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# Perception and Expressing Habits of Smiling and Angry Expressions Modulated by Facial Physical Attractiveness in Asian Female Persons[1]

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**Abstract:** In this study, we investigated the effects of facial physical attractiveness on perception and expressing habit of smiling and angry expressions. In experiment 1, 20 participants rated 60 photo subjects' smiling and angry expressions of uncontrolled physical expression configuration. The results showed that for the angry faces, the perceived expression intensity and the expression naturalness in the attractive group were significantly stronger than those in the unattractive group; for the smiling faces, this attractiveness bias was not observed. In experiment 2, using artificial expressions made by an identical expression template, interestingly, the perceived expression intensity and the expression naturalness of the smiling faces in the attractive group were stronger than those in the unattractive group, while the impression strength of anger between the two groups was approximately the same. A comparison of the two observations suggests that facial physical attractiveness can enhance the perceived intensity of a smiling expression but not an angry expression, and that the inconsistencies between the two experiments are due to the difference of expressing habits between unattractive and attractive persons. These results have implications as regards the effect of facial attractiveness on the expressing habits of expression senders and the person's development of social skills.

**Key words:** expression perception, expressing habit, facial physical attractiveness, smiling expression, angry expression.

Facial physical attractiveness (abbreviated as *facial attractiveness* below) has important biological and social roles. An attractive individual benefits considerably from this physical trait in many aspects, such as social evaluation (Miller, 1970), mate selection (Thornhill & Furlow, 1998), and employment decisions (Watkins & Johnston, 2000). One key factor that affects an

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attractiveness assessment is facial expression. Previous studies have reported that positive and negative expressions asymmetrically influence the evaluations of facial attractiveness. Sad faces were found to be rated as less attractive than neutral or happy faces (Mueser, Grau, Sussman, & Rosen, 1984; Ueda, Kuraguchi, & Ashida, 2016), and angry faces were also reported to discount the attractiveness bias, to some extent (Jaensch et al., 2014). In contrast, smiling faces were rated as more attractive and having more positive personality traits than neutral faces (Berscheid & Walster, 1974; Magda & Goodwin, 2008; Mehu, Little, & Dunbar, 2008).

These studies show the effects of emotional expressions on facial attractiveness. However, little is known about the opposite, that is, how facial attractiveness affects the perception of emotional expression. To the best of our knowledge, only two studies have specially investigated this question. Golle, Mast, and Lobmaier (2014) instructed participants to choose the happier face between two simultaneously presented faces varying in attractiveness; they found that participants easily chose the attractive face as happier even though the two faces presented the same smiling expression, indicating that facial attractiveness enhances the evaluation of happiness. In the second study, Taylor and Bryant (2016) compared the reaction times to categorize different facial expressions (happy, neutral, and angry) between attractive and unattractive faces. They found that participants were significantly faster when judging the expressions of attractive faces compared to unattractive faces, and that there was no interaction between facial attractiveness and facial expression in terms of expression identification time. Although Taylor and Bryant's results suggest that facial attractiveness does not play an important role in judging expressions, it should be noted that their study focused on the effect of facial attractiveness on identification speed of the facial expressions. Thus, the effect of facial attractiveness on expression impression still requires further investigation.

More specifically, we reason that facial attractiveness affects emotional expressions in two ways. On one hand, the expression perception of the expression receiver may be affected by attractiveness bias. Although facial attractiveness was found to strengthen the impression of a smile, as described above (Golle et al., 2014), there are few studies directly examining the effect of facial attractiveness on the impression of negative expression, such as anger. It is not surprising that facial attractiveness can exert different effects on happy and angry expressions because they are explicit indicators of positive or negative emotions in humans as two opposites in expression categories (Buxton, 1954), and facial attractiveness may have asymmetrical effects on these expressions. In terms of the positive reinforcement effect (Agthe, Spörrle, & Maner, 2011; Michael, 2005), both attractiveness and a smiling expression can induce relatively positive or rewarding emotional cues, resulting in mutual enhancement in the perceived expression impressions. However, an angry expression is generally aversive to other persons, indicating negative or unrewarding potential, which is opposed to facial attractiveness. It is reasonable to expect that attractiveness would affect smile expression, but not influence or perhaps lessen the perception of an angry expression.

On the other hand, the expressing habit of expression from the sender may also be affected by facial attractiveness on the person's development of social skills. Previous studies have indicated that due to their advantage in social communication, attractive persons—especially attractive female persons—develop a different expressing ability of emotions compared to unattractive persons (Adams, 1977; Brideau & Allen, 1980; Larrance & Zuckerman, 1981; Poling, 1978; Sabatelli & Rubin, 1986). For instance, Larrance and Zuckerman (1981) examined the relationship between facial attractiveness and the sending skills of emotion. The posed and spontaneous facial expressions of unattractive and attractive participants were videotaped when participants watched emotion-arousing movies (e.g., an accident scene, unpleasant traffic fatalities). These videotapes were identified and rated by the original participants (the participant did not, however, rate his or her own

