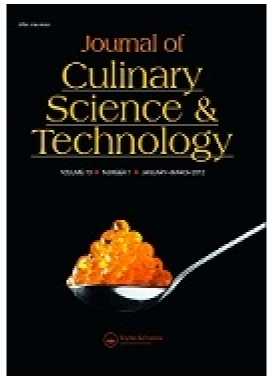

Sensory expectations from aesthetic perceptions of coffee beverages presented in different mugs

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Sensory expectations from aesthetic perceptions of coffee beverages presented in different mugs

The present work examined how the aesthetic impression caused by a specific mug selection seems to influence the expected flavor elicited by a coffee beverage. Participants from Mexico viewed online photographs of espresso, Americano, latte and cappuccino presented in two different mugs, including a transparent glass mug and a white ceramic mug. The type of mug influenced participants' subjective ratings of the drinks. Espresso and Americano were expected to be more aromatic, bitter, hotter and more intense when served in a transparent glass mug rather than in a white ceramic mug. Results extend the knowledge of consumer preferences and bring an idea for the best way to better fulfill customer's sensory expectations.

Keywords: coffee; receptacle; mug; consumer expectations; cross-modal correspondences; sensory science; flavor.

Introduction

In recent years, researchers have increased attention to the visual aesthetic information related to food and beverage expectations (Albors-Garrigós et al., 2018).

This article aims at investigating how aesthetic impression caused by a coffee mug may influence certain flavor, intensity sweetness or other attribute subjective expectations from a sample of individuals. The field study was carried out through a virtual setting. This has a relevant importance on the coffee producers and services marketing and merchandising.

The manuscript has been organized in the following way. A first introduction about theoretical context is presented. Following, the methodological approach has been described and justified. In the fourth section, the results and its analysis are discussed and, finally, in the fifth section the conclusions and practical implications are drawn.

Theoretical context

Cross-modal correspondence

The relationships between different senses are known as cross-modal correspondences, which refer to the tendency to match various attributes and sensory dimensions across different sensory modalities (Spence, 2011).

Different rationales can explain cross-modal correspondences. Some similarities concerning the association between color and flavor, according to Spence (Spence, 2011), can be attributed to three types of correspondences. The first is a structural correspondence which is due to an equal or similar neural coding (Marks, 1978). The second correspondence, the statistical one, is related to the correlation between stimulus attributes existing in the environment (Walker, 1987). The third and last correspondence is the semantically mediated correspondence, which is the result of the use of linguistic terminology to describe the stimuli falling along different constant periods (Gallace & Spence, 2006). According to the last two points, cross-modal correspondences are not universal. This fact is also supported by evidence that highlights cultural differences in cross-modal correspondences. Some studies have demonstrated variances between color and flavor food associations in participants from four (Wan et al., 2014), and seventeen different countries (Tomasik-Krótki & Strojny, 2008). Other authors have shown differences in expectations on a mug's shape and taste between three different countries (G. Van Doorn et al., 2017).

Therefore, many visual factors influence the flavor perception or expectation. Direct characteristics of the beverage or food, such as visual-tactile cues (rough/smoothness) modify its flavor (Slocombe et al., 2016). Visual factors play an essential role in a purchasing situation. In fact, the first sensory contact with products is mainly through the eyes (Wadhera & Capaldi-Phillips, 2014). According to Spence (

2011), flavor perception is a multisensory combination. Visual and auditory cues, smell, the trigeminal system and touch can impact our perception of flavor, even before tasting occurs. Visual appearance has been shown to alter the perception of taste and flavor (Delwiche, 2004, 2012). In particular, it has been demonstrated that visual cues associated with food can improve perceived flavors and subsequently affect consumer decision-making process (Wadhera & Capaldi-Phillips, 2014).

Other studies report cross-modal correspondences between a beverage and particular figure shapes (Deroy & Valentin, 2011), and tastes and shapes (Velasco et al., 2015). Most research has focused its attention on the cross-modal correspondences between the color and flavor/taste of a product. Indeed, when color is absent in the food or is incongruent with the typical characteristics of the food, people tend to misidentify the flavor or the odor of the food (Morrot et al., 2001; Stillman, 1993; Zampini et al., 2007). It has also been proved that color is a strong predictor of the sensory properties of coffee, specifically, Münchow confirmed that darker roasts are associated with an increase in bitterness and sweetness perception (Münchow et al., 2020).

Virtual environments

Nowadays, consumers interact through a digital environment in which sensory information is limited (Petit et al., 2015). This implies that photos are essential visual cues to convey information about products (Kotler et al., 2015). In fact, it has been reported that many people tend to select unplanned items from a food menu (Dodd, 1996). There are many indications that sensations of taste and sight interact with each other. Robust findings suggest that the packaging and/or design elements such as typeface, logo, label and images (Lick et al., 2017; Piqueras-Fiszman & Spence, 2011; Salgado-Montejo et al., 2014; Velasco et al., 2014) or even atmosphere of context in which the consumer drinks an alcoholic beverage (Velasco et al., 2013), can alter flavor perception. Previous research has demonstrated that the elements of the environment may influence the drinking experience of beer (Desira et al., 2020), and that foodservice professionals should match table settings with their restaurants or cafeterias to trigger customers' positive impressions related to the food (García-Segovia et al., 2015). Another visual cue that affects flavor perception is color (Koza et al., 2005). Over the years, evidence has shown that people systematically associate specific colors with particular tastes (Piqueras-Fiszman & Spence, 2012; Spence & Velasco, 2018; Spence & Wan, 2015; Woods et al., 2016).

Some highly-respected researchers have confirmed that when beverages are served, the drinking receptacle can modify flavor expectations (Spence, 2010). The color of the glass or cup can change the perceiving aroma and flavor of the wine (Ross et al., 2008) or other beverages like chocolate (Piqueras-Fiszman & Spence, 2012). Another characteristic of the container that influences the perception of the drink is the shape. Early research has drawn attention to the impact of glass shape on beer's perceived flavor; for instance, Mirabito, Oliphant, Van Doorn, Watson, & Spence (Mirabito et al., 2017) demonstrated that the curvature of the glasses could influence beer's perceived fruitiness and intensity. Spence & Wan (Spence & Wan, 2015) reported that the properties of a drink container not only affect the perception of the contents but also influence people's consumption behavior and preference. For example, researchers (Risso et al., 2015) have shown that people opted to drink specific types of water when served in plastic cups having a certain color.

There is also a relationship between the material of the container and the expected flavor. The material (e.g., different types of metal or plastic) of the cutlery affects the taste of the food such as bitterness or pleasantness (Risso et al., 2015) amongst other characteristics such as density (Piqueras-Fiszman et al., 2012). Besides these effects, it has been found that the type of receptacle of a beverage (e.g., a different type of glass or cup) influences the cross-modal correspondences between color and flavor (Wan et al., 2014) or the experience of drinking, such as temperature (Schifferstein, 2009). Finally, it has been reported that some indirect characteristics of the container such as its congruency with the drink can alter its intensity and/or pleasantness (Cavazzana et al., 2017; Raudenbush et al., 2002; Schifferstein, 2009; Wan et al., 2015).

Specifically, exploring sensory perceptions in coffee, it has been reported that differences in roasting degrees affect the taste of the coffee (Barbosa et al., 2019). Research exploring cross-modal correspondences in coffee has shown that the color of the container can influence the perception of taste/flavor (G. H. Van Doorn et al., 2014; Koch & Koch, 2003; Shankar et al., 2009), for example, that brown containers make people perceive the coffee as too strong (Koch & Koch, 2003) or that white ones enhance its intensity (G. H. Van Doorn et al., 2014). The color of the container influences not only the bitterness of the coffee, but also its warmness (Guéguen & Jacob, 2014). It has been shown that a mug's shape (e.g., diameter, height and thickness) can also influence coffee expectations of taste, like bitterness, sweetness, intensity and aroma (Spence & Velasco, 2018).

