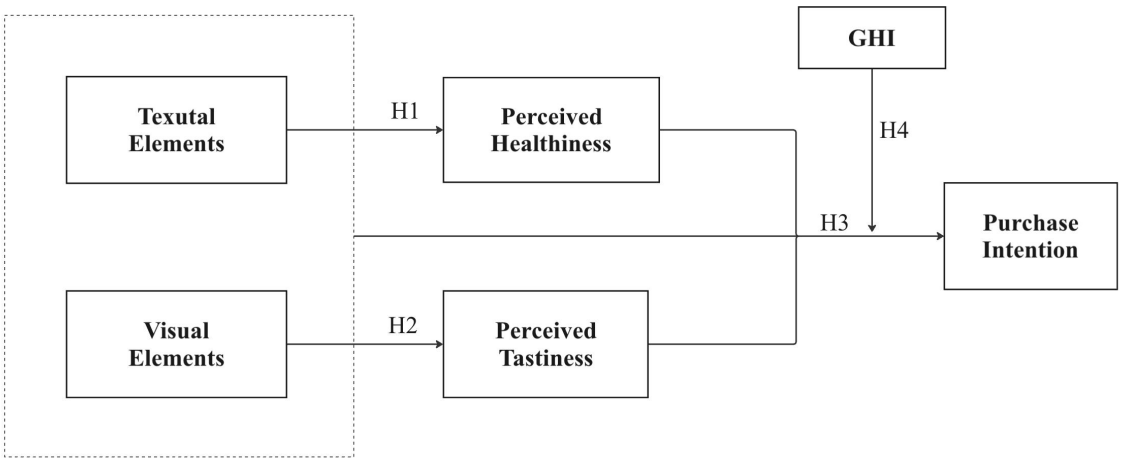

Fig.2. Research model

To establish a more effective packaging communication strategy, it is important to analyze the effectiveness of individual elements in conveying specific product benefits. Different categories of elements, due to their inherent characteristics, such as being ambiguous or direct, vary in their ability to communicate particular product benefits, such as tastiness or healthiness.

Festila & Chrysochou (2018) synthesized findings from several previous studies,

highlighting that explicit package design elements can significantly influence perceived food product healthiness, as well as food choice and consumption. Among these elements, informational elements represent the most explicit method for conveying healthiness to consumers. Supporting this viewpoint, Schifferstein (2021) found that in orange juice, muesli bar and yogurt category, textual elements were more effective in conveying healthiness, while visual elements had a negative impact in this context. Consequently, it can be inferred that textual elements have a stronger influence on the communication of healthiness compared to visual elements. Given the differences in consumer attitudes towards vice foods and typical healthy food like muesli bars, we also aim to test whether this theory holds true specifically in the context of vice foods. Thus, the following hypothesis is proposed:

H1: Textual elements have a stronger influence on shaping consumer's perceptions of food product's healthiness compared to visual elements.

Regarding tastiness, it was observed that food images serve as powerful stimuli that rapidly and involuntarily capture consumer attention, leading to increased salivation and appetite, which in turn may boost their willingness to purchase (Simmonds & Spence, 2017). Since it's a common case in food product to show the product contained inside the package or the ingredients or food products that give it its flavour (Gil-Pérez, Rebollar & Lidón, 2020), using visual elements, represented by images to convey tastiness is hypothesized to be a more efficient strategy. Apart from that, in Schifferstein (2021)'s analysis towards visual elements, it's indicated that using imagery elements to convey sensory benefits still remained positive results, while textual claims exert negative impact on perception of sensory attributes in certain cases, such as yogurt packaging. Thus, the hypothesis is proposed as:

H2: Visual elements have a stronger influence on shaping consumer's perceptions of food product's tastiness compared to textual elements.

Once the characteristic of each element is identified, it is essential to understand how they interact to maximize the benefits on product evaluation, as simply considering and applying the strengths of each element does not necessarily guarantee the best overall outcome. Previous research indicated that elements bringing about higher tastiness tend to lower the overall perception of healthiness (Mai, Symmank & Seeberg-Elverfeldt, 2016; Schnurr, 2019; Van Doorn & Verhoef, 2011), potentially resulting in the decrease in the overall purchase intention. In this research, our focus product benefits were healthiness and tastiness. For each type of element (textual and visual), designs that better reflect the two benefits were sequentially cross-combined, resulting in a total of four packaging combinations (2*2).

We assumed that the combination of higher healthiness and higher tastiness will ultimately result in greater higher purchase intention. Based on H1, textual elements are better suited for conveying healthiness. Furthermore, using healthy textual elements may not necessarily decrease tastiness but rather remain stable (Wansink & Chandon, 2006).

On the other hand, according to H2, visual elements are more effective in conveying tastiness. Thus, compared to other combinations, this approach is expected to scored the highest in terms of the overall product evaluation. The corresponding hypotheses are proposed:

H3: Packaging designs with graphic expressing tastiness and textual expressing healthiness will yield the highest consumer purchase intention compared to other combinations for vice food.

Besides, the consumer's factor would also be moderating in this process. In our study, we expect that consumers with high GHI will be more attracted by elements conveying healthiness, leading to higher purchase intentions for products with higher perceived healthiness. Conversely, consumers with low GHI are more likely to purchase food products based on their hedonic benefits rather than health benefits. Therefore, we assumed that the effect of packaging elements combination on purchase intention are moderated by general health interest of consumers. Therefore, we propose the following hypotheses:

H4: General health interest moderates the effect of the packaging on purchase intentions. Consumers with higher GHI will show higher purchase intentions when exposed to products with elements expressing healthiness, while consumers with low GHI will show higher purchase intentions when exposed to products with elements expressing tastiness.

4 Method

4.1 Food category

Two vice food product categories were selected in this experiment, which are chocolate chip cookies and yogurt dessert. Chocolate cookies as a classic food category in market shelf, has been widely studied in consumer behavior research (e.g., Sahni & Shere, 2017; Sielick‐ ożynska, Jerzyk & Gluze, 2020). Yogurt dessert was chosen to expand the research scope beyond solid foods, reflecting the diverse range of contemporary indulgent offerings. Yogurt dessert products are typically rich, sweet, creamy and are marketed as luxurious or sweet leisure, which aligns them more closely with the concept of vice foods. Despite the presence of yogurt, which can be perceived as healthy, these dessert variants are higher in sugar, fats, and are consumed for their indulgent qualities rather than their health benefits. This categorization fits within the broader definition of vice foods, particularly in the European market, where products like these are often positioned as treats rather than staples.

4.2 Stimuli design

According to table 1 which summarized the elements and their effects, we designed multiple versions for each sub-elements under the visual and textual categories that

convey either tastiness or healthiness. Since our experiment would be conducted online, packaging elements such as texture, material, and transparency, which cannot be adequately perceived online, remained consistent as control variables. Accordingly, we had chosen to focus the creation of variant sub-element categories on the elements listed in the table 3. Additionally, given that our experiment is constructed under Dutch context, all textual elements were created in Dutch to ensure the accuracy and cultural relevance of the experimental results.

