

# LATTÉ ART INFLUENCES BOTH THE EXPECTED AND RATED VALUE OF MILK-BASED COFFEE DRINKS

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Authors' Contributions.

GVD, CS, and RHB conceived the study and participated in its design. GVD, CS, and MCD were involved in the data collection. GVD performed the statistical analyses. GVD, CS, RHB, and MCD helped interpret the results and draft the final manuscript. All of the authors read and approved the final manuscript.

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## ABSTRACT

The present study investigated whether consumers' expectations and perceptions concerning milk-based coffee drinks would be influenced by: (1) the presence/absence of latté art on the froth of the coffee, and (2) shape-taste symbolism (i.e., angular versus rounded shapes presented on the froth). An online survey conducted using photographs of cups of coffee revealed that the presence of latté art did indeed influence people's expectations concerning the value of the drink. Follow-up research revealed that people were willing to pay more for a milk-based coffee drink that had latté art as compared to a similar drink served without art. In a third experiment, an online survey revealed that an angular shape, relative to a more rounded shape, influenced people's expectations concerning the likability, bitterness and quality of the drink. A final experiment (Experiment 4) revealed that shape influenced people's perception of the quality and estimated price of the coffee. Taken together, the various results reported here demonstrate that the presence of latté art influences how much people expect, and are willing, to pay for a café latté. As such, adding art to, and the type of visual design on, a customer's drink should be considered by those serving café latté as an effective means of increasing value.

## PRACTICAL APPLICATIONS

The addition of latté art to milk-based coffees is an interesting, and somewhat recent, phenomenon. The inclusion of latté art can help baristas differentiate their product from those of others. The results reported here suggest that the addition of latté art influences how much people expect, and are willing to pay for milk-based coffees. As such, for the cafe owner thinking about how to increase profits, the experiments reported here suggest that people are willing to pay between 11–13% more for coffee with latté art than for those without it.

## INTRODUCTION

In Britain alone, an estimated 70 million cups of coffee are consumed in cafés, restaurants and other outlets daily (Howie 2012).<sup>1</sup> In Australia, the equivalent figure is around

<sup>1</sup>Although note that the majority (approximately 70%) are instant coffee. It would clearly be relevant here to know how many of the remainder are steamed, milk-based coffee drinks.

2.7 million cups (Green Food Safety Coach 2014). Such figures clearly highlight the strong financial incentive to try and optimize a consumer's experience of a given cup of coffee.

The creation and evaluation of latté art constitutes an important component of many international coffee competitions (World Coffee Events 2014; Veneziano Coffee Roasters, 2015). Here, although, we sought to assess whether the presence of latté art would influence people's expectations and,

subsequently, their ratings of the contents of the coffee cup. Although various factors have been shown to influence the taste of a coffee made with the same ingredients (Pangborn *et al.* 1971; Favre and November 1979; Guéguen and Jacob 2012; Hendon *et al.* 2014; Van Doorn *et al.* 2014), including branding (Martin 1990) and the stated eco-friendly origin of the coffee (Sörqvist *et al.* 2013), to the best of our knowledge, the topic of latté art has not been studied previously, at least not scientifically.

Nevertheless, what is already known is that the artistic presentation of food can influence people's perception, and how much people say that they are willing to pay for it. Recently, Michel *et al.* (2014) reported that arranging the very same ingredients in different ways (i.e., conventionally plated [or tossed] salad versus artfully arranged to represent one of Kandinsky's paintings versus neatly [but nonartistically] arranged) influenced both people's expectations and their subsequent experience of the food. Specifically, and prior to tasting the dish, the artful arrangement of the food was, unsurprisingly, rated as more artistic. However, and more importantly, it was also liked significantly more than the other arrangements. After consuming the dish, the Kandinsky-inspired arrangement was rated as significantly tastier than the other presentations, and the participants were willing to pay significantly more for the artistically plated dish relative to the other presentations of exactly the same ingredients. It should be noted that the "expected" qualities of food and drink (both sensory and hedonic) may anchor "actual" experience when consumers come to taste the food and drink (see Piqueras-Fiszman and Spence, 2015, for a review).

Michel *et al.* (2015a) extended this line of research to the setting of a dining room, showing that diners were willing to pay more than twice as much for the art-inspired salad presentation than for the regular presentation (see Deroy *et al.* 2014, for a historical overview of the evolution of plating food). Meanwhile, other researchers have shown that the balance of the elements on the plate also exerts an influence on people's ratings (Zellner *et al.* 2010).

