RUNNING HEAD: RECEPTACLE & COLOUR-FLAVOUR ASSOCIATIONS

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The Effects of Receptacle on the Expected Flavour of a Coloured Beverage: Cross-Cultural Comparison among French, Japanese, and Norwegian Consumers

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ABSTRACT

The present online study was designed to investigate whether the expected flavour associated with a coloured beverage is affected by the type of receptacle in which the drink is presented. More than 400 participants from France, Japan, and Norway viewed photographs of red, green, yellow, blue, orange, brown, and clear beverages presented in a water glass, a wine glass, a cocktail glass, or a plastic cup. They had to indicate the first flavour that came to their mind by choosing a flavour from a list of 24 options, and to rate the familiarity and pleasantness of each drink. The results revealed that the nature of the receptacle modulated the meaning (expected flavour) of colour for the red, green, yellow, blue, and orange drinks. Cultural differences were observed in terms of the expected flavour elicited by the blue drinks, as well as how different receptacles influenced the familiarity and pleasantness ratings of the same drinks.

Practical Applications

The present study provides a better understanding of the crossmodal correspondences observed in the case of beverages. We demonstrate how the type of receptacle, an important but all too frequently neglected contextual factor, influences the expected flavour elicited by colour. These findings regarding crossmodal correspondences are relevant to sensory scientists interested in the flavour-colour associations of beverages. What is more, our results also reveal cross-cultural differences in the perception of beverages, and demonstrate how associations that people in certain countries/cultures may take for granted could be very surprising or novel in other cultures/countries. Specially, the present study provides new evidence concerning how people from France and Japan (both of which are well known for their unique and distinctive food cultures) would respond to the same coloured drinks in similar or different fashions with other groups of people (who have been tested in the present or previous research). Therefore, our findings are also important in terms of international

marketing, and highlight the importance of getting the receptacle right when displaying a beverage in online marketing.

Keywords: crossmodal correspondence; colour-flavour associations; receptacle; flavour; contextual factors; cross-cultural differences

Introduction

Humans associate certain features or stimuli across the senses, a phenomenon that is often referred to as crossmodal correspondences. One of the most common crossmodal correspondences is the association between colours and tastes/flavours (e.g., Spence 2011; Spence *et al.* 2014). On the one hand, specific colour terms may be associated with certain taste terms, such as red being associated with sweet, and yellow/green with sour (Koch and Koch 2003; O'Mahony 1983; Tomasik-Krótki and Strojny 2008; but see also Wan *et al.* 2014b). On the other hand, though, in the case of drinks, colour is known to be an important cue that exerts a significant influence over consumers' expectations (e.g., Delwiche 2012; Shankar *et al.* 2010; Woods *et. al.* 2010), and hence their subsequent perception of taste and flavour (see Spence 2013; Stevenson 2009, for reviews). Plenty of studies have demonstrated the influence of colour on perceived taste and flavour intensity (Johnson and Clydesdale 1982; Roth *et al.* 1988), and the perceived identity of a beverage's flavour (e.g., DuBose *et al.* 1980; Hoegg and Alba, 2007). People may, however, be misled by an unusual colour-flavour pairing (i.e., one that is incongruent with their daily experience) into misidentifying a flavour (Stillman 1993; Zampini *et al.* 2007).

In addition to the colour of a food or drink, a number of contextual factors have also been shown to influence the multisensory perception of flavour, such as tableware and cutlery (see Spence *et al.* 2012; Spence and Piqueras-Fiszman 2014, for reviews). In the case of beverages, the receptacle that we use to present and consume drinks is one of the most important, but all too frequently neglected, contextual factors (Krishna and Morrin 2008; see Spence and Wan 2015, for a review). For one, whether people consider a receptacle to be appropriate or inappropriate for a given drink likely depends on their previous drinking experience, such as using a beer mug to drink the beer or using a wine glass to drink wine. For another, the situation in which people consume the beverages might also influence their

expectations concerning the receptacles that are appropriate to serving the beverages. For example, when people order a beverage at a fast food restaurant, they might expect the drink to be served in a plastic or paper cup; whereas when they order a drink at a regular restaurant, they will presumably expect the drinks (even water) to be served in a glass instead. The important point to note here is that people appear to like drinks more when they are presented in the appropriate receptacle (Raudenbush *et al.* 2002; Wan *et al.* 2015b), and report bbeing willing to pay more for it (Wan *et al.* 2015b).

The type/shape of the receptacle might also be expected to influence the flavour that people associate with a drink based on its colour. We have recently conducted a series of online cross-cultural studies to investigate the influence of drinking receptacles on the colour-flavour associations that people hold (Wan *et al.* 2014a; Wan *et al.* 2015a). Photos of coloured drinks in different receptacles were shown to participants from China, India, South Korea, the UK, and the USA. Participants indicated the first flavour that came to mind. As summarized in Table 1, these two studies consistently revealed the influence of receptacle on colour-flavour associations concerning the green, yellow, and orange drinks, as well as some cross-cultural differences in the colour-flavour associations concerning the red and blue drinks. That being said, it should also be noted that there are some discrepancies between the findings of these two studies For one thing, the influence of the receptacle on people's colour-flavour associations for brown drinks was only significant for those participants who were from China and USA in Wan *et al.*'s (2014a) study, but not for the participants from India, South Korea, and the UK in Wan *et al.*'s (2015a) study. What is more, cross-cultural differences in the colour-flavour associations of the green, yellow, orange, and brown drinks were only significant among the Indian, Korean, and British participants (Wan *et al.* 2015a), but not for the Chinese and North American participants (Wan *et al.* 2014a).

INSERT TABLE 1 ABOUT HERE

The discrepancies between the findings of these two studies might be difficult to interpret, as these five countries/cultures are quite different from one another in many regards. For one thing, the UK and USA are often chosen to represent "Western culture" in the literature of cross-cultural psychology, whereas China, India, and South Korea are often chosen to represent "Eastern culture." Nevertheless, the cross-cultural difference in colour-flavour associations observed among these five countries cannot simply be interpreted in terms of the difference between East and West. A number of other factors should also be taken into account as well, such as regional geographic location, climate, agriculture, and unique food culture (see also Wan *et al.* 2014b). Even though people nowadays find it much easier to consume different types of food and drinks which originate from different places in the world due to increasing globalization, factors such as climate and transportation might still influence the availably of those foods and drinks that are not manufactured locally (Fieldhouse, 1995). Colour-flavour associations concerning drinks are likely generated based on the repeated exposure to the pairing of certain fruits and their colours. Consequently, people from different areas might have had a different exposure to such pairings and therefore differ in the likelihood that they will have picked it up and internalized it. As for the influence of receptacles, even if a certain type of food or drink might be imported and become available to a new area, the receptacle that has often been used to serve the food or drink in its area of origin might not travel with it. In this case, the same food or drink might be served in completely different receptacles in different parts of the world.

