



# Signalling taste through packaging: The effects of shape and colour on consumers' perceptions of cheeses

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## ABSTRACT

This paper questions whether manufacturers can utilize visual packaging cues, in particular colours and shapes, to communicate the intrinsic attributes of cheeses. While the existence of crossmodal correspondences between packaging shapes and tastes have been demonstrated in previous food studies, we still need knowledge about how the interaction of colour and shape of the packaging that the cheese is sold influence customers' expectations of taste and liking. Throughout two studies, we illustrate that specific shapes and colours communicate certain cheese tastes. In study 1, we found that, while a mild tasting cheese is associated with round shapes, high colour brightness and low colour saturation, a sharp tasting cheese is associated with an angular shape, lower level of colour brightness and higher level of colour saturation. This knowledge can be utilized to communicate taste via the design of the packaging. In study 2, we moved on to test this via packaging. We found that a round shaped packaging combined with high colour brightness and low colour saturation communicates a mild taste, whereas a triangular shape packaging combined with a low colour brightness/ high saturation signals a sharper tasting cheese. Moreover, a round packaging elicits the highest degree of liking. Our findings demonstrate that multiple sensory elements of a product's packaging can enhance respondents' taste expectations and expected liking of a product. In conclusion, this paper offers guidance to managers seeking to design packaging that communicates the flavour of food products, specifically for cheeses.

## 1. Introduction

In the present research, we evaluate how packaging cues, in particular colour and shape, interact to shape expectations of cheese liking and taste. The extensive use of pre-packed food products and the emergence of online distribution channels stresses the importance for manufacturers to understand how packaging design can signal the sensory attributes of a product, and thereby facilitate consumers' decision-making process.

The primary function of a product's packaging is to protect the content (Wikström, Williams, Vergheze, & Clune, 2014). However, it is important to keep in mind that the packaging also communicates something to consumers. Indeed, it has been suggested that the days in which packaging was only thought of to protect and conserve a product are the past and that a packaging today is considered a multisensory experience device capable of transforming the product experience (Velasco & Spence, 2019).

Previous studies show that consumers tend to evaluate products

more favourably if they find the packaging attractive (Westerman et al., 2012). Being visually dominant creatures (Spence, 2016), consumers often base their purchase decisions on the visual appearance of products (Becker, van Rompay, Schifferstein, & Galetzka, 2011; Pombo & Velasco, 2021), and packaging plays a key role in capturing the customers' attention and setting their product-related expectations (e.g., Kauppinen-Räsänen, 2014; Schifferstein, 2006; Spence, 2016; Spence & Velasco, 2018).

Packaging can vary in both graphics (e.g. colour, typeface, and images) and structure (e.g. shape, size, and material). Preferences for cheese packaging have been investigated and it seems that consumers prefer a plastic packaging with rectangular shape, with a resealing system and unsliced format, with easy opening and additional information provided (Eldesouky, Mesías, Elghannam, Gaspar, & Escribano, 2016). One of the first studies investigating how the shape one sees modify the taste of cheese was an unpublished laboratory study conducted by Gal et al. in 2007 (See Spence & Deroy, 2013). Here a cheddar cheese was rated 7 % sharper after participants had been watching

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angular shapes compared to another group who looked at organic shapes. These results are attributable to the existence of crossmodal correspondences, that is, the associations that exist between features across the senses (Velasco, Woods, Petit, Cheok, & Spence, 2016).

The shape of the packaging in which the product is served can impact consumer's responses to food and beverage products. For different types of food, such as coffee, soft drinks and snack, packaging attributes have been found to influence consumers' taste perception (de Sousa, Carvalho, & Pereira, 2020; Khan & Lee, 2020). Packaging attributes can make consumers susceptible to specific taste expectations and thereby make them more inclined to purchase products that signal their preferred taste. Overall, it is reasonable to suggest that packaging attributes affect consumers' perceptions and expectations of a product (see Velasco & Spence, 2019, for an edited collection on multisensory packaging research). In the present research, we study how packaging design influences consumers' expectations of liking and expectations of mild or sharp taste of cheeses. We contribute to the literature by investigating not only one modality, but by investigating how different colours and different shapes on cheese packaging match consumers expectations of taste and expectations of liking of cheeses. While previous studies show that packaging attributes influence taste perception of food and beverage, the preferred taste varies for different food products. Accordingly, different products need to signal different taste via the packaging. For cheese, mild and sharp taste are important attributes (Bemfeito, Rodrigues, Silva, & Abreu, 2016; Meals, Schiano, & Drake, 2020). Some consumers like mild tasting cheese, others like sharp; some dishes fit best with sharp tasting cheese, others with mild. By investigating how packaging can signal taste, we aim with this study not only to generate new knowledge of how colour and shape of packaging signals taste of cheese. We aim to present a stepwise procedure that managers can apply when designing food packaging that signals a specific taste that is important for their product.

While flavour and taste sometimes are used interchangeably in the literature, there is a difference. Taste refers to the senses in the mouth and has to do with how the tongue and mouth interact with food and drinks. Flavour, on the other hand, is a combination of sensory stimuli that includes sight (visual), taste (gustatory), smell (olfactory), touch (tactile), temperature (thermal) etc. We focus on taste, and how colour and shape of packaging match specific tastes and create taste expectations. In addition, the two studies that we present serve as a guide for practitioners to evaluate crossmodal correspondences (study 1) and then capitalize on them to set up product expectations (study 2).

## 2. Multisensory attributes in brand touchpoints

Various authors have highlighted that the human senses are of crucial importance when investigating consumer decision-making and consumption processes. It is through the different senses (e.g., vision, touch, smell, hearing, and taste) that consumers become aware and develop knowledge of products, brands, and firms (Hultén, Broweus, & van Dijk, 2009). Importantly, the senses interact with each other during perception (Eimer, 2004). Notably, thought, the sensory modality that provides the most detailed and reliable information about the external world can dominate other sensations (Fenko, Schifferstein, & Hekkert, 2010).

Since the multisensory design of the packaging can significantly affect consumers' judgments of the contents (e.g., Spence & Levitan, 2021; Mohan, 2013; Raine, 2007), designers may use sensory cues, such as size, shape, colour, weight, and smell in order to convey a message to consumers (Schifferstein, 2006; Schifferstein, Fenko, Desmet, Labbe, & Martin, 2013). Various scholars have found crossmodal correspondences between tastes and other visual and non-visual sensory cues such as colours (e.g., Piqueras-Fiszman & Spence, 2011), sounds (e.g., Knöferle & Spence, 2012), shapes (e.g., Becker et al., 2011) and even words (e.g., Spence & Gallace, 2011) to influence consumers perception of a product. In this study, we focus on two specific visual cues of cheese packaging,

colours and shapes.