Here, we wanted to explore the impact of latté art on people's expectations and perceptions concerning a milk-based coffee drink. Initially, online surveys were used to assess people's expectations concerning latté art. These were followed-up with experiments that had been designed to assess people's coffee drinking experience in the naturalistic setting of an independent coffee shop, and in the laboratory. In this study, and consistent with Zellner *et al.* (2011), it was expected that people would assume that latté art involves somewhat more work, effort or skill on the part of the barista, and thus coffees with latté art might be seen as of higher quality and/or worth more. As such, it seemed sensible to assess whether people might be willing to pay more for coffee *with* art. Furthermore, and consistent with the findings reported by Michel *et al.* (2014), we expected the coffee with

latté art to be liked significantly more than the coffee without art. In later experiments, we modified the art on each coffee while keeping "effort" constant.

## EXPERIMENT 1

Initially, we conducted a **survey** in which pictures of two cups of coffee were shown to people over the internet. The general strategy here was first to assess the expectations elicited by the visual presentation of the coffee and then, should significant differences in people's expectations be detected, to test the actual perception and ratings of the coffee in a different group of participants in a naturalistic coffee drinking environment.

## Methods

**Participants.** One hundred and twenty members of the general public logged in to complete the survey. However, four people failed to answer any questions about the coffees while another four failed to answer half of the questions. As such, data from these people (6.7% of respondents) were removed prior to analysis. This left 112 members of the general public who completed the online survey; those whom entered their demographic information were aged between 18 and 57 years ( $M = 27.6$  years,  $SD = 11.0$  years). Ethical approval was granted by, and all the surveys and experiments presented here were carried out in accordance with the regulations of, Federation University's Human Research Ethics Committee (Ref: E14-003). This research project was carried out in accordance with the Helsinki Declaration. In all surveys presented here, participants gave their informed consent before completing the survey, but after reading an Explanatory Statement, by clicking an "I agree" button.

**Materials and Procedure.** Prospective participants were invited to complete a short, online questionnaire. A link to the questionnaire was posted and shared on social media sites (e.g., Federation University's Facebook page) stating that participation was completely voluntary and that no compensation would be provided. Those participants who clicked on this link were taken to the online questionnaire, where they were told that they would be asked to complete a survey about coffee. They could complete the questionnaire in their own time and at their own pace. The participants were assured that their responses would be treated anonymously and confidentially.

A repeated-measures design was utilized with the independent variable being whether or not latté art was present (see Fig. 1). The dependent variables were the expected monetary value of the drink, the expected liking and the expected intensity of the coffee's flavor.



**FIG. 1.** THE PICTURES USED IN THE SURVEY REPORTED IN EXPERIMENT 1  
Milk-based coffee with artistic presentation (left panel). Milk-based coffee without art (right panel).

The online survey was designed to assess whether consumers' expectations about the characteristics of a milk-based coffee drink would be influenced by the presence/absence of latte art. The two pictures used in the survey were identical except for the presence of latte art on one of them (see Fig. 1); the two pictures were presented sequentially with the order of presentation counterbalanced across participants. The participants were asked how much they would expect to pay for a cup of coffee like the one in the picture. They were also asked to rate the expected attributes of the coffee on 9-point Likert scales (1 = Not at all, 9 = Very much). Both the text-box and Likert scales were presented directly beneath the relevant questions and on the same screen-page as the picture to which the questions related.

## Results

A paired-samples *t*-test revealed that the presence ( $M = \$4.02$  AUS,  $SE = \$0.06$ , 95% CI [3.89, 4.14]) versus absence ( $M = \$3.57$ ,  $SE = \$0.08$ , 95% CI [3.42, 3.72]) of latte art exerted a significant influence on the expected monetary value of the drink,  $t(111) = 6.30$ ,  $P < 0.001$ . The presence ( $M = 6.07$ ,  $SE = 0.19$ , 95% CI [5.69, 6.46]) versus absence ( $M = 5.12$ ,  $SE = 0.21$ , 95% CI [4.70, 5.54]) of latte art also influenced expected liking,  $t(111) = 4.88$ ,  $P < 0.001$ , being higher in the former case. Finally, the presence ( $M = 5.90$ ,  $SE = 0.14$ , 95% CI [5.62, 6.18]) versus absence ( $M = 6.50$ ,  $SE = 0.16$ , 95% CI [6.18, 6.82]) of latte art was also found to influence the expected intensity of the coffee,  $t(111) = -4.04$ ,  $P < 0.001$ , this time being higher in the latter case.