Therefore, different groups of individuals might associate the same drink colour with qualitatively different flavours based on their own previous experience in the marketplace (Shankar *et al.* 2010). People from different countries might also have different experiences with the same drinking receptacle, or even consider entirely different drinks appropriate for one and the same receptacle (see Spence and Wan 2015; Wan *et al.* 2015b). In summary, people's cultural background might be expected to interact with the contextual factors (such as the receptacle to present the drinks) and therefore influence the flavours that they associate with a certain colour. That is, people from different countries/cultures might associate the same receptacle with different types of drinks, and therefore generate different expectations regarding the drinks (e.g. their type, flavour etc.) presented in the same receptacles.

In order to further test the modulatory role of the receptacle in the flavour expectations that are elicited by drinks of different colours, we extended this on-going line of experimental research and tested participants from three other cultural backgrounds - France, Japan, and Norway - in the present study. France and Japan are well known for their unique and distinctive food cultures featured with exclusive food ingredients and exquisite recipes (e.g., Brittin 2010), which may significantly impact people's colour-flavour associations. It is well-known that contextual factors are an integral part of French cuisine, including the receptacles, cutlery, plating, and atmosphere. Therefore, it is very interesting to test whether French participants are any more "susceptible" to the influence of receptacles in terms of their colour-flavour associations. For another thing, Japan shares some food styles with China (tested in Wan *et al.* 2014a) and Korea (tested in Wan *et al.* 2015a), such as the tradition of using chopsticks to eat rice with dish or noodles (Albala, 2011; Brittin, 2010). Yet, Japan also has its own food style (such as the popularity of sushi); and unlike China and Korea, Japan is one of the largest importers of fruits and vegetables worldwide (e.g., Cook, 2003), and many of the fruits and vegetables available in the Japanese marketplace tend to have been imported

and are thus expensive (IBISWorld, 2015). Therefore, it is important to test the colour-flavour associations held by the Japanese consumers and then compare to people from other country. By contrast, Norwegian food culture is rooted in the traditions of living off the land and dealing with the consequences of long and cold weather for much of the year. Norway is well-known as having (relatively) simple preparation processes with fishing and local farming products (e.g., Laurence 2007). Thus, we chose to study the responses of participants from these three countries in the present study. We examined the influence of the receptacle on the expected flavours elicited by drink colour, as well as the influence of the different cultural backgrounds on the expected flavours. Taken together with the findings of two previous studies (Wan *et al.* 2014a, 2015a), the findings of the present study allow us to further disentangle the cross-cultural differences in colour-flavour associations.

Materials and Methods

Participants

A total of 401 participants from 3 different populations took part in this study online via the Xperiment software package (http://www.xperiment.mobi). The sample consisted of 145 participants from France (42.2±13.8 years on average, ranging from 20 to 74 years; 103 females and 42 males), 166 participants from Japan (19.8±3.4 years on average, ranging from 18 to 61 years; 108 females and 58 males), and 90 participants from Norway (26.2±5.2 years on average, ranging from 19 to 44 years; 51 females and 39 males). The French participants were recruited via social and institutional network on a voluntary basis. The Japanese participants were undergraduate students of Doshisha University, and they took part in this study in return for course credits for a lecture course that they were taking. The Norwegian participants were students recruited at the campus of a large Norwegian Business School, who were able to enter a lottery for 3 of 500 NOK reward for their participation. This study

was approved by the Central University Research Ethics Committee of the University of Oxford.

Materials

As can be seen in Fig. 1, the photographs of the drinks used in the present study were the same as those in Wan et al. (2014a). The differently coloured drinks were created by mixing commercial food colourings and still water to give red, green, yellow, blue, orange, and brown colours; while unadulterated still water was also used as an additional neutral condition. The four types of receptacles were a water glass, a wine glass, a cocktail glass, and a plastic cup. There was a total of 28 (7 drinks × 4 receptacles) drink photos. Each photo subtended (in pixels) 180 in width and 240 in height on the computer monitor. The participants from France, Japan, and Norway completed French, Japanese, and English version of the studies, respectively.

INSERT FIG. 1 ABOUT HERE

Procedure

At the start of their experimental session, the participants were shown a webpage summarizing the general purpose of this study, and they were required to sign the informed consent forms electronically. The 28 drink photos were then shown to the participants in a random order, one photo on each webpage at a time. Upon seeing each photo, the participants were required to perform two types of task. First, they had to indicate the first flavour that came to mind based on the drink's colour by choosing a flavour from a list of 24 flavours.

The flavour list consisted of “apple, banana, blackcurrant, blueberry, cherry, cola, cranberry, grape, kiwi, lemon, lime, lychee, mandarin, melon, mint, orange, peach, pear, pineapple, raspberry, strawberry, watermelon, flavourless, and other.” The participants were asked to enter a specific flavour when they chose “other” as their answer. Second, based on the colour of the drink, the participants rated their familiarity with the drink, as well as how pleasant the drink looked to them, both of which were measured on 7-point Likert Scales. Specifically, the anchors from 1 to 7 were extremely unfamiliar/unpleasant, very unfamiliar/unpleasant, somewhat unfamiliar/unpleasant, neutral, somewhat familiar/pleasant, very familiar/pleasant, and extremely familiar/pleasant.

Data Analysis

Initially, the most frequently chosen flavours elicited by the coloured drinks were summarized, and post-hoc pairwise comparisons[1] on the chosen frequency data performed in order to examine whether each coloured drink was strongly associated with one or two flavours. Second, Flavour × Receptacle and Flavour × Country log-linear analyses were performed for each coloured drink in order to examine whether the receptacle and/or the Country of Origin of the participants influenced the flavours that they expected, respectively. As for those significant interaction terms, post-hoc pairwise comparisons were also performed. Third, Receptacle × Country ANOVAs were performed on the familiarity and pleasantness ratings to examine their influence on the rating scores, respectively.

Results

Expected Flavours

[1] In this and the following tests of multiple comparisons, Bonferroni’s corrections for multiple comparisons were used, and p-values are reported after such correction.

