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Crossmodal associations and subjective ratings of Asian noodles and the impact of the receptacle

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ABSTRACT

We investigated the crossmodal associations that people hold for Asian noodles, and the influence of the plateware/receptacle. Chinese participants viewed online photographs of natural, red, green, and yellow noodles presented in bowls or plates made from ceramic, glass, paper, or stainless steel. In Experiment 1, the participants reported the first taste/flavour that came to mind, and rated their feelings and taste/flavour expectations concerning the noodles. In Experiment 2, the participants had to choose a taste term from a list to indicate the first taste that came to mind, and rated their feelings about the noodles. The results of both experiments revealed that the red noodles tended to be associated with a spicy taste/flavour; whereas the yellow noodles were often associated with a savoury taste/flavour, and rated as looking more familiar and pleasant than either the red or green noodles. The receptacles used to present the noodles did not influence the observed colour-flavour associations. However, the material of the receptacles appeared to interact with the colour of the noodles in terms of influencing people's subjective ratings of, and taste/flavour expectations concerning, the noodles. These findings therefore demonstrate the complex interactions that can occur between the colour of the product and the type/material of the receptacle on people's expectations regarding the taste/flavour of Asian noodles in the Asian marketplace.

Introduction

Perceiving the flavour of a food or a drink depends on the integration of multiple sensory cues (e.g., Auvray & Spence, 2008; Stevenson, 2009). However, cognitive factors such as a person's expectations may also play an important role. The colouring of a food, for instance, can provide useful information concerning the likely identity and intensity of the associated taste/flavour, but may also lead people to generate incorrect expectations and therefore misidentify the taste/flavour of a food or beverage (Shankar, Levitan, & Spence, 2010). In one oft-cited early study, DuBose, Cardello, and Maller (1980) reported that the same lemon-flavoured cakes were rated as having a more intense flavour when more yellow colouring was added to the cake mixture (so that the cake actually looked yellower). Another example comes from a study by Shankar, Levitan, Prescott, and Spence (2009) in which the same plain M&M's (chocolate candy) were rated as having a more intense chocolate flavour when they were coated with a brown shell as compared to when they were coated with a green shell instead.

Contextual elements such as the tableware and cutlery have also been shown to modulate the perception of taste/flavour (Spence, Harrar, & Piqueras-Fiszman, 2012; Spence, Levitan, Shankar, & Zampini, 2010; Spence & Piqueras-Fiszman, 2014). Interestingly, the colour of the plateware, glassware, cutlery, and lighting have all been shown to influence people's ratings of the taste/flavour of food (Harrar, Piqueras-Fiszman, & Spence, 2011; Harrar & Spence, 2013; Oberfeld, Hecht, Allendorf, & Wickelmaier, 2009; Piqueras-Fiszman, Alcaide, Roura, & Spence, 2012; Spence, Velasco, & Knoeferle, 2014; Spence & Wan, 2015; Stewart & Goss, 2013). So, for example, when participants were asked to rate the flavour of sweet or salty popcorn served in bowls of different colours, the same salty popcorn was rated as being slightly, but significantly sweeter when served in a blue or red bowl than in a white bowl. Meanwhile, sweet popcorn was rated as saltier when served from a blue bowl than in a white bowl (Harrar et al., 2011).

The type of receptacle in which a drink is presented also influences people's colour–flavour associations when they are simply looking at the coloured drinks (i.e., without actually tasting or smelling them; see Spence & Wan, 2015, for a comprehensive

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review). These findings therefore highlight the existence of complex colour-receptacle-flavour interactions, at least in the case of beverages (Wan et al., 2014). It should be noted that the type of receptacle used to serve coloured drinks usually does not completely change which flavour(s) would be associated with a certain colour, but it might nevertheless still affect the strength of the colour–flavour associations. For example, orange-coloured drinks were found to be more often associated with an orange flavour when presented in a cocktail glass than when presented in a water glass (Wan, Woods, Seoul, Butcher, & Spence, 2015). As yet, though, it remains unclear whether similar interactions also exist for solid foods.

One reason to believe that the situation when it comes to solid foods might be somewhat different than for beverages relates to the fact that most drinks tend to be monotone/uniform and their appearance typically lacks detail and/or any texture variation (Spence, in press). Under those conditions in which fewer cues are available about the contents (as in the case of beverages), it is probable that people will rely more on contextual cues (such as the glassware used to serve the drinks). In some cases, of course, people drink beverages direct from the can or opaque bottle, and hence might not necessarily see the contents at all. Under such conditions, consumers might end up being influenced more by the colour, shape, and other visual properties of the receptacle, and less by the properties of the drinks themselves. It would therefore seem entirely reasonable that colour-receptacle-flavour interactions should emerge in the case of drinks. By contrast, solid foods often contain more colour variation, and their appearance provides rich cues, such as concerning food texture, the complexity and arrangement of multiple food elements, and so on. Considering more information about the contents is normally available in the latter case, it would seem likely that people would rely less on contextual cues, and rather use product-intrinsic information instead.