## Discussion

The results of the survey conducted in Experiment 1 clearly demonstrate that people were willing to pay significantly more for a milk-based coffee drink with latte art than for an equivalent drink without art. Given Zellner *et al.*'s (2011) previous findings, our hypothesis was that latte art sets an expectation that more time, effort and/or skill has gone into

the making of the drink. People may thus associate latte art with a higher quality product offering, and thus be willing to pay more for it (cf. Michel *et al.*, 2014). It is also possible that people may keep some kind of tally of their previous experiences and realise that, on average, they have paid more for food and beverage products that are presented in a more aesthetically pleasing manner, and thus such presentations may end up giving rise to the expectation that coffee presented this way will cost more.

Consistent with the findings of Michel *et al.* (2014), latte art influenced people's expected liking of the coffee. That is, the participants who took part in Experiment 1 expected that they would like the coffee *with* art significantly more than the coffee *without* art. The results of the online survey clearly demonstrated that people expected to pay significantly more for the milk-based coffee drink with latte art than for the drink without art. Given such results, we decided to conduct a follow-up study in order to determine whether such differences in people's expectations would carry-over to influence their actual experiences when they came to taste the drink.

## EXPERIMENT 2

### Methods

The data were collected at an evening talk held at the 2014 Bath Festival (Bath and North East Somerset Council 2014). The 23 people who attended the event were seated on benches on either side of the room at Colonna & Small's, an independent coffee shop (Colonna & Small's 2014).<sup>2</sup> Those

<sup>2</sup>Note that one intriguing feature of this coffee shop is that there are no prices written on the list of offerings mounted on the wall behind the service counter, only a description of the beans used and their sensory characteristics. The idea here being that this will likely give rise to a discussion between the customer and the barista, in which the latter can get across verbally a little of the ethos of the enterprise (i.e., that it is not just a regular coffee shop).

**TABLE 1.** DESCRIPTIVE STATISTICS FOR THE INTENSITY AND LIKEABILITY RATINGS IN EXPERIMENT 2

Response	Latté art	<i>M</i>	<i>SD</i>
Intensity	Present	4.54	1.78
	Absent	5.18	1.25
Likeability	Present	4.71	2.14
	Absent	4.50	1.29

seated at the tables on one side of the room were given a regular café latté, while those sitting on the other side were given a milk-based coffee drink with latté art instead. A between-participants experimental design was used to reduce any possible demand characteristics (Gravetter and Forzano 2003; Piqueras-Fiszman *et al.* 2013). Given the nature of the event, it was not possible to collect any detailed demographic information from the participants. They were, however, informed verbally that they were under no obligation to complete the score sheets, and that they could stop responding at any point should they so desire. They were also informed that they could complain should they be unhappy with any aspect of the procedure.

Each cup of coffee was made by Maxwell Colonna-Dashwood – U.K. barista champion in 2012, 2014 and 2015 – together with his colleagues. Given that the participants were randomly allocated to each group, it should not matter how they usually take their coffee (e.g., with or without sugar). Each participant was given their coffee as soon as it had been prepared. They were instructed to rate the intensity of the coffee (“How intense is the flavor of the coffee?”) entering a value on their score sheet between “1 (Not at all)” and “9 (Very much).” The participants also rated how much they liked the taste of the coffee, entering another value between 1 and 9. Finally, the participants were asked “How much would you expect to pay for a cup of coffee like the one you are having in a place like this?”

## Results

As the survey provided grounds for a directional hypothesis, one-tailed significance tests were used to assess the cost, liking and intensity ratings. An independent-samples *t*-test revealed that the presence ( $M = £2.95$ ,  $SD = £0.60$ , 95% CI [2.63, 3.31]) versus absence ( $M = £2.56$ ,  $SD = £0.35$ , 95% CI [2.34, 2.76]) of latté art exerted a significant influence on how much people were willing to pay for the drink,  $t(17.92) = -1.90$ ,  $P = 0.037$ , one-tailed; as the assumption of homogeneity of variance (Levene’s  $F = 8.36$ ,  $P = 0.009$ ) was not met, corrected parametric statistics (i.e., equal variances not assumed) were used. None of the other analyses reached statistical significance. As such, the presence versus absence of latté art did not influence: (1) the coffee’s perceived intensity [ $t(21) = 0.99$ ,  $P = 0.167$ , one-tailed; see

Table 1], or (2) how much the participants liked the coffee [ $t(21) = -0.28$ ,  $P = 0.391$ , one-tailed].

