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The association between the colour of a container and the liquid inside: An experimental study on consumers' perception, expectations and choices regarding mineral water

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ABSTRACT

Multisensory interactions have been shown to affect food and beverage perception. Here we investigated if the colour of a plastic cup can affect the perception and expectation of the mineral water that is served in it. In Experiment 1, the participants were required to evaluate freshness, pleasantness, level of carbonation, and lightness of 3 different kind of mineral water (natural, slightly carbonated and carbonated) using visual analogue scales. The water was served in white, red, and blue plastic cups. In Experiment 2, we investigated the participants' expectations regarding the water served in the same coloured plastic cups without tasting the liquid. In Experiment 3, we investigated if the participants chose to drink a given kind of water when served in a plastic cup of a specific colour. The results of Experiment 1 showed that people perceived mineral water as more carbonated when contained in a red or blue plastic cup, than when contained in a white cup. In Experiment 2, the participants expected the sparkling water contained in a blue cup to be less carbonated than the same water contained in a red or white cup and the slightly carbonated water more carbonated when served in a white or red cup with respect to the blue cup. Moreover, people expected the water to be fresher when contained in a white cup than in a red cup. In Experiment 3, the participants preferentially chose a white plastic cup to taste still water and blue or red cup to taste slightly sparkling water. These results clearly demonstrate that people's perceptions, expectations, and choices regarding mineral water are differently modulated by the colour of the container where the liquid is served. The present study has important implications not only for understanding the multisensory interactions affecting beverage perception, but also for marketing and packaging design purposes.

1. Introduction

The behaviours associated with thirst are guided by a complex set of factors that include physiological states, genetic inheritance and activation of high and low level neural processes (comprising perceptual and semantic elaboration) (Egan et al., 2003; McKinley & Johnson, 2004; Szinnai, Schachinger, Arnaud, Linder, & Keller, 2005). The interaction between these factors certainly contributes to determine people's judgements of food and beverages (see Gallace & Spence, 2014; Spence, Hobkinson, Gallace, & Piqueras-Fiszman, 2013; Wan, Woods, Seoul, Butcher, & Spence, 2015, for recent reviews).

Pioneering work on the effects of modulating a visual quality of food, namely the colour, on people's perception of carbonated water demonstrated that the addition of food colorants (red, brown and yellow) to sparkling mineral water, did not compromise the identification of the liquid in blindfolded and not blindfolded individuals (Hyman, 1983). More recent studies have also investigated whether or not certain aspects of the container, rather than of the content itself, can affect the participants' judgements regarding the beverage that is contained inside it (see Wan et al., 2015). For example, it has been shown that an orange plastic cup can enhance the flavour of hot chocolate, as compared to conditions where the same liquid is served in a red or in a white cup (Piqueras-Fiszman & Spence, 2012). Similarly, Guéguen (2003) has demonstrated that beverages contained in blue and green (cold colours) plastic cups were considered most thirst-quenching, as compared to the same beverages contained in red and yellow (warm colours) cups. Importantly, by using questionnaire procedures, it has been shown that certain colours are associated with particular basic tastes (see also Spence & Wan, 2015, for a recent internet-based study regarding the effect of the 'appropriateness'

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of the container on the overall perception of the beverage that is usually served in it). For example, the colours red and orange were shown to be positively associated with sweet, green and the colour yellow with sour and white with salt. In contrast, green, brown, black and grey were found to be negatively associated with sweet and red, blue, brown, purple, black, grey and white negatively linked to sour (Koch & Koch, 2003; O'Mahony, 1983; see also Tomasik-Krótki & Strojni, 2008, for the effect of crosscultural factors on the associations between basic tastes and colours; see Wan, Woods, et al., 2014, for a review on this topic).

Recently, Ngo, Piqueras-Fiszman, and Spence (2012) employed an on-line questionnaire to assess the presence of crossmodal correspondences between still and carbonated water, colours (blue, red, green) and shapes (rounded or angular). This research showed that participants associated still water with rounded shapes and carbonated water with angular shapes (see also Spence & Gallace, 2011a, for similar results; see Wan, Velasco, et al. (2014) for a cross-cultural study on the associations between colour/shape of a container and food). Moreover, both water samples (still and carbonated) were preferably associated with the colour blue rather than red or green.