Expectations from individual perceptions

Expectations are in some sense the primary source of all the contents of perceptions (Piqueras-Fiszman & Spence, 2015). Therefore, if visual cues as shape or color can prime people's sensory expectations of a drink that they are about to consume, it is possible to shift the overall perceptual experience as well. Finding the relationships among the characteristics of the products is convenient in marketing (Keane, 1992). This is also important in the development of processed food and drink products, considering that heating processes can alter their physical properties (Paniagua-Martínez et al., 2018). For that reason, knowing how to enhance the perception of natural and fresh-like characteristics can lead to consumer acceptance.

There are reports that cover sensory characteristics of infusions (yerba mate, tea and coffee mainly) (Calviño et al., 1996; De Jong et al., 1998; Kato et al., 1993; Santa Cruz, 2002). It has also been revealed that a mug's shape (e.g., diameter, height and thickness) can influence coffee expectations of taste, like bitterness, sweetness, intensity and aroma (G. Van Doorn et al., 2017). However, the effect of the mug's material on different coffee characteristics has not been yet analysed.

The objective of this study is to shed some light on the effect of the mug (glass or ceramic) on coffee expectations of taste (bitterness, sweetness, intensity, aroma, liking and beverage-mug congruency). Authors expect to contribute to the previous literature body and enlighten practical applications for coffee merchandising.

Experiment 1: Materials and methods

Participants

The empirical study was conducted in the city of Guadalajara (Mexico). Data were collected through online questionnaires. The questionnaire was written in Spanish. A total of 270 participants (146 females, 124 males, mean age = 34.2, SD=11.63 years, aged between 15 to 60) were invited to take part in the study via the database of the School of Business and Economic Sciences at Universidad Panamericana, see Table 1. A series of questions were included as inclusion/exclusion criteria in order to make sure that the participants were habitual coffee drinkers. The experiment was reviewed and approved by the University's Research Committee.

[Insert Table 1 here]

Coffee photographs

Photographs of coffee beverages were shown to the participants. A Canon EOS Rebel T6 digital camera was used; mugs were placed in front of a white background. Given that the experiment was conducted online, the device varied from one participant to the other. Nevertheless, the experiment utilized full-screen mode (e.g., using the entirety of the participant's monitor) and took place within a 1024 x 768-pixel box in the center of the screen. Four different types of coffee beverages were presented, including espresso, Americano, latte and cappuccino. Each drink was presented in two different types of mugs: a transparent glass mug and a white ceramic mug. The mug shapes were selected accordingly to the most common presentation of the coffee drinks in the cafeterias in Mexico. A total of 8 pictures (4 types of drinks by 2 types of mugs) were shown to participants, see Fig. 1.

[Insert Figure 1 here]

Design and procedure

Participants took part in the study at http://www.questionpro.com. Before completing all trials, participants were debriefed as to the nature of the study. All 8 pictures were presented in a random order. During each trial, participants were shown one picture and were asked to rate (1) aroma, (2) bitterness, (3) temperature, (4) intensity, (5) sweetness, (6) pleasantness and (7) congruence (e.g., how much the kind of coffee and mug were congruent with each other), on a 7-point Likert scale. This online study took approximately 12 minutes to complete by each participant.

[Insert Table 2 here]

Analyses

The statistical analysis was based on two treatment factors (the type of coffee and the type of material) where the type of coffee has four levels: espresso, Americano, cappuccino and latte, while the type of material has only two levels: glass and ceramic. There are seven dependent variables (see Table 2) on a 7-point Likert scale. R ordinal package (version 2015.6-28) was used to implement a cumulative link (CL) or mixed (CLM) model in order to analyze ordinal data. Furthermore, individuals were treated as random effects using the function clmm to account for the repeated measures. In this case, the interest was only in the contrasts for the interactions between the two main factors. For this matter, after a significant result was found on the interaction, a post-hoc analysis was performed on the contrasts adjusting the p-value through the Tukey method for comparing a family of 8 estimates (4 levels for type of coffee times 2 levels of type of material). Finally, given that this procedure was repeated seven times (for each dependent variable) the results of this analysis were subjected to Holm-Bonferroni corrections. There are 2 main effects and 1 interaction under study; therefore a p-value of $0.05/(3 \times 7) = 0.0024$ was used to find significant results.

For this analysis, the following cumulative link mixed model was fitted to the dataset

$$logit(P(Y_i \leq j)) = \theta_j - \beta_1(cof_i) - \beta_2(mat_i) - \beta_3(cof_i \times mat_i) - u(subject)_i$$

where cof is the type of coffee and mat the material. The model computes the cumulative probability of the i-th score falling in the j-th category or below, where $= 1,\ldots,n$ is the index for observations and $j = 1,\ldots,J-1$ is the index for the response categories ($J = 7$).

Results and discussion

The Akaike information criterion (AIC) estimates the quality of each of the three models presented relative to each other, the lesser, the better. The likelihood ratio Chi-Square (LRT) tests that at least one of the predictors' regression coefficients is not equal to zero in the model. A pseudo R^2 is a statistic that is normally computed in the ordinal least squares as a goodness-of-it measure. In this case, Table 3 shows McFadden's pseudo R^2, where the log-likelihood of the intercept is the total sum of squares and the log-likelihood of the "full" model is treated as the sum of the squared errors.

[Insert Table 3 here]

In Table 4, results are given on the log odds ratio and not on the response scale. For example, the "Espresso, Ceramic" – "Espresso, Glass" contrast for temperature has an estimate of 1.09; this means that "Espresso, Ceramic" is expected to be $e^{-1.09}$ ≈ 0.34 more likely to have a higher temperature than "Espresso, Glass" or stated differently, "Espresso, Glass" is $1/0.34 = 2.97$ times more likely to be perceived as having a higher temperature than "Espresso, Ceramic". In this way, it can be noted the expectations that differ significantly according to the mug's material in different types of coffee. Also, the number of iterations in which they differ can be observed. This information is shown in a more precise way in Figs. 2-5, which show the odds ratio estimates of the dependent variables according to each type of coffee. The dark bar shows the odds ratio estimate according to the glass mug's material and the light bar, the odds ratio estimate according to the ceramic material.

[Insert Table 4 here]

Expectations

For expectation of bitterness, a statistically significant difference was found between glass and ceramic material only for espresso and latte. In particular, espresso in a glass mug was 7.46 times more likely to be perceived bitterer than in a ceramic mug; while latte in a ceramic mug was 2.59 times more likely to be expected as bitterer. No significant differences were found for bitterness in Americano and cappuccino, see Fig 2.

[Insert Figure 2 here]

Regarding the expectation of sweetness, there was a statistically significant difference between glass and ceramic for espresso, cappuccino and latte. Espresso was 6.13 times more likely to be expected as sweeter in a ceramic mug than in a glass mug. Cappuccino and latte, when served in a glass mug, were expected to be 2.21 and 2.32 times sweeter than in ceramic mug, respectively. Only in Americano, there were no significant differences, see Fig. 3a.

[Insert Figure 3 here]

There was a statistically significant difference in expectation of temperature for espresso, cappuccino and latte. It was found that espresso served in a glass mug was 2.97 times more likely to be expected as hotter than espresso served in a ceramic mug. Cappuccino and latte in a ceramic mug were 1.7 and 2.04 times, respectively, expected as hotter than these kinds of coffee in a glass mug. Only in Americano, there were no significant differences, see Fig. 3b.

The material of the mug showed to exert a statistically significant influence on the expectation of intensity in espresso, Americano and latte. Espresso and Americano are 8.21 and 1.61times, more likely to be expected as more intense when served in a glass mug than in a ceramic mug, respectively. Latte in a ceramic mug is 1.61 more likely to be expected as more intense than latte in a glass mug. No significant differences were found in cappuccino, see Fig. 4a.