### 2.1. Colour

Colour is, perhaps, the most important sensory feature of a product's packaging (Spence & Velasco, 2018; Spence, 2016). Colour is critical when consumers engage in low involvement decisions (Garber, Hyatt, & Starr, 2000; 2001) and can be used as a marketing tool for fast moving consumer goods (Lichtlé, 2007). Also, for high involvement products colours have been found relevant (see Labrecque & Milne, 2013 for an interesting study of how colour norms for logos in a category influence brand equity). Three components of the packaging colour: hue, brightness, and saturation, can be used (Spence et al., 2015). Hue is the colour category, such as red, blue, and yellow, brightness refers to the amount of white or black added to the hue, and saturation is the intensity of the colour. All of these can convey meaning to the consumer and influence their behaviour (e.g., Gimba, 1998; Labrecque & Milne, 2012; Tijssen, Zandstra, de Graaf, & Jager, 2017).

Researchers have documented notable cognitive and affective responses to colour hue, ranging from brand personality perceptions to the moral acceptability of undesirable behaviours (e.g., De Bock, Pandelaere, & Van Kenhove, 2013; Labrecque & Milne, 2012). According to Hine (1995), consumers perceive packaging colour at three different levels, namely the physiological, the cultural, and the associational. The latter refers to colour expectations associated with a brand developed over time (Cheskin & Ward, 1948). In many cases, the colour of a packaging represents an association with a specific brand, such as the colour blue for Barilla products or purple for Cadbury (Spence, 2016). For instance, when the colour red appears on a beverage it may suddenly offer consumers linkages to the Coca-Cola brand.

There are already well-established conventions of what colours are more appropriate to certain product categories and contexts (van Rompay, Deterink, & Fenko, 2016). For instance, Piqueras-Fiszman and Spence (2011) performed a study that sought to detect the meaning and impact of packaging colour for potato crisps in the United Kingdom. The authors highlighted that different colours indicate different taste and showed that the meaning of colour on taste perception depends on the participants' brand affiliations. They found that light blue signals 'salt and vinegar' tasting crisps, whilst green is associated with 'cheese and onion' taste. However, the Walkers brand has used the opposite colour-taste convention for its crisp products since 1983 and has been rather successful with this strategy. Notably, the colour affiliations of potato crisps in the UK market may not necessarily be present in other countries. The meaning of colour varies across cultures and geographical regions, and colour nearly always is seen in context (e.g., Spence, 2016; Velasco et al., 2014; Wan et al., 2014). For example, the colour red is used in packaging to signify 'full fat' in the milk aisle in the United States (Rox, 2011) and 'ready salted' in the crisp category in the United Kingdom (Piqueras-Fiszman & Spence, 2011).

Several researchers have looked at crossmodal correspondences between colour hues and basic tastes bitter, sweet, sour, salty and umami (Saluja & Stevenson, 2018; Spence & Levitan, 2021; Spence et al., 2015; Spence, 2019). The emphasis has been on the first four and how people assess colour hues to match these basic tastes, either by asking them what colour goes best with a certain taste, or the other way around. In their review, Spence et al. (2015) highlights that all the various colour studies conducted categorized colours to taste in a similar manner. Black, green, violet and brown were associated with a bitter taste, green and yellow had associations with a sour taste, whereas orange, pink and red were associated with a sweet taste. Finally, blue, white and grey were associated with a salty taste.

Overall, prior research indicates a higher preference for colours that are very bright (McManus, Jones, & Cottrell, 1981), that lighter colours increase size perception of objects (Gundlach & Macoubrey, 1931; Mahnke, 1996), while objects with darker colours appear heavier (Walker, Francis, & Walker, 2010). Interestingly, Ampuero and Vila

(2006) revealed that colder and darker colours indicate premium quality. Their findings from the Spanish market revealed that products with a high price, based on elegance and refined aesthetics, require packaging with colder and darker colours, preferably black. In contrast, more accessible products directed to more price sensitive consumers, require light coloured packaging, preferably white.

In 2017, Tijssen et al. investigated how variations in brightness on food packaging influenced expected healthiness, attractiveness and sensory properties of a low-sugar dairy drink and a low-fat sausage. An alteration of the brightness levels turned out to have opposite effects on the expected taste intensity of the two products. More specifically, an increase in brightness increased the taste intensity for the dairy drink but decreased the expected taste intensity for the sausage. The two products also varied in terms of how the respondents perceived their product properties. Sausages in less bright coloured packaging was perceived as fattier, while dairy drinks in more bright coloured packaging was perceived as creamier.

Since, previous studies investigating colour brightness ability to communicate taste shows that a high level of colour brightness indicates a mild and creamy taste of dairy products, we state the following hypothesis for cheeses:

*H1: A cheese with a mild taste will be associated with a higher level of colour brightness than a cheese with a sharp taste.*

Saturated colours, especially highly saturated ones, capture consumers' attention by triggering arousal, (e.g. Lichtlé, 2007; Mikellides, 1990). Research focusing on how saturated packaging colours affect consumers' expectations and perceptions, reveal that highly saturated colours are preferred amongst consumers, and that consumers expect a correspondence between saturated packaging colours and taste intensity (Camgöz, Yener, & Güvenç, 2004; Gatti, Bordegoni, & Spence, 2014; Mai, Symmank, & Seeberg-Elverfeldt, 2016; McManus et al., 1981; Tijssen et al., 2017). Highly saturated colours boost consumers' perceptions of stimulus intensity (Schifferstein & Tanudjaja, 2004; Tijssen et al., 2017; Valdez & Mehrabian, 1994), and consumers believe that the content of packaging will have a stronger and more intense taste if the colour of the packaging is more saturated. A product packaging with strong and bold colours signifies more intense taste experiences regardless of country and category (Spence, 2016).

Since, previous studies have found that a high level of colour saturation indicates an intense taste in general we state the following hypothesis for cheeses:

*H2: A cheese with a mild taste will be associated with a lower level of colour saturation than a cheese with a sharp taste.*

## 2.2. Shape

In addition to colour, shape is one of the most important factors to consider when designing packaging (Suzianti, Rengkung, Nurtjahyo, & Al Rasyid, 2015). The shape of both product and packaging can affect consumers' associations and sensory expectations towards a product, as well as their expected liking and their willingness to purchase the product (Ares & Deliza, 2010; Velasco et al., 2016).

Most food and drink products come in packaging of a particular shape, and van Ooijen, Franssen, Verlegh, and Smit (2017) suggested that the shape of a packaging serves as a symbolic signal that can communicate specific attributes to consumers. Shapes prime attributes in the mind of the consumer (e.g., Ampuero & Vila, 2006; Zhang, Feick, & Price, 2006). While angular shapes induce perceptions of traits that express energy, toughness and strength, rounded shapes generate associations with approachability, friendliness and harmony. Researchers have found that packaging with round shapes have significantly higher expected liking than squared packaging (Ares & Deliza, 2010), and that round packaging elicit the highest preference amongst consumers (Li,

Zeng, & Zhou, 2020; Motoki & Velasco, 2021; Suzianti et al., 2015; Wang, Yu, & Li, 2020). Round shapes are generally liked more than angular shapes (Gómez-Puerto, Munar, & Nadal, 2016; Salgado-Montejo et al., 2015). Furthermore, when comparing cheese packaging of rectangular, triangular and round shapes, Eldesouky et al. (2016) revealed that consumers prefer the rectangular shape.