Table 3 List of the sub-elements targeted at tastiness or healthiness for the stimuli design

	Tastiness	Healthiness
Cookies		
Visual		
Color	highly saturated color	lighter color
Imagery content	chocolate chip cookies, nut chocolate	chocolate chip cookies, nut wheat
Imagery style	motion	static
Typeface	bold	delicate
Textual		
claims	flavour claim: heerlijk knapperig(deliciously crunchy)	nutrition claim: rijk aan vezels(rich in fibre)
label	vol van smaak (full of flavour)	gezonde keuze (healthy choice)
Yogurt		
Visual		
Color	highly saturated color	lighter color
Imagery content	berries, fluid yogurt cream, spoon	berries, natural image, health-related image
Imagery style	cute, motion, bigger image of fruit	clam, smaller image of fruit
Typeface	bold	delicate
Textual		
claims	flavour claim: heerlijk romig (deliciously creamy)	nutrition claim: rijk aan eiwit (rich in protein)
label	volle smaak (full flavour)	gezonde keuze (healthy choice)

4.3 Pretest

To identify the sub-elements that best convey the intended product benefits, a pretest was conducted. For each product category (cookies and yogurt dessert), we created two groups of packaging variants for each target product benefit (healthiness and tastiness). Each group consisted of two sets of variants, each designed with different layouts or color. Specifically, the first set of three variants (A, B, C) differed in layout while maintaining the same color scheme, and the next three variants (C, D, E) differed

in color while keeping the layout constant. The experiment employed within-subject design. Participants were presented with ten packages from the same food category in random order. Both food categories were shown to all participants. 27 participants (44% are female, mean age 24.9) judged on a 7-point scale to what extent each packaging looked tasty, healthy, and attractive. The mean scores for each packaging were then calculated.

Table 4

Pretest stimuli for chocolate cookies and the mean scores for perceived product benefits

	Tasty Elements Group			Healthy Elements Group		
	Tastiness	Healthiness	Attractiveness	Tastiness	Healthiness	Attractiveness
A						
	4.30	2.44	4.78	4.04	4.67	4.37
B						
	4.81	2.78	5.11	3.93	4.78	4.00
C						
	4.26	2.41	4.00	4.00	4.81	3.74
D						
	4.63	2.33	4.30	3.56	4.74	3.74
E						
	4.07	3.07	3.78	3.56	5.36	3.78

ANOVA tests revealed no significant differences among the groups in terms of perceived healthiness and tastiness. This lack of significance could be due to the small

sample size. However, by examining the mean scores, we can still derive valuable insights to select the most suitable sub-elements for the main test.

In the group for tasty elements, among the three packaging varying in layout design, the style of package B scored the highest in terms of tastiness (M_B = 4.81) and attractiveness (M_B = 5.11). As for the three different color variants, package D which used purple achieved the highest in tastiness (M_D = 4.63) and attractiveness (M_D = 4.33) . Therefore, the combination of layout from package B and the color purple from package D are selected as the visual elements to convey tastiness. In the group for healthy elements, package C had the highest healthiness score among the layout variants (M_C = 4.81). Among the color variants, the light blue color of package E scored the highest in healthiness(M_E = 5.26), outperforming light pink and purple. Consequently, these two sub-elements were chosen for the main test.

Table 5

Pretest stimuli for yogurt dessert and the mean scores for perceived product benefits

	Tasty Elements			Healthy Elements		
	Tastiness	Healthiness	Attractiveness	Tastiness	Healthiness	Attractiveness
A						
	4.33	4.22	4.41	3.96	5.11	3.85
B						
	4.56	4.26	4.44	3.89	5.22	4.22
C						
	4.44	4.78	4.44	3.56	4.37	3.78
D						
	4.63	5.03	4.78	4.22	5.22	4.11

E						
4.81	4.07	4.81		4.67	4.78	4.70

ANOVA tests again revealed no significant differences among the groups in terms of perceived healthiness and tastiness. But as the same of cookies group, we can still get some direction regarding the choice of sub-elements by comparing mean value.

In the group for tasty elements, among the three packaging variants differing in layout, the style of package B scored the highest in terms of tastiness (M_B = 4.56) and attractiveness (M_B = 4.44). As for color, the pink color from package E achieved the highest in tastiness (M_E = 4.81) and attractiveness (M_E = 4.81), outperforming other color variants. Therefore, the combination of layout from package B and the pink color from package E are selected as the visual elements to convey tastiness. In the group for healthy elements, the style of packaging B rated the highest in terms of healthiness (M_B = 5.22). Among the three color variants, the light blue from package D rated the highest in healthiness (M_D = 5.22). Therefore, for the main test, these two sub-elements were combined, as shown in table 6.

In the subsequent analysis, we will refer to the four kinds of package combinations using labels (eg. Tasty textual & Healthy visual as “TH”; Healthy textual & Tasty visual as “HT”).

Table 6 Stimuli design for the main test

Label	Text	Visual	Cookies	Yogurt
TT	Tasty	Tasty		
HT	Healthy	Tasty		
HH	Healthy	Healthy		
TH	Tasty	Healthy		

4.4 Main test

4.4.1 Procedure

A 2*2 between-subject experiment was designed and conducted in this research. The data were gathered online using Qualtrics online survey tool. After answering screening questions about the frequency they ever purchase or eat cookies and yogurt dessert, participants were randomly assigned to one of the four experimental conditions from each food category. They were shown the stimuli and were asked to rate the product on perceived tastiness, perceived healthiness, perceived aesthetic package attractiveness and their purchase intention. The last part of the survey included general health interest scale and demographic information.

4.4.2 Measurement

Perceived product tastiness was measured with three items on a 7-point Likert scale (1 = strongly disagree, 5 = strongly agree) adapted from Schnurr, 2019: (1) I expect this product to taste good. (2) This product looks delicious. (3) I think this product looks tasty.

For the measurement of healthiness, we referred to Fenko et al 2016 also with three items on a 7-point Likert scale: (1) l expect this product to be healthy. (2) This product looks healthy. (3) This product looks healthier than similar products.

For the measurement of purchase intention, we referred to Wang, Minor & Wei, 2011 with two items measured on a 7-point scale: (1) I would buy this product when I see it in the store. (2) I would consider this product when I intend to buy this type of food.

Packaging aesthetic evaluation was measured on two 7-point Likert scales: (1) This is a beautiful-looking package. (2) This package is visually appealing (Blijlevens et al., 2014). General health interest was measured by eight items of the Taste & Health

Items for general health interest was referred to the attitude scale by Roininen et al. (1999) on a 5-point Likert scale: (1) The healthiness of food has little impact on my food choices. (2) I am very particular about the healthiness of food I eat. (3) I eat what I like and I do not worry much about the healthiness of food. (4) It is important for me that my diet is low in fat. (5) I always follow a healthy and balanced diet. (6) I do not avoid foods, even if they may raise my cholesterol. (7) The healthiness of snacks makes no difference to me. (8) It is important for me that my daily diet contains a lot of vitamins and minerals. For statistical analyses, the average score on each scale was calculated after the negative items had been reversed.