As a case in point, food texture has been shown to influence flavour perception (Okajima & Spence, 2011). The visual appearance of a plate or bowl of food will normally contain more visual features that people can use to help them distinguish what they have before them. Both the taste/flavour and the visual appearance properties of foods influence people's choices (e.g., Clark, 1998; Köster, 2009). For example, a plate or dish of food at a restaurant might consist of a number of different components comprising several elements exhibiting various colours and textures. The latest research now shows that the complexity and arrangement of these elements can influence people's ratings of the dish (Mitchel, Velasco, Gatti, & Spence, 2014; Zampollo, Wansink, Kniffin, Shimizu, & Omori, 2011; Zellner, Lankford, Ambrose, & Locher, 2010; Zellner et al., 2011; see Spence, Piqueras-Fiszman, Michel, & Deroy, 2014, for a review). It would therefore seem possible that the colour–flavour associations concerning food might be less subject to the influence of the receptacles in which those foods are presented than is the case for drinks. Specifically, we thought it possible that the colour-receptacle-flavour interactions found with the uniformly-coloured drinks tested in previous research (Wan et al., 2014, 2015) might not emerge when a solid food was presented in one of a range of different receptacles. In the present study, we tested whether the receptacle used to serve the food would influence people's subjective ratings and/or expectations concerning the flavour of the food.

We chose Asian noodles as a sample food, to test the colour-receptacle-flavour interactions in an online testing environment. Noodles constitute a staple food in many Asian cuisines. They originated in China thousands of years ago before spreading to many other Asian countries (Hou & Kruk, 1998; Lu et al., 2005). A formal Chinese meal will often consist of a portion of rice or noodles, one or more vegetable dishes and/or meat, and one or two servings of soup (see Newman, 2000). Asian noodles are typically made of wheat flour, water, and salt, and are often presented in the form of long strips of varying width (e.g., Tan, Li, & Tan, 2009). Asian noodles may be cooked in a variety of different ways. However, they are typically cooked in boiling water and eaten with certain sauces stirred in, or in a soup (e.g., Fu, 2008; Hou & Kruk, 1998). Traditional Asian noodles are white or yellowish-white in appearance, but nowadays they may also be coloured in the home kitchen or at the restaurant in order to try and stimulate the appetite (see Piqueras-Fiszman & Spence, 2014, for a review). Zhu, Cai, and Corke (2010) reported that the addition of low levels of colourants will not influence the sensory or textural properties of Asian noodles.

For the above reasons, Asian noodles were considered an appropriate experimental food stimulus to present to the Chinese participants in the present study. To the best of our knowledge, ours may be the first study to examine crossmodal associations in the context of Asian noodles. What is more, we also chose 8 different receptacles in which to present the noodles, including bowls and plates made from ceramics, glass, paper, and stainless steel. Note that all of these are commonly seen in the Chinese marketplace. As for the shape of the receptacles, both bowls and plates are commonly used to serve noodles in China. In fact, bowls are sometimes used even if the noodles happen not to be served with a soup (e.g., Kittler & Sucher, 2007). As for the materials from which the receptacles were made, ceramic receptacles are used on many different occasions such as at home and in restaurants. They are certainly much more commonly used than glass receptacles in China. Meanwhile, disposable paper receptacles are often used to serve fast food, and stainless steel receptacles are more often found in public dining halls in China (e.g., Xie, Lin, Chen, Zhao, & Zhao, 2009).

We addressed three specific research questions in the present study: First, do people hold any strong colour–flavour associations for Asian noodles? Second, if such colour–flavour associations do exist, does the type of plateware/receptacle in which those noodles are presented influence these colour–flavour associations, and, if so, how? And third, we were interested in investigating whether the colour of the noodles and the type of receptacles influenced our participants' subjective ratings of, and expectations concerning, the likely flavour/taste of the noodles?

Experiment 1

Methods

Participants

One hundred and eight undergraduate students (mean age = 19.8 years, *SD* = 1.2, ranging from 18 to 23 years; 40 females) from Tsinghua University, Beijing, China, took part in this study. They received course credit in order to fulfil the requirements of an introductory psychology course that they were taking part in. All of the participants reported having normal colour vision. The experiment was approved by the ethics committee at the Psychology Department of Tsinghua University.

Apparatus and materials

This study was conducted online at http://www.unipark.info. As shown in Fig. 1, pictures of noodles were shown on the computer screen to the participants, one at a time. The noodles were presented in one of four different colours: natural (yellowish-white), red, green, and yellow. The coloured noodles were made by mixing and stirring cooked noodles with 100 ml of purified water that had been mixed with the following commercial food colourings (Rayner's brand, West Sussex, UK) in order to achieve the following colours: red (.10 ml red food colouring), green (.20 ml green food colouring), and yellow (.10 ml yellow and .01 ml red food colouring). As shown in Fig. 2, the noodles were presented in bowls