RUNNING HEAD: PLATEWARE & SLURPING INFLUENCE THE PERCEPTION OF SOUP

Plateware and slurping influence regular consumers' sensory discriminative and hedonic responses to a hot soup

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ABSTRACT

Slurping (e.g., as when consuming a hot liquid such as soup) is a common practice in many parts of Asia. The practice is also encouraged amongst many professional wine and coffee tasters in order to help enhance the release of volatile aromas. Would slurping enhance flavour perception in western participants (regular consumers) too, and/or simply make them feel self-conscious? These were the key questions addressed in the present study. Specifically, we investigated the impact of slurping vs. sipping on ratings of flavour of hot soup samples served in either a bowl or mug at one of two temperatures. 207 participants (regular consumers) rated the flavour intensity of the soup, how much they liked it, and how self-consciousness they felt after having tasted each of the four samples. The results revealed that the soup was rated as having a significantly more intense flavour when it was slurped rather than sipped, though the participants also felt a little more self-conscious. Additionally, the participants preferred the soup when served from the mug rather than when served from the bowl (this difference was more pronounced for the hotter of the two soup samples), and they felt less self-conscious. Participants liked the soup significantly more when they sipped rather than when they slurped; this difference was more pronounced when participants sampled the soup from the bowl. These results therefore highlight the impact of plateware, temperature, and consumption style on our perception and enjoyment of food.

Keywords: Flavour perception; slurping; sipping; temperature; plateware; self-consciousness.

Introduction

A growing number of chefs are coming to realize the importance of sound in the kitchen, acknowledging it as, in some sense, '*the forgotten flavour*' sense (see Spence, 2015, 2017; Spence, Shankar, & Blumenthal, 2011). Just think about many of the most desirable food qualities, things like crispy, crunchy, crackly, creamy, carbonated, and even the squeaky sound of certain cheeses (see Spence, 2014, for a review). Intuitively, these desirable attributes could be taken to be determined solely by what is *felt* in the mouth (or between the teeth). But all of these food attributes also provide distinctive *auditory* cues to the consumer as well. Importantly, changing such food sounds has been shown to alter people's perception of the foods that they happen to be evaluating (e.g., Demattè, Pojer, Endrizzi, Corollaro, Betta, Aprea, Charles, Biasioli, Zampini, & Gasperi, 2014; Zampini & Spence, 2004, 2005).

In addition, separately from the literature on food sounds, of interest here is also the literature on embodied cognition or mental simulation (see Barsalou, 2008, for the general framework of embodied and mental stimulation; and Williams & Bargh, 2008, for a specifc example relevant to the themes of the present article). For instance, there are several famous examples, such as the suggestion that holding a pen between your teeth or adopting a power pose which have been put forward as enhancing our sense of happiness and confidence (Cuddy, 2015; though see also Gelman & Fung, 2016; Ranehill et al., 2015, for failures to replicate). Taking the embodied cognition approach as a reference, here we were interested in testing whether making slurping sounds (i.e., behaving as if one is really enjoying what one is tasting, according to embodied mental simulation hypothesis) would influence people's appreciation of the foodstuff currently being tasted (soup, in this study).

Here, it is interesting to note that wine experts will sometimes make a slurping sound, as they try to obtain the maximum aeration of the wine sample that they happen to be holding in their mouth (e.g., Crosariol, 2012). This process helps them to extract more of the aromatic volatiles from the surface of the wine by aerating the wine in their mouth, and thus delivering a richer tasting experience.Slurping is also common practice amongst professional coffee cuppers (e.g., https://www.theguardian.com/discover-nespresso/2015/sep/16/do-you-slurp-or-sip-an-experts-

guide-to-coffee-tasting; http://www.coffeereview.com/coffee-reference/coffee-basics/tasting-or-cupping-coffee/systematically-tasting-coffee/).