5. Result

5.1 Participants

The questionnaire was distributed via the online platform Prolific among Dutch consumers. We had 180 valid responses with an average age of 30 ranging from 18 years to 54 years old. Of the participants, 67% were male, 30% were female, and 3% were other. The one-way ANOVA results showed that there is no significant difference in age

(F(3, 177) = .72, p = .54), gender (F(3, 177) =1.24, p = .30), education level (F(3, 177) =1.59, p = .19) and GHI level (F(3, 177) =1.35, p = .26) among the participants under each different experimental conditions.

Based on the screening questions, we found that 10 participants who had (almost) never eaten chocolate cookies and 20 participants who had (almost) never eaten yogurt dessert. However, after removing these participants, our analysis results remained unchanged. Therefore, in the presentation of the results below, we continue to report our findings based on the full sample of N = 180, since these participants still hold research value, as with sufficiently attractive packaging or complementary promotional activities, they could become potential future purchasers..

5.2 Reliability Test

Reliability analysis was conducted on the measurement scales used in this experiment. The scales for healthiness (α=0.85) and purchase intention (α=0.87) were both proved to be reliable. And the scales for tastiness (α=0.93) and attractiveness (α=0.94) were indicated to be of high reliability.

5.3 Manipulation Check

For manipulation check, we expected the packaging with textual and visual expressing healthiness (HH) yields the highest in terms of consumer perceptions of healthiness, while the packaging with textual and visual expressing tastiness (TT) yields the highest in terms of perceived tastiness.

5.3.1 Manipulation check for healthiness

Chocolate cookies

We then examined the varying performance of the four cookies groups. The one-way ANOVA (N=180) results showed a significant effect of packaging designs on health perceptions (F(3, 176) = 18.52, p < .001). Descriptive statistics revealed that HH package (M_{HH} = 3.96) scored the highest health perceptions and was significantly higher than those of HT and TT package (p < .001), however, not significantly higher than TH package (p = .70). The manipulation was partly successful.

Table 7 Mean table of perceived healthiness in chocolate cookies stimuli

Textual Element	Visual Element	Mean	N	SD
Tasty	Tasty (TT)	2.23	45	0.84
	Healthy (TH)	3.86	45	1.52
Healthy	Tasty (HT)	3.04	45	1.27
	Healthy (HH)	3.96	45	1.20

Yogurt dessert

The ANOVA results of yogurt groups also suggests a significant difference among the stimuli (F(3, 176) = 11.86, p < .001) in perceived tastiness, with HH package scoring the highest (M_{HH} = 5.09). Specifically, HH package had significantly higher health

perceptions compared to TT package ($p < .001$) and HT package ($p = .01$). However, the difference in health perceptions between HH package and TH package was not significant ($p = .47$). The manipulation of healthiness in yogurt dessert is as well partly successful.

Table 8 Mean table of perceived healthiness in yogurt dessert stimuli

Textual Element	Visual Element	Mean	N	SD
Tasty	Tasty (TT)	2.23	45	0.84
	Healthy (TH)	3.86	45	1.52
Healthy	Tasty (HT)	3.04	45	1.27
	Healthy (HH)	3.96	45	1.20

5.3.2 Manipulation check for tastiness

Cookies

Results from ANOVA for the cookies groups demonstrated significant differences in tastiness perceptions among the groups ($F(3, 176) = 17.85$, $p < .001$), while TT package had the highest score among the groups. Post Hoc Test showed that TT package scored statistically higher than HH package ($p < .001$) and TH package ($p < .001$). However, there was no significant difference between HH and HT package ($p = .83$). The manipulation was partly successful.

Table 9 Mean table of perceived tastiness in chocolate cookies stimuli

Textual Element	Visual Element	Mean	N	SD
Tasty	Tasty (TT)	5.74	45	0.98
	Healthy (TH)	4.79	45	1.22
Healthy	Tasty (HT)	5.69	45	0.94
	Healthy (HH)	4.27	45	1.37

Yogurt:

As for Yogurt, the ANOVA results indicated no significant differences in tastiness perceptions between the groups ($F(3, 176) = .76$, $p = .52$). Descriptive statistics showed the mean tastiness perceptions for the four groups were relatively close, which suggests that the combination of textual and visual elements does not significantly impact consumer perceptions of tastiness for yogurt. The manipulation for the expression of tastiness from both textual and visual elements in yogurt dessert did not success.

Table 10 Mean table of perceived tastiness in yogurt dessert stimuli

Textual Element	Visual Element	Mean	N	SD
Tasty	Tasty (TT)	5.38	45	1.30
	Healthy (TH)	5.04	45	0.98
Healthy	Tasty (HT)	5.13	45	1.05
	Healthy (HH)	5.22	45	1.15

5.4 Package elements and their effects on perceived healthiness (H1)

Chocolate cookies

An factorial ANOVA (N = 180) was performed to evaluate the influence of textual and visual elements on health perceptions. The analysis revealed that while textual elements do have a statistically significant effect on perceived healthiness ($F(1, 176) = 5.93$, $p = .02$, $\eta^2 = .03$), the influence of visual elements is notably stronger ($F(1, 176) = 46.10$, $p < .001$, $\eta^2 = .21$). This indicated that visual elements account for a significantly larger portion of the variance in healthiness perceptions than textual elements. Thus, H1 for chocolate cookies category is not supported.

Yogurt dessert

A factorial ANOVA (N = 180) was conducted to assess the impact of textual and visual elements on health perceptions. The results demonstrated that textual elements had a statistically significant effect on perceived healthiness ($F(1, 176) = 6.51$, $p = .012$,$\eta^2 = .036$), indicating that they contribute to a small but significant portion of the variance. However, the influence of visual elements is as well significantly stronger ($F(1, 176) = 26.72$, $p < .001$, $\eta^2 = .13$), suggesting that visual cues play a more substantial role in shaping health perceptions. H1 for yogurt dessert category is as well not supported.

5.5 Package elements and their effects on perceived tastiness (H2)

Chocolate cookies

We did a factor analysis (N=180) for perceived tastiness in cookies. The results indicated that textual elements had a marginally significant effect on perceived tastiness ($F(1, 176) = 2.81$, $p = .095$, $\eta^2 = .016$). On the other hand, the influence of visual elements was statistically significant and substantially stronger ($F(1, 176) = 48.86$, $p < .001$, $\eta^2 = .22$), suggesting that visual cues play a more influential role in conveying the tastiness. The interaction between textual and visual elements was not statistically significant ($F(1, 176) = 1.88$, $p = .17$), implying that the combined effect of these elements does not significantly impact the dependent variable beyond their individual effects. We can conclude from the above analysis that H2 for cookies is supported.

Yogurt dessert

A factorial ANOVA (N = 180) was conducted to assess the impact of textual and visual elements on T_Mean. The results demonstrated that neither textual elements ($F(1, 176) = 0.040$, $p = .84$, $\eta^2 = .00$) nor visual elements ($F(1, 176) = 1.70$, $p = .19$) had a statistically significant effect on the dependent variable. The interaction between textual and visual elements was also not statistically significant ($F(1, 176) = 0.53$, $p = .47$). The overall model was not significant ($F(3, 176) = 0.76$, $p = .52$) and explained only 1.3% of the variance in the dependent variable ($R^2 = .013$, Adjusted $R^2 = -.004$). H2 in yogurt dessert category is not supported.

