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Intentional facial expression variation per taste preference for beverages

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Abstract

This study examined how individuals would express their preference or distaste for experiences associated with beverages they found to be delicious or unpalatable using facial expressions. We recorded videos where six individuals were asked to drink their preferred or unpreferred beverages and to make "delicious" or "unpalatable" expressions irrespective of what they drank, resulting in four conditions: (1) "delicious" expression with a preferred beverage (genuine delicious), (2) "unpalatable" expression with an unpreferred beverage (genuine unpalatable), (3) "delicious" expression with an unpreferred beverage (fake delicious), and (4) "unpalatable" expression with a preferred beverage (fake unpalatable). A total of 33 participants watched the videos and estimated the level of deliciousness of the beverage and inferred the emotions of happiness, sadness, and disgust conveyed by the actor. The results showed genuine and fake delicious expressions conveyed more deliciousness than genuine and fake unpalatable expressions. The participants interpreted that the drink was more unpalatable when observing fake expressions than when observing genuine unpalatable expressions. There was no difference in the evaluation of deliciousness between the genuine and fake delicious expressions. Furthermore, fake unpalatable expressions were rated as containing more disgust than genuine unpalatable expressions. These results suggest that individuals exaggerate disgust when making fake and unpalatable expressions.

Keywords: facial expression, deliciousness, unpalatable, beverage

Introduction

Eating with others is crucial for maintaining physical and mental health and facilitating social life (Douglas, 1972; Dunbar, 2017). During social meals, nonverbal cues such as facial expressions are frequently observed among individuals (Barthomeuf et al., 2009; Barthomeuf et al., 2012). Facial expressions convey significant amounts of social information and contribute to communication with others (Buck, 1994; Ekman, 1992; Fridlund, 2014). Facial expressions in eating situations have been widely used as indicators of potential consumer behavior (Danner et al., 2014a; Danner et al., 2014b; de Wijk et al., 2012; Wakihira et al., 2022).

It has been reported that individuals make various facial expressions depending on their taste or odor preferences for food and beverages (Danner et al., 2014a; Danner et al., 2014b; de Wijk et al., 2012). Danner et al. (2014b) showed that beverage taste preferences correlate significantly with happy and disgusted facial expressions. Although the sincerity of individuals' preferences for the taste of food and beverages has been validated, individuals may not always express honest sentiments in real-life social eating settings. For example, even when consuming foods or beverages that a person does not like, one might intentionally regulate facial expressions to avoid negative perceptions from others, such as being perceived as offensive. We conducted deliciousness and emotion evaluation tasks of others' facial expression videos to examine how individuals would express their delicious and unpalatable experiences associated with beverages through facial expressions.

Methods

Video preparation

Six Japanese undergraduate students with a mean age of 21.5 ± 0.7 volunteered to create experimental stimuli. They were instructed to display specific facial expressions after drinking a beverage for 5 s. There were four conditions: (1) making a "delicious" expression after drinking a preferred beverage (genuine delicious), (2) making an "unpalatable" expression after drinking an unpreferred beverage (genuine unpalatable), (3) making a "delicious" expression after drinking an unpreferred beverage (fake delicious), and (4) making an "unpalatable" expression after drinking a preferred beverage (fake unpalatable). Participants were asked to specify their most unpreferred and preferred beverages beforehand. However, to nullify the impact of visual cues on facial expressions (de Wijk et al., 2012), the participants were not informed whether the beverage they would drink was their preferred or unpreferred beverage. They were instructed to make facial expressions toward an imaginary person behind the camera and to maintain facial expressions while looking at the center of the camera lens following beverage consumption.