The question therefore arises as to whether there is a sound reason to believe that we should all be slurping more than, in fact, most of us currently do. More specifically, if slurping really does enhance the taste experience, should we use slurping on a regular basis? And if so, the next question is why most of us do not do that already? One principle reason here is that slurping is a behaviour where one sees large amounts of cultural difference. In some countries (e.g., in the West) it is seen as rude to make any sounds while eating,[1] while in other cultures (e.g., in countries such as Hong Kong and Japan), it can be considered rude not to slurp and make a lip-smacking sound on finishing a bowl of noodles (e.g., Brett, 2014). Nevertheless, there seem to be signs of change, even in the mostly silent-eating west – Changes are taking place both in the world of wine and in the world of food (Newberry, 2014). On the flip side, however, there is also a suggestion that mechanisms of perceptual constancy may work against any changes in olfactory perception resulting from differences in the amount of volatile-rich air that passes the olfactory receptors (see Spence & Youssef, 2015; Teghtsoonian, Teghtsoonian, Berglund, & Berglund, 1978).

The participants in the present study evaluated samples of soup served from different receptacles (either mugs or bowls) and they either sipped it (as soup is often eaten in the West), or else, they slurped it with a loud sound (as is more common in the East). Utensils for tasting the soup were provided, whereas the soup itself was served at two different temperatures in order to determine how this would affect the pattern of results obtained. Due to cultural considerations, we served half of the soups in mugs as it was hypothesized that the British participants tested in the present study would be less likely to feel inhibited while slurping from a mug than if asked to slurp using a spoon. As soup is also commonly consumed using a bowl and utensil/cutlery (i.e., spoon) this was also considered an appropriate form of presentation for the other two samples. The serving temperatures, receptacle, and utensil were all judged as relevant factors that might modify or

[1] Just take the following quote from Brett (2014): *"I have always had difficulty enjoying my pasta, ramen, or other noodle dish silently. My mother would instantly reprimand me as a child if I were to make even the slightest of slurping noises while eating. This is how I learned that eating noodles or other food in the United States should be a silent act. In fact it is considered quite taboo to make noises while eating. However, in Japan, slurping noodles is actually considered to be a flattering action for the chef who has prepared one's food* [...] *In some circumstances it is even considered rude not to make noises as this signifies a lack of enjoyment. Surely such polar opposite, culturally defined, "acceptable" behaviours require the analysis of a few cultural anthropologists."*

enhance the appreciation and/or preference for the soup. Our hypothesis was that slurping the soup might lead to increased experienced pleasure in the case of Western consumers.

Methods

Participants

207 western participants (129 female) took part in the study which was conducted in the UK; they were tested in groups (convenience sample). The participants were recruited by an agency to take part in the study. They were informed that they could withdraw at any point, should they so desire. All of the participants signed an informed consent form, and declared any relevant food allergies. The participants received a small monetary reward for taking part in the study. As collected on a tablet drop-down menu after having tasted the soups, participants' chose one of the available 8 age groups, with the final median age of the sample being 35.5 years. The sample comprised the following distribution: 20% younger than 18, 10% 18-23 years old, 10% 24-28 years old, 7% 29-33 years old, 9% 34-38 years old, 8% 39-43 years old, 26% 44-49 years old, and 10% over 50 years of age. The participants also reported how often they ate soup, with 13% of the participants reporting that they consumed soup almost every day, 46% of the participants reporting that they ate soup once a week, 31% roughly once a month, and 10% of the participants once a year or less. For the question regarding their favourite soup, chicken soup (including chicken noodle soup) was liked best (37%), followed by tomato (22%), and vegetable soup (17%), with minor preferences also expressed for potato, noodle, onion, mushroom, bean, and squash soups. The final question before sampling the soup asked; "How hungry are you right now?" to which participants also indicated how hungry they were on a 10-point visual analog scale (VAS). There was no specific reason for choosing this scale over any other, other that the fact that we have found it to provide a sufficient degree of detail in our previous research.