5.5 Elements combination and their effects on purchase intention (H3)

Chocolate cookies

We checked the aesthetic attractiveness for the cookies package. The average score of perceived aesthetics is 4.58 out of 7, which indicates that the designed stimuli for this category are visually appealing to most consumers. The result of one-way ANOVA shows that there is a significant difference among the four experimental conditions regarding aesthetics ($F(3, 176) = 7.19$, $p < .001$). Given the significant differences in aesthetic attractiveness, we included it as a covariant in our analysis to control its impact and better isolate the effects of design elements on purchase intention.

Table 11 Mean table of aesthetic attractiveness of chocolate cookies

Textual Element	Visual Element	Mean	N	SD
Tasty	Tasty (TT)	4.98	45	1.08
	Healthy (TH)	4.39	45	1.59
Healthy	Tasty (HT)	5.11	45	1.46
	Healthy (HH)	3.86	45	1.59

More specifically in attractiveness, as shown in Fig.3 , T-tests revealed that the mean attractiveness for the group exposed to tasty visuals ($M_{Tasty} = 5.04$) is significantly higher than for those exposed to healthy ones ($M_{Healthy} = 4.12$, $p < .001$), confirming that consumers find packaging significantly more attractive when the visuals emphasize tastiness rather than healthiness. Conversely, there was no significant difference in aesthetic attractiveness between healthy and tasty textual cues ($p = .38$), indicating that visual cues play a more crucial role than textual cues in shaping consumers' perceptions of packaging attractiveness.

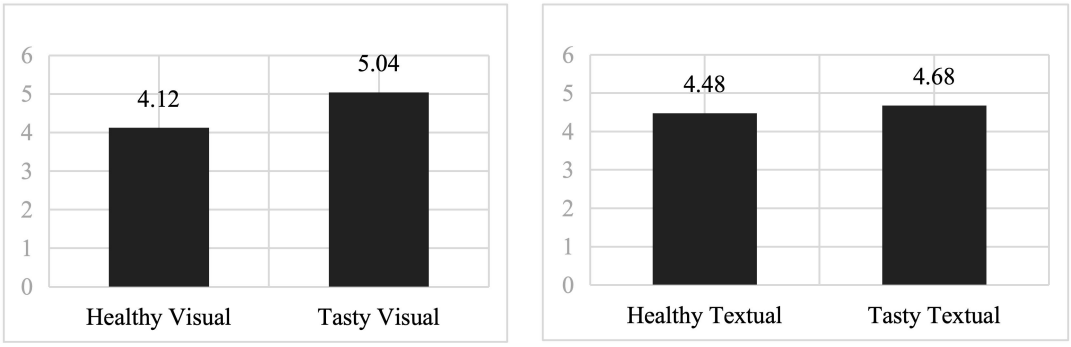

Fig.3. (a) Attractiveness of the group exposed to different visuals condition (b)attractiveness of the group exposed to different textual condition

An ANCOVA was then conducted to examine the effects of textual and visual elements on consumer purchase intention, while controlling for attractiveness as a covariant. The analysis revealed that the overall model was significant ($F(4, 175) = 28.23$, $p < .001$, $\eta^2 = .39$). Attractiveness has a significant influence on purchase intention ($F(1, 175) = 68.88$, $p = .88$, $\eta^2 = .28$), suggesting that this variable is a strong predictor in this context. Based on the regression analysis, it was found that higher aesthetic

attractiveness leads to higher purchase intention (β = .59, p < .001).

The results showed that textual elements did not significantly influence purchase intention (F(1, 175) = 0.02, p = .88, η^2 = .00). In contrast, visual elements had a significant effect on purchase intention (F(1, 175) = 13.13, p < .001, η^2 = .070), suggesting that visual cues play a critical role in enhancing consumer purchase intentions. We then calculated the means of the purchase intention from the two group of people assigned to healthy and tasty visual. An T-test was performed and indicated that the mean purchase intention for the group exposed to tasty visuals (M_{Tasty}=5.10) is significantly higher then those to healthy visual ($M_{Healthy}$ = 3.90, p < .001), confirming that consumers are more likely to have higher purchase intentions when the product visuals focus on tastiness rather than healthiness.

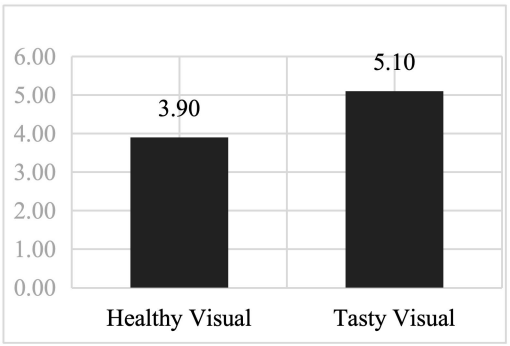

Fig.4. purchase intention of the group exposed to different visual condition

The interaction between textual and visual elements, on the other hand, was also not significant (F(1, 175) = 0.06, p = .81, η^2 = .00), indicating that the combination of these elements does not significantly affect purchase intention beyond their individual effects. H3 for cookies is not supported.

Yogurt dessert

We checked the aesthetic attractiveness for the yogurt dessert packages. Although the results showed no significant difference among the four stimuli (F(3, 176) = .46, p = .71), aesthetic attractiveness was still included in the following analysis as a covariant in the following analysis for H3 in the yogurt dessert category, since we assumed individual differences in aesthetic attractiveness might still have a significant impact on purchase intention.

The ANCOVA result revealed that the overall model was significant (F(4, 175) = 11.37, p < .001, η^2 = .21). As the same result of cookies, the attractiveness significantly influence the purchase intention (F(1, 175) = 47.76, p < .001). The regression analysis suggested that higher aesthetic attractiveness would result in higher purchase intention (β = .44, p < .001). Besides, textual elements (F(1, 175) = .22, p = .64) and visual elements (F(1, 175) = 29.23, p = .46) both had no significant influence on purchase intention. The interaction between textual and visual elements was not significant (F(1, 175) = .31, p = .58), indicating that the combination of these elements does not significantly affect purchase intention beyond their individual effects. H3 for yogurt is not supported.

5.6 General health interest as moderating role (H4)

First, we performed a median split of the sample's GHI score (the median value was 3.0) to create two groups and factorial analysis was conducted in both groups.

Chocolate cookies

In lower GHI group, visual elements had a significant impact on purchase intention ($F(1, 92) = 23.36$, $p < .001$). More specifically, T-test result indicated that consumers show significantly higher purchase intentions when exposed to products with visuals emphasizing tastiness ($N = 44$) compared to those emphasizing healthiness ($N = 53$; $t(89.68) = -6.05$, $p < .001$). Besides, textual elements ($F(1, 92) = 0.66$, $p = .42$) and the interaction between two types of elements ($F(1, 92) = 1.24$, $p = .27$) both showed no significant effect on purchase intention.