First we analysed the expected flavours that were elicited by the differently coloured beverages. We focused on just those flavours that were chosen by more than 5% of the participants for each coloured drink (see Table 2 for a summary). The results revealed that even though a total of 24 flavour options were provided for each coloured drink, only a few of the flavours were often chosen for each coloured drink. Post-hoc pairwise comparisons on the chosen frequency data revealed that the red, green, yellow, and brown drinks were most often associated with the strawberry, kiwi, lemon, and cola flavours, respectively; and the clear drink was most often associated with flavourless. By contrast, the orange drink was more often associated with the orange or mandarin flavour; whereas the blue drink was more often associated with the mint flavour or the "other" option. In summary, these results revealed that 6 of the drinks were each strongly associated with one or two flavours; whereas blue was associated with mint flavour as well as other flavours that were not listed in this study.

INSERT TABLE 2 ABOUT HERE

In order to examine the modulatory role of the receptacle on the expected flavours that were elicited by the drinks of different colours, log-linear analyses were performed for each coloured drink, using Flavour (the flavours that were often chosen as listed in Table 2) × Receptacle (water glass, wine glass, water glass, and cocktail) as the variables. While the likelihood ratio of each model was $\chi^2 = 0$, $p = 1.00$ (indicating that each provided a good fit for their corresponding data), the two-way interaction between Flavour and Receptacle was significant for the red, green, yellow, blue, and orange drinks (see also Table 2 for the statistics), but not for the brown or clear drinks. These results therefore demonstrate that the

receptacle in which a coloured beverage was shown might influence the expected flavour for the red, green, yellow, blue, and orange drinks.

In order to interpret these interactions, post-hoc pairwise comparisons were performed on the chosen frequency data. As can be seen in Table 3, the influence of the receptacle on the green and yellow drinks was subtle. That is, regardless of the receptacle in which these drinks were presented, the green and yellow drinks were always most strongly associated with the kiwi and lemon flavours, respectively. However, the receptacle exerted an influence on the first flavour that came to the participants' mind on the sight of the red, blue, and orange drinks. Specifically, the red drinks presented in the wine glass or plastic cup was strongly associated with strawberry flavour[2]; whereas no such pattern was significant for the red drink presented in the cocktail glass. The mint flavour and the "other" option were often chosen for the blue drinks presented in the water glass, the wine glass, or the plastic cup; whereas the blue drink presented in the cocktail glass was only strongly associated with the mint flavour. What is more, the orange coloured drinks presented in the wine glass, the cocktail glass, or the plastic cup was associated with the orange or mandarin flavours; whereas the orange, peach, and mandarin flavours were equally chosen for the orange coloured drink presented in the water glass.

INSERT TABLE 3 ABOUT HERE

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[2] The results of the red drinks presented in the water glass also revealed a trend toward a red-strawberry association, but this pattern failed to reach the significance level after Bonferroni's correction for multiple testing.

Next, were performed log-linear analyses for each coloured drink, using Flavour (the often chosen flavours as listed in Table 2) × Country (France, Japan, and Norway) as the independent variables. While the likelihood ratio of each model was $\chi^2 = 0$, $p = 1.00$, the two-way interaction between Flavour and Country was only significant for the blue drinks, but not for the other 6 types of coloured drink (see Table 2 for the statistics). These results revealed significant cross-cultural differences in terms of the flavours associated with the blue drinks. As can be seen from Table 3, post-hoc comparisons revealed that the French and Japanese groups both associated the blue drinks with the mint flavour or chose the "other option;" whereas the Norwegian group most often chosen the blueberry, mint, or the other options.

Familiarity ratings

The average familiarity ratings for each coloured drink are shown in Fig. 2. The data for the different coloured drinks were combined, and a 4 (Receptacle: water glass, wine glass, cocktail glass, or plastic cup) × 3 (Country: France, Japan, or Norway) ANOVA was performed on the familiarity scores. The results revealed a significant main effect of Receptacle, $F(3, 1194) = 14.45$, $p < .001$, a main effect of Country, $F(2, 398) = 16.71$, $p <.001$, and a significant interaction term, $F(6, 1194) = 3.07$, $p < .01$. As can be seen in Table 4, post-hoc comparisons revealed that the French participants were less familiar with the drinks presented in the cocktail glass than those in the wine glass or the plastic cup; the Japanese participants were more familiar with the drinks in the plastic cup than with those presented in the water or wine glass, and were the least familiar with the drinks presented in the cocktail glass; meanwhile, the Norwegian participants were more familiar with the drinks in the wine glass than with those in the cocktail glass.

INSERT FIG. 2 & TABLE 4 ABOUT HERE

Pleasantness ratings

The average pleasantness ratings for each of the coloured drinks are shown in Fig. 3. The same analyses were performed on the pleasantness scores as for the familiarity scores. The ANOVA revealed a main effect of Receptacle, $F(3, 1194) = 38.50$, $p < .001$, a main effect of Country, $F(2, 398) = 21.30$, $p <. 001$, and a significant interaction term, $F(6, 1194) = 4.04$, $p < .01$. As can be seen in Table 4, post-hoc comparisons revealed that the French participants gave higher pleasantness ratings to the drinks in the water and wine glasses than to those in the cocktail glass or the plastic cup; the Japanese and Norwegian participants both gave higher pleasantness ratings to the drinks in the wine or cocktail glass than those in the water glass or plastic cup.

INSERT FIG. 3 ABOUT HERE

Cross-cultural comparison among 8 countries

However, it should be noted that the participants from three countries were not exactly matched. For one, the Japanese group (19.8 ± 3.4 years, N=166) was somewhat younger than the other two groups, and the Norwegian group (26.2 ± 5.2 years, N=90) was also younger than the French group (42.2 ± 13.8 years, N=145), all *t*s > 10.53, $p < .001$. For another thing, there were more female than males participants in the Japanese (103 females vs. 42 males) and French (108 females vs. 58 males), both $\chi^2 > 7.74$, $p < .01$, though this

difference was not significant for the Norwegian group (51 females vs. 45 males). These differences might make it difficult to clarify whether some of the observed cross-group differences were due to culture or other factors. In order to further examine the cross-cultural differences and to rule out confounding factors, we combined the data from the present study with that from two previous studies, including Wan et al.'s (2014) data of the Chinese and North American participants, and Wan et al.'s (2015) data from the British, Indian, and Korean participants[3]. What is more, considering that there were only 100 participants in each group in those two studies, we also randomly selected 100 participants from the Japanese and Norwegian groups in the present study (with the constraint to obtain comparable number of male and female participants in each group if possible). Therefore, a total of 100 French participants (43.2 ± 13.9 years, ranging from 21 to 74 years; 58 females and 42 males), 100 Japanese participants (19.6 ± 1.4 years, ranging from 18 to 29 years; 50 females and 50 males), and all of the 90 Norwegian participants were selected into these data analyses.