Overall, evidence indicates that the shape of a packaging conveys meaning about various sensory attributes of its content (Becker et al., 2011; Spence, 2012; Velasco et al., 2016). For instance, various authors have found angular shapes to evoke intense tastes (e.g., Becker et al., 2011). What is more, Velasco, Woods, Deroy, and Spence (2015) revealed that the taste words bitter, salty and sour were matched to angularity, whereas sweetness was more closely linked to roundness. More specifically, the literature indicates that consumers associate round shapes with sweetness, and angular shapes with sour tastes (e.g., Velasco et al., 2014; Salgado-Montejo et al., 2015; Ngo et al., 2013). In terms of the latter, consumers have been found to match an acidic tasting cranberry juice with angular shapes (Spence & Gallace, 2011).

Prior research has also found that carbonation, bitterness, sourness, and crispiness/crunchiness appear to be matched with more angular shapes, whilst noncarbonated, sweet and creamy foods all seem to be matched with more rounded shapes. For example, Spence and Gallace (2011) found that people seem to match sparkling water with angular shapes, whereas still water was matched with more rounded shapes. In a recent study, Pathak, Motoki, Techawachirakul, and Calvert (2022) found that brand names containing voiceless consonants (p, k, t, f) were more associated with carbonated beverages and spikiness, compared to voiced consonants (b, d, g, v) that are more associated with still water and roundedness. Furthermore, Ngo, Misra, and Spence (2011) found that bitter, dark chocolate (i.e., 70 and 90 per cent cocoa) was matched with angular and sharp shapes. On the contrary, the respondents matched a sweet and creamy milk chocolate (i.e., 30 per cent cocoa) with rounded shapes. Similarly, Ares and Deliza (2010) discovered that consumers associated round packaging with runny, creamy and soft desserts. Various authors have emphasized that angular shapes drive intense taste sensation and seemingly, these shapes have associations with the taste words bitter, salty and sour. On the contrary, round shapes are connected with the taste words sweet and creamy.

Interestingly, people often use shapes when describing the taste of consumables. For example, wine is often described as having a round, sharp or pointy shape (e.g., Lehrer, 2009, Spence & Gallace, 2011). The same when describing cheeses. It is common for people to describe cheeses as having a sharp taste (Marks, 1991; Spence & Gallace, 2011). Consistent with this, Spence, Ngo, Percival, and Smith (2013) revealed that consumers consider strong and pungent cheeses to have angular shapes, whereas milder cheeses have associations with a more rounded shape. This study was one of the first to investigate shape taste correspondence in such a complex product as a cheese. One limitation of this study is the number of cheeses included. They investigated only three cheeses, and replication studies including more cheese samples have been asked for.

Since a large stem of research has revealed that angular shapes indicate intense taste sensations, we argue that more sharp cheese samples are connected to an angular shape, while milder cheese samples with less intense taste sensations could be connected to round shapes. Moreover, Ares and Deliza (2010) revealed that round shapes are more pleasant and have higher utilities in terms of expected liking than angular shapes. Spence et al., 2013, demonstrate that taste is the leading contributor to the systematic associations consumers have between the flavours of cheese and certain angular/sharp or organic/round shapes. These assumptions have been used to create the following hypotheses:

*H3: A cheese with a sharp taste will be more associated with an angular shape than a cheese with a milder taste.*

*H4: A cheese with a mild taste will be more associated with a round shape than a cheese with a sharp taste.*

H5: Cheese types associated with round shapes will score higher in terms of liking than cheese types associated with angular shapes.

Spence and Ngo (2012), summaries of the latest evidence demonstrating that the shapes of the packaging in which the product is served can influence a consumer's sensory-discriminative and hedonic responses to food and beverage products. Based on previous findings stating that the design of the packaging influence product-related expectations (Spence & Levitan, 2021; Velasco & Spence, 2019) and our proposed associations between cheese taste, shape and colour in H1 to H4, we propose that the shape and the colour of a cheese packaging will interactively influence taste expectations.

H6: The expected sharpness of a cheese in an angular packaging with low colour brightness and high colour saturation will be higher than a cheese in a round shaped packaging with high colour brightness and low colour saturation.

### 3. Study 1

#### 3.1. Participants

Ten groups of 12 respondents partook in the study (N = 120). The data collection took place at Måltidets Hus in Stavanger (Norway) and respondents, originated from this geographical area were recruited through the consumer panel of Tine (<https://www.tine.no>), the largest Norwegian dairy company. Data from 11 participants were excluded since they had confused the cheese samples, resulting in data from 109 respondents (Mean age = 43. SD = 1.78; 68 female and 41 males) being used for the analyses.

#### 3.2. Apparatus and material

The study includes 11 different cheese samples selected by Tine to secure variation in taste among high sales volume cheeses in Norway. The cheese samples were cut in 72 identical pieces of rectangular dices and served in a white, round plastic container. To avoid brand expectation biases, no brand information was given to the respondents. Each cheese sample had a three-digit number placed on the container.

#### 3.3. Design and procedure

Over the course of two days, the respondents were instructed to blind taste the cheese samples prior to accessing an online survey created in the software Qualtrics (Version February 2019) and they repeated this task 10 times.

The respondents were instructed to start by specifying the number of the cheese they were about to taste. Together with the cheese samples, the respondents were provided crackers, water, napkins, and spitting cups. Prior to entering the room, the respondents were given an explanation regarding the procedure of the study and were told that they would be exposed to 11 different cheeses in random order. The respondents were situated in their own stalls and accessed the survey on a computer screen in the laboratory. The respondents would taste one cheese and perform four sensory matching tasks (i.e., choose the visual features that best match the taste of the cheese, namely shape, colour hue, brightness, and saturation, see Fig. 1), in addition to answer questions regarding liking of the cheese and perceived taste characteristics (e.g., check-all-that-apply, CATA). The respondents were then told they were to repeat this task for the remaining ten cheeses. In line with Nicholls, Bradshaw, and Mattingley (1999), the respondents were able to look at the entire stimulus for as long as they needed. Not only were the cheese samples randomly delivered to the respondents, they were also exposed to the various colour hues and CATA questions in a randomized order. Through a forced choice task, inspired by the method of Salgado-Montejo et al. (2015), the respondents were asked to choose the colour hue they found to be the best match for the given cheese sample

(Fig. 2). After choosing a colour hue that matched, the respondents were exposed to brightness and saturation scales for that particular hue. Similarly, the respondents were asked to choose the level of brightness and saturation that best matched the taste of the given cheese sample (see Fig. 3). The survey ended after the respondents stated their gender and age.