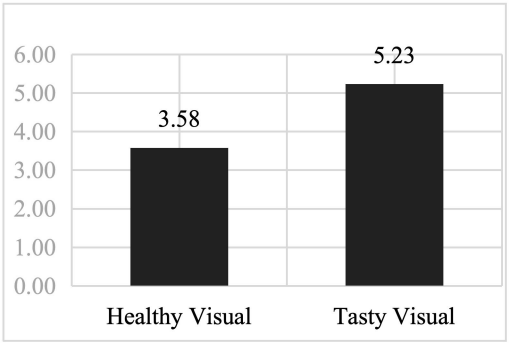

Fig.5. purchase intention of chocolate cookies group exposed to different visual condition

On the other hand, in the high GHI group, neither visual nor textual elements significantly influenced purchase intention in the high GHI group. Visual elements ($F(1, 78) = 0.47$, $p = .49$), textual elements ($F(1, 78) = 1.92$, $p = .17$), and their interaction ($F(1, 78) = 1.73$, $p = .19$) all failed to significantly predict purchase intention.

Thus, the moderation effect proposed in the H4 is partially supported: consumers with low GHI indeed exhibit higher purchase intentions when the visual elements emphasize tastiness, while the response from high GHI consumers to both visual and textual elements was relatively insignificant in this experiment.

Yogurt

In low GHI group, a factorial analysis was conducted and results showed that the main effects of textual ($F(1, 91) = .07$, $p = .80$) and visual elements ($F(1, 91) = 4.82$ $p = .07$) did not reach the significance level in the low GHI group, indicating that these elements do not have a significant effect on purchase intention among low GHI consumers.

In the high GHI group, the main effect of both textual ($F(1, 78) = 4.42$, $p = .04$) and visual elements ($F(1, 78) = 7.06$, $p = .01$) on purchase intention reached a significant level, with the effect of visual elements being more pronounced, which suggests that visual elements have a greater effect on purchase intention among high GHI consumers. More specifically, T-test results showed that healthy visual elements ($N = 40$)

significantly contributed to higher purchase intention compared to tasty ones (N = 43; t(81) = 2.56, p = .01). As for textual elements, although there was some difference in the mean value of purchase intention between the two groups, the difference was not statistically significant (t(81) = 1.38, p = .17), which indicates that the impact of textual element on high GHI consumers may exist, but its effect is weak, which is not significant enough under specific conditions.

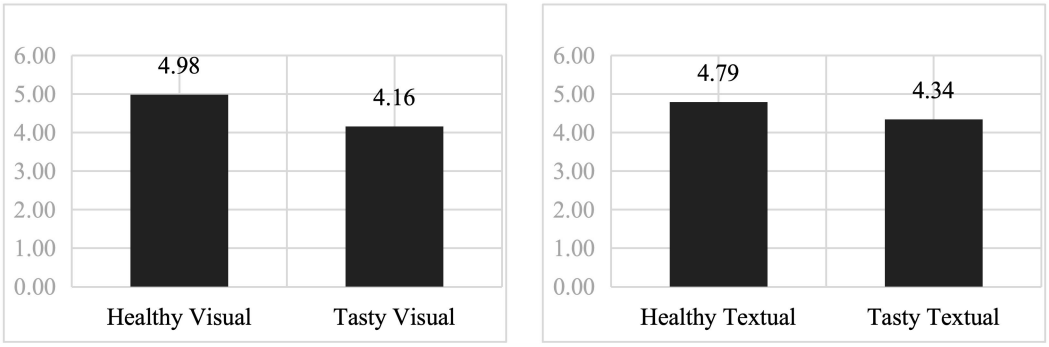

Fig.5. (a)purchase intention of yogurt dessert group exposed to different visual condition (b)purchase intention of yogurt dessert group exposed to different visual condition

In summary, in the high GHI group, consumers did show higher purchase intentions for products with visual elements expressing healthiness. Conversely, the purchase intention of consumers with low GHI was not influenced by both product benefits. H4 in yogurt dessert category is partially verified.

6. Discussion

6.1 Theoretical implications

The effects of package elements on tastiness and healthiness

The conceptual model used in this paper tried to see the global picture of the factors that influence the consumer perceptions when it comes to food products. The findings of this study contribute to the broader literature on consumer behavior and packaging design. Besides, it expand the research scope beyond the common healthy food to the domain of vice food, where the perceived indulgence and sensory pleasure might play a more critical role in consumer decision-making. The results from H1 and H2 demonstrated that visual elements play a significantly more substantial role than textual elements in shaping consumer perceptions across both vice food product categories, which aligns with existing research that suggests visual cues are more immediate and impactful in consumer decision-making processes compared to textual information (Chrysochou & Grunert, 2014; Schifferstein, 2021). In contrast to healthy food, where textual health claims are generally impactful, the findings indicate that in the domain of vice foods, consumers may predominantly rely on visual cues to reconcile the tension between health and indulgence, possibly due to the more immediate and emotionally resonant experience provided by them.

More specifically, for chocolate cookies, visual elements were found to exert a

powerful influence on both healthiness and tastiness perceptions. This suggests that consumers are more responsive to visual cues when facing the choice of indulgent products. In the yogurt dessert category, the results were consistent but less significant. Visual elements still plays a more influential role than textual ones during conveying health and taste perceptions, although the overall influence was weaker compared to the cookies category. This difference could be attributed to the inherent nature of the product categories, where consumers may tend to categorize yogurt desserts into more of a healthy food acquiescently, thereby diminishing the relative impact of textual or visual cues.

The effects of package elements on purchase intention

In H3, the significant influence of visual cues on purchase intention was validated, reinforcing the idea that visual elements play a crucial role in consumer decision-making. Additionally, when analyzing the overall sample, it was observed that packaging with tasty visual cues significantly outperformed packaging with healthy visual cues in terms of purchase intention. This finding suggests that in the context of vice foods, tastiness remains a more influential factor than healthiness. This outcome contributes to the theoretical understanding of how consumers prioritize different product attributes in vice food categories. It highlights that, despite growing health consciousness, the immediate sensory appeal conveyed through visual elements still have a stronger impact on consumer choices.

On the other hand, the initial focus of this study: the interaction between textual and visual elements failed to show significant influence purchase intention in either product category, suggesting that these elements may function independently rather than jointly influencing consumer perceptions and behaviors. However, based on the results of H1 and H2 which textual elements appeared to have little influence on either product attribute, the insignificant effects of the interaction on purchase intention could be due to the possibility that the selected textual elements in the experimental design lacked sufficient variety or contrast to effectively fulfill their intended roles.

The influence of attractiveness

In this study, aesthetic attractiveness has been validated as a crucial factor influencing consumers' purchase intentions. The analysis revealed that in the context of vice foods, visual cues that effectively convey tastiness significantly enhance the perceived attractiveness of the packaging, which in turn boosts purchase intention. This finding underscores the importance of visual elements as a key predictor of consumer behavior. Specifically, standing in front of the vice food shelf in the market, where products are often associated with indulgence and sensory pleasure, consumers are more likely to be attracted by packaging that offers strong visual appeal and enjoyment. This finding contributes to the theoretical understanding of the role of visual elements in consumer behavior, particularly in the context of vice products, demonstrating that aesthetic attractiveness is beyond only a critical factor in attracting consumers' attention, but also important in influencing their purchasing decisions.