First, we focused on the flavours that were chosen by more than 5% of the participants for each coloured drink (as shown in Table 5) when analysing colour-flavour associations. The results of participants from 8 countries revealed that the green, yellow, orange, and brown drinks were most often associated with the kiwi, lemon, orange, and cola flavours, respectively; and the clear drink was most often associated with flavourless. By contrast, the red and blue drinks were each associated with several different flavours. Second, we performed Flavour (the flavours that were often chosen as listed in Table 5) × Receptacle log-linear analyses for each of the coloured drinks. While the likelihood ratio of each model was $\chi^2 = 0$, $p = 1.00$ (indicating each provided a good fit for their corresponding data), the

[3] Note that the results regarding the subjective ratings of clear drinks or coloured drinks presented in the plastic cup were not reported in Wan et al. (2015a), although the data was collected.

two-way Flavour by Receptacle interaction was significant for the red, green, yellow, blue, orange, and brown drinks (see also Table 5 for the statistics), but not for the clear drinks. Third, we performed Flavour (the flavours that were often chosen as listed in Table 5) × Country (8 countries) log-linear analyses for each coloured drink. While the likelihood ratio of each model was $\chi^2 = 0$, p =1.00, the two-way interaction between Flavour and Country was significant for all the coloured drinks, but not for the clear drinks (see Table 5 for the statistics).

INSERT TABLE 5 ABOUT HERE

In order to rule out the influence of factors other than culture on the familiarity and pleasantness ratings, we compared the ages of all 8 groups. The results revealed that the French group was the oldest (43.2 ± 13.9 years); the second oldest were the North American (32.9± 11.2 years), Indian (31.3± 8.8 years), and Korean (30.8± 7.0 years) groups; then the second youngest were the Chinese (27.3± 1.8 years) and Norwegian (26.2±5.2 years) groups; whereas the British (19.0 ± 2.8) and Japanese (19.6 ± 1.4 years) groups were the youngest of all, $p < .01$. Therefore, we first compared the subjective ratings of the Japanese and British groups, after the data of drinks in different colours were combined. The 4 (Receptacle: water glass, wine glass, cocktail glass, or plastic cup) × 2 (Country: Japan or UK) ANOVA on the familiarity scores revealed a significant main effect of Receptacle, $F(3, 594) = 13.55$, $p < .001$, a main effect of Country, $F(1, 198) = 39.62$, $p <. 001$, and a significant interaction term, $F(3, 594) = 2.66$, $p < .05$. Similar analyses on the pleasantness scores revealed a significant main effect of Receptacle, $F(3, 594) = 18.12$, $p < .001$, and a significant main effect of Country, $F(1, 198) = 35.71$, $p <. 001$, but the interaction effect was not significant, $F(3, 594)$

= 1.26, p = .29. We also compared the subjective ratings of the Norwegian and Chinese groups. The analyse on the familiarity scores revealed a significant main effect of Receptacle, $F(3, 564) = 3.29$, $p < .05$, but neither the main effect of Country nor the interaction term was significant, both Fs < 0.88, $p > .45$. Similar analyses on the pleasantness scores revealed a significant main effect of Receptacle, $F(3, 564) = 20.79$, $p < .001$, and a significant main effect of Country, $F(1, 188) = 14.55$, $p <. 001$, but the interaction term was not significant, $F(3, 564) = 0.64$, p = .59. Taken together, then, these results revealed the cross-cultural difference in the subjective ratings of drinks, which might not be interpreted by age difference between the groups.

Discussion

Colour-flavour associations

The results of the present study revealed that French, Japanese, and Norwegian participants strongly associated each of the red, green, yellow, blue, orange, brown, and clear drinks with one or two flavours. The emergence of strong crossmodal associations between green, yellow, blue, orange, and brown drinks and either one or two of the flavours is consistent with Wan et al.'s (2015a) recent findings with Indian, Korean, and British participants. However, the strong association between the red drink presented in the wine glass or plastic cup and the strawberry flavor observed in the present study was quite surprising, for at least two reasons. First, it was not seen in previous studies where red was often associated with several different red fruit flavours (Wan *et al.* 2015a; Zampini *et al.* 2007), such as cherry, strawberry, and cranberry. Second, as a common colour for many fruits, red is a drink colour which is commonly seen with varied flavours in everyday life.

The French, Japanese, and Norwegian participants in the present study showed colour-flavour associations for the blue drinks that were very different from those reported by participants from the other countries reported in the previous studies. That is, the blueberry flavour was strongly associated with the blue drinks by those participants from China, India, Korea, the UK, and the USA, though some of the Koreans did associate it with mint flavor (Wan *et al.* 2014a; Wan *et al.* 2015a). In contrast, the participants in the present study overall, chose the mint flavour and the "other" option. However, we did observe significant cross-cultural differences in the crossmodal associations such that Norwegian participants also frequently chose the blueberry flavor. Interestingly, as the participants had to input the specific flavour that they were thinking of when choosing the "other" option, the Japanese mostly manually inputted "Blue Hawaiian Cocktail" as their answer, even when the blue drinks were presented in other receptacles than the cocktail glass. On the other hand, the French participants suggested "Curacao", referring to the orange-flavoured liquor made from the dried peel of a fruit grown on the island of Curacao (the laraha citrus) and often in colour blue (Spence 2014). In other words, the Japan and French participants in the present study each associated the blue drink with a special type of drink that they may have encountered in their daily life, but not to a flavour *per se*.

On the other hand, when we include the data from all 8 countries (including those collected in the present study and two previous studies), the results revealed universally shared colour-flavour associations might be green drink-kiwi flavour, yellow drink-lemon flavour, orange drink-orange flavour, brown drink-cola flavour, and clear drink-flavourless. That being said, it should also be noted that these colour-flavour associations may depend on the colour of the specific drinks shown to the participants in these three studies. The coloured drinks used in these studies were created by mixing commercial food colourings and still water, and their colours were only classified by basic colour terms without much

specification on the colour lightness or hues. It is possible that the same colour with different hues might also elicit different expected flavours.