[Insert Figure 4 here]

For aroma, there was a statistically significant difference between glass and ceramic for espresso, Americano and latte. Espresso and Americano in a glass mug were 7.67 and 2.65 times more likely to be expected to be more aromatic than in a ceramic mug, respectively. Also, latte in the ceramic mug was 1.97 times more likely to be expected to be more aromatic. Only in cappuccino, there were no significant differences, see Fig. 4b.

This characteristic shows a statistically significant difference according to the material of the mug only in espresso and cappuccino. Espresso coffee in a ceramic mug is 2.2 times more likely to be perceived as more pleasant than espresso in a glass mug; while cappuccino in a ceramic mug is 1.94 times more likely to be pleasant than cappuccino in a glass mug. No significant differences were found in Americano or latte, see Fig. 5a.

[Insert Figure 5 here]

The material of the mug appeared to be closely related with the expectation of congruence with espresso, Americano, cappuccino and latte. Espresso, Americano and latte are 2.54, 7.11 and 4.95 times, respectively, expected to be more congruent when served in a ceramic mug. Concerning cappuccino, this coffee drink was perceived 2.65 times more congruent when was shown in a glass container, see Fig. 5b.

Espresso in a glass mug was expected to have a higher temperature, more intensity, aroma and bitterness but less sweetness, less congruence and less pleasantness than espresso in a ceramic mug. Americano in a glass mug was expected to be more intense and aromatic but less congruent than this kind of coffee in a ceramic mug.

Cappuccino served in a glass cup was expected to be sweeter, more pleasant and congruent but less hot than cappuccino in a ceramic cup. Latte in a glass mug was expected to being sweeter but less hot, congruent, aromatic and bitter than latte in a ceramic mug.

Summarizing, as shown in Table 5, expectations of different characteristics of coffee change according to the material of the mug. The left column shows the types of coffee used in the study and the following columns show the different expectations. Beneath each column related to expectations, is shown the material of the mug that enhanced the expectation. The glass mug enhances the expectations of high temperature in espresso, the sweetness in latte and cappuccino; the intensity in Americano and espresso, the aroma in Americano and espresso and the bitterness in espresso. It also boosts the pleasantness and congruence of the coffee in cappuccino. A ceramic mug enhances the expectations of higher temperature in cappuccino and latte; the sweetness in espresso; the intensity, aroma and bitterness in latte. Also, it increases the pleasantness of the coffee in espresso and the congruence in espresso, Americano and latte.

[Insert Table 5 here]

The main issue explored in this study was whether consumer's expectations about coffee beverages are influenced by the material of the mug in which they were presented (transparent glass or white ceramic). The results demonstrate that the material influenced the expected temperature, sweetness, pleasantness, intensity, congruence, aroma and bitterness. It has equally been demonstrated that those influences change according to the type of coffee. Although the findings of this investigation are related to the impact of the material of the mug in which the coffee drinks were presented, some other characteristics of the mug or the beverage could influence the results. Following, we discuss some of these possible factors related to each expectation.

Regarding bitterness, participants expected espresso from a glass mug to be bitterer than from a ceramic mug. Moreover, they expected latte from ceramic mug to be bitterer than from a glass mug. This difference may be related to the colour of the beverage. According to Koch and Koch (Koch & Koch, 2003), brownness is negatively associated with sweetness and whiteness negatively associated with bitterness. So, a darker colour of coffee could be associated with a bitterer beverage; this could be the effect found about espresso in the current study: the transparency of the glass could have allowed the brownness of the coffee to enhance its bitterness.

However, this effect did not explain the results related to latte. In such case, the colour of the container could have influenced the bitterness of the coffee. Van Doorn et al. (G. H. Van Doorn et al., 2014) found that latte from a white container is expected to be less sweet than in a totally transparent mug. They attribute their results to a contrast mechanism between the brownness of the coffee and the whiteness of the mug. This effect could explain that the white of the ceramic mug in our study may enhance the brownness of the coffee latte and, in turn, its perception of bitterness. Nevertheless, the background of the picture (picture of different types of coffee) was white, so the whiteness of the background could have enhanced the brownness of the coffee in the glass mug, increasing its perception of bitterness. Furthermore, if the colour of the beverage and the container would exert the principal influence for the expectancy of bitterness, the same effect should be reflected in Americano and cappuccino, which was not the case. In this sense, it can be hypothesised that these differences could not be attributed only to the colour of the beverage, but to other factors such as the material of the mug and the type of coffee. Van Doorn et al.'s (G. H. Van Doorn et al., 2014) findings could bring some support to this hypothesis. They found that coffee latte from a white ceramic mug is expected to be more intense than latte from a transparent glass mug. The authors remark that people usually blur the distinction between strength and bitterness (the results in the present study show that the same material of the mug enhances the intensity as well as the bitterness in the same type of coffee), so the white ceramic mug could exert some influence over the bitterness expected. In this sense, the results obtained concord with Van Doorn et al.'s (G. H. Van Doorn et al., 2014) study concerning coffee latte.

Participants' expectations of sweetness differ according to the material of the mug. They expected espresso from a ceramic mug to be sweeter. They also expected cappuccino and latte to be sweeter from a glass mug. As can be noted, these results are the inverse from those related to bitterness; this is because typically, people understand bitterness as less sweet. Results from the present study support prior research (G. H. Van Doorn et al., 2014) showing that latte in a wholly transparent glass container was perceived as sweeter than in a white glass container. As mentioned above, this effect could be due to the colour of the mug. In such a case, the whiteness of the container could enhance the brownness of the coffee, making the coffee to be expected as less sweet. However, in the present study, the background of both pictures (for both, ceramic and glass mug) was white, so it is logical to expect the same effect. Not being the case, as a hypothesis, this difference could be attributed to the material of the mug. In the case of cappuccino and espresso, the contrast between the brownness of the coffee and the whiteness of the background (or the ceramic mug) did not appear to explain the differences in the expectation of sweetness. In this regard, the primary effect of the differences in expectation of sweetness could be explained by the material of the mug and the type of coffee.

The material of the mug (glass, ceramic) exerted a significant influence on participants' ratings of the expected temperature in espresso, cappuccino and latte. Espresso from glass mugs was expected by participants to be hotter than espresso from a ceramic mug. Latte and cappuccino served in a ceramic mug were expected to be hotter. These results contrast with a previous study (Guéguen & Jacob, 2014); this study reported some differences in perceiving the warmness of a coffee (the participants took the coffee) depending on the colour of the mug (blue, green, yellow and red). The authors explained their findings in the light of the associations between warm colours versus cool colours. They found that warm colours were associated with warm temperature. In the present study, all possible colours of the beverages through the glass were warm colours, so the differences found cannot be attributed to colours. However, the tone of the colour of the beverage in relation to the material of the mug could have influenced the expected temperature. The types of coffee with the lighter tones (latte and cappuccino) were expected to be hotter in ceramic rather than in glass, while the darkest one (espresso) was perceived warmer when it was presented in the glass mug. This result could suggest that glass enhances the expectation of warmness in dark coffees, while ceramic enhances the expectation of warmness in lighter coffees. Nevertheless, the fact that the expectation of temperature of Americano in a glass mug did not differ significantly from coffee in a ceramic mug, questions this hypothesis. In this sense, the only fact that can be shown is that glass enhances the expectation of warmness in espresso coffee, while ceramic, in cappuccino and latte coffees. In other words, the combination of the material of the mug and type of coffee seem to exert the main effect.

