Hot or not? Conveying sensory information on food packaging through the spiciness-shape correspondence

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ABSTRACT

The packaging of a product is a key element in the communication between producers and consumers, so getting the consumer to interpret the packaging visual signs in the desired way is crucial to be successful in the marketplace. However, this is not easy as images can be ambiguous and may be interpreted in different ways. For example, depicting an icon of fire on the front of a bag of nuts may lead the consumer to interpret either that the nuts are spicy or that the nuts have been roasted. This paper addresses this problem and, using this case as an example, assesses if the interpretation of a fire icon (spicy vs roasted) can be modulated by manipulating its shape (angular vs rounded). 66 participants carried out an experiment which results show that there is a crossmodal correspondence between spiciness and pointy shapes and that this association can be used to modulate sensory expectations: in a speeded classification task, the bags of nuts depicting pointy fire icons were categorised more quickly as being spicy than as being roasted, while the opposite was true for the bags of nuts displaying rounded fire icons. In addition, the results of a mediation analysis suggest that this effect occurs indirectly through affective appraisal: the pointy fire icons were judged as being more aggressive than the rounded fire icons, which in turn raised spiciness expectations. These findings contribute to the research on crossmodal correspondences and semiotics by showing that the association between spiciness and abstract shapes can be used to modulate how people interpret an ambiguous image.

1. Introduction

One of the main tasks of a packaging designer is to effectively communicate the characteristics of the product contained within, as packaging is an important communication tool between producers and consumers (Nancarrow, Wright, & Brace, 1998). To that end, the designer must understand and untangle the codes and language used by consumers (Frascara, 1988; Laing & Masoodian, 2016) and, in addition, reproduce them clearly in an appealing design (Silayoi & Speece, 2007). Images allow the designer to both communicate messages and gain aesthetic quality, which is why they are frequently used in food packaging (Underwood & Klein, 2002). Images are a key element in the packaging visual appearance as they allow the consumer to quickly identify and categorize the product (Loken, 2006) and to generate expectations about it (see Deliza & MacFie, 1996; Piqueras-Fiszman & Spence, 2015, for reviews). However, for the designer it is not easy to

anticipate the meaning that a consumer will assign to an image since in a given context an image can evoke different concepts (Smith, Barratt, & Selsøe Sørensen, 2015): for example, when viewing an icon depicting fire on a bag of nuts the consumer may interpret that the nuts are spicy or that the nuts have been roasted. For both designers and producers it is key to know what does the elicitation of one meaning or another depend on, as previous works suggest that for a product to succeed in the market it should satisfy consumer expectations (Piqueras-Fiszman & Spence, 2015). The investigation reported here addresses this problem by studying if it is possible to use the crossmodal correspondence between spiciness and shapes to favour one of the possible interpretations of the same image, which would allow the designer to gain control over the communication process. Specifically, we argue that the meaning implicitly assigned to an icon of fire depicted on a bag of nuts (i.e. spicy or roasted) depends on the angularity of the icon, and propose that the nature of this effect is affective.

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2. Background

2.1. The image displayed in the package as a propositionally indeterminate semantic sign

The visual appearance of a package plays a key role during the categorisation process and the generation of expectations, since consumers use the different elements of the package as signs from which to infer information (Loken, 2006; Loken, Barsalou, & Joiner, 2008). Based on Peirce (1991), Ares et al. (2011) distinguish two kinds of signs in the context of food packaging: linguistic signs (i.e. signs that produce meaning by social convention, like texts or words) and visual signs (i.e. signs that produce meaning by resemblance, like colours or images). Today we have abundant information regarding the way in which linguistic signs or some visual signs such as colour influence these processes (Kauppinen-Räisänen & Luomala, 2010; Lähteenmäki, 2013; Piqueras-Fiszman & Spence, 2015; Spence & Piqueras-Fiszman, 2014; Sütterlin & Siegrist, 2015). On the contrary, the specific effect of the images in the communication between packaging and consumer has been less studied. For example, Smith et al. (2015) showed that having an image on the package of the major taste-giving ingredient instead of a text description makes consumers believe there is a greater proportion of it in the product, while Rebollar et al. (2016) showed that products accompanied with the main product in the serving suggestion depicted on a package of fresh cheese influence the time of the day it is considered most suitable to consume it. More recent work from the same team suggest that communicating that the potato chips contained in a package had been fried in olive oil by showing an image of an oil dispenser instead of by stating it by a text increases the sensory, non-sensory and hedonic expectations of the product and increases the willingness to buy it (Rebollar et al., 2017).