The first study seeks to measure how shapes, colours and taste of cheeses correspond. In order to uncover information about the sensory characteristics of the cheeses, the respondents state their overall liking of the samples. The following question was asked: "Please, indicate how well you like the taste of this cheese". In line with the method proposed by Ares & Jaeger, 2013, the respondents were asked to indicate their overall liking using a horizontal 9-point hedonic scale anchored at 'Dislike extremely' (1) and 'Like extremely' (9).

In order for the respondents to communicate the complex sensory experience of the eleven cheeses, a check all that apply (CATA) questionnaire with 47 descriptive words (Firm, Usable, Flavour-rich, Fresh, Boring, Grass, Off-flavour, Wet, Cream, Cellar taste, Aromatic, Sweet, Tasty, Creamy, Nuts, Crispy, Soft, Fruity, Full, Besk, Hay, Mature, Pungent, Earth, Sour, Butter, Velvet, Balanced, Round, Easily soluble, Beginner cheese, Powerful, Bitter, Smooth, Interesting, Flat, Broth, Salt, Pleasure, Delicate, Fusible, Sharp, Rich, Agile, Mild, Fat, Exotic) were included. This design has been found efficient, as it does not limit respondents to only one answer (Smyth, Dillman, Christian, & Stern, 2006). The 47 terms were randomized, and the respondents were asked to check the five terms they considered most appropriate when describing the cheese samples.

Following the research on taste/shape correspondences (Velasco et al., 2015), the scale for shape was anchored with a round shape on the left and a triangular on the right. More specifically, a line scale of 20 cm with a mark centred on the mid-point of the scale was included. Similar to the first task, the respondents were instructed to place each of the cheese samples on a 9-point Likert scale along the line scale to indicate which shape that best matched the taste of the individual cheese.

The chosen colour hues for this study were inspired by Heller (1999) and Wan et al. (2014), who used black, blue, brown, green, grey, orange, pink, purple, red, white, and yellow to evaluate how respondents would match different tastes and colour hues. We did not include black, brown, grey and white hues, due to problems manipulating these colours to 100 per cent brightness and saturation. The following question was asked: Please, indicate what color that best matched the taste of this cheese.

Thereby, seven colour hues (i.e., blue, green, orange, pink, purple, red and yellow) were included in the study. In order to manipulate the hues, Windows' colour picker tool was used. Thus, Windows' colour picker tool and HSL (Hue, Saturation and Lightness) slider function were used as guidelines for manipulating the various values of brightness and saturation. In line with Camgöz et al. (2004), the scales ranged from 0 to 100 per cent and had a 10 per cent interval between each level. Notably, a 0 per cent brightness level equals a black colour hue, whilst a 0 per cent saturation level equals a white colour hue. By default, these two colour hues were still part of the study. In order to achieve the proper scales, the level of brightness was kept constant (i.e., 100 per cent) when manipulating the levels of saturation, and vice versa. The following questions were asked: Please, indicate what colour brightness/ saturation that best match the taste of this cheese".

#### 3.4. Analyses

To investigate the cheese characteristics, descriptive analyses of the CATA data were conducted, while an analysis of variance (ANOVA) and a Bonferroni-corrected pairwise comparison were used to investigate the liking, shape, and colour correspondence. Note that, whenever sphericity was violated in the ANOVA, the Greenhouse-Geisser correction was used.

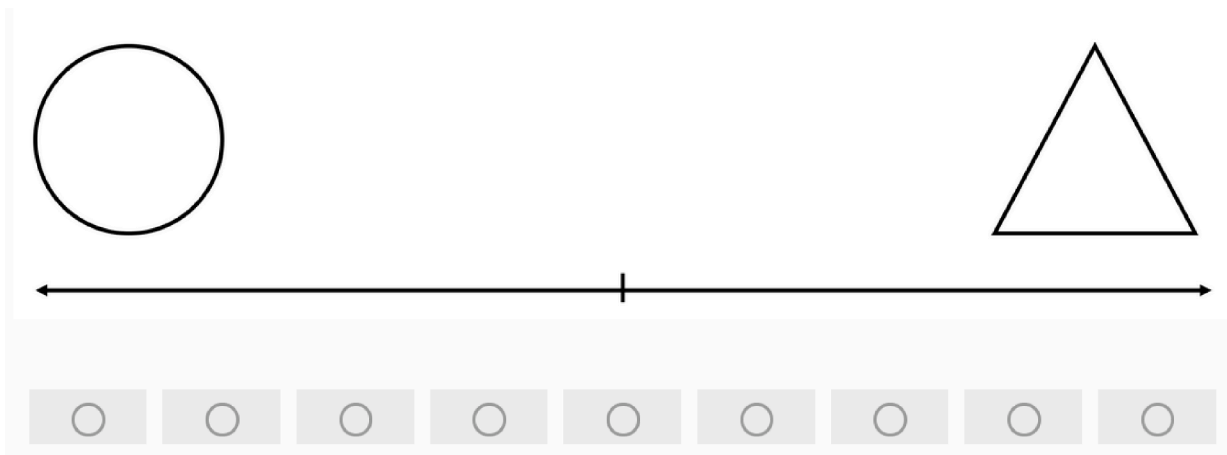


Fig. 1. Shape scale used in study 1.

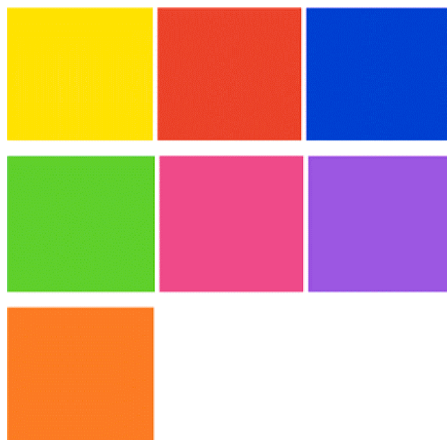


Fig. 2. Colour hues used in study 1; Yellow (56°), red (8°), blue (229°), green (132°), pink (325°), purple (227°) and orange (30°). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

### 3.5. Results

#### 3.5.1. CATA cheese characteristics

Table 1 presents the three most frequent words used by the respondents to describe the different cheeses in the CATA test. The cheese samples of 4., followed by 7., 5., 6. and 2., are all described as mild, while 10., 9., 11., 8., and 1. are described as more bitter, pungent, and sharp, and can be defined as ‘sharp’ cheeses.