The impact of the receptacle on the expectations of French, Japanese, and Norwegian Consumers

The results of the present study also revealed the influence of the type of receptacle on the expected flavours that were elicited by the red, green, yellow, blue, and orange drinks. As summarized in Table 1, the type of receptacle moderated the crossmodal association between colour and flavour for the green, yellow, and orange drinks in samples from all eight countries, though the influences of the receptacle on the green and yellow drinks were quite subtle in the present study. Note that green, yellow, and orange drinks are all commonly seen for different types of beverages with varied flavours worldwide, so different people might pick-up different colour-flavour pairings for the same drinks presented in different receptacles from their own everyday experience. Hence, when they saw these coloured drinks presented in different receptacles, people from different countries might generate different expected flavours concerning the drinks presented in different receptacles (see also Wan *et al.* 2015a).

In contrast, the type of receptacle only moderated the expected flavours elicited by colour for the red, blue, and brown drinks in samples from some countries, but not others. The influence of the receptacle on the expected flavours concerning the red drinks was not obtained in our previous studies (Wan *et al.* 2015a) with participants from India, Korea, and the UK, but such interactions were observed here. One possibility is that the participants from India, Korea, and the UK did not strongly associate the red drinks with one or two specific flavours in that study. Thus, the possible influence of receptacle on the flavour expectations

concerning the red drinks might have been masked or diminished by the variations in the colour-flavour associations. In contrast, the participants in the present study strongly associated the red drinks (at least when they were presented in certain receptacles) with strawberry flavour, making it easier to detect the cross-cultural difference in colour-flavour association effects. In this sense, the results of the present study go beyond previous research, by providing converging evidence for speculative arguments that could not be tested previously. That is, all of the results obtained from samples of participants from eight countries have revealed that the type of receptacle is more likely to moderate the flavour expectations that are elicited by colour for those drink colours that are commonly seen in daily life and strongly associated with certain flavours. What is more, it may be that cross-cultural differences in colour-flavour associations are too complex and subtle to use the common differentiation into Western / Eastern cultures (see also Wan *et al.*, 2014b). In addition to cultural values, many other factors, such as the geographical location, climate, agriculture and food culture, might also influence people's life experience and their expectations concerning flavours.

The type of receptacle used to present the drinks not only interacted with the colour of the drink to influence our participants' perception of the flavour of the beverage, but also influenced their subjective ratings of the drinks (see also Raudenbush *et al.* 2002; Wan *et al.* 2015b). Despite some cross-cultural differences in their ratings, the results consistently revealed that the participants from France, Japan, and Norway were all more familiar with the drinks presented in the wine glass than when the same drinks were presented in the cocktail glass, but they all gave comparable pleasantness ratings to the drinks presented in these two glasses. Interestingly, the participants from these three countries gave higher pleasantness ratings to the drinks that were presented in wine or cocktail glasses than those presented in a plastic cup. These findings highlight the importance of choosing the appropriate glassware to

present the drinks in order to enhance consumer's experience with drink products. What is more, it is also possible that a drink presented in a receptacle, such as a plastic cup, might be considered an affordable everyday beverage, whereas when exactly the same drink is presented in another type of receptacle, such as a wine or cocktail glass, it might be considered as an expensive, or luxury, drink instead.

That being said, caution should be taken when applying the results of the present study to a more general population due to some limitations of the present study. First, note that the participants from three countries were not exactly matched. Specifically, the Japanese group (19.8 ± 3.4 years) was younger than the French (42.2 ± 13.8 years) or Norwegian (26.2 ± 5.2 years) groups, and there are more female participants than males within the French and Japanese groups. These demographic differences between the groups might make it difficult to clarify whether some of the observed cross-group differences were due to culture or other factors. For example, the results revealed that the Japanese participants were also more familiar with the drinks presented in the plastic cup than those presented in the water or wine glass, whereas neither the French nor the Norwegian participants exhibited such a trend. Considering that the Japanese participants in the Japanese group (19.8 ± 3.4 years, N=166) were younger than the Norwegian participants (26.2 ± 5.2 years, N=90) and the French group (42.2 ± 13.8 years, N=145), this cross-group difference might be interpreted (at least partially) by the age difference between groups. Younger and older participants might differ in their drinking experience with certain receptacles or their daily consumption of certain drinks, so when the ages of different cultural groups were not matched, it is difficult to say whether the observed cross-group difference was due to culture, age, or other factors[4]. The additional

[4] Allen et al. (2008) demonstrated that one's values can also influence how they rate the taste of a food or beverage. Specifically, they found that the taste of a food or beverage might be evaluated as a function of whether the human values symbolized by this food or beverage is

analyses performed on the data from the Japanese and British participants (with comparable ages), and on the data from the Norwegian and Chinese participants (also with comparable ages) also revealed that at least some cross-cultural differences might not be interpreted by age difference. Therefore, in future studies, the influence of age should be more thoroughly examined and participants of different age groups should ideally be recruited.

Conclusions and Implications

In conclusion, the present findings provide further understanding of the crossmodal correspondences observed in the case of beverages, which have direct relevance to the practice of sensory marketing and the enhancement of consumer experience (Krishna 2012). First, in a series of studies, we demonstrated the colour-flavour associations held by people from 8 countries / 3 continents (Asia, Europe, and North America). Some of these colour-flavour associations are shown to be universally shared (at least amongst the countries we tested), whereas some other associations that people in certain countries/cultures may take for granted could be very surprising or novel in other cultures/countries. Therefore, in the practice of sensory marketing, deciding the "right" colour for a new drink (e.g., a new beer or juice drink) might require decision makers to jump out of their scope or belief but really consider what their target customers might think of the drinks.

Second, the results of our studies revealed that receptacles to present the drinks might influence people's expectations concerning the flavour of the drinks, thus suggesting the importance of choosing the "appropriate" receptacles in which to serve the drinks. Even though beverages are often sold in packages such as bottles and cans, they are often served in

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congruent with one's own values, and people tend to like the taste of food or beverage that endorse their own values.

glasses/cups in restaurants, bars, or at home. Therefore, the importance of receptacles should be taken into consideration of sensory marketing practitioners. One of the trickiest parts about choosing the "appropriate" receptacle is that people from different parts of the world might have very different opinions about what the most appropriate glassware for a drink is. Due to globalization, it is now much easier than ever before for many consumers to have access to food and drinks originating from different parts of the world. Nevertheless, the receptacle that has often been used to serve the food or drink in its area of origin might not be imported together with it; and even if the "appropriate" receptacle from its area of origin is imported, it might not be considered the most appropriate receptacle by customers from other areas. Therefore, when introducing a new type of food or drink to a certain area, one possible marketing strategy might be to assess in advance which of the locally available receptacles might be considered the most "appropriate" in the mind of target consumers, based on the three-way interactions among colour, flavour, and receptacle that have been already developed and influence their everyday life.