## Discussion

The findings of Experiment 2 clearly demonstrate that even though the perceived likability of the café latté did not differ as a function of the presence versus absence of latté art, the participants were willing to pay significantly more for the drink in the former case. A possible explanation for this pattern of results might be that the participants ascribed a higher effort and/or skill to the creation of the café latté when it was served in a more aesthetically pleasing manner (Zellner *et al.* 2010, 2011; Michel *et al.* 2014; Zellner *et al.* 2014), a phenomenon called “art-infusion” (Hagtvedt and Patrick 2008; see also Michel *et al.* 2014). That said, and as suggested by Michel *et al.* (2015a), in the absence of an aesthetic component, it is unlikely that “effort” will be valued in its own right. In fact, it can sometimes be hard to dissociate whether it is the effort that has gone into the act of creation that people value or the extent to which the aesthetic appeal of the end result matters. It is difficult to distinguish between these alternative explanations in the present study. However, for the café owner thinking about how to increase profits and enhance the perceived quality of their product offering, the key points to note here are: (1) people are willing to pay approximately 13% more for coffee *with* latté art<sup>3</sup> (11% in Experiment 1) than without, (2) there is a question of whether the baristas have sufficient time for the additional effort that is involved in latté art, and (3) is the increased willingness-to-pay worth the expenditure in terms of the additional effort involved?

## EXPERIMENT 3

In the third experiment, we wanted to hold “effort” or “skill” constant, but modify the visual design (or “artwork”) on top of the coffee to see whether different expectations could be induced by sprinkling an angular versus a rounded shape on the coffee (see Fig. 2). To achieve this goal, a survey was conducted in which pictures of cappuccinos with either a chocolate star-like shape or a chocolate amoeba-like shape sprinkled on them<sup>4</sup> were shown to people over the internet. Given previous research showing that people prefer rounded shapes (e.g., circles) relative to angular shapes (e.g., triangles) (see Cheskin 1957; Westerman *et al.* 2012; Velasco *et al.* 2015), we hypothesised that people would like cappuccinos with rounded shapes on them significantly more than

<sup>3</sup>Interestingly, Michel *et al.* (2015a) showed that people were willing to pay more than twice as much for art-inspired food.

<sup>4</sup>Here, chocolate shakers were used as these are common in many cafés due to the popularity of the cappuccino.



**FIG. 2.** THE PICTURES USED IN THE SURVEY REPORTED IN EXPERIMENT 3  
Cappuccino with the angular, star-like shape (on the left) and the rounded, organic shape (on the right). Similar shapes have been used in several previous experiments (see text for details).

cappuccinos with star-like shapes on them. Furthermore, as rounded shapes correspond to an increase in the rating of sweetness (see Spence and Deroy 2012, 2013; Liang *et al.* 2013), cappuccinos with rounded shapes on them were, if anything, expected to be rated as sweeter than those with star-like shapes. Lastly, as angularity is often associated with bitterness (see Spence 2013, 2014; Velasco *et al.*, 2015), it was expected that cappuccinos with star-like shapes on their froth might be rated as more bitter than those with a more organic, rounded shape.

Experiment 3 extends earlier work showing that people consistently match the geometric properties of abstract shapes (e.g., angularity and roundness) with a variety of tastes, flavors, aromas and oral-somatosensory attributes (i.e., carbonation, oral texture and mouth-feel) in food (e.g., chocolate) and drink (e.g., fruit juices) (see Dichter, 1971; Gal *et al.* 2007; Ngo *et al.* 2011, 2012; Spence 2012; Spence and Deroy 2012, 2013; Liang *et al.*, 2013). It has often been reported that bitterness, sharpness (of taste), sourness and carbonation are associated with angular shapes, whereas sweet tastes are paired with rounded shapes (Spence 2013, 2014; Velasco *et al.*, 2015).

## Methods

**Participants.** One hundred and thirty-seven members of the general public logged in to complete the survey. However, 11 people failed to answer any questions about the coffees, while a further six failed to answer half of the questions. As such, data from these individuals (12.4% of respondents) were removed prior to analysis, and their demographic details were not included in the descriptive sta-

tistics below. This left 120 members of the general public (90 females) who completed the online survey. These people were aged between 19 and 75 years ( $M = 39.7$  years,  $SD = 12.7$  years).

**Method and Procedure.** Participants were invited to complete a short, online questionnaire. They were recruited via social media and word of mouth. They were given a web address to access and were asked to complete the questionnaire in their own time. They were assured that their responses would be treated anonymously and confidentially.

A repeated-measures design was used with the independent variable being the shape appearing on the cappuccino's froth (see Fig. 2). The dependent variables were the expected monetary value of the drink, the expected liking and quality of the drink, the coffee's expected aroma, and the expected intensity, bitterness and sweetness of the coffee's flavor.