Design and procedure

All of the participants tasted the same vegetable-based soup. We utilized a 2 RECEPTACLE (mug vs. bowl, with spoon) x 2 TEMPERATURE (85 vs. 65°C) x 2 MODE OF TASTING (sip vs. slurp)

experimental design. Each participant tasted a total of four soup samples. For each sample, they were first asked to sip it as they normally would, rate it, and then proceed to slurping it, and follow by rating it. The ratings were made on 10-point VASs, for each of the following questions: '*How much do you like the soup?', 'How flavourful did you find the soup?', and 'How self-conscious did you feel while tasting the soup?'*

The order of presentation of the soups was counterbalanced across participants, as was the order in which the rating questions were asked, so as to eliminate any potential order effects. To control the temperature of the soup samples, the chef plated up each sample while the participants tasted the preceding sample. See Figure 1 for an example of the experimental setup.

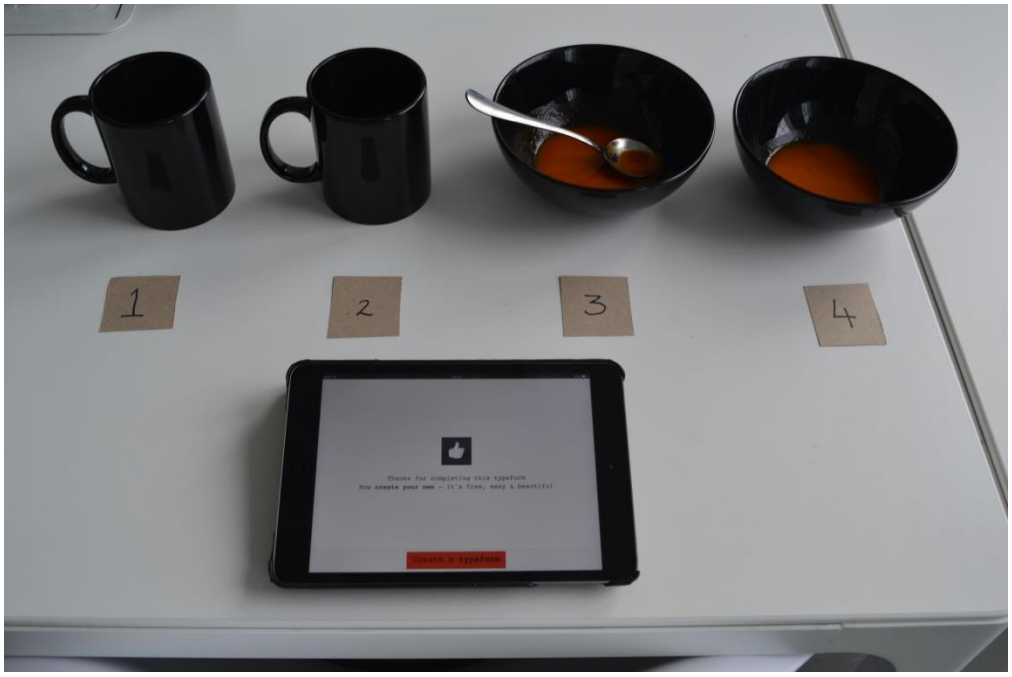

Figure 1. Experimental set-up used in the present study.

Data analysis

For each of the scales (Likeability, Flavor, and Self-consciousness), the data were analyzed with analyses of variance (ANOVAs) with the within-participants factors of Receptacle (mug vs. bowl), Temperature (65 vs. 85°C), and Mode of tasting (sip vs. slurp). Additional correlations were also

conducted between the ratings and participants' reported hunger. See Table 1 for the summary of the Results.