The role of consumer factor

In addition, this study addresses a significant gap in the literature regarding the interplay between consumer's health interest and packaging elements within the vice food category. Previous research has primarily concentrated on how consumer attitudes influence their perceptions and choices of healthy foods (Ares et al., 2010; Bublitz et al., 2010; Van Herpen & Van Trijp, 2011). By validating that the General Health Interest moderates the impact of packaging cues on vice foods, this research demonstrates that even within the vice food category, where hedonic value is priority, it is still essential to provide differentiating packaging communication strategies for those health-conscious consumers. This finding contributes to a more nuanced understanding of consumer behavior, particularly in how individual different interest in health would shape their perception to different packaging. It highlights that consumers with higher health consciousness still respond positively to health-focused packaging cues, even when the product is supposed to be hedonic.

6.2 Practical implications

The findings that visual elements exert a stronger influence than textual elements on consumer perceptions of tastiness and healthiness, particularly in the vice food category, suggest that brands should prioritize visual cues in their packaging design. Managers should focus on creating visually appealing designs that emphasize intended product qualities through imagery, color schemes, layout etc. This approach is especially critical for products where consumers seek sensory pleasure, as visual elements can quickly convey the desired emotional appeal and drive purchase intentions more effectively than textual claims.

Besides, given that packaging with tasty visual cues significantly outperformed those with healthy visual cues in terms of purchase intention, marketers should consider emphasizing the tastiness of their vice food products through visually-driven marketing strategies to ensure higher purchase intention, while appropriately enhancing the expression of healthiness through other channel.

The significant role of attractiveness reinforces the idea that visual attractiveness is a significant driver in the decision-making process for consumers seeking hedonic benefits. Marketers aiming to promote vice foods should therefore prioritize the visual appeal of their packaging to effectively capture consumer attention and increase purchase likelihood. Moreover, designers can devise more attractive expressions or forms to express health benefits in order to promote healthy vice food choices.

Besides, by recognizing and leveraging the moderating role of consumer health interest, companies can more effectively align their products with the preferences of their target consumers, leading to greater satisfaction and increased purchase intentions. Marketers must first clearly understand their market position and the characteristics of their consumer before developing targeted packaging strategies; otherwise, they risk achieving the opposite of their intended effect. For instance, for consumers with high health concern, purchase intentions increase when visual elements emphasize healthiness. In such cases, it would be inappropriate to use visuals that focus on tastiness; instead, the focus should remain on health-oriented visuals, with an emphasis on enhancing the

overall attractiveness of the packaging. Conversely, for consumers with low health interests, it is more effective to use visuals that highlight tastiness, complemented by appropriate health cues. By tailoring packaging strategies in this way, companies can better cater to the specific needs and preferences of different consumer segments.

6.3 Limitation and future research

While this study provides some insights into the influence of packaging elements on consumer perceptions and behaviors, it is not without its limitations. One significant limitation is the manipulation of textual elements, which was not entirely successful in conveying the intended product benefits.

For the design of the stimuli, we aimed to minimize the potential cognitive burden that could arise from overwhelming participants with too much information. To achieve this, we intentionally kept the content of the textual elements straightforward and concise and didn't adapt the commonly used nutrition labels in the Dutch food market. In order to achieve the overall better aesthetic level, the size of these textual elements was relatively smaller compared to the visual elements. All the factors mentioned above might result in the inefficient expression of textual elements. Moreover, given that the questionnaire was administered online, the actual size of the packaging images differed from what participants would encounter in a real-world consumption environment. This discrepancy in scale could potentially influence the quality of information intake. When viewing the scaled-down images on smartphones, participants are more likely to focus on the direct, eye-catching visuals, and might need to zoom in to read the textual content. This extra effort could create operational difficulties, possibly leading to reduced attention to and processing of the textual elements. As a result, the textual content might not have been as effectively communicated as visual one. However, even in the absence of significant interactions, comparing means can still provide some initial insights and directions for future research. In this experiment, the combination of tasty visual and healthy textual scored the highest. This may indicate that this combination still has potential advantages in boosting product appeal and purchase intent and is worth further exploration.

In the selection of the independent variables for this study, packaging elements were categorized into textual and visual ones. However, in practical packaging design, each category includes various sub-elements such as color schemes, font, image style, verbal claims which can themselves serve as independent variables to convey different product benefits. Future research could further diversify the exploration of packaging elements by expanding the categories and classification methods used, thereby enhancing both the accuracy of the research and its practical applications. Additionally, since this study was conducted online, it inevitably overlooked variables such as material, shape, and transparency, which can only be perceived in a real purchasing environment. These variables might significantly impact consumer purchase decisions during the actual shopping experience. Therefore, future research should consider incorporating these factors by using actual packaging designs in offline tests.

In terms of consumer perception, this study revealed differences in aesthetic attractiveness, suggesting that the design quality of the stimuli may not have been balanced, potentially interfering with the analysis of the effectiveness of textual and

visual elements in conveying product attributes. However, at the same time, it prompts us to consider whether attractiveness might also enhance purchase intention through other mechanisms. Attractiveness could potentially moderate the way information is interpreted; when packaging is more visually appealing, consumers might be more inclined to accept the health or tastiness messages conveyed by the packaging, thereby increasing their purchase intentions. In future research, particularly in the realm of vice foods, it may be valuable to explore attractiveness as a distinct characteristic. Besides, this study focused primarily on the tradeoff between tastiness and healthiness to explore how packaging influences consumer behavior. However, consumer decision-making is a complex process that involves more than just these two factors. Elements such as emotion (Floyd, 2011), perceived sustainability (Hallez et al., 2023), and brand loyalty also play critical roles in shaping consumer perceptions and choices. These factors interact in various ways, co-functioning to the formation of consumer perception and ultimately influencing purchase decisions. Given this complexity, there is substantial room for further theoretical exploration.

Another limitation in this research is the relatively small and homogenous sample size, which may limit the generalization of the findings. The study was conducted among Dutch consumers, which and the results may not necessarily apply to other consumer segments or cultural contexts. Future research could address this limitation by including a larger and more diverse sample.

Appendix A. Pretest Questionnaire

Intro

. Welcome to this research. In this research we want to know your perception of several cookie and yoghurt packages. We expect the whole survey to take about 5-8 min.

I am Nian Liu, a second-year SPD student and this research is part of my graduation research project. I am mentored by Dr. Marielle E.H. Creusen and Dr. Rick H.N.J. Schifferstein. Should you have any questions or need further information, feel free to contact us at N.Liu-4@student.tudelft.nl.

Participation of this research is voluntary and you are free to withdraw at any time from the it. Data collected will be recorded anonymously and kept secured on personal computers under password protection, and will only be used for academic research. By proceeding, you voluntarily agree to participate in this study, and you confirm that you've read and understood the above information.

- ○ Yes, I do
- ○ No, I don't

Cookie

. In this section, you will see several chocolate cookies packages that differ in the picture, layout used and color. Please indicate how tasty, healthy and visually attractive you think each package is.