The online survey was designed to assess whether consumers' expectations about the characteristics of a cappuccino would be influenced by the chocolate shape that had been sprinkled on its froth. The two pictures used in Experiment 3 were identical except for the shape on each cappuccino (see Fig. 2); they were presented sequentially with the order counterbalanced across participants. The participants had to report how much they expected to pay for a cup of coffee like the one in the picture. They also had to rate the expected attributes of the coffee on 9-point Likert scales. The Likert scales were labeled at the anchors with "1 (Not bitter at all)" and "9 (Very bitter)," "1 (not sweet at all)" and "9 (very sweet)," "1 (no aroma at all)" and "9 (very strong aroma)," "1 (not intense at all)" and "9 (very intense)," "1 (very low quality) and "9 (very high quality)" and "1

**TABLE 2.** DESCRIPTIVE STATISTICS FOR THE INTENSITY, SWEETNESS, AROMA, AND COST RATINGS IN EXPERIMENT 3

Response	Shape	<i>M</i>	<i>SE</i>
Intensity	Rounded	2.98	0.16
	Angular	2.91	0.17
Sweetness	Rounded	4.71	0.20
	Angular	4.89	0.18
Aroma	Rounded	3.33	0.15
	Angular	3.53	0.17
Cost	Rounded	\$3.04	\$0.11
	Angular	\$3.31	\$0.27

(greatest imaginable dislike)” and “9 (greatest imaginable like).” Both the text-box for estimating value and the Likert scales were presented directly beneath the relevant questions and on the same screen-page as the picture to which the questions related.

## Results

Ratings on each scale (cost, intensity, aroma, quality, bitterness, sweetness and acceptability) were compared using paired-samples *t*-tests. These tests revealed that **the shape influenced expected liking** [ $t(119) = 2.01, P = 0.047$ ], with participants expecting to like the coffee with a rounded shape ( $M = 2.92, SE = 0.18, 95\% CI [2.57, 3.27]$ ) less than the coffee with an angular shape ( $M = 3.13, SE = 0.19, 95\% CI [2.74, 3.51]$ ). The participants also expected the coffee with an **angular shape to taste more bitter** ( $M = 3.25, SE = 0.17, 95\% CI [2.91, 3.59]$ ) than the coffee with the rounded shape ( $M = 3.00, SE = 0.17, 95\% CI [2.66, 3.34]$ ),  $t(119) = 2.18, P = 0.032$ . Finally, the geometric shape also influenced expected quality [ $t(119) = 2.57, P = 0.012$ ], i.e., rounded ( $M = 2.85, SE = 0.16, 95\% CI [2.54, 3.16]$ ) versus angular ( $M = 3.13, SE = 0.18, 95\% CI [2.77, 3.48]$ ). None of the other analyses reached statistical significance. As such, the different shapes failed to exert any significant influence on: (1) the coffee’s expected intensity [ $t(119) = -0.44, P = 0.658$ ; see Table 2], (2) the coffee’s expected sweetness [ $t(119) = 1.31, P = 0.193$ ], (3) the coffee’s expected aroma [ $t(119) = 1.89, P = 0.061$ ] or (4) how much the participants were willing to pay for the coffee [ $t(119) = 1.07, P = 0.288$ ].

## Discussion

The analysis of the results from Experiment 3 revealed significant effects of shape on the expected liking, bitterness and quality of the cappuccino. The participants expected the cappuccino to be more bitter, liked more and to be of better quality when accompanied by an angular shape, as compared with the cappuccino with the rounded shape. The “bitterness” finding is consistent with the results of Ngo *et al.* (2011). There, it was reported that people tend to match sweet-tasting foods with organic (and rounded)

shapes while matching more angular shapes with bitter-tasting foods (see also Dichter 1971; Gal *et al.* 2007; Ngo *et al.* 2012; Spence 2012, 2013, 2014; Spence and Deroy 2012, 2013).

The finding that people expected to like a cappuccino with an angular shape more than one with a rounded shape is somewhat odd given that Bar and Neta (2006) and Larson *et al.* (2007) have shown that, overall, people associate angular shapes with threat. It may be that, although there is a threat value, there is a separate influence of angularity on priming taste and on whether the priming makes the taste more liked or not (see Shen *et al.* 2015, for a similar argument).