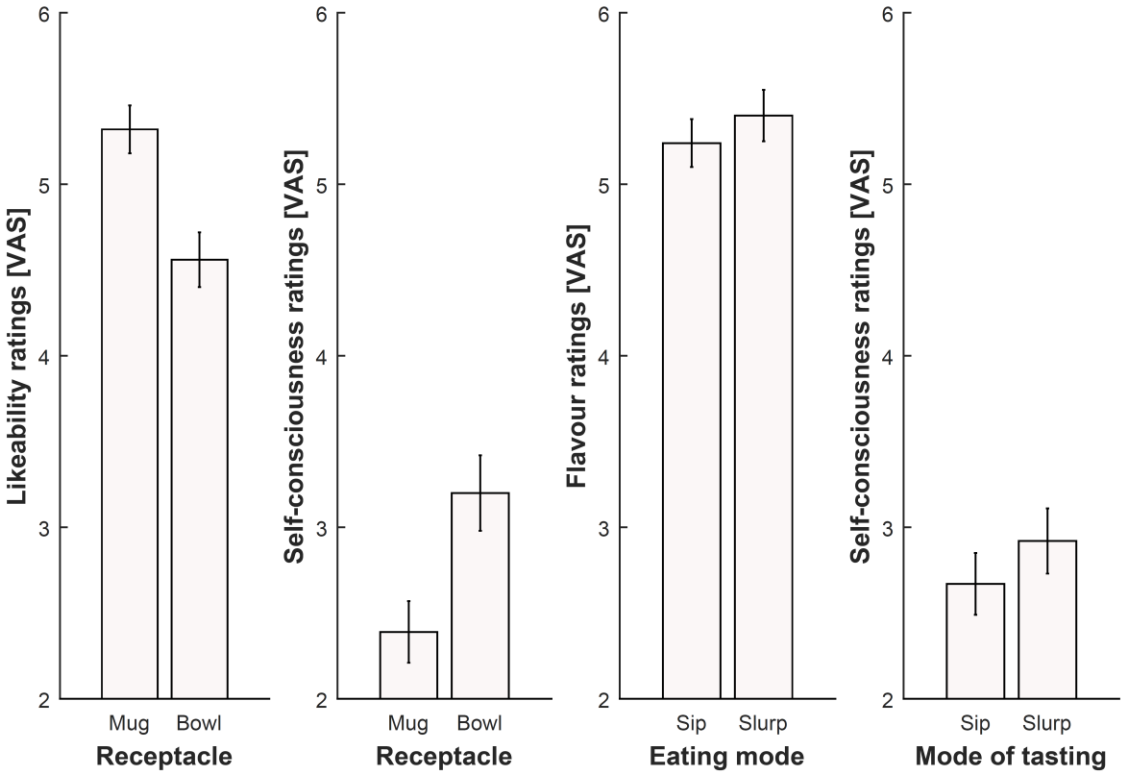

Figure 2. Main effects on Likeability (a) and Self-consciousness (b) as a function of the receptacle, as well as of Flavour (c), and Self-consciousness (d) with respect to the Mode of tasting. The participants rated the soup on 10-point visual analog scales [VAS]. Vertical error bars represent the standard error of the mean.

Results

Likeability: The hungrier the participants were, the more likely they were to appreciate the soup when it was served from the bowl (r = .34, p < .001), when it was served at 85°C (r = .24, p < .001), as well as when they slurped it (r = .24, p < .001). The analysis revealed a significant main effect of Receptacle ($F(1,206) = 28.66$, p < .001, ω^2 = .117), with participants reporting liking the soup significantly more when it was served from a mug (M = 5.32, SE = .37), than when it was served from a bowl (M = 4.56, SE = .32; See Figure 2 for a depiction of the main effect). Two-

way interactions were further observed between the Receptacle and Temperature ($F(1,206) = 8.20$, $p = .005$, $\omega^2 = .033$), Receptacle and Eating mode ($F(1,206) = 30.65$, $p < .001$, $\omega^2 = .125$), with all post-hoc comparisons significant (all ps < .001, see Figure 2 for a depiction of the two-way interactions). Furthermore, there was also an interaction between Temperature x Eating mode ($F(1,206) = 9.24$, $p = .003$, $\omega^2 = .038$; See Figure 3). This was driven by the fact that the soup served at 65°C was preferred in the mug rather than the bowl ($t(206) = 2.63$, $p = .009$, $d = .18$). A three-way interaction was also observed ($F(1,206) = 11.33$, $p < .001$, $\omega^2 = .047$). None of the other main effects or interactions reached significance.