Regarding intensity, espresso and Americano from glass mug were expected by participants to be more intense than from a ceramic mug. These results are congruent with previous findings (Koch & Koch, 2003), which conclude that the brown containers are related to a stronger perception of the beverage. In the present study, the glass mug, when containing a dark kind of coffee (espresso or Americano), enhanced the intensity of the beverage. Furthermore, the fact that latte was more likely to be expected as more intense in a ceramic mug agreed with previous results (G. H. Van Doorn et al., 2014) in which it was found that latte from a white ceramic mug is expected to be more intense than from a transparent glass mug. In the present study, it could be possible that a lighter beverage in a white container could enhance its darkness by contrast and, consequently, the expectation of its intensity. However, as explained in previous dependent variables (sweetness and bitterness), the fact that the background and ceramic mug was white plays against this explanation. It appeared that is the material of the mug and the type of coffee which exerts the primary effect on the differences in the expectation of intensity.

Espresso and Americano from a glass mug were expected to be more aromatic than the same kinds of coffee from a ceramic mug. Latte from ceramic mug was expected to be more aromatic than latte from a glass mug. These results are the same than the expectations of flavour intensity. It is possibly that the participants blur the distinction between flavour intensity and aroma, finding both terms as synonymous.

Espresso from a glass mug was expected as less pleasant than espresso from a ceramic mug, while cappuccino glass was expected to be more pleasant than cappuccino ceramic. Linking these results with other dependent variables, it could be hypothesized that, for Mexican people, espresso and cappuccino coffee is more pleasant sweeter coffee. Since cross-cultural differences in "liking expectation" of coffee have been found (G. H. Van Doorn et al., 2014), these results could possibly only be related to the country in which the study was conducted.

Results show that cappuccino from a glass mug was more congruent while espresso, Americano and latte from ceramic mug were perceived as more congruent. This characteristic was the only one that showed significant differences in the four types of coffee, which could point out that the material of the coffee mug is an essential factor to alter congruence or incongruence of the container and the beverage. It is important to remark that the material that enhanced the congruency (espresso and cappuccino) was the same that improved the liking of the coffee. These results support the previous studies (Cavazzana et al., 2017; Raudenbush et al., 2002) which report that pleasantness of a drink changes according to the common usage of the container, in other words, with the congruency of the container. However, the congruency of the receptacle could also be affected by cultural differences. As Spence and Wan (Spence et al., 2015) point out, probably, consumers from different cultures in the world may hold different views about the associations of a particular container with a specific drink. In this regard, these findings can only be considered for Mexican people.

Experiment 2: Materials and methods

Experiment 2 was designed to investigate the possible variations that could occur when modifying the shape of the cups in which the coffees are shown. In this case, two drinks (American and Latte) were evaluated, considering that they could be more congruent with the mugs used in this test. In the same way, two identical mugs were designed, changing only the material (ceramic and glass).

Participants

Three hundred and thirty-nine participants (217 women, 122 men) aged between 15 to 71 years (M = 31.86 years, SD = 14.10 years) were recruited through emails and invitations via social networks on a referral basis: undergraduate students were asked to invite friends or family members who would be willing to participate. Students received course credit for taking part in the study. A series of questions were included as inclusion/exclusion criteria in order to make sure that the participants were habitual coffee drinkers. Those participants who had already participated in experiment 1 were excluded. The experiment was reviewed and approved by the University's Research Committee.

Apparatus and materials

A web-based survey was designed and conducted in QuestionPro (www.questionpro.com).

Photographs of coffee beverages were presented to participants who were quizzed about the expectations of the sensory properties of the coffee beverages. In this case, only two different types of coffee beverages were presented, including Americano and latte. Each drink was shown in two different mugs identical in size, but different in the material from which they were made: glass and ceramic. A total of 4 pictures (2 types of drinks by 2 serving temperatures) were shown to participants, see Fig. 6.

[Insert Figure 6 here]

Design and procedure

The experiment followed a 2 x 2 mixed design with material (glass mug vs. ceramic mug) and type of coffee beverage (Americano vs. Latte) as two between-subjects manipulations.

Data were collected through online questionnaires at http://www.questionpro.com. The questionnaire was written in Spanish. We used the same online survey approach that had been used previously on experiment 1. Irrespective of the size of the monitor that the participants used, the experiment ran in 'full screen' mode (if the screen was of a smaller resolution, visual information was scaled to fit the screen whilst maintaining aspect ratio). All 4 pictures were presented in a random order. During each trial, participants were shown one picture and were asked to rate the same sensory properties tested in Experiment 1: (1) aroma, (2) bitterness, (3) temperature, (4) intensity, (5) sweetness, (6) liking and (7) congruence (e.g., how much the kind of coffee and mug were congruent with each other), on a 7-point Likert scale. This experiment took approximately 8 minutes to complete by each participant.

Analyses

Two separate analyses were conducted. First, an analysis was performed only with the data from experiment two, while in the second phase, the results of experiment two were contrasted with data reported in Experiment 1. Data from the second experiment were analyzed by means of One-way analysis of variance (ANOVA) using SPSS, with the between-subjects factors of material (glass and ceramic) and the within-subjects factor of type of coffee (Americano vs. latte). Seven different attributes were considered (aroma, bitterness, temperature, intensity, sweetness, liking, and finally congruence). In the second phase, ANOVA and Correlations between ratings of the sensory expectations of Americano and latte in Experiment 2 and ratings of the Experiment 1 were compared.

Results and discussion

For ANOVA we get a significant interaction of material (glass vs. ceramic). ANOVA revealed a significant main effect of material on aroma, bitterness, temperature and congruence expectations for both kinds of coffee: Americano and latte. By contrast, no significant effects of material on intensity and expectations of liking were observed.

The ANOVA performed on the data revealed a main effect between material and expectation of aroma in latte $F(1, 398) = 5.275$, $p = .022$, $\eta_p^2 = .008$ and Americano $F(1, 398) = 15.686$, $p = .000$, $\eta_p^2 = .023$. This means that 2.3% of all variance in expectations of aroma of the Americano is attributable to the material. It was also yielded significant main effects for the expectation of bitterness in Americano $F(1, 398) = 4.218$, $p = .040$, $\eta_p^2 = .006$ and latte $F(1, 398) = 13.256$, $p = .000$, $\eta_p^2 = .019$ see Fig. 7.

[Insert Figure 7 here]

Regarding the expectation of temperature, there was also shown an effect of material in Americano $F(1, 398) = 7.673$, $p = .006$, $\eta_p^2 = .011$ and latte $F(1, 398) = 6.474$, $p = .011$, $\eta_p^2 = .009$. Likewise, an influence of the mug's material on the perception of congruence between the container and the type of beverage was observed in Americano $F(1, 398) = 105.418$, $p = .000$, $\eta_p^2 = .135$ and latte $F(1, 398) = 154.832$, $p = .000$, $\eta_p^2 = .061$. And finally, an effect of the material of the mug on sweetness was also identified in Americano $F(1, 398) = 3.935$, $p = .048$, $\eta_p^2 = .007$ and latte $F(1, 398) = 3.94$, $p = .048$, $\eta_p^2 = .006$ (see Fig. 8).

[Insert Figure 8 here]

Here it should be noted that as was detected in Experiment 1, in Experiment 2, the sensory expectations also differed significantly depending on the material of the mug in which Americano and latte were presented. People expected a more aromatic, bitter and hotter beverage when it was presented in a glass mug. The ceramic mug enhanced the sweetness and was perceived to be more congruent with both types of coffee: Americano and latte. Table 6 reports a summary of the ANOVA results.

[Insert Table 6 here]

In order to eliminate any bias derived from the shape of the mug, we compared the ratings of sensory expectations of Americano and latte with coffee mugs from Experiment 1 to the ratings of the same coffee beverages shown in identical mugs, changing only the material of which they were made (Experiment 2), see Fig. 9.