The finding that the cappuccino with an angular, star-like shape on it was expected to be of better quality than one with a rounded shape might, at first glance, seem inconsistent given Cheskin’s (1957) early finding that 80% of participants preferred a product from a package with circles on it (relative to one with triangles on it); often citing that this product was of “better quality” (see Westerman *et al.* 2012, for similar findings regarding people’s preference for rounded shapes on, and rounded contours of, product packages). This finding is difficult to reconcile with those presented here but, and although speculative, it is possible that: (1) people judged the coffee with a star on it to be of better quality because the star brings to mind the positive characteristics of a market leading company (e.g., Costa are known to sprinkle a star on their coffees; see Van Horen and Pieters, 2012, for a discussion) or (2) the explanation may boil down to something as simple as people recognizing that more surface area was covered by the chocolate on the cappuccino with a star-like shape, relative to the cappuccino with the rounded shape, and therefore rated it as being of better quality (this second possibility may also help explain why people “liked” the coffee with a star on it more than they liked the coffee with a rounded shape on it).

## EXPERIMENT 4

The results of our second online survey clearly demonstrate that people expect a cappuccino with an angular, star-like shape to be more likeable, more bitter and of higher quality than a cappuccino with an organic, amoeba-like shape. That said, our participants did not expect to pay more for one coffee than for the other. Given the results of Experiment 3, we decided to conduct a final follow-up in order to determine **whether such differences in people’s expectations would carry-over to influence their actual experiences when they came to taste the drink**.

**TABLE 3.** DESCRIPTIVE STATISTICS FOR THE INTENSITY, AROMA, BITTERNESS, SWEETNESS, AND LIKEABILITY RATINGS IN EXPERIMENT 4

Response	Shape	<i>M</i>	<i>SE</i>
Intensity	Rounded	61.29	3.46
	Angular	51.01	6.11
Aroma	Rounded	48.74	6.76
	Angular	48.52	6.07
Bitterness	Rounded	50.34	5.66
	Angular	55.41	6.04
Sweetness	Rounded	31.63	4.68
	Angular	34.79	5.40
Likeability	Rounded	57.09	5.95
	Angular	42.69	7.96

## Methods

**Participants.** Thirty volunteers (11 males) aged between 18 and 66 years ( $M = 35.0$  years,  $SD = 11.8$  years) took part in Experiment 4. The participants gave their written informed consent before the start of the experiment.

**Materials and Procedure.** The participants were given ~200 mL of cappuccino coffee (~135 mL of full-cream milk and ~65 mL of coffee). All of the participants were given their coffee in a white, porcelain mug, but 15 had a 5 cm × 5 cm star-like shape sprinkled in chocolate on top of the foam on their coffee; the other 15 had a 5 cm × 5 cm amoeba-like shape added to their milk-based coffee (see Fig. 2). A between-participants experimental design was used to avoid any possible demand characteristics (Gravetter and Forzano 2003; Piqueras-Fiszman *et al.* 2013).

The same white, ceramic mug was used for each person; the coffee was not stirred as this would upset the level of froth the machine had placed on top of the coffee (and on which the shapes were placed). The mug was cleaned using water between participants. We kept the mug identical because it has been shown that the container can influence perception (Van Doorn *et al.* 2014; see also Piqueras-Fiszman and Spence 2012). Each cup of coffee was made using a DeLonghi Magnifica coffee machine set to “extra-strong” taste. Each coffee was made just prior to the experiment to ensure the temperature of each was as similar as possible. The experimenter was not blind to the hypothesis, but was careful not to give away any hints as to the nature of the experiment. The participants were told that the purpose of the study was to assess certain characteristics of coffee. None of the participants were aware of the existence of different visual presentations. As an aside, participants were randomly allocated to each group and, as such, it should not

matter how they usually take their coffee (e.g., with or without sugar).

As the participants were handed their coffee, they were also handed several forms with one 10-cm long visual analog scale on each sheet. As they drank their coffee, they rated the bitterness of the coffee by making a mark through the line which provided a quantitative measure of the relevant characteristic. This line was labeled at its anchors with “0 (Not bitter at all)” and “100 (Very bitter).” The participants also rated the perceived sweetness (0 [not sweet at all], 100 [very sweet]); aroma (0 [no aroma at all], 100 [very strong aroma]); flavor intensity (0 [not intense at all], 100 [very intense]); quality (0 [very low quality], 100 [very high quality]) and acceptability (0 [greatest imaginable dislike], 100 [greatest imaginable like]) of the coffee on similar scales. The scales were presented on separate sheets and the order of presentation was varied between participants. They were also asked to write down “how much they would be willing to pay for this cup of coffee.”