Speaking of the methodology of our studies, the online testing methodology allows the researcher to obtain a multi-national participants pool and therefore generate specific hypotheses to test in future laboratory-based experiments, although it is very difficult to match the demographic characteristics of the participants from different populations, or for example, have much control over the equipment used to view the experimental stimuli (e.g., Llieva *et al.* 2002, Woods *et al.* 2015). That being said, these are also the same challenges that marketers face online. This is also why multinational online testing is so important, as it allows the researchers to reach participants who would never have the chance to take part in the study in laboratories.

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Table 1. The influence of receptacle on colour-flavour associations and cross-cultural differences in different studies

		Wan *et al.* (2014a)	Wan *et al.* (2015a)	The present study	
Number of participants		200	300	401	790
Country of Origin		China USA	India Korea UK	France Japan Norway	France, Japan, Norway China, USA India, Korea, UK
Receptacles		3 Glasses & Plastic cup	3 Glasses	3 Glasses & Plastic cup	3 Glasses & Plastic cup
Influence of Receptacle on Colour-Flavour Associations	Red			Yes	Yes
	Green	Yes	Yes	Yes	Yes
	Yellow	Yes	Yes	Yes	Yes
	Blue			Yes	
	Orange	Yes	Yes	Yes	Yes
	Brown	Yes			Yes
	Clear		-		
Cross-Cultural Differences in Colour-Flavour Associations	Red	Yes	Yes		Yes
	Green		Yes		Yes
	Yellow		Yes		Yes
	Blue	Yes	Yes	Yes	Yes
	Orange		Yes		Yes
	Brown		Yes		Yes
	Clear		-		

Note: The results of the clear drink or drinks presented in the plastic drink were not reported in Wan et al.'s (2015a) study, but these data were collected.

Table 2. The flavours (percentage in brackets) that more than 5% of the participants chosen for each coloured drink (N=401)

Colour	Associated flavours	χ^2 for Flavour × Receptacle Interaction	χ^2 for Flavour × Country Interaction
Red	Strawberry(27) > Cherry(17), Raspberry(17), Cranberry(16), Blackcurrant(6), Other(6)	40.17**	1.19
Green	Kiwi(49) > Lime(13), Other(11), Melon(9), Pear(6)	72.64**	0.76
Yellow	Lemon(50) > Pineapple(18), Lime(9)	66.14**	3.47
Blue	Other(37), Mint(30) > Blueberry(9), Flavourless(9)	29.51**	24.36**
Orange	Orange(33), Mandarin(27) > Peach(16), Melon(7), Other(6)	53.88**	0.22
Brown	Cola(75) > Other(10)	0.17	1.39
Clear	Flavourless(80) > Other(12)	1.15	1.51

Note: * denotes $p < .05$, and ** denotes $p < .01$, after Bonferroni's correction for multiple testing.

Table 3. Post-hoc comparisons between the flavours (percentage in brackets) that more than 5% of the participants chosen

	Colour		Associated flavours
Flavour × Receptacle Interaction	Red	Water	Strawberry(27), Cranberry(19), Cherry(15), Raspberry(15), Other(7), Blackcurrant(6)
		Wine	Strawberry(27) > Raspberry(18), Cherry(17), Cranberry(16), Blackcurrant(6)
		Cocktail	Strawberry(25), Raspberry(23), Cherry(21), Cranberry(19), Blackcurrant(7)
		Plastic	Strawberry(30) > Raspberry(22), Cherry(15), Cranberry(9), Blackcurrant(6), Other(6)
	Green	Water	Kiwi(49) > Other(14), Lime(10), Melon(8)
		Wine	Kiwi(51) > Lime(11), Melon(11), Other(9), Pear(6)
		Cocktail	Kiwi(42) > Lime(21), Melon(12), Other(6)
		Plastic	Kiwi(55) > Other(16), Lime(8), Melon(6)
	Yellow	Water	Lemon(33) > Lime(16), Pineapple(10)
		Wine	Lemon(59) > Pineapple(19), Lime(8)
		Cocktail	Lemon(49) > Pineapple(24), Lime(6)
		Plastic	Lemon(62) > Pineapple(18), Lime(6)
	Blue	Water	Other(38), Mint(29) > Blueberry(10), Flavourless(8)
		Wine	Other(38), Mint(31) > Flavourless(8), Blueberry(7)
		Cocktail	Mint(31) > Other(18), Blueberry(9), Flavourless(8)
		Plastic	Other(36), Mint(31) > Flavourless(10), Blueberry(9)
	Orange	Water	Orange(25), Peach(21), Mandarin(19) > Other(9), Melon(7)
		Wine	Orange(38), Mandarin(31) > Peach(15), Melon(7)
		Cocktail	Orange(33), Mandarin(33) > Peach(14), Melon(8)
		Plastic	Orange(35), Mandarin(25) > Peach(14), Other(8), Melon(6)
Flavour × Country Interaction	Blue	France	Other(38), Mint(36) > Flavourless(10)
		Japan	Other(37), Mint(29) > Flavourless(10)
		Norway	Blueberry(28), Mint(24), Other(17)

Note: < denotes significant difference when $p < .05$, after Bonferroni's correction for multiple testing.

Table 4. The pairwise comparisons on the familiarity and pleasantness scores.

	Familiarity scores			Pleasantness scores		
	France (*df*=144)	Japan (*df*=165)	Norway (*df*=89)	France (*df*=144)	Japan (*df*=165)	Norway (*df*=89)
Water vs. Wine	0.62	0.45	1.43	0.50	5.82**	3.08*
Water vs. Cocktail	2.16	2.77*	1.94	3.04*	7.03**	3.00*
Water vs. Plastic	0.69	3.75**	0.46	4.17**	2.06	2.20
Wine vs. Cocktail	3.01*	3.56**	3.24*	2.48	2.04	0.24
Wine vs. Plastic	0.02	3.13*	1.82	3.89**	3.04*	5.67**
Cocktail vs. Plastic	2.70*	7.03**	1.47	5.72**	4.42**	4.66**

Note: * denotes $p < .05$, and ** denotes $p < .01$, after Bonferroni's correction for multiple testing.