Cookie-1.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-2.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-3.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-4.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-5.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-6.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-7.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-8.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-9.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Cookie-10.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think these cookies will be tasty	○	○	○	○	○	○	○
I think these cookies will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt

. In this section, you will see several yogurt packages that differ in the picture, layout used or color. Please indicate how tasty, healthy and visually attractive you think each package is.

Yogurt-1.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-2.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-3.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-4.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-5.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-6.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I thinkthis yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-7.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I thinkthis yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-8.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-9.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○
This package looks visually attractive	○	○	○	○	○	○	○

Yogurt-10.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert will be tasty	○	○	○	○	○	○	○
I think this yogurt dessert will be healthy	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This package looks visually attractive	○	○	○	○	○	○	○

Personal Information

. Thanks for your patience! You are 99% done with the research. Here are a few last questions

Please enter your age:

. Which of the following best describes your gender identity?

- ○ Male
- ○ Female
- ○ Non-binary
- ○ Prefer to self-describe:
- ○ Prefer not to say

. If you have any question, feedback or suggestion, please tell us here:

Appendix B. Main Test Questionnaire

Consent form

. Welcome to this research!

In this research, you will be presented with a chocolate chip cookies packaging and a yogurt dessert packaging, followed by questions about them. We expect the whole survey to take about 5-8 mins.

Data collected will be recorded anonymously and reported only in an aggregate format (combined results, never individual results). The aggregated data will be used for academic research and publication.

There appear to be no risks and discomforts associated with the study. Participation of this research is voluntary and you are free to withdraw at any time.

This research is conducted by Dr. Marielle E.H. Creusen, Dr. Rick H.N.J. Schifferstein and Nian Liu from the Delft University of Technology. Should you have any questions or need further information, feel free to contact us at N.Liu-4@student.tudelft.nl.

By proceeding, you voluntarily agree to participate in this study and confirm that you've read and understood the above information.

- ○ Yes, I do
- ○ No, I don't

Prolific ID

. What is your Prolific ID?
Please note that this response should auto-fill with the correct ID

${e://Field/PROLIFIC_PID}

Cookies Intro

. How often do you **purchase** chocolate chip cookies?

- ○ Multiple times a week
- ○ 2-4 times a month
- ○ Once a month
- ○ A few times a year
- ○ (Almost) never

. How often do you **eat** chocolate chip cookies?

- ○ Every day
- ○ Multiple times a week
- ○ 2-4 times a month
- ○ Once a month
- ○ A few times a year
- ○ (Almost) never

Cookies 1

. In the following section, you will be presented with a chocolate chip cookies package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to taste good.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
These cookies look delicious.	○	○	○	○	○	○	○
I think these cookies look tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to be healthy.	○	○	○	○	○	○	○
These cookies look healthy.	○	○	○	○	○	○	○
These cookies look healthier than similar cookies products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy these cookies when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy chocolate chip cookies.	○	○	○	○	○	○	○
This is a beautiful-looking cookies package.	○	○	○	○	○	○	○
This cookies package is visually appealing.	○	○	○	○	○	○	○

Cookies 2

. In the following section, you will be presented with a chocolate chip cookies package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to taste good.	○	○	○	○	○	○	○
These cookies look delicious.	○	○	○	○	○	○	○
I think these cookies look tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to be healthy.	○	○	○	○	○	○	○
These cookies look healthy.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
These cookies look healthier than similar cookies products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy these cookies when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy chocolate chip cookies.	○	○	○	○	○	○	○
This is a beautiful-looking cookies package.	○	○	○	○	○	○	○
This cookies package is visually appealing.	○	○	○	○	○	○	○

Cookies 3

. In the following section, you will be presented with a chocolate chip cookies package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to taste good.	○	○	○	○	○	○	○
These cookies look delicious.	○	○	○	○	○	○	○
I think these cookies look tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to be healthy.	○	○	○	○	○	○	○
These cookies look healthy.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
These cookies look healthier than similar cookies products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy these cookies when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy chocolate chip cookies.	○	○	○	○	○	○	○
This is a beautiful-looking cookies package.	○	○	○	○	○	○	○
This cookies package is visually appealing.	○	○	○	○	○	○	○

Cookies 4

. In the following section, you will be presented with a chocolate chip cookies package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to taste good.	○	○	○	○	○	○	○
These cookies look delicious.	○	○	○	○	○	○	○
I think these cookies look tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect these cookies to be healthy.	○	○	○	○	○	○	○
These cookies look healthy.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
These cookies look healthier than similar cookies products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy these cookies when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy chocolate chip cookies.	○	○	○	○	○	○	○
This is a beautiful-looking cookies package.	○	○	○	○	○	○	○
This cookies package is visually appealing.	○	○	○	○	○	○	○

Yogurt Intro

. How often do you **purchase** a yogurt dessert?

- ○ Multiple times a week
- ○ 2-4 times a month

- ○ Once a month
- ○ A few times a year
- ○ (Almost) never

. How often do you **eat** a yogurt dessert?

- ○ Everyday
- ○ Multiple times a week
- ○ 2-4 times a month
- ○ Once a month
- ○ A few times a year
- ○ (Almost) never

Yogurt 1

. In the following section, you will be presented with a yogurt dessert package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to taste good.	○	○	○	○	○	○	○
This yogurt dessert looks delicious.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I think this yogurt dessert looks tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to be healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthier than similar yogurt dessert products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy this yogurt dessert when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy yogurt dessert.	○	○	○	○	○	○	○
This is a beautiful-looking yogurt dessert package.	○	○	○	○	○	○	○
This yogurt dessert package is visually appealing.	○	○	○	○	○	○	○

Yogurt 2

. In the following section, you will be presented with a yogurt dessert package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to taste good.	○	○	○	○	○	○	○
This yogurt dessert looks delicious.	○	○	○	○	○	○	○
I think this yogurt dessert looks tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to be healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthier than similar yogurt dessert products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy this yogurt dessert when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy yogurt dessert.	○	○	○	○	○	○	○
This is a beautiful-looking yogurt dessert package.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This yogurt dessert package is visually appealing.	○	○	○	○	○	○	○

Yogurt 3

. In the following section, you will be presented with a yogurt dessert package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to taste good.	○	○	○	○	○	○	○
This yogurt dessert looks delicious.	○	○	○	○	○	○	○
I think this yogurt dessert looks tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to be healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthier than similar yogurt dessert products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy this yogurt dessert when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy yogurt dessert.	○	○	○	○	○	○	○
This is a beautiful-looking yogurt dessert package.	○	○	○	○	○	○	○
This yogurt dessert package is visually appealing.	○	○	○	○	○	○	○

Yogurt 4

. In the following section, you will be presented with a yogurt dessert package. Please indicate how much you agree with each statement.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to taste good.	○	○	○	○	○	○	○
This yogurt dessert looks delicious.	○	○	○	○	○	○	○
I think this yogurt dessert looks tasty.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I expect this yogurt dessert to be healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthy.	○	○	○	○	○	○	○
This yogurt dessert looks healthier than similar yogurt dessert products.	○	○	○	○	○	○	○

.