However, despite the importance of transmitting a clear and unambiguous message to the consumer, the designer cannot easily anticipate the meaning that will be inferred from an image displayed on a food package. An image by itself is propositionally indeterminate and may evoke many interpretations in the mind of the consumer, since it lacks the syntactic devices necessary to emit an explicit propositional meaning (Messaris, 1994, 1997; Smith et al., 2015). For example, consider the case of depicting an image of fire on a bag of nuts: the consumer may interpret that the product is spicy or that the product has been roasted (Smith et al., 2015), as in this context *fire* may be congruently understood in either way. Although this propositional indeterminacy can be broken by making the meaning of the image explicit by using supporting text (Barthes, 1977; Phillips, 2000), the paths by which the meanings of text and image are decoded are different and can lead to different interpretations. In that case, an additional process is required to resolve the conflict and select a definitive meaning (Lewis & Walker, 1989), which may negatively affect the processing fluency and the overall attitude toward the product (Alter & Oppenheimer, 2009). In addition, it is also worth noting that the image captures attention faster than the text (Honea & Horsky, 2012; Silayoi & Speece, 2007; Venter, van der Merwe, de Beer, Kempen, & Bosman, 2011), is processed more quickly (Mueller, Lockshin, & Louviere, 2009; Underwood & Klein, 2002), and that the first impression may condition the response to subsequent stimuli (Epley & Gilovich, 2006; Madzharov & Block, 2010). Thus, effectively controlling the expectations evoked by the image is thus crucial for the designer in order to ensure that the message conveyed by all the signs displayed on the package is congruent.

2.2. Conveying spiciness through the shape of an image

The literature dedicated to crossmodal correspondences gives a hint about why it can be expected that the shape of an image depicted on a food package may influence the sensory expectations of the product contained within. Crossmodal correspondences are the often surprising associations that the majority of people seems to share across stimuli from different sensory modalities (Spence, 2011). Although many of the studies that initially analysed these effects focused on the correspondences between audition and vision (Parise & Spence, 2013; Spence, 2011), crossmodal correspondences have been documented among all sensory modalities (Spence, 2011). Specially regarding the gustatory sense, it has been shown that expected and perceived flavour may be influenced by audition (see Spence, 2015a for a review), touch (Barnett-Cowan, 2010; Piqueras-Fiszman, Harrar, Alcaide, & Spence, 2011) or vision. In this particular case, associations have been found between both flavour and taste and cues as colour (Piqueras-Fiszman & Spence, 2011; Piqueras-Fiszman, Velasco, & Spence, 2012), packaging shape (Becker, van Rompay, Schifferstein, & Galetzka, 2011; Velasco, Salgado-Montejo, Marmolejo-Ramos, & Spence, 2014) or abstract shapes (Liang, Roy, Chen, & Zhang, 2013; Velasco, Woods, Petit, Cheok, & Spence, 2016). However, the majority of the research conducted to date has focused in basic tastes and other components of flavour like the burning sensation of spiciness/piquancy[1] have been barely studied (Wang, Keller, & Spence, 2017).

Literature makes a clear distinction between the concepts of taste and flavour (Spence, Smith, & Auvray, 2014). While the basic tastes include bitter, sweet, salty, sour and umami, and are understood as the specific gustatory sensations that occur with the stimulation of receptors located in the tongue (Delwiche, 1996), flavour is a more complex multisensory perception that is processed from gustatory, olfactory (mainly retronasal) and trigeminal inputs (Spence et al., 2014; Spence, 2015a, 2015b). The trigeminal system is the chemosensory system responsible of mediating sensations as the cool feeling caused by peppermint chewing gum, the tingling produced on the tongue by carbonated drinks or the burning sensation while eating chili peppers (Lundström, Boesveldt, & Albrecht, 2011). The spiciness/piquant sensation that arises when you eat chili peppers or other pungent products is therefore produced by the activation of the trigeminal system receptors located in the mouth when the irritants contained in these products, such as capsaicin, are released. These receptors are the same ones that are responsible for processing temperature, pain and chemical irritation, so the sensation produced by capsaicin is processed by the brain in similar terms to those of an increase in temperature (Caterina, Schumacher, Timinaga, & Rosen, 1997). The intensity of the perceived heat depends on factors such as the concentration of capsaicin present in the food (Baron & Penfield, 1996), time elapsed between intakes (Carstens et al., 2002) or serving temperature (Reinbach, Toft, & Møller, 2009), and usually takes a few tenths of a second to reach its maximum level (Prescott & Stevenson, 1995). Although the spiciness/burning sensation produced by capsaicin is not considered a basic taste, it is described as a significant contributor to flavour perception and has even been described as "the forgotten flavour sense" (Lawless, 1989; Spence, 2015b; Tu, Yang, & Ma, 2016; Viana, 2011). As is the case with other flavour components, people seem to match spiciness with stimuli from other sensory domains such as audition and vision. Thus, both expected and perceived spiciness can be enhanced with specific sound attributes (high pitch, fast tempo or high levels of distortion; Wang et al., 2017), by manipulating the intensity of red colouring of a salsa (the more intense the red, more spicy the salsa; Levitan & Shermer, 2014) or with the colour of the plate on which a food is served (being red the spiciest; Tu et al., 2016).

In recent years there has been a growing interest in understanding shape symbolism within the framework of flavour-vision correspondences (Becker et al., 2011; Velasco et al., 2014; Velasco, Woods, Petit, et al., 2016). However, despite the burning sensation caused by pungent food being considered a significant contributor to flavour

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[1] Although the terms *spiciness* or *spicy* may also refer to the aroma of a given food (Spence et al., 2014), in the present paper they are used to describe the burning sensation caused by capsaicin (Caterina et al., 1997).