## Results

As the survey provided grounds for directional hypotheses, one-tailed significance tests were used to assess the liking, bitterness and quality ratings. Independent-samples *t*-tests revealed that the type of pattern, i.e., rounded shape ( $M = \$3.75$  AUS,  $SE = \$0.39$ , 95% CI [2.92, 4.58]) versus angular shape ( $M = \$2.67$ ,  $SE = \$0.31$ , 95% CI [2.01, 3.33]), placed on top of the cappuccinos exerted a significant influence on participants’ cost estimates,  $t(28) = -2.19$ ,  $P = 0.037$ . The shape of the chocolate also influenced expected quality [ $t(28) = -2.01$ ,  $P = 0.028$ , one-tailed], i.e., rounded ( $M = 58.87$ ,  $SE = 4.80$ , 95% CI [48.57, 69.18]) versus angular ( $M = 45.99$ ,  $SE = 4.26$ , 95% CI [36.84, 55.13]). **The different shapes failed to exert any significant influence on participants’ ratings of the other attributes of the drink, i.e., intensity [ $t(28) = 1.47$ ,  $P = 0.15$ ; see Table 3], aroma [ $t(28) = -0.02$ ,  $P = 0.98$ ], bitterness [ $t(28) = -0.61$ ,  $P = 0.27$ , one-tailed], sweetness [ $t(28) = 0.44$ ,  $p = .66$ ] or liking [ $t(28) = 1.45$ ,  $P = 0.08$ , one-tailed].**

## Discussion

The findings of Experiment 4 demonstrate that the perception of cost and quality were affected by the round versus angular shape sprinkled on the coffee, even though the results of Experiment 3 had revealed that other expectations concerning the coffee differed depending on the shape of the chocolate. That is, there is a discrepancy between the expected ratings of liking and bitterness and the perceived ratings of liking and bitterness. Zellner *et al.* (2011) suggest that expected and actual ratings are often different from one another (see also Cardello and Maller 1982; Raudenbush and Frank 1999; Piqueras-Fiszman and

Spence 2015) and one reason for this is that, in the survey, participants based their decisions on 2D pictures of coffee, whereas in the experiment judgments were based on viewing the actual 3D beverage (Zellner *et al.*, 2011; see also Michel *et al.* 2015b).

Our findings that the cappuccino with a rounded shape on it was perceived to be of better quality and should cost more than one with a star-like shape are interesting. The quality estimation results reported in Experiment 4 stands in contrast to the finding relating to expected quality in Experiment 3 (i.e., the cappuccino with a star-like shape on it was expected to be of better quality in that experiment). This may be explained by referring to differences between expectations and perceptions (Zellner *et al.*, 2011). However, perceived quality is consistent with Cheskin's (1957) much earlier claim that people preferred a product from a package with circles on it. When considered together, the significant findings from Experiment 4 support the position that people are willing to pay more for items they consider to be of better quality but, as effort was held constant, it seems as though it is the aesthetic appeal of the end result that matters.

Finally, the finding that shape has no effect on the perception of certain attributes of taste (e.g., bitterness and sweetness) is not new. Piqueras-Fiszman *et al.* (2012) also reported that different shaped plates had no influence on the perception of the taste of the food placed on them (although see also Stewart and Goss 2013; Fairhurst *et al.* 2015).

## GENERAL DISCUSSION

Artistic presentation can influence people's perception of food, and the amount that they are willing to pay for it. Consistent with the results of several studies (e.g., Hagtvedt and Patrick 2008; Zellner *et al.* 2010, 2011, 2014; Michel *et al.* 2014) that found that participants ascribed a higher effort and/or skill to the creation of dishes served in a more aesthetically pleasing manner, it was thought that people hold an expectation that there is extra effort and/or skill involved in creating latté art. As such, this expectation generates the observed difference in the rated and expected monetary values of the milk-based coffee drink with latté art relative to one without art (see Michel *et al.* 2014, for a similar argument). The prediction was that the amount that a person would be willing to pay for the drink would be lower in the absence of latté art. The empirical data collected from a naturalistic environment (a small, independent coffee shop) provided support for this hypothesis.