[Insert Figure 9 here]

The potential influence of the mug (ceramic and glass) in the sensory expectations of coffee beverages (Americano and latte) was examined by ANOVA. Table 7 shows the ANOVA results for Experiment 1 and Experiment 2 for Americano and latte, respectively. From the table, we have the following findings. First, by using the glass and ceramic mugs from Experiment 2 (rounded mugs), the expectations related to the aroma and pleasantness of American coffee were increased. On the other hand, intensity expectations augmented significantly for Americano coffee when evaluated in the round ceramic mug of Experiment 2. Meanwhile, the glass mug evaluated in Experiment 2 increased the expectations of temperature. Second, the p-values show that there are significant differences between Experiment 1 and Experiment 2 for latte coffee. When showing both, the glass and the ceramic mug from Experiment 2, a significant increase in expectations of bitterness and pleasantness was observed. Likewise, temperature, intensity and aroma expectations augmented significantly for latte coffee when evaluated in the glass mug of Experiment 2. Finally, the glass mug used in Experiment 2 decreased the sweetness for latte. And the ceramic mug of the Experiment 2, was evaluated as significantly less congruent for latte than the ceramic mug evaluated in Experiment 1.

[Insert Table 7 here]

In general, main outcomes highlight the fact that in both experiments, the glass mug enhances the aroma of a coffee drink and that the ceramic mug is significantly more congruent than the glass mug for Americano and latte. In order to assess any relationship between the liking expectations (how much they would expect to like them) and the congruence of the ceramic mug (how congruence exists between the coffee mug and the kind of coffee), Pearson correlations with 2-tailed significance tests were performed. A significant positive correlation was observed between congruence and liking ($r = .245$, $p = .000$). The correlation between liking and congruence ratings supports the notion that the congruence acts in part as driver of liking. All other correlations were non-significant and irrelevant to our hypotheses (see Table 8).

[Insert Table 8 here]

The results imply that, if coffee shops or restaurants wish to increase the perceived sensory expectations of coffee drinks, photographs of mugs similar to those shown in the Experiment 2 should be used in menus and marketing communication. It was found that mugs that are rounder and allow a better contrast between the color of the drink and the material from which the mug is made positively affect the sensory expectations of coffee beverages. However, enhancing sensory expectations does not imply preference or willingness to consume. Consumers may honestly believe they want dark coffee when they do not. Previous studies has shown that personality affects consumers' valuation of food products (Li et al., 2015). Probably, based on the habitual purchase behavior, people prefer a sweeter coffee, in which case the drink should be shown in a round ceramic mug.

General discussion

The present study demonstrates that a mug's material influenced the expectations of different qualities of the coffee and that these expectations differ according to the type of coffee and the shape of the mug. In general terms, the results support the idea that visual information influences the expectation of a beverage. This finding is in line with Wan et al.'s, (Wan et al., 2015) earlier observations concerning the glassware to present the beverages contributes to generating expectations about the quality of a beverage even when people are looking at a photo of it via online advertising.

Practical implications

These findings also provide an understanding of the effects of store atmospherics on attributes that matter to coffee consumers as proposed by Poncin and Mimoun (2014). In this sense, the images coming from coffee shop menus could boost different sensory aspects of consumption. Additionally, it could be essential for baristas and cafe owners to know how to manipulate customers' expectations as a relevant tool to offer an extraordinary customer experience. However, this is not only crucial for the point of sale, but also for online marketing that uses different images of beverages. In order to attract customers' attention, marketers need to guarantee that the visual features used to promote the products are congruent with their other sensory attributes (Petit et al., 2019). As Van Doorn et al. (G. Van Doorn et al., 2017) remark, aligning the visual product design and the contextual conditions with consumer expectations could also contribute to increasing the sales and therefore, the share of market, even in a scenario of global competition. Moreover, these results contribute in the understanding of consumer and enhance the gastronomic perception and improve the consumption experience. As Piqueras-Fiszman et al. (Piqueras-Fiszman et al., 2013) propose, the insights from the study of contextual factors and the new evaluation methods used, can enhance the gastronomic experience. Identifying which attributes are relevant to consumers and communicate them in the claims of the product could also increase the probability of success of new products.

Taking into account the relevance of the coffee services market this research sheds some light on certain merchandising recommendations for coffee marketeers.

This paper is not without limitations. It should be noted that this work must be interpreted in the cultural context in which the study took place. Research is already underway in order to compare these results with different populations to achieve a more extensive panorama of the effects of the material of the mug in the expectation of coffee. Likewise, knowing the consumers' expertise and the container-coffee type associations could be essential to determinate which factors should be manipulated. Further investigations may do well to focus on how knowledge on coffee and cultural factors regarding a coffee container interact with the participants' expectations. Because the study was conducted online, the device varied from one participant to the other and the colours could have been represented differently due to variations in screens and light strength on each device. In future studies, the images should be presented by using the same laptops for all respondents. It is also important to identify which sensory properties are preferred for the consumer.

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Tables

Table 1. Summary statistics of the data sample.

	Number	%
Age groups		
15-35	135	50.0%
36-60	135	50.0%
Gender		
Male	124	45.9%
Female	146	54.1%
Total	270	100.0%

Table 2. Questions and scale for each dependent attribute variable.

Dependent variable	Question	Scale anchors (left to right)
Aroma	Please evaluate these coffee drinks in order of how strong you would expect each coffee's aroma to be	1 (no aroma at all) - 7 (very strong aroma)
Bitterness	Please evaluate these coffee drinks in order of how bitter you would expect each to taste	1 (not bitter at all) - 7 (very bitter)
Temperature	Please evaluate these coffee drinks in order of how hot you would expect each to taste	1 (body temperature) - 7 (too hot to hold)
Intensity	Please evaluate these coffee drinks in order of how intense you would expect each to taste	1 (not intense at all) - 7 (very intense)
Sweetness	Please evaluate these coffee drinks in order of how sweet you would expect each to taste	1 (not sweet at all) - 7 (very sweet)
Liking	Please evaluate these coffee drinks in order of how much you would expect to like each	1 (greatest imaginable dislike) - 7 (greatest imaginable like)
Congruence	Please evaluate these coffee drinks in order of how much congruence exists between the coffee mug and the kind of coffee	1 (not congruent at all) - 7 (very congruent)

Table 3. Results for the seven ordered regression models using the implementation of cumulative link mixed models.

Dependent variable	**Factors**	**df**	**AIC**	**LRT**	***p*-value**	**Pseudo R^2**
Aroma	Coffee	3	7656.2	760.01	<0.0001*	0.0959
	Material	1	6954.1	53.91	<0.0001*	0.0038
	Coffee x Material	3	6902.2	145.49	<0.0001*	0.1219
Bitterness	Coffee	3	8284.5	1314.6	<0.0001*	0.1578
	Material	1	6888.1	14.1	0.0002*	0.0007
	Coffee x Material	3	6976.0	173.73	<0.0001*	0.1806
Temperature	Coffee	3	6881.3	388.04	<0.0001*	0.05646
	Material	1	6500.0	2.74	0.098	0.00280
	Coffee x Material	3	6499.2	74.24	<0.0001*	0.06765
Intensity	Coffee	3	7713.8	984.22	<0.0001*	0.12346
	Material	1	6791.7	58.12	<0.0001*	0.00358
	Coffee x Material	3	6735.6	132.34	<0.0001*	0.14811
Sweetness	Coffee	3	8161.3	978.78	<0.0001*	0.12011
	Material	1	7187.3	0.82	0.3659	0.0011
	Coffee x Material	3	7188.5	175.09	<0.0001*	0.1417
Liking	Coffee	3	7927.1	197.37	<0.0001*	0.0248
	Material	1	7739.1	5.36	0.0206	0.0005
	Coffee x Material	3	7735.7	41.39	<0.0001*	0.0307
Congruence	Coffee	3	6809.7	144.80	<0.0001*	0.0196
	Material	1	6793.7	124.77	<0.0001*	0.0167
	Coffee x Material	3	6670.9	158.64	<0.0001*	0.0606

Note: Significant results are shown with an asterisk *

Table 4. A post-hoc analysis for type of coffee and type of material was performed when the interaction was found significant. Adjustments on the p-valued were made using Tukey's method for comparing a family of 8 estimates (4 levels for the type of coffee times 2 levels of the type of material).