Despite of the increasing number of studies on the topic of multisensory interactions in food/beverage perception, at the moment it remains unclear whether the associations and the perceptual effects found in the existent literature between colour and flavour are general or specific for certain kinds of products. For example, does a certain colour always enhance the flavour of different food/liquids (perhaps also on the basis of the intrinsic arousing/calming effect of such colour on people's perception; see Labrecque & Milne, 2012; Wilson, 1966). As far as this point is concerned, it is important to consider the broad range of flavours and the diversity in terms of intensity of taste among different liquids and food. On the basis of these peculiarities, one might expect different multisensory interactions for every kind of beverages or food. In support of this view, it should be considered that the enhancement of taste perception of a certain liquid served in a particular coloured container often depends on some sort of associative and memory based elaborations made by the participants. For example, it was demonstrated that a coffee (a typically dark brown beverage) served from a brown jar (a clay container with a wide opening at the top, that is usually used for storing food) was judged as stronger than the same coffee served in red, blue or yellow jar (Favre & November, 1979; pp. 82–85). By contrast, in a recent experiment Van Doorn, Wuillemin, and Spence (2014) demonstrated that a white mug enhanced the flavour intensity and reduced the perceived sweetness of the coffee served in it, as compared to coffee served in a transparent or a blue mug.

As far as the main causes of these effects are concerned, it is worth noting that a number of studies have suggested that people's expectations regarding a specific product can exert an important influence on its overall evaluation (e.g., Levitan, Zampini, Li, & Spence, 2008). In particular, Levitan and her colleagues (2008) asked their participants to judge whether a pairs of differently coloured candies (Smarties©) had the same flavour or not. The authors demonstrated that the judgments were affected by the participants' previous beliefs (i.e., regarding whether or not such orange candies taste differently from other coloured candies). Miller and Kahn (2005) proposed an interesting explanation for the influence of colours on people's flavour perception based on Grice's (1975) theory of "conversational implicature". Specifically, these authors postulated that an ambiguous use of colours or flavour names (i.e. blue haze, Alpine snow) might lead the consumer to search for the reason of the deviation from their expectations. Such search might in turn results in more cognitive efforts to characterize the product, and even to more favourable responses. Therefore, on the basis of these considerations, and on the fact that water is colourless as compared to other beverages, one might expect completely different (or even none) interactions between the colour of the container where the liquid is served and its taste, as compared to studies performed on other kinds of beverage.

Importantly, previous studies on the topic of multisensory interactions in food evaluation investigated separately perception, expectations, opinions and choice regarding a given product. It is however important to notice, that all of these three aspects might be differently modulated by the same experimental manipulation. This difference is certainly relevant to the applied field (see Spence & Gallace, 2011b). In fact, from a marketing perspective one might reasonably claim that in order to maintain old customers it is more profitable to invest more resources into the perceptual characteristics of a product (in order to maintain it constant or even to improve it). The possible associations between the perception of the product and the colour of the container might be also relevant here. In fact, if it becomes apparent that a certain visual quality of a food product (i.e., a colour) is associated with its taste in the mind of the consumers, it might be profitable for the company that produces it to try to brand such visual aspect (e.g., see the Coke red or T-Mobile pink). By contrast, if a company's aim is to extend the sales of their products to new customers, it is essential to focalize the efforts on the expectations of their potential clients.

The aim of the present study is to investigate the effects of manipulating the colour of a container on the perception, expectations and choices regarding a naturally not coloured liquid, namely water, that is served inside such a container. The participants' evaluation of the water was measured by means of four different scales (along the dimensions of freshness, pleasantness, level of carbonation and lightness). The choice of these scales was justified by the fact that people do not recognise other aspects regarding the basic taste of water (sweet, sour, salty and bitter) if not professionally trained. Therefore the scales that were used here are those that people generally associate to thirst and evaluation of water intake, or to those emerging from marketing strategies studies (Dietrich, 2006; Lucchiari & Pravettoni, 2012).

2. Experiment 1

2.1. Participants

Twenty-seven participants, with a mean age of 25.40 years (*SD* = 5.31, 19 female), took part in Experiment 1; they were graduate and undergraduate students and received course credits for their participation in the study. All the participants gave written consent prior to their participation. The Experiments described here were all performed in accordance with the ethical standards laid down in the 2008 Declaration of Helsinki and approved from the local ethical committee. Experiment 1 lasted for approximately 50–60 min. This duration comprises an initial overview of the experimental setup, the explanation of the instructions, the explanation and signature of the ethical forms and a final 10–15 min of debriefing regarding the main aims of the experiment. The actual experiment lasted about 30–35 min. People who claimed to be affected by any olfactory or taste dysfunctions, as well as people suffering from cold or flu were excluded from taking part in the experiment.

2.2. Stimuli

Three different types of mineral water were used: slightly sparkling (Ferrarelle®, 0.5 l bottle) sparkling and still mineral water (S. Benedetto® sparkling and still mineral water, 0.5 l bottle) The chemical and physical properties of each type of water are represented in Table 1. Each plastic cup used was filled with 20 g of