Table 5. The flavours (percentage in brackets) that more than 5% of the participants chosen by participants from 8 countries (N=790) for each coloured drink

Colour	Associated flavours	χ^2 for Flavour × Receptacle Interaction	χ^2 for Flavour × Country Interaction
Red	Strawberry(24), Cherry(20), Cranberry(16), Raspberry(12), Watermelon(9)	69.53**	455.88**
Green	Kiwi(38) > Lime(19), Melon(8), Apple(7), Mint(6), Other(5)	92.06**	1320.89**
Yellow	Lemon(41) > Pineapple(19), Lime(11)	76.26**	61.31**
Blue	Blueberry(34), Mint(22), Other(20), Raspberry(6), Flavourless(6)	2.63	78.28**
Orange	Orange(43) > Mandarin(19), Peach(16)	48.00**	54.17**
Brown	Cola(66) > Blackcurrant(11), Grape(7), Other(6)	29.13*	457.92**
Clear	Flavourless(75) > Other(11)	1.13	0.00

Note: * denotes $p < .05$, and ** denotes $p < .01$, after Bonferroni's correction for multiple testing.

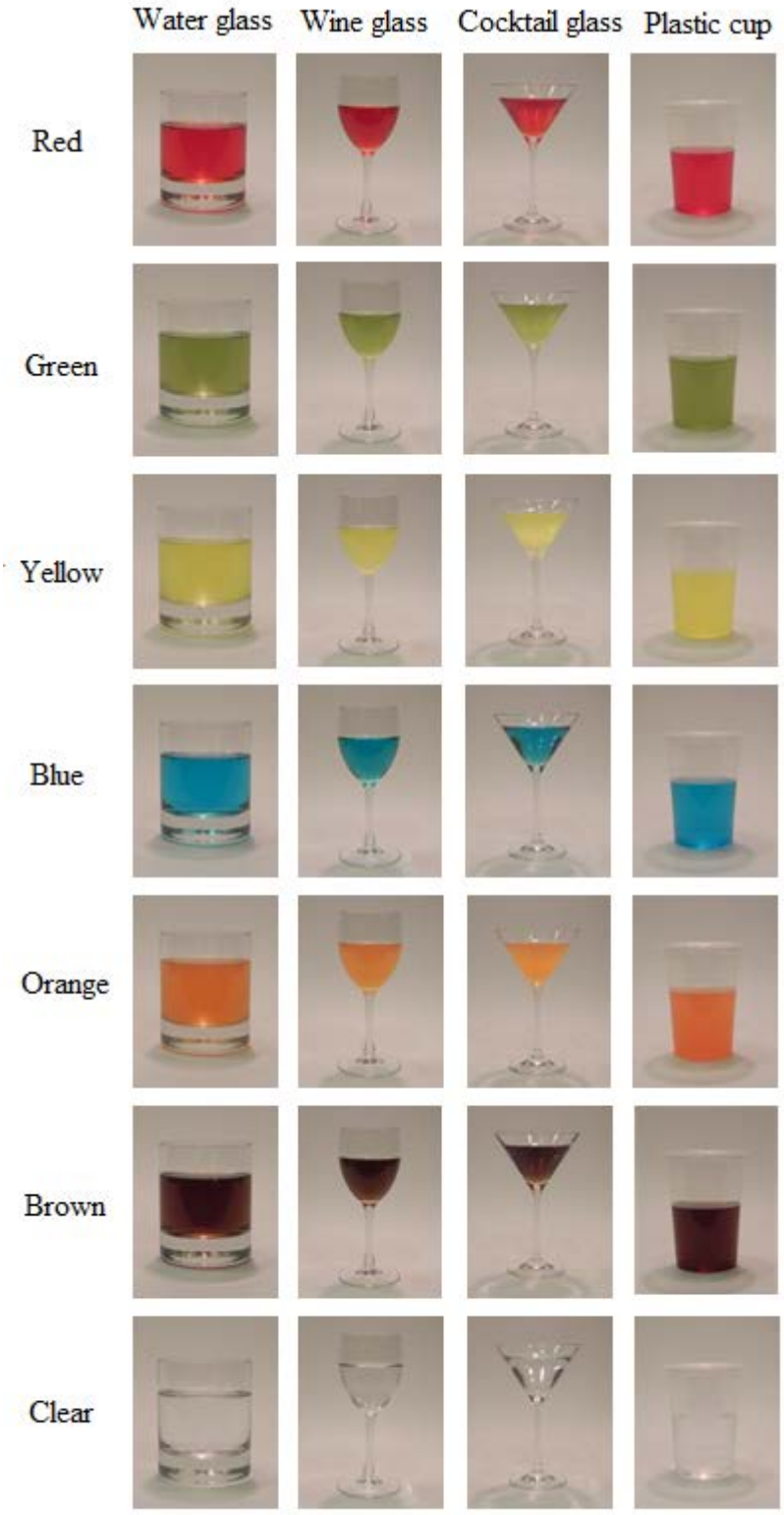

FIG. 1. Different coloured drinks presented in different types of receptacles.