Participants

Thirty-three Japanese undergraduate students (24 women) with a mean age of 21.5 ± 3.8 participated. All the participants had normal or corrected-to-normal vision. A priori power analysis for two-way analysis of variance (ANOVA) (2 tastes [unpreferred vs. preferred] x 2 facial expressions [unpalatable vs. delicious]) on the deliciousness evaluation task (see Results section) was conducted to estimate the sample size using G* Power 3.1.9.7. software (Faul et al., 2007). Our sample size exceeded the number of samples (N = 24) estimated with statistical power α = 0.05,

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power = 0.80) and a medium effect size (F = 0.25). All participants provided informed consent before participation.

Procedure

Participants observed 24 silent facial expression videos (6 individuals x 4 conditions) on the screen for 5 s following the fixation point. Subsequently, the participants guessed the taste of the beverage consumed in the video using the visual analog scale (VAS) method of 0 (very unpalatable) to 100 (very delicious). FaceReader 8.0 (Noldus Inc., Wageningen, The Netherlands) was used to detect and measure six basic emotions (happiness, sadness, anger, surprise, fear, and disgust) on a scale of 0 to 1. Face Reader 8.0 analyses facial expressions in three steps (den Uyl & van Kuilenburg, 2005). First, faces are detected using the Viola-Jones algorithm (Viola & Jones, 2011), and then faces are modeled accurately using an algorithmic approach (den Uyl & van Kuilenburg, 2005). Finally, the classification of facial expressions is performed based on an artificial neural network trained on 10,000 images. FaceReader's accuracy in classifying facial expressions has been reported to be high, with 94 % accuracy for neutral, 82% for scared, and over 80 % accuracy in other studies (den Uyl & van Kuilenburg, 2005; Terzis et al., 2013; Skiendziel et al., 2019). Average emotional intensity was computed for each condition. As we found that happy, sad, and disgusted emotions appeared most frequently, we selected them as the target emotions for the emotion evaluation task. Participants rated the intensity of happiness, sadness, and disgust in facial expressions on a VAS of 0 (very weak) to 100 (very strong). The presentation order of the facial expression videos was randomized. The experiments were conducted online. The Ethics Review Board of Waseda University approved the study protocol.

Results

Facial expression analysis using FaceReader

Figure 1 displays the facial expression analysis outcomes obtained using FaceReader. One-way ANOVA conducted on the emotional intensity data for the various combinations of taste (unpreferred vs. preferred) and facial expression (unpalatable vs. delicious) conditions resulted in a significant main effect of emotion for all combinations. Specifically, genuine delicious, $F(5, 25) = 3.256$, $p = .021$, $\eta_p^2 = .394$; genuine unpalatable, $F(5, 25) = 11.907$, $p < .01$, $\eta_p^2 = .704$; fake delicious, $F(5, 25) = 4.440$ $p < .01$, $\eta_p^2 = .470$; and fake unpalatable, $F(5, 25) = 7.745$, $p < .01$, $\eta_p^2 = .608$. Notably, in the genuine unpalatable expression, the intensity of sadness and disgust was higher than that of happiness, anger, surprise, and fear (ps < .01). In the fake unpalatable expressions, the intensity of sadness and disgust was higher than that of happiness, surprise, and fear (ps < .05). In the fake nice expression, the intensity of happiness was higher than that of anger, surprise, and fear (ps < .05). For genuine delicious expression, the intensity of happiness was higher than that of surprise (ps < .05).

Deliciousness evaluation task

The results of the deliciousness evaluation task are shown in Figure 2a. The two-way repeated ANOVA for the deliciousness evaluation score for the combination of taste condition and facial expression condition revealed a significant interaction ($F(1, 32) = 5.60$, $p < .05$, $\eta_p^2 = .15$) (Figure 2a). A simple main effect test indicated that the deliciousness score was higher for genuine and fake delicious expressions than for genuine and fake unpalatable expressions (ps < .01). Furthermore, the fake unpalatable expressions were rated more unpalatable than the genuine unpalatable expressions ($p < .01$). There was no difference.