#### 3.5.2. Liking, shape, and colour correspondences

Significant differences in the liking,  $F(6.323, 682.901) = 6.23, p < .001$ , generalized eta squared ( $g\eta^2$ ) = 0.044, shape,  $F(8.343, 900.998) = 22.57, p < .001, g\eta^2 = 0.153$ , brightness,  $F(7.147, 771.853) = 13.08, p < .001, g\eta^2 = 0.079$ , and saturation,  $F(8.42, 910.170) = 14.19, p < .001, g\eta^2 = 0.080$ , ratings were observed between the cheeses (see Fig. 4).

Bonferroni-corrected pairwise comparisons revealed that the participants liked cheese 1 significantly less than cheeses 2, 4, 5, 6, and 7, and cheese 8 less than 2, 4, 6, and 7 (all  $p$ s  $\leq 0.029$ ). Interestingly, cheese 1 and 10 were considered as sharper than all cheeses, cheese 2 as significantly rounder than all the other cheeses, cheese 3 as significantly rounder than cheeses 5, 8, 9, and 10, and cheese 4 as rounder than cheese 10 (all  $p$ s  $\leq 0.037$ ). These findings support H5 (see Fig. 4).

In terms of brightness, cheese 1 was considered as less bright than cheeses 3, 4, 5, 6, and 7, cheeses 2 and 3, as brighter than cheeses 5, 8, 9,

10, and 11, and cheese 4 as brighter than cheeses 8 and 10. Cheeses 5, 6, and 7, were considered as brighter than cheese 10, and cheese 6 also as brighter than cheese 8 (all  $p$ s  $\leq 0.034$ ).

Finally, in terms of saturation, the participants considered cheese 1 as more saturated than cheeses 2, 3, 4, 5 and 6, cheeses 2 as less saturated than cheeses 8, 9, and 10, cheese 3 as less saturated than 5, 6, 7, 8, 9, 10, 11, cheeses 4, 5, 6, and 7 as less saturated than 8 and 10, and cheese 10 as less saturated than 11 (all  $p$ s  $\leq 0.047$ ).

The results of the cheese/colour-matching task are presented in Table 2. The results revealed an association between colour and cheese,  $\chi^2(60, N = 109) = 111.80, p < .001$ , Cramer's  $V = 0.125$ . For most cheeses, the participants chose the colour yellow, though not in all cases significantly more than it would be expected by chance level. Differences between colour choices were observed in cheese number two, three, and ten.

### 3.6. Conclusion study 1

The first study used a crossmodal matching task seeking to uncover crossmodal correspondences between taste and various shapes and colours. The findings from this study indicate how specific cheeses match specific colours and shapes. Through utilizing 11 cheese samples, the study revealed that it is possible to distinguish between mild and sharp cheeses. We found the existence of crossmodal correspondences between taste/ colour and taste/ shape. Two mild cheeses (2. and 3.) were matched with a round shape and colours as yellow, green and blue, while the sharp cheese (10.) was matched with the triangular shape and red and orange colours (Supporting H3 and H4). In relative terms, sharp cheeses (like 1. and 10.) were matched with higher saturation and lower brightness of the colours compared to the mild cheeses (like 2. and 3.) (Supporting H1 and H2).

The mild cheeses scored higher on the CATA-words that express less intense taste sensations (e.g., mild, soft, round and creamy), whilst the sharp cheeses were matched with CATA-words that express intense taste sensations (e.g., sharp, bitter and pungent).

## 4. Study 2

Based on the crossmodal matching task in study 1, we move on in study 2 to evaluate if actual combinations of colour and shape on a packaging influence consumers expectations of liking and taste of cheeses. The results from this study should yield some indications as to what the optimal packaging combination would be for mild vs sharp taste expectations.

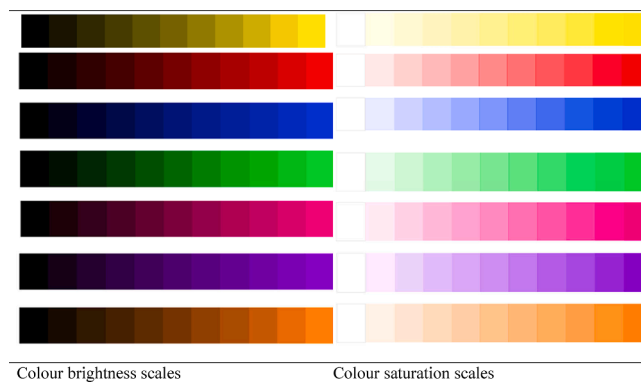


Fig. 3. Colour brightness and colour saturation scales used in study 1.

**Table 1**  
The three most frequent CATA words used to describe the cheeses.

Cheese	Three most frequent descriptors
1	Sharp, powerful, bitter
2	Mild, round, butter
3	Mild, firm, boring
4	Firm, tasty, mild
5	Firm, flavour-rich, tasty
6	Firm, mild, tasty
7	Firm, mild, round
8	Flavour-rich, sharp, powerful
9	Firm, tasty, powerful, mature
10	Strong, tasty, sharp
11	Soft, mild, bitter

#### 4.1. Participants

118 participants (Mean age = 34.02, SD = 13.76, 72 females, 45 males, 1 other) participated in the study and were recruited via social media, in particular, Facebook. The experiment was designed on Qualtrics.

#### 4.2. Apparatus and material

In line with previous research (e.g., Almlí, Øvrum, Hersleth, Almøy, & Næs, 2015; Ares & Deliza, 2010; Tijssen et al., 2017), this study presents the stimuli in pictorial formats. A graphic designer at Tine designed the product scenarios by combining brand, shape and colour into realistic product descriptions.

We focused on two large volume cheese brands from Norway with both a mild and a mature cheese in the portfolio. More specifically, the choice fell on two cheese types of Jarlsberg and two types of Norvegia (i. e., Original and Vellagret), both semi hard Gouda type cheeses (see Figs. 5 and 6). Even though neither of these cheese samples showed extreme differences in Study 1, the tendency of the findings was still apparent. Since we were not interested in the effect of brands but in the effect of shape and colour, the two brands were collapsed to give us more generalizability.

#### 4.3. Design and procedure

A 2 brands  $\times$  3 shapes  $\times$  3 hues  $\times$  2 brightness/saturation experimental design was conducted, yielding a combination of 36 cheese packaging samples that all participants were presented individually and in a randomized order. To offer realistic product scenarios, the shapes included resembles common cheese packaging shapes in Norway (round, square, and triangular). The three primary colours of red, blue, and yellow were chosen as the basis for Study 2. Similar to Tijssen et al.

(2017) and Lichtlé (2007), the levels of brightness and saturation were combined (high brightness/ low saturation and low brightness/ high saturation for all the three colours), since we hypothesised that high brightness and low saturation both trigger associations to a mild taste, while low brightness and high saturation both triggers a more intense taste.