Contrasts	**Dependent variable**	**Estimate**	**SE**	**z.ratio**	***p*-value**
Espresso,Ceramic - Espresso,Glass	Temperature	1.0899	0.2217	4.917	<.0001*
	Sweetness	-1.8135	0.1722	-10.53	<.0001*
	Liking	-0.7895	0.1577	-5.007	<.0001*
	Intensity	2.1059	0.1761	11.96	<.0001*
	Congruence	-0.9326	0.1674	-5.57	<.0001*
	Aroma	2.0379	0.1759	11.588	<.0001*
	Bitterness	2.0095	0.1737	11.598	<.0001*
Americano,Ceramic - Americano,Glass	Temperature	-0.2875	0.1740	-1.649	0.7199
	Sweetness	-0.4205	0.1697	-2.477	0.2051
	Liking	-0.2283	0.1543	-1.48	0.8185
	Intensity	0.8881	0.1715	5.179	<.0001*
	Congruence	-1.9608	0.1712	-11.453	<.0001*
	Aroma	0.9749	0.1657	5.884	<.0001*
	Bitterness	0.4829	0.1625	2.972	0.0593
Capuccino,Ceramic - Capuccino,Glass	Temperature	-0.5291	0.1596	-3.316	0.0206*
	Sweetness	0.7921	0.1561	5.074	<.0001*
	Liking	0.6611	0.1655	3.994	0.0017*

	Intensity	0.3284	0.1553	2.114	0.4054
	Congruence	0.9752	0.1863	5.236	<.0001*
	Aroma	0.4089	0.1563	2.616	0.1501
	Bitterness	-0.0290	0.1571	-0.185	1
Latte,Ceramic - Latte,Glass	Temperature	-0.7154	0.1593	-4.49	0.0002*
	Sweetness	0.8407	0.1535	5.476	<.0001*
	Liking	-0.2795	0.1487	-1.88	0.5648
	Intensity	-0.4733	0.1502	-3.151	0.0349*
	Congruence	-1.5986	0.1643	-9.73	<.0001*
	Aroma	-0.6759	0.1513	-4.466	0.0002*
	Bitterness	-0.9528	0.1526	-6.244	<.0001*

Note: Significant results are shown with an asterisk *

Table 5. Type of material that enhances different sensory expectations of coffee.

	Sensory expectations						
Type of coffee	Bitterness	Sweetness	Temperature	Intensity	Aroma	Liking	Congruence
Espresso	Glass	Ceramic	Glass	Glass	Glass	Ceramic	Ceramic
Americano				Glass	Glass		Ceramic
Cappuccino		Glass	Ceramic			Glass	Glass
Latte	Ceramic	Glass	Ceramic	Ceramic	Ceramic		Ceramic

Table 6. ANOVA for each of the variables in Experiment 2. Rows in bold indicate a significant difference (significance at p-value ≤0.05) between material (glass vs. ceramic) and variables.

Variable		ANOVA Mean (glass vs. ceramic)	F	p	partial η^2
Aroma	**Americano**	**6.41 vs. 6.06**	**15.69**	**0.000**	**0.023**
	Latte	**4.90 vs. 4.52**	**5.28**	**0.022**	**0.008**
Bitterness	**Americano**	**5.64 vs. 5.40**	**4.22**	**0.040**	**0.006**
	Latte	**3.40 vs. 2.99**	**13.26**	**0.000**	**0.019**
Temperature	**Americano**	**6.03 vs. 5.78**	**7.67**	**0.006**	**0.011**
	Latte	**5.34 vs. 5.06**	**6.47**	**0.011**	**0.009**
Intensity	Americano	6.26 vs. 6.14	2.07	0.150	0.003
	Latte	4.56 vs. 4.42	1.53	0.217	0.002
Sweetness	**Americano**	**2.17 vs. 2.42**	**4.55**	**0.033**	**0.007**
	Latte	**4.24 vs. 4.49**	**3.94**	**0.048**	**0.006**
Liking	Americano	4.53 vs. 4.78	2.18	0.140	0.003
	Latte	5.40 vs. 5.51	0.76	0.383	0.001
Congruence	**Americano**	**4.57 vs. 5.92**	**105.42**	**0.000**	**0.135**
	Latte	**4.47 vs. 5.42**	**44.00**	**0.000**	**0.061**

Table 7. Results of ANOVA for sensory expectations in Experiment 1 and Experiment 2 for Americano and latte. Rows in bold indicate a significant difference between material (significance at p-value ≤0.05) and variables.

Variable		Americano				Latte			
		Mean	**F**	**P-value**	**partial η^2**	**Mean**	**F**	**P-value**	**partial η^2**
Aroma	Glass	**5.86 vs. 6.26**	**16.506**	**0.000**	**0.026**	**3.91 vs. 4.59**	**38.919**	**0.000**	**0.060**
	Ceramic	**5.30 vs. 5.90**	**31.883**	**0.000**	**0.050**	4.37 vs. 4.36	0.007	0.931	0.000
Bitterness	Glass	5.86 vs. 5.64	3.132	0.077	0.005	**3.00 vs. 3.40**	**11.318**	**0.001**	**0.018**
	Ceramic	5.63 vs. 5.40	3.806	0.052	0.006	**3.71 vs. 2.99**	**36.137**	**0.000**	**0.056**
Temperature	Glass	**5.80 vs. 6.03**	**5.926**	**0.015**	**0.010**	**4.59 vs. 5.34**	**42.927**	**0.000**	**0.066**
	Ceramic	5.97 vs. 5.78	3.532	0.061	0.006	5.06 vs. 5.06	0.002	0.961	0.000
Intensity	Glass	6.20 vs. 6.26	0.446	0.505	0.001	**3.91 vs. 4.56**	**32.933**	**0.000**	**0.051**
	Ceramic	**5.79 vs. 6.14**	**12.692**	**0.000**	**0.020**	4.26 vs. 4.42	2.047	0.153	0.003
Sweetness	Glass	2.26 vs. 2.17	0.485	0.486	0.001	**5.14 vs. 4.24**	**48.187**	**0.000**	**0.074**
	Ceramic	2.47 vs. 2.42	0.139	0.709	0.000	4.47 vs. 4.49	0.028	0.867	0.000
Liking	Glass	**4.03 vs. 4.53**	**8.048**	**0.005**	**0.013**	**4.71 vs. 5.40**	**26.252**	**0.000**	**0.041**
	Ceramic	**4.27 vs. 4.78**	**9.441**	**0.002**	**0.015**	**5.03 vs. 5.51**	**13.712**	**0.000**	**0.022**
Congruence	Glass	4.30 vs. 4.57	2.662	0.103	0.004	4.37 vs. 4.47	0.357	0.550	0.001
	Ceramic	5.98 vs. 5.92	0.280	0.597	0.000	**5.83 vs. 5.42**	**9.869**	**0.002**	**0.016**

Table 8. Pearson correlation coefficients between congruence and liking expectations of the coffee drink evaluated. Bold indicates significant correlations at the .01 level (2-tailed).

N=609	Liking | Ceramic | Latte	Congruence | Ceramic | Latte
Liking | Ceramic | Latte	1	.245** 0.000
Congruence | Ceramic | Latte	.245** 0.000	1

** Correlation is significant at the 0,01 level (2-tailed).

Figure captions

Figure 1. The four different coffee drinks shown in the two different types of mugs used.

Figure 2. Logg odds ratio estimates for effects of contrasts on response variable bitterness. Significant results are marked with *.