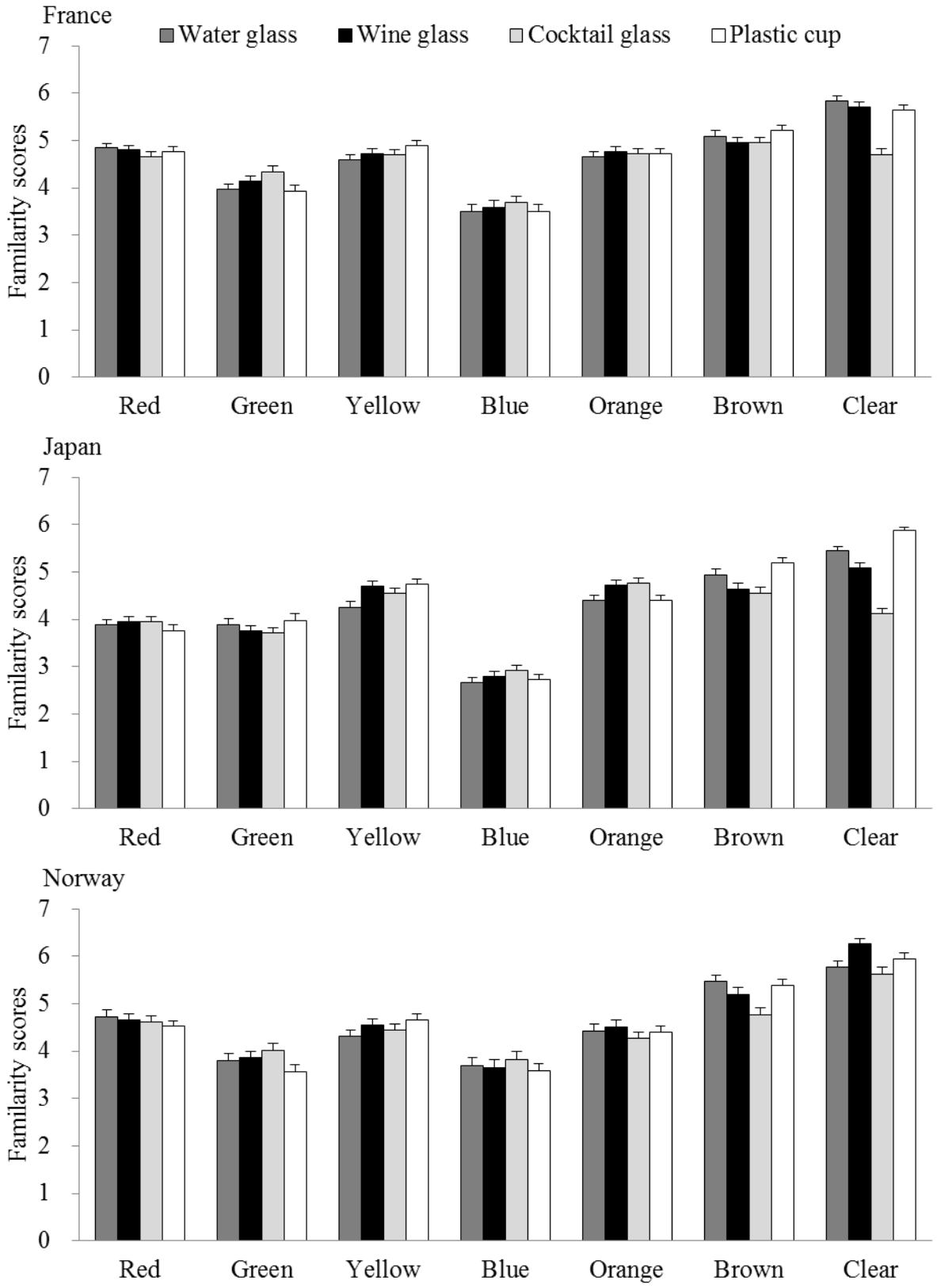

Fig. 2. The familiarity scores for the groups of participants from France, Japan, and Norway. Error bars show the standard errors of the means.

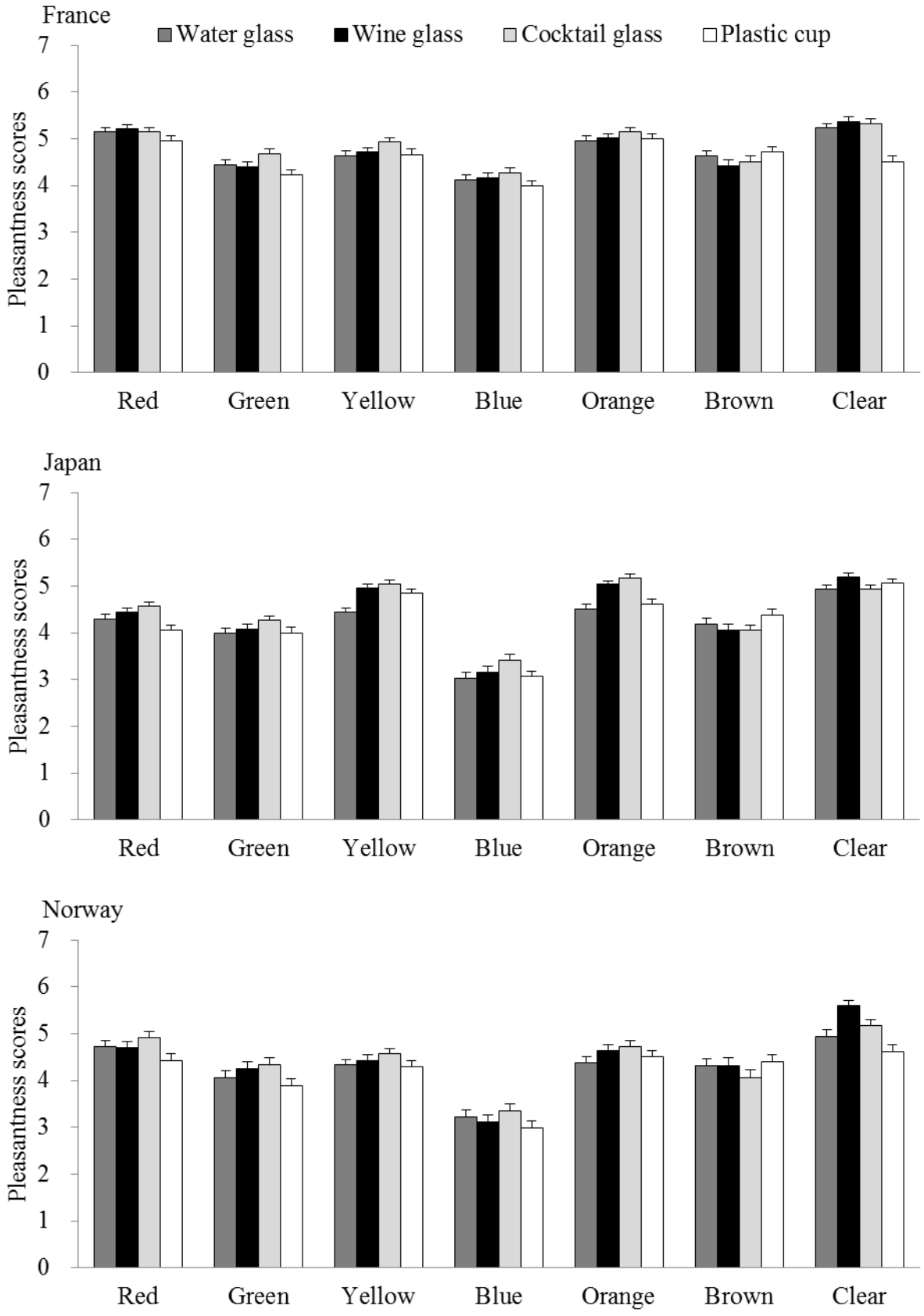

Fig. 3. The pleasantness scores for the groups of participants from France, Japan, and Norway. Error bars show the standard errors of the means.