After the presentation of each cheese packaging stimulus, the participants responded to a questionnaire to evaluate the packaging. The respondents begun the survey with indicating their liking of the packaging. They were asked: "Please, indicate how much you like this cheese packaging". Here, a rating scale anchored from 1 to 9, with 1 being 'dislike extremely' and 9 being 'like extremely', was chosen (e.g., Murphy, Cowan, Henschion, & O'Reilly, 2000). Because previous studies have illustrated that liking of food and willingness to purchase are correlated (e.g., Delgado, Crisosto, Heymann, & Crisosto, 2013; Mueller & Szolnoki, 2010), it was made a choice to solely focus on liking.

To test whether the shape and colour of the packaging influenced taste expectations of the cheese, respondents were asked to assess the degree in which they regarded the taste of the cheese inside the packaging to be sharp, using the same 9-point scale (i.e., 1 being 'extremely mild' and 9 being 'extremely sharp'). The exact wording was "Based on the packaging, please, indicate how you perceive the taste of the cheese". No tasting was involved in study-two.

#### 4.4. Analyses

We aggregated the data as a function of brand and conducted a 3-way repeated measures ANOVA, with factors colour (blue, yellow, red), shape (square, circle, triangle), and brightness/saturation (high/low vs low/high) on each of the dependent variables, namely packaging liking, and cheese sharpness.

#### 4.5. Results

The results of the study are summarized in Table 3 (see also Fig. 7, for a visual summary of the results). In terms of packaging liking, the participants liked the round packaging more relative to the square and triangle packaging ( $ps \leq 0.010$ ). The participants also liked the blue and red packaging more than the yellow one ( $ps \leq 0.010$ ). As for the interaction between hue and brightness/saturation, the participants liked the lighter/less saturated red packaging more than the blue and the yellow ones ( $ps < 0.001$ ). Whereas they liked the darker/more saturated blue packaging more than the yellow and red ( $ps \leq 0.006$ ), and the red more than the yellow ( $p = .039$ ).

In terms of cheese sharpness, the participants expected the cheeses in the packaging with a triangle to be sharper than those in the packaging with a circle or a square ( $ps < 0.001$ ). Significant differences in expected mildness were observed between all colours such that the cheese was

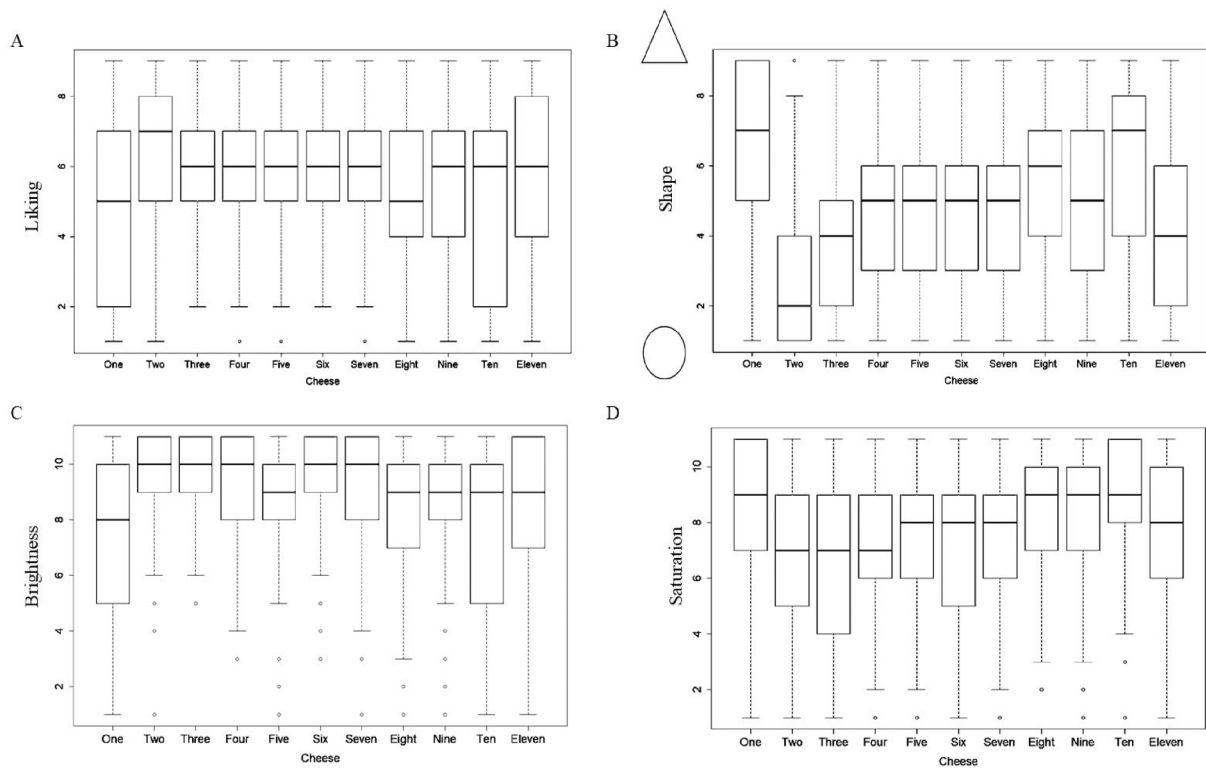


Fig. 4. Box plot illustrating the mean scores of A) liking, B) shape, C) brightness, and D) saturation ratings of the eleven cheeses.

Table 2

Cheese and colour matching. Pairwise comparisons, using the Bonferroni correction were conducted and significant differences are indicated by different sub letters in the table.

Cheese	Colour						
	Blue	Green	Lilla	Orange	Pink	Red	Yellow
One	8 <sub>a</sub>	15 <sub>a</sub>	11 <sub>a</sub>	25 <sub>a</sub>	5 <sub>a</sub>	19 <sub>a</sub>	26 <sub>a</sub>
Two	5 <sub>a, b, c</sub>	17 <sub>c</sub>	4 <sub>a, b, c</sub>	9 <sub>b</sub>	7 <sub>a, b, c</sub>	13 <sub>a, b, c</sub>	54 <sub>a, c</sub>
Three	17 <sub>a</sub>	14 <sub>a, b</sub>	3 <sub>a, b</sub>	13 <sub>b</sub>	8 <sub>a, b</sub>	5 <sub>b</sub>	49 <sub>a, b</sub>
Four	10 <sub>a</sub>	15 <sub>a</sub>	6 <sub>a</sub>	23 <sub>a</sub>	8 <sub>a</sub>	11 <sub>a</sub>	36 <sub>a</sub>
Five	11 <sub>a</sub>	10 <sub>a</sub>	5 <sub>a</sub>	28 <sub>a</sub>	3 <sub>a</sub>	13 <sub>a</sub>	39 <sub>a</sub>
Six	12 <sub>a</sub>	9 <sub>a</sub>	4 <sub>a</sub>	28 <sub>a</sub>	5 <sub>a</sub>	7 <sub>a</sub>	44 <sub>a</sub>
Seven	8 <sub>a</sub>	15 <sub>a</sub>	7 <sub>a</sub>	15 <sub>a</sub>	6 <sub>a</sub>	12 <sub>a</sub>	46 <sub>a</sub>
Eight	12 <sub>a</sub>	11 <sub>a</sub>	8 <sub>a</sub>	34 <sub>a</sub>	4 <sub>a</sub>	12 <sub>a</sub>	28 <sub>a</sub>
Nine	8 <sub>a</sub>	13 <sub>a</sub>	14 <sub>a</sub>	22 <sub>a</sub>	6 <sub>a</sub>	10 <sub>a</sub>	36 <sub>a</sub>
Ten	17 <sub>a</sub>	7 <sub>a, b</sub>	6 <sub>a, b</sub>	29 <sub>a, b</sub>	5 <sub>a, b</sub>	20 <sub>a</sub>	25 <sub>b</sub>
Eleven	6 <sub>a</sub>	16 <sub>a</sub>	9 <sub>a</sub>	23 <sub>a</sub>	7 <sub>a</sub>	18 <sub>a</sub>	30 <sub>a</sub>