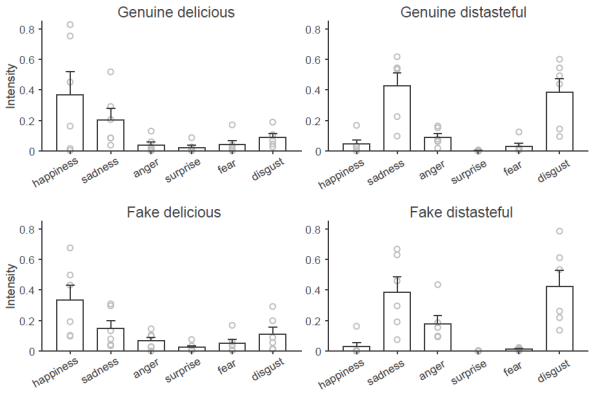

Figure 1. Results of the facial expression analysis using FaceReader. Gray circles show individuals' data. Error bars indicate the standard errors.

between the genuine delicious expression and fake delicious expression ($p = .883$).

Emotion evaluation task

The results of the emotion evaluation task for happiness, sadness, and disgust are shown in Figure 2a. The two-way repeated ANOVA on the scores for the intensity of happiness revealed a significant main effect for the facial expression condition on the intensity of happiness ($F(1, 32) = 332.95$, $p < .01$, $\eta_p^2 = .86$). Simple main effect test revealed that the intensity of happiness in the making a "delicious" facial expression condition (genuine delicious and fake delicious conditions) was higher than that in the making an "unpalatable" facial expression condition (genuine unpalatable and fake unpalatable conditions).

The two-way repeated ANOVAs for the intensity of sadness showed a significant main effect for the facial expression condition ($F(1, 32) = 108.67$, $p < .01$, $\eta_p^2 = .773$). The intensity of sadness in the making an "unpalatable" facial expression condition was higher than that in the making a "delicious" facial expression condition ($p < .01$).

The two-way repeated ANOVAs for the intensity of disgust revealed significant interactions between the taste condition and facial expression condition ($F(1, 32) = 9.07$, $p < .01$, η_p^2

= .22). As a result of the simple main effect test, the intensities of sadness and disgust in the making an "unpalatable" facial expression condition were higher than those in the making a "delicious" facial expression condition, regardless of the beverage taste condition ($ps < .01$). Furthermore, fake unpalatable expressions were rated as more disgusted than genuine unpalatable expressions ($p < .05$). There was no difference in the intensity of disgusted depending on the beverage taste in making a "delicious" facial expression condition.

Figure 2b shows the correlation plots of the scores for the deliciousness and emotion evaluation tasks for happy, sad, and disgusted emotions. The results revealed a significant positive correlation between the evaluation scores for deliciousness and happiness ($r = .95$, $p < .01$). Moreover, significant negative correlations were found between the evaluation scores for deliciousness and sadness/disgust (sadness: $r = -.52$, disgust: $r = -.74$, $ps < .01$).

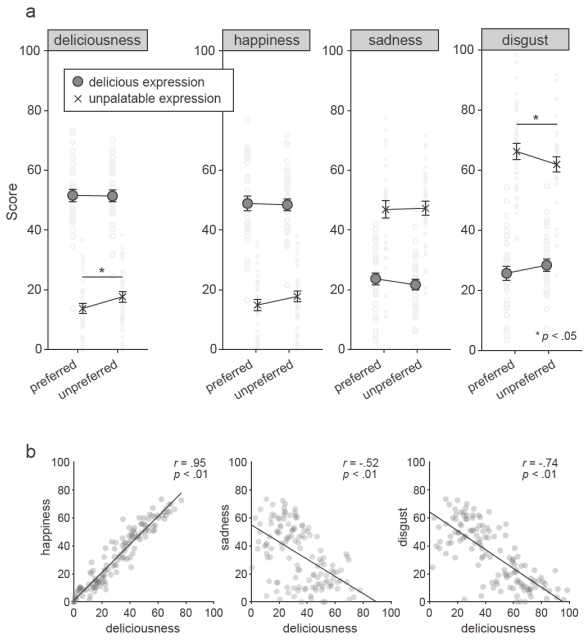

Figure 2. (a) Results of the deliciousness and emotion evaluation tasks and (b) The correlation plots of scores for the deliciousness and emotion evaluation tasks. Error bars indicate standard errors.