Figure 3. Logg odds ratio estimates for effects of contrasts on response variables (a) sweetness and (b) temperature. Significant results are marked with *.

Figure 4. Logg odds ratio estimates for effects of contrasts on response variables (a) intensity and (b) aroma. Significant results are marked with *.

Figure 5. Logg odds ratio estimates for effects of contrasts on response variables (a) liking and (b) congruence. Significant results are marked with *.

Figure 6. The two different coffee drinks shown in the two different types of mugs used in the present study.

Figure 7. Results of sensory expectations of coffee drinks for (on a scale of 0-5) aroma (a,b) and bitterness (c,d) (on a scale of 1-7), for the glass mug and the ceramic mug. Error bars indicate the standard error of the means. The points that are shown individually are those which fall in the lower or upper percentiles.

Figure 8. Results of sensory expectations of coffee drinks for (on a scale of 0-5) temperature (a,b) and congruence (c,d) (on a scale of 1-7), for the glass mug and the ceramic mug. Error bars indicate the standard error of the means. The points that are shown individually are those which fall in the lower or upper percentiles.

Figure 9. The different coffee drinks shown in the different types of mugs used for Experiment 1 (a) and Experiment 2 (b).

Figure 1. The four different coffee drinks shown in the two different types of mugs used.

153x60mm (150 x 150 DPI)

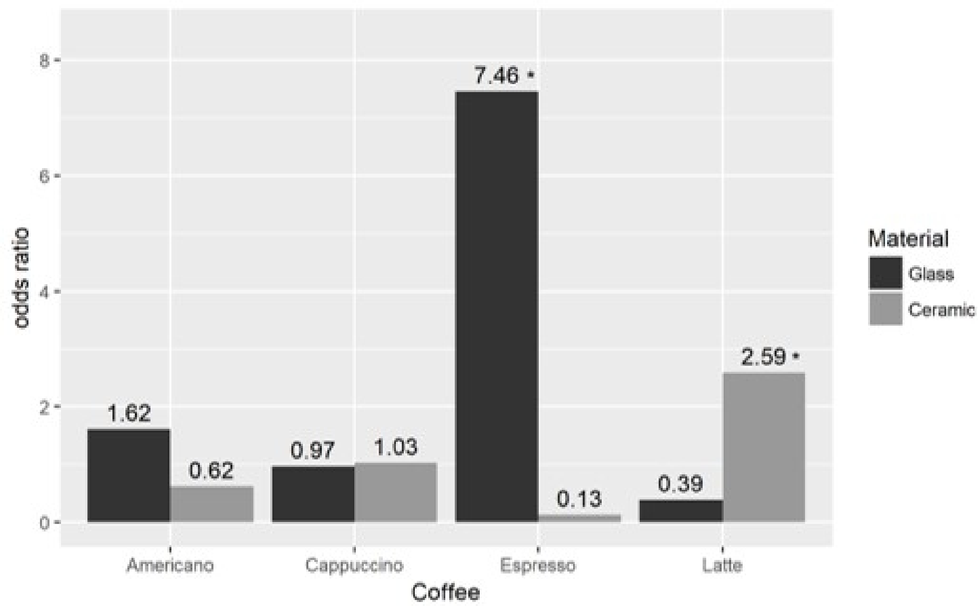

Figure 2. Logg odds ratio estimates for effects of contrasts on response variable bitterness. Significant results are marked with *.

88x54mm (150 x 150 DPI)

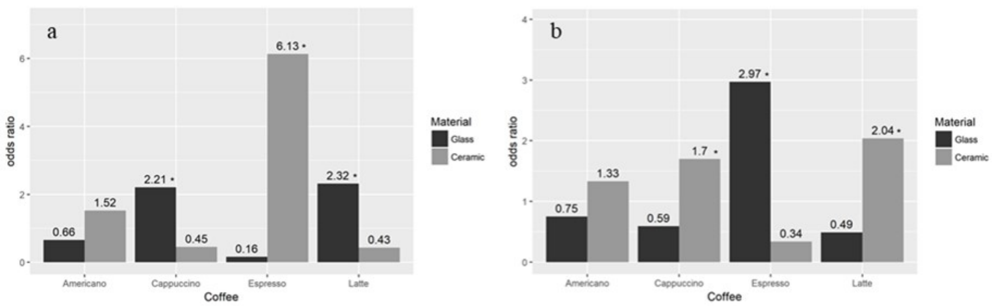

Figure 3. Logg odds ratio estimates for effects of contrasts on response variables (a) sweetness and (b) temperature. Significant results are marked with *.

155x46mm (150 x 150 DPI)

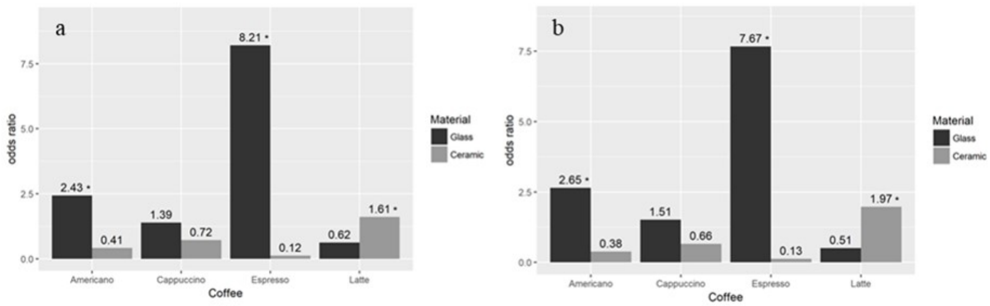

Figure 4. Logg odds ratio estimates for effects of contrasts on response variables (a) intensity and (b) aroma. Significant results are marked with *.

156x47mm (150 x 150 DPI)

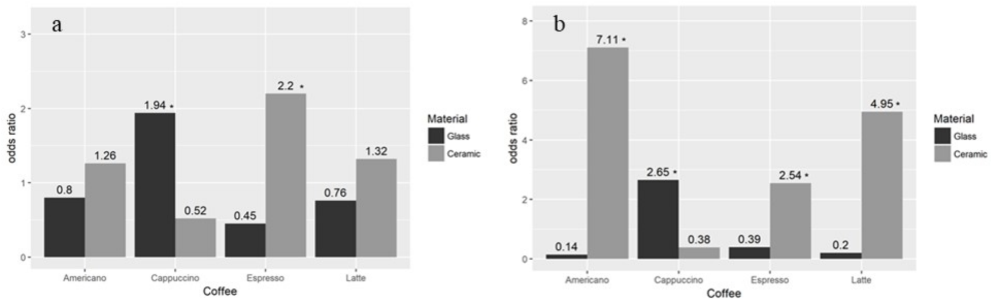

Figure 5. Logg odds ratio estimates for effects of contrasts on response variables (a) liking and (b) congruence. Significant results are marked with *.