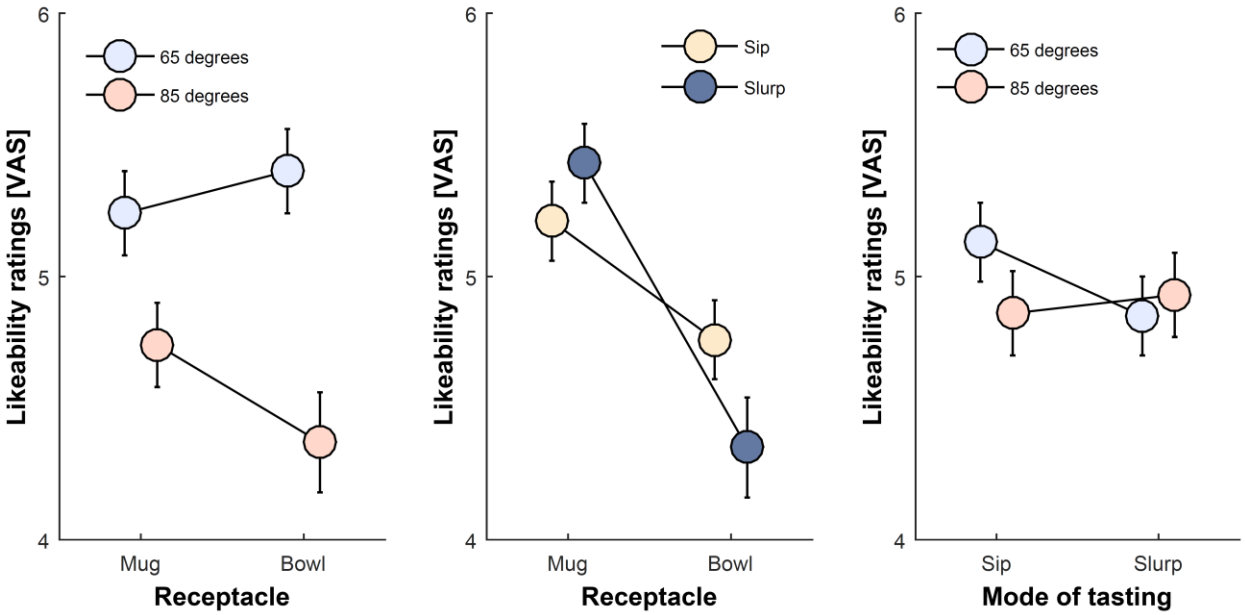

Figure 3. Two-way interactions identified in the data for the Likeability ratings. Participants rated the soup on 10-point visual analog scales [VAS]. Vertical error bars represent the standard error of the mean.

Flavour: The only significant result for the flavour analysis indicated that participants found the soup significantly more flavourful when they slurped it ($M = 5.40$, $SE = .38$), as opposed to when they sipped it ($M = 5.24$, $SE = .37$, $F(1,206) = 11.39$, $p < .001$, $\omega^2 = .048$; See Figure 2 for a visual depiction of the main effect).

Self-consciousness: Self-reported hunger correlated positively with how self-conscious the participants felt when they tasted the soup from the mug (r = .27, p < .001). However, the hungrier participants were when they tasted the soup from the bowl, the less self-conscious they reported themselves to be (r = -.24, p < .001). The results also indicated significant main effects of Receptacle (F(1,206) = 19.11, p < .001, ω^2 = .080), and Mode of tasting (F(1,206) = 13.77, p < .001, ω^2 = .058) on the self-consciousness rating data. That is, the participants were significantly less self-conscious when they tasted the soup from the mug (M = 2.39, SE = .17), as compared to tasting it from the bowl (M = 3.20, SE = .22). Furthermore, as expected, the participants were significantly less self-conscious when they sipped the soup (M = 2.67, SE = .19), as compared to when they slurped it (M = 2.92, SE = .20). See Figure 2 for a depiction of the main effects.