To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I would buy this yogurt dessert when I see it in the store.	○	○	○	○	○	○	○
I would consider this product when I intend to buy yogurt dessert.	○	○	○	○	○	○	○
This is a beautiful-looking yogurt dessert package.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
This yogurt dessert package is visually appealing.	○	○	○	○	○	○	○

Health Interest

. Please indicate how much you agree with the following statements

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The healthiness of food has little impact on my food choices.	○	○	○	○	○
I am very particular about the healthiness of food I eat.	○	○	○	○	○
I eat what I like and I do not worry much about the healthiness of food.	○	○	○	○	○
It is important for me that my diet is low in fat.	○	○	○	○	○
I always follow a healthy and balanced diet.	○	○	○	○	○
I do not avoid foods, even if they may raise my cholesterol.	○	○	○	○	○
The healthiness of snacks makes no difference to me.	○	○	○	○	○
It is important for me that my daily diet contains a lot of vitamins and minerals.	○	○	○	○	○

General Question

. Please enter your age

. Which of the following best describes your gender identity?

- ○ Male
- ○ Female
- ○ Non-binary
- ○ Prefer to self-describle

. What is the highest level of education that you have finished?

- ○ Basisschool (primary school)
- ○ LBO (lower vocational training) or VMBO (pre-vocational education)
- ○ Havo (higher secondary education)
- ○ VWO (preparatory scientific secondary education)
- ○ MBO (secondary vocational training)
- ○ HBO Bachelor (higher vocational training BSc)
- ○ WO Bachelor (University BSc)
- ○ HBO Master (higher vocational training MSc)
- ○ WO Master (University MSc)
- ○ Other, please fill in

. If you have any question, feedback or suggestion, please tell us here:

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TU Delft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	Liu
Initials	N
Given name	Nian
Student number	5536308

IDE master(s)	IPD ☐ DfI ☐ SPD ✓
2nd non-IDE master	
Individual programme *(date of approval)*	
Medisign	☐
HPM	☐

SUPERVISORY TEAM

Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Marielle Creusen	dept./section	MCR/DOS
mentor	Rick Schifferstein	dept./section	DA/HCD
2nd mentor			
client:			
city:		country:	
optional comments			

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in **by the Chair** of the supervisory team

Sign for approval (Chair)

Name M. Creusen Date 26-3-2024 Signature

CHECK ON STUDY PROGRESS

To be filled in **by SSC E&SA** (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total _____ EC

Of which, taking conditional requirements into account, can be part of the exam programme _____ EC

X	**YES**	all 1st year master courses passed
	NO	missing 1st year courses

Comments:

Sign for approval (SSC E&SA)

Name Robin den Braber Date 09-04-2024 Signature RdB

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	V	Supervisory Team approved
NO		Supervisory Team not approved

Comments:

Based on study progress, students is ...

V	**ALLOWED** to start the graduation project
	NOT allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Name Monique von Morgen Date 15/4/2024 Signature MJ van Morgen

Personal Project Brief – IDE Master Graduation Project

Name student Nian Liu **Student number** 5,536,308

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT

Complete all fields, keep information clear, specific and concise

Project title Conveying healthfulness and tastefulness for vice food categories utilizing packaging

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

There is a notable demand for what is often referred to as "vice food" or "indulgent food" in contemporary society. These food typically include items high in sugar, fat, and salt, such as fast food, desserts, and snacks. Despite the growing awareness of the importance of healthy eating, individuals often seek out these foods due to their palatability, convenience and psychological associations with pleasure and comfort(Wansink&Chandon, 2014). With the rise of diet-related diseases, the growing emphasis on healthy nutrition and health-concerned consumers becoming a critical market segment, healthier choice within vice food categories is in urgent need.

Consumer's purchase decisions often rely on multisensory cues such as packaging design. Packaging helps consumer decide which product to choose by capturing their attention and convincing them that it contains the product which best suits their needs (Gil-Perez et al,2020). The increased competition in the "healthier" food market is forcing food managers to find more effective ways to convey healthfulness in their brand (Chrysochou, 2010; Kemp&Bui, 2011). While previous study mainly focus on the effects of package design elements in health-positioned categories, there is a lack of emphasis on vice food categories. A more healthy-looking competitive package will attract consumers with healthfulness needs and therefore serve to promote sales. This research would provide insights for policymakers and food brands regarding the utilization of packaging design in the promotion of healthier vice food alternatives which eventually improves the consumer's healthier behaviours.

→ *space available for images / figures on next page*

introduction (continued): space for images

image / figure 1

image / figure 2

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

In the domain of vice food, simply incorporating excessive health-oriented elements may not necessarily enhance, but rather diminish, the appeal and sales of the product. One of the well-documented heuristics in food choice was defined as the "unhealthy=tasty intuition" (Raghunathan, Naylor&Hoyer, 2006), which shows that when it comes to the choice of vice food, the perceived tastefulness tends to have a higher impact on the consumer's purchase intention than simply emphasizing healthfulness. While certain packaging elements would each have different effects on different aspect of consumer perception, the categories of elements that play more vital roles in the consumer perception process in vice food domain need to be concluded. Then, a balanced combination of those elements conveying both healthfulness and tastefulness will be explored. How would the interplay between those elements effect consumer's perception of healthfulness and tastiness, demonstrating that this product is not only delicious but also healthy, and how would all perceptions influence the eventual purchase intention would be the focus of this research.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

To explore the relationship between package design and consumer perception in vice food categories to provide design guidelines for promoting healthier food alternative chocie in the Dutch food market.

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

This research would be achived through the implementation of a quantitative research design. The first step would be to review existing literature and formulate the research question and hypothesis. The vice food category would be selected based on market landscape and packaging element as independent variables would be identified based on previous literature. A study will later be conducted preceded by a pretest to ensure the manipulation of the design is justified. The study will explore the effects of the independent variables have on dependent variables, which is, the perceived healthfulness, perceived tastefulness and purchase intention, including the individual effects and interaction effects. The data collected will be analyzed and presented in the research discussion, followed by implications for healthy packaging design.

Project planning and key moments

To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a ***kick-off meeting, mid-term evaluation meeting, green light meeting*** *and* ***graduation ceremony****. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	4 Mar 2024
Mid-term evaluation	29 Apr 2024
Green light meeting	24 Jun 2024
Graduation ceremony	26 Jul 2024

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	
For how many project weeks	
Number of project days per week	

Comments:

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

I'm excited to embark on a research-focused graduation project to further practise and extend my research capabilities. As a designer, I've always been curious to uncover what users want and need and use those insights to inspire and guide design solutions. Through the previous SPD research project experience, I have develped a keen interest in probing and resolving problems through an objective research approach. In this project, I aim to gain a better understanding of consumer attitudes and behaviors in terms of healthy eating and behaviors.

I have obtained fundamental research skills from previous studies. However, there are still some competences that I wish to develop. As this is my first independent research project, it's crucial to master the ability for time-management and multi-stakeholder-collaboration. I believe I would harvest not only skills mentioned above but also a solid understanding towards my capability as a designer and insights for my future career path.