The second idea that was tested in the present study was that the type of art might be important, with angular shapes often being associated with bitterness (e.g., Spence

2013, 2014; Velasco *et al.* 2015) and rounded shapes often being associated with sweetness (and increased liking and quality) (e.g., Cheskin 1957; Spence and Deroy 2012, 2013; Liang *et al.* 2013). The survey revealed that shape had an influence on the expected liking, bitterness and the rated quality of the cappuccino. Participants expected the cappuccino to be more bitter, to like it more and the drink to be of better quality when accompanied by an angular, star-like shape, as compared with the cappuccino with the more organic, amoeba-like shape. The "bitterness" finding is consistent with previous research (e.g., Dichter 1971; Gal *et al.* 2007; Ngo *et al.* 2011, 2012; Spence 2012, 2013, 2014; Spence and Deroy 2012, 2013) showing that participants tend to match angular shapes with bitter-tasting foods. However, the findings that people expected: (1) to like a cappuccino with an angular shape more than one with a rounded shape, and (2) the quality of a cappuccino with an angular, star-like shape on it to be higher than one with a rounded shape are odd given the results of previous experiments (i.e., Cheskin 1957; Bar and Neta 2006; Larson *et al.* 2007; Shen *et al.* 2015).

Here, though, it could perhaps be argued that the rounded shape looks like the experimenter was attempting to create a star-like shape but simply failed to do so. As such, it would not be surprising that participants liked the angular shape more. This concern was addressed in Experiment 3 where the order of presentation of the stimuli was counterbalanced. That is, half of the participants saw the rounded shape first and rated the coffee with this shape prior to seeing the coffee with the angular shape. Thus, these participants were not able to associate the drink's attributes with it being a poor attempt to create a star-like shape, as they had not yet seen the star-like shape. Further, Experiment 4 was a between-participants experiment, and thus those who took part were not aware of the "other" condition (e.g., people getting the rounded shape did not know that there was also a star-like shape condition). Furthermore, in Experiment 4, it should be remembered that participants saw the experimenter place a stencil over their cup and shake chocolate powder onto the froth. As such, the participants should presumably have realized that the shape was deliberately rounded. Nevertheless, despite all of this, it has to be said that the final result still looks slightly better (i.e., more professional) in the star-like, compared with the rounded, format.

The results of the experiments reported here reveal that cost and the attribute of quality were influenced by the type of visual design. As such, the presence of latté art and the type of visual design a barista chooses to place on a milk-based coffee are important. Experiments 3 and 4 were designed to establish whether it was the effort or the aesthetic appeal that was important and, as perception of cost and quality were modified by the type of visual design, we suggest that it is the aesthetic appeal, and not the effort



of making latté art, that seems to be important in influencing consumer behavior (i.e., willingness-to-pay). This interpretation is consistent with Michel *et al.*'s (2014) finding that “effort” does not seem to be valued in its own right, thus supporting the likely importance of aesthetic appeal.<sup>5</sup>

It is also true that, in addition to latté art, the two coffee beverages (see Figs. 1 and 2) varied in many other visual properties (e.g., color, texture, complexity). Research has already established that various pieces of information (e.g., color, orthonasal aroma, weight, shape, sound) influence people's expectations and perceptions in terms of their sensory and hedonic evaluations of food and drink (see Yeomans *et al.* 2008; see also Piqueras-Fiszman and Spence, 2015, for a review). This is, in a way, a necessary constraint whenever one does this kind of research. That said, and given that in Experiments 1 and 2 we were testing the presence versus absence of art while in Experiments 3 and 4 we were testing the type of art, the differences across experiments should not confound the findings (and could, potentially, add to the ecological validity of them).

## CONCLUSIONS

Taken together, the results of the series of surveys and experiments reported here demonstrate that the presence/absence of latté art influences people's willingness-to-pay for a warm, milk-based coffee beverage. If coffee producers want to manipulate people's expectations of their products, adding a star-like shape to a cappuccino will likely increase expected bitterness, likability and quality; although rounded and angular shapes influence the perception of cost and quality. The effect reported here suggests that café owners and baristas should carefully consider whether latté art should be added to the product they are serving, and what type of visual design they intend to use (rounded designs may be preferable). These results are consistent with a growing body of research demonstrating that the visual presentation of food can exert a profound effect on how much people are willing to pay and, on occasion, can even affect the consumer's enjoyment of the food.

<sup>5</sup>Interestingly, Bremner *et al.* (2013) found that non-Western people (the Himba of Kaokoland in rural Namibia) not exposed to written language, supermarkets or advertising failed to show the “usual” (i.e., Western) association between angular and rounded shapes and: (1) sparkling and still water and (2) chocolates varying in their cocoa content. Given this finding, it is likely that at least some of the associations between shapes and the tastes of food and drink are learned (Spence and Ngo 2012), and thus it may be possible to teach coffee consumers to value different forms of latté art.

## NOMENCLATURE

M	mean
SD	standard deviation
AUS	Australian dollars

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