Discussion

In the present study, we investigated how the mode of tasting (slurping vs. sipping) interacts with and affects the appreciation of a sample of hot soup. Moreover, we were interested to see whether slurping a soup would result in enhanced self-consciousness ratings in our sample of British participants. The soup was liked more when tasted from the mug, even though the participants seemed to like it more from the bowl when this was served at the lower of the two temperatures tested here. As expected, the western participants tested in the present study were more self-conscious when they were served the soup from the bowl, as well as when they slurped the soup, as opposed to sipping it, as most people normally do. However, even though it came at the expense of feeling more self-conscious, participants rated the samples of soup tasted while slurping as having a flavour that was significantly more intense.

With specific reference to the potential role of slurping on the consumption of food, it has been reported that those who experience more of the aroma cues associated with a sample of soup will consume less and thus become satiated sooner (e.g., see Yeomans & Boakes, 2016; see Spence, 2016, for a review). Consistent with this finding, the hungrier our participants were, the likelier they were to appreciate the food when they slurped it.

Now, In a related vein, researchers in Japan have recently been working with older populations who find it difficult to chew – To help them increase their enjoyment of food, the researchers played chewing noises in synchrony with the jaw movements of their participants. The results demonstrated that increased eating sounds, even if they are not one's own (eating sounds), led to increased liking and enjoyment ratings (Endo, Ino, & Fujisaki, 2016). Here it is perhaps also worth noting that the consequences of slurping may not only be experienced by the tasters themselves. There are also a small number of individuals out there who suffer from a condition known as *misophonia* (e.g., Edelstein, Brang, Rouw, & Ramachandran, 2013; Kumar, Tansley-Hancock, Sedley, Winston, Callaghan, Allen, et al., 2017; Parker-Pope, 2011; Russell, 2013; Schröder, Vulink, & Denys, 2013). Those who are affected find the sounds associated with other people eating to be especially disturbing.

One of the other major results to have emerged from the present study was that the regular consumers tested in the present study liked the soup significantly more when they tasted it from the mug rather than the bowl. It is possible that the feeling of warmth in the hand when holding the mug may have had a role to play (see Williams & Bargh, 2008). The soup was also liked much more when served at the lower temperature (65°C) rather than the higher temperature (85°C). It should, though, be noted that while the temperature of the soup was carefully controlled when it was poured into the various receptacles, it wasn't possible to keep the thermal conductivity (see Bergmann Tiest, 2010; Bergmann Tiest & Kappers, 2009; http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html) of the different materials of the bowl and mug, not to mention the metal spoon, constant. Any such differences in thermal conductivity may have resulted in small differences in perceived temperature, especially given the exquisite thermal sensitivity of the lips and tongue (see Gallace & Spence, 2014; Weinstein, 1968). However, any such differences, while an unavoidable confound when using such varied natural materials, are unlikely to have played much of a role relative to the 20°C differences in temperature between the samples.

In future research, it would be interesting to repeat this experiment with participants from a culture where slurping (and the associated sounds) is already an acceptable practice to determine whether the increase in self-consciousness documented in our western sample would disappear.

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Table 1. Means (M) and standard deviations (SD) for the three response scales (likeability, flavor, and self-consciousness) used in the present study.

	Mug								*Bowl*							
	65°C				*85°C*				*65°C*				*85°C*			
	Sip		*Slurp*		*Sip*		*Slurp*		*Sip*		*Slurp*		*Sip*		*Slurp*	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Likeability	5.1	2.4	5.4	2.4	5.3	2.4	5.5	2.4	5.1	2.5	4.4	2.8	4.4	2.8	4.3	2.9
Flavour	5.3	2.4	5.4	2.5	5.3	2.4	5.5	2.4	5.2	2.5	5.3	2.5	5.2	2.4	5.3	2.5
Self-consciousness	2.3	2.8	2.5	2.9	2.2	2.9	2.6	3	3.1	3.3	3.3	3.3	3.1	3.2	3.3	3.2