163x49mm (150 x 150 DPI)

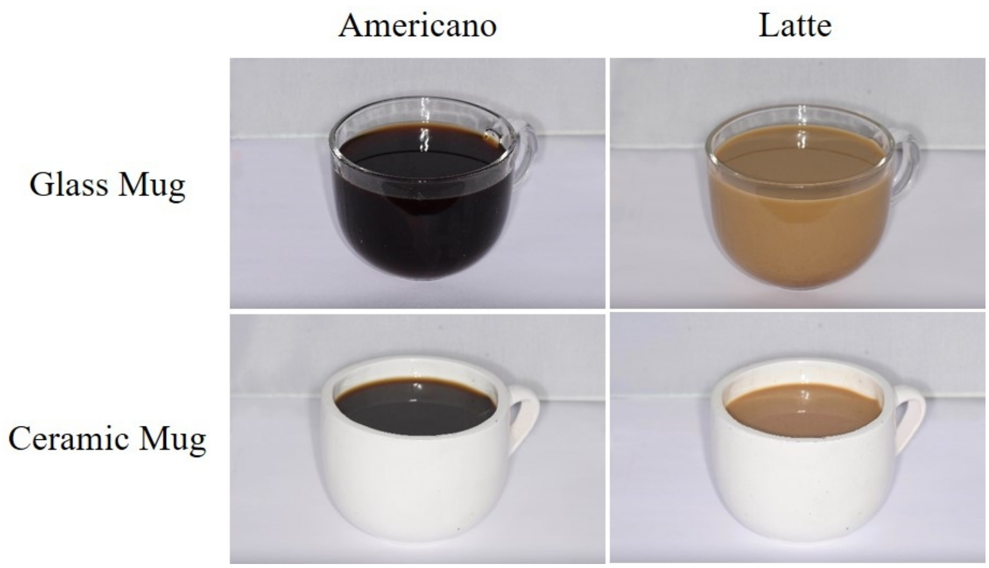

Figure 6. The two different coffee drinks shown in the two different types of mugs used in the present study.

157x90mm (150 x 150 DPI)

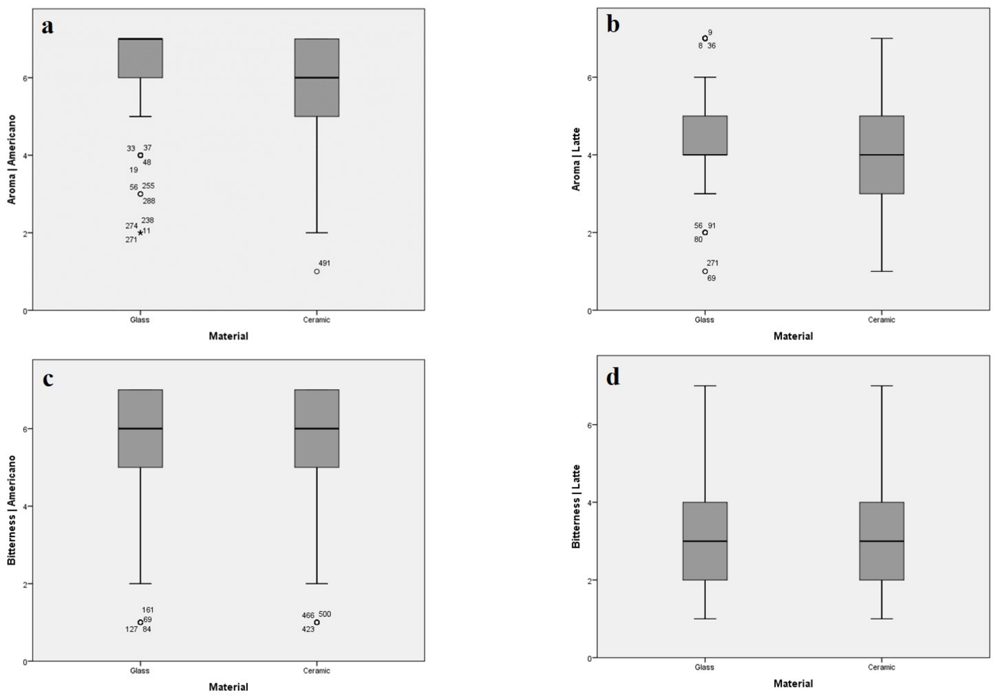

Figure 7. Results of sensory expectations of coffee drinks for (on a scale of 0-5) aroma (a,b) and bitterness (c,d) (on a scale of 1-7), for the glass mug and the ceramic mug. Error bars indicate the standard error of the means. The points that are shown individually are those which fall in the lower or upper percentiles.

246x174mm (150 x 150 DPI)

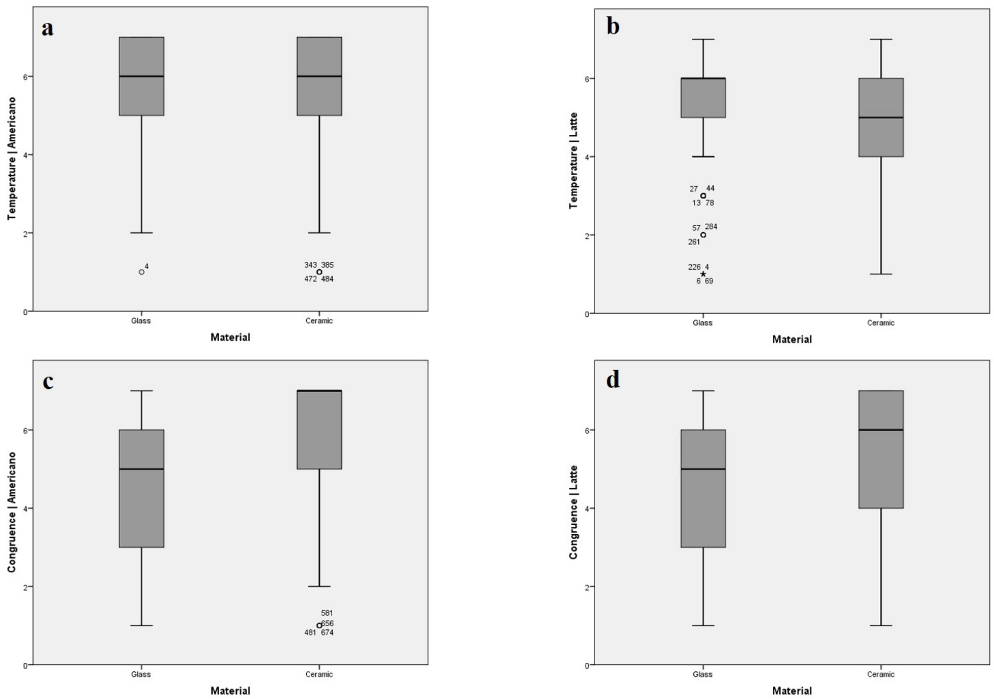

Figure 8. Results of sensory expectations of coffee drinks for (on a scale of 0-5) temperature (a,b) and congruence (c,d) (on a scale of 1-7), for the glass mug and the ceramic mug. Error bars indicate the standard error of the means. The points that are shown individually are those which fall in the lower or upper percentiles.

246x174mm (150 x 150 DPI)

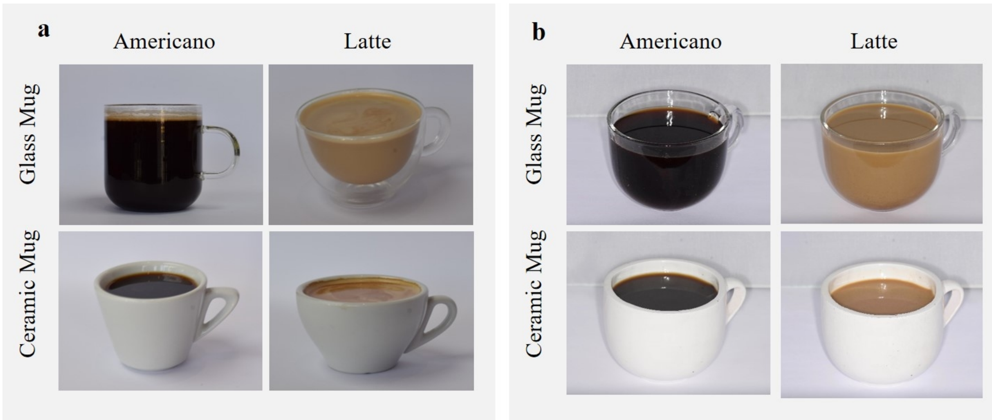

Figure 9. The different coffee drinks shown in the different types of mugs used for Experiment 1 (a) and Experiment 2 (b).

244x102mm (150 x 150 DPI)