Discussion

To investigate how individuals intentionally express their taste experiences associated with beverages through facial expressions, we examined individuals who perceived genuine or fake delicious and unpalatable expressions. The results of facial expression analysis using FaceReader 8.0, which can estimate six basic emotions from videos of facial expressions (happiness, sadness, anger, surprise, fear, and disgust) from facial expressions revealed that happiness was observed most intensely when the participants expressed "delicious" facial expressions regardless of participants' beverage preferences (Danner et al., 2014b). Only happiness is associated with a positive emotion among the six basic emotions (Ekman & Friesen, 2003). Therefore, when the participants expressed "delicious," the positive emotion of "happiness" might be strongly observed. On the other hand, when the participants expressed "unpalatable" facial expressions, sadness and disgust expressions were observed more intensely than other emotions. This is consistent with the findings of a previous study that sadness and disgust were most strongly expressed when participants drank a non-preferred beverage in a situation in which they intentionally expressed their taste preferences (Danner et al., 2014b).

The deliciousness and emotion evaluation tasks showed that the participants could identify intentionally expressed "delicious" or "unpalatable" facial expressions regardless of exact taste preference. It was also shown that the participants scored higher on happiness when evaluating "delicious" facial expressions, and they scored higher on sadness and disgust when evaluating "unpalatable" facial expressions. Interestingly, it is suggested that the deliciousness and disgust evaluation scores differed according to the beverage taste in the videos in which the participants were instructed to make "unpalatable" facial expressions. Notably, when evaluating the videos of "unpalatable" facial expressions, deliciousness evaluation scores tended to rate the "preferred" taste as "unpalatable" more than the "unpreferred" taste. The disgust evaluation score was higher for the "preferred" taste than the "unpreferred" taste. Further, the correlation value between the deliciousness and disgust evaluation score was higher than that between the deliciousness and sadness evaluation score, suggesting that humans judged based on the disgusted facial expression when humans recognized the others' "unpalatable" facial expression.

When individuals make facial expressions that do not correspond to their genuine emotions, i.e., when they fake facial expressions, they may excel at faking them in some instances and may struggle in others. It has been shown that people can effectively produce fake positive facial expressions; however, it is relatively challenging to produce fake negative facial expressions (Dawel et al., 2017; Okubo, Kobayashi, & Ishikawa, 2012). Additionally, for negative facial expressions, it has been reported that stronger facial expressions were observed when a person intentionally makes facial expressions to mask emotions (Larochette, Chambers, & Craig, 2006). The findings suggest that when there is a difference between the genuine emotional response to taste preference and the facial expression, such as when the "unpalatable" facial expression is made despite a preference for the taste, the positive facial expressions might not significantly differ between fake and genuine facial expressions. Conversely, "unpalatable" facial expressions associated with negative facial expressions might be observed to be more intense in the fake expressions.

In summary, this study indicated that taste preferences for food and beverages can affect deliberately

expressed facial expressions associated with perceived deliciousness. It demonstrated that intentional fake facial expressions related to "unpalatable" expressions have the potential to mislead others. In specific circumstances, it may be necessary to deliberately adjust facial expressions even when personal food and beverage preferences differ. Barthomeuf et al. (2012) suggested that individuals' food choices can be influenced by the facial expressions of others, regardless of whether the food is preferred. Caregivers often encourage children to eat by displaying positive expressions even when the caregiver dislikes the particular food. Masking true emotions while eating may significantly impact both physical and mental health as well as social interaction. Therefore, investigating the role of facial expressions during eating, particularly in light of current social issues such as solitary eating, is becoming increasingly essential for understanding and addressing these concerns.

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