rated as sharper in the red packaging, followed by the blue, followed by the yellow ( $p_s < 0.001$ ). As for the main effect of brightness/saturation, the cheeses in the low brightness/ high saturation packaging were rated as sharper than the cheeses in the high brightness/ low saturation packaging ( $p_s < 0.001$ ). In terms of the interaction between hue and brightness/saturation, the participants considered as sharper the cheeses in the brighter/more saturated red packaging than the others ( $p \leq 0.002$ ), whereas they considered as sharper the cheeses in the darker/ more saturated red packaging than the others ( $p_s < 0.001$ ) and the blue as sharper than the yellow ( $p = .048$ ). The packaging with darker/ more saturated red colour and with a triangular shape has the highest mean expected sharpness rating. These findings support H6.

#### 4.6. Conclusion study 2

Study 2 aimed to test if the shape and colour of the packaging triggered taste expectations of the cheese. The results show that both shape

and colour of the packaging influence expected sharpness of the cheese and support our hypotheses that the expected sharpness of a cheese in an angular packaging with low colour brightness and high colour saturation will be higher than a cheese in a round shaped packaging with high colour brightness and low colour saturation.

## 5. Discussion

The present research illustrates how sensory packaging cues influence consumers' taste expectations of a product. The results from the two studies conducted support findings from previous research (e.g., Velasco & Spence, 2019), that consumers tend to infer how products taste from the packaging and that packaging attributes affect consumers' expectations of a product.

Study 1 aimed to reveal whether the taste of a cheese were associated with specific sensory packaging attributes. It revolved around a cross-modal matching task, seeking to uncover crossmodal correspondences between taste and various shapes and colours. The results from study 1 showed that respondents associate different shapes, colour hues, and colour brightness and saturation with mild and sharp cheeses. The CATA analysis conducted in Study 1 was used to create a taste profile for each of the cheese samples included and to make a distinction between mild and sharp cheese samples. The cheese samples that scored higher on the CATA-words that express less intense taste sensations (e.g., mild, soft, round and creamy) are regarded as mild, while the cheese samples with high scores on the intense CATA words (e.g., sharp, bitter and pungent) are regarded as sharp. In line with the developed hypotheses (H1 and H2), the respondents associated low levels of brightness and high levels of saturation with sharp cheese samples. The opposite effect was found for mild cheese samples, which coincides with the proposed hypotheses. These findings consist with the results reported by Tijssen et al. (2017), and suggests that a high level of brightness communicates milder products and that the opposite levels communicate a less intense taste sensation.

Moreover, the respondents in study 1 associated the mild cheese



Fig. 5. Norvegia product packaging.

samples with round shapes and sharp cheese samples with angular shapes. This is consistent with the developed hypotheses (H3 and H4). As previously argued, the mild cheese samples seem to be associated with less intense taste sensations and round shapes. More specifically, less intense taste words, such as sweet, creamy and soft, have been found to elicit associations towards round shapes (e.g., Ares & Deliza, 2010; Ngo et al., 2011; Spence et al., 2013; Velasco et al., 2015).

Importantly, study 1 revealed that the respondents had a higher preference for mild cheese samples, which were associated with round shapes, and a lower preference for the sharp cheese samples, which were associated with angular shapes. The higher preference for mild cheeses compared to sharp cheeses, align with previous cheese studies finding that mild and soft cheeses often are liked (Bemfeito et al., 2016), while bitterness is a driver of dislike of cheeses (Meals et al., 2020). Sensory properties seem to strongly affect consumer acceptance. Some people like mild cheeses because of the taste, other because of the texture, and mild cheeses are associated with a round shape. Our findings support the proposed hypothesis (H5), as cheese types associated with round shapes score higher in terms of liking than cheese types associated with angular shapes, but it is the taste and not the shape that drives the liking.

Why people seem to match a triangular shape with dark red colour more with a sharp tasting cheese than a mild tasting cheese, might be due to specific real-life associations. A triangular shape can evoke associations to something sharp, something that can hurt you easier than a round, smooth shape. Dark red might also be associated with blood or a warning triangle, and therefore easier associated with a sharp than a mild tasting cheese. This way of arguing is in line with what Jacobsen (2002) calls the association correspondences, suggesting that

individuals choose combinations based on specific real-world object associations. Another proposed explanation for peoples' colour and shape matching is the affective correspondence, which is acquired through the association of two dimensions based on similar emotional valence (Dreksler & Spence, 2019). This individual tendency for people to match colour they like with shapes and other things they like, can explain why the round shape is more often matched with a liked packaging. Previously researchers have reported that consumers have higher preferences for round shapes than for angular ones (e.g., Ares & Deliza, 2010; Salgado-Montejo et al., 2015).

Study 2 sought to investigate how specific combinations of packaging attributes could communicate the taste. Through combining brand, shape and colour onto 36 pictures of cheese packaging, the study aimed to uncover the respondents' expected liking and expected taste of the cheese. Interestingly, Study 2 revealed that both packaging shape and colour hue, brightness and saturation actually influence expected liking and taste. The use of an angular shape in combination with low brightness and high saturation (e.g. a triangular shaped packaging with a dark saturated red colour) seems to communicate a sharp taste expectation for cheese, while a round shape in combination with higher brightness and lower saturation communicates a milder taste expectation (e.g. a round shaped packaging with a light unsaturated yellow colour) (Support H6). It is worth noting that the findings from Study 2 revealed that the square shape had the lowest liking rating, which contradicts the results reported by Eldesouky et al. (2016). Still, Piqueras-Fizman and Spence (2011) emphasized that the meaning of colour on taste perception depends on the respondents' brand affiliations. Please, also be aware that the effect sizes and the differences





Fig. 6. Jarlsberg product packaging.

**Table 3**  
Summary of the repeated measures ANOVAs conducted in Experiment 2.

Factors	Packaging liking			Cheese sharpness		
	F	p	$\eta^2$	F	p	$\eta^2$
Shape	4.47	0.012	0.037	19.02	<0.001	0.140
Hue	8.59	<0.001	0.068	31.97	<0.001	0.215
Brightness / Saturation	0.153	0.696	0.001	42.77	<0.001	0.268
Shape. Hue	0.34	0.852	0.003	1.86	0.116	0.016
Shape. Brightness / Saturation	0.48	0.620	0.004	2.94	0.055	0.025
Hue: Brightness / Saturation	24.53	<0.001	0.173	5.54	0.004	0.045
Shape: Hue: Brightness / Saturation	2.24	0.064	0.019	0.26	0.889	0.002

between the conditions are rather low, and that only two very familiar brands of semi hard Gouda type cheeses, were tested. We don't know if the results can generalize to less familiar brands, or to other types of cheese.

This paper aimed to detect how sensory attributes of packaging can convey the meaning of a cheese product's taste. We present a procedure for how to design a packaging that signals specific sensory attributes (see Table 4). First, the design attributes that matches the sensory properties are described via a matching task. Then these design attributes are included in the design of the packaging. Our results show that this is a viable way to develop packaging that communicate specific taste expectations.

5.1. Limitations and future studies

While this study focused solely on the mild and sharp taste, future studies could also include more specific tastes and possibly obtain a more robust analysis and results. The results from Study 1, where respondents were set to go through a taste matching task, did not provide any extreme differences in terms of liking. This could possibly stem from the types of cheeses included in the study, all cheeses with a rather mild taste. More specifically, including more mature and sharper tasting cheese types, such as blue cheeses, could have provided the study with more extreme differences. Therefore, although we have included more cheeses than previous studies investigating shape/ taste correspondence (Spence et al., 2013) future studies could benefit from including an even wider range of cheese types when conducting similar studies.

It would also be interesting to investigate whether consumers in search of cheese for various usage situations are attracted by different variations in the size of product packaging. For instance, future researchers could aim to detect whether the size of packaging can contribute to communicate the perceived quality of the cheese through exposing participants to two or more different sized variants of the cheese. Mesías, Escribano, Rodríguez De Ledesma, and Pulido (2003) detected four homogeneous clusters of cheese consumers in their study. Interestingly, consumers in these groups eat cheese for different reasons: for its good taste, as a dietary habit, to accompany other food and/or for cooking. This indicates that consumers might also have different usage situations in mind when browsing the supermarket for a cheese. Hence, it could be beneficial for researchers to identify whether consumers value different sensory attributes for these different occasions. This could be done by creating various product packaging with different sensory attributes and have respondents match product packaging to

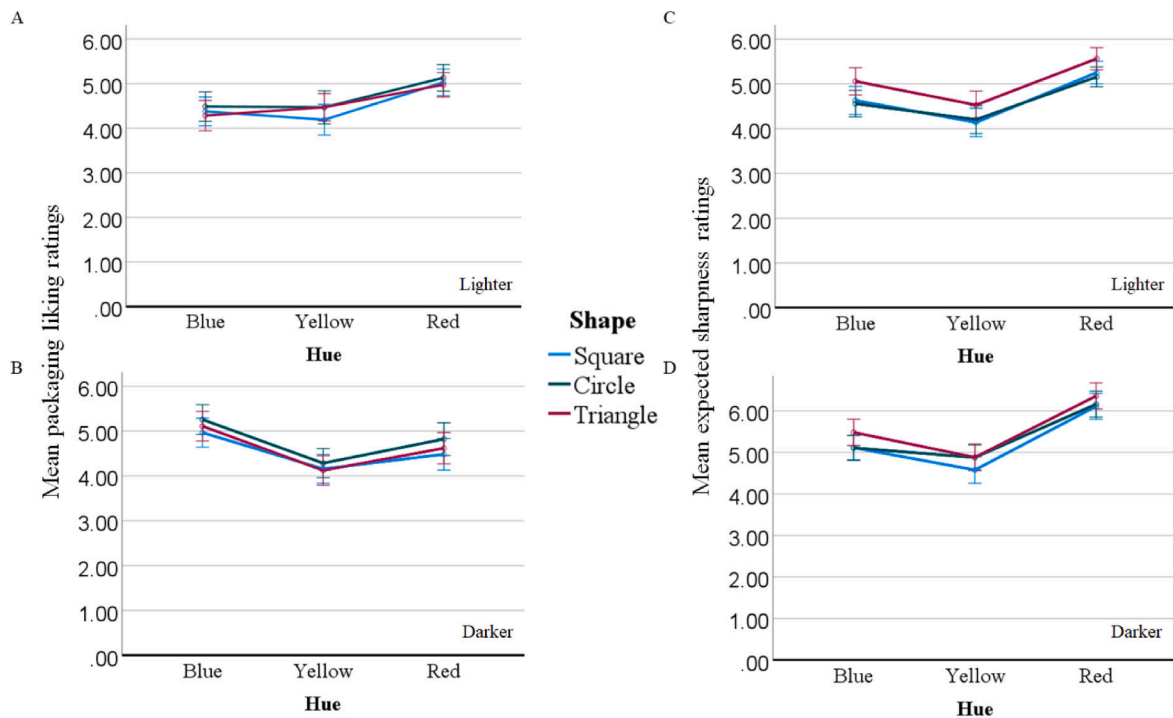


Fig. 7. Mean packaging liking and expected taste sharpness as a function of hue (x-axis), shape (lines), and brightness/saturation (A & C = lighter/less saturated, B & D = darker / more saturated).

**Table 4**  
Procedure for designing packaging that signals a specific taste.

Step 1	Conduct a sensory profile test to define what taste attributes best explain your product and the products you compete with.
Step 2	Define the taste attribute you want to communicate for your product
Step 3	Define, by looking at the literature, what sensory attributes (visuals as colour or shape, texture, sounds or smell) of the packaging that communicates this taste.
Step 4	Conduct a matching test between the most important packaging attributes and the taste of the product.
Step 5	Design pictures of the packaging and test in an experimental design how different packaging attributes influence expectations of taste and expectations of liking.
Step 6	Define and launch the packaging design that best communicate the taste you want to communicate.

scenarios based on consumer usage situations.

**6. Conclusion**

Conclusively, the results presented in this paper extend the work of previous studies. Multiple sensory elements of a packaging can enhance consumers’ taste expectations. Importantly, the results indicate that specific sensory packaging attributes may be utilized when the aim is to communicate the taste sensations a product elicits. The paper presents a stepwise procedure for how to design and test taste signalling packaging.

**CRedit authorship contribution statement**

**Nina Veflen:** Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision, Validation. **Carlos Velasco:** Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision, Validation. **Hilde Kraggerud:** Funding acquisition, Supervision, Validation.

**Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

**Data availability**

Data will be made available on request.

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