videotape) to indicate whether the target person accurately expressed the emotion cue contained in the movie. The results show that attractive persons have a stronger ability to express emotional cues, especially for happy emotions, than unattractive persons. A consistent finding was also reported in Sabatelli and Rubin (1986), who found that attractive persons have better nonverbal encoding accuracy but worse nonverbal decoding accuracy than unattractive persons. It should be noted that previous studies mainly focused on expressive ability modulated by facial attractiveness instead of expressing habit. It is still not clear whether the expressing habit of the expression sender is also affected by facial attractiveness in the development of social skills. The distinctive feature of expressing habit is the expression intensity that senders are accustomed to using to express emotions. If attractive and unattractive persons really differ in expressing habits, it can be expected that an attractive person will use a different expression intensity compared to an unattractive person when presenting emotional expressions.

In the present study, we intended to examine the effects of facial attractiveness on happy and angry expressions from the perspective of the perception bias of expression receivers, and expressing habits of expression senders. According to the above discussion, two hypotheses were tested in the current study. First, facial attractiveness would strengthen the expression impressions of smiling, but not angry, expressions. Second, attractive persons are accustomed to using different expression intensities to express emotion compared to unattractive persons. These issues are important for understanding the richness and complexity of the emotion-perception process; they also help to address the behavior patterns and perception bias of humans in the case of presenting or interpreting expressions in social communication.

As the effects of facial attractiveness on emotional expressions come from the perception bias of the expression receiver and the expressing habit of the expression sender, we conducted two experiments to dissociate these two factors. In experiment 1, the facial attractiveness, expression intensity (Frijda & Philipszoon, 1963; Schlosberg, 1952), and expression naturalness (Frijda & Philipszoon, 1963) were rated for the expression images of 60 female photo subjects. These photo subjects were divided into attractive and unattractive groups based on their facial attractiveness. We compared the expression intensity and expression naturalness between these two groups to evaluate whether expression impression is related to facial attractiveness. Importantly, we did not explicitly control the physical expression configuration of the expression images in this experiment. Because the physical expression configuration is determined by the expressing habits of the photo subjects, the results of experiment 1 reflect both the effects of the perception bias of the expression receiver, and also the expressing habit of the expression sender. In experiment 2, using a computer-morphing technique, we generated artificial expressions with the same expression template for the photo subjects in experiment 1. In this case, the physical expression configuration of the photo subjects was the same between the attractive and unattractive groups; the difference in expression impression between the two groups could only be attributed to the attractiveness bias from the expression receiver. Finally, we evaluated the effect from the expressing habits of the expression sender by comparing the results of experiments 1 and 2.

## Experiment 1

### Participants

A total of 20 participants (age = 25.0 ± 3.8 years, two females) from Kochi University of Technology in Japan consented to participate in experiment 1. All participants reported normal or corrected-to-normal vision, and were naive to the purpose of the experiments. All 20 participants attended the magnitude estimation sessions and 15 participants attended the paired-comparison sessions (see Methods). The protocol of experiments 1 and 2 was approved by the Kochi University of Technology Research Ethics Committee.

### Apparatus

Face images were presented on a 19-in. LCD display, with spatial resolution 1,024 × 768 pixels and refresh rate of 85 Hz; the display was controlled by a Dell Xeon computer. All experiments

were run by the Matlab platform with the Cogent 2000 Psychophysics Toolbox extensions (http://www.vislab.ucl.ac.uk/cogent.php).

### Stimuli

The 60 photo subjects were randomly selected from the CAS PEAL Large-Scale Face Database, which contains 99,594 images of 1,040 Chinese individuals (595 males and 445 females) with varying poses (nine directions), expressions (five expressions: smiling, angry, disgust, surprise, and fear), accessories (three glasses and three caps), and lighting (15 lighting conditions; Gao, Cao, Shan, & Chen, 2008). All selected photo subjects were females, and each had smiling, blank, and angry expressions, resulting in a total of 180 expression images used. The expression image subtended a visual angle of 12° wide and 15° high.

### Procedure

There were two sessions in experiment 1, with each participant being individually tested. A Likert-style 9-point task was used in the first session to rate facial attractiveness, expression naturalness, and expression intensity. This session consisted of two blocks, with one block for attractiveness rating and the other for expression rating. In the attractiveness rating block, the participants were seated approximately 50 cm from the screen, and were instructed to rate the facial attractiveness on a scale of 1 (*low strength*) to 9 (*high strength*). A pilot result showed that the participants tended to use a very limited range when rating, which would diminish the rating capacity of the magnitude estimation. We thus instructed the participants to divide the score range into three sub-categories, that is, 1–3 (*low strength*), 4–6 (*normal strength*), and 7–9 (*high strength*). The participants were asked to first choose the subcategory and then to determine the rating score according to the attractiveness. In each trial, the face stimulus was continuously presented on the screen to enable participants to carefully observe the face, and it remained there until the participants pressed a number key using a keyboard to respond. Feedback for pressing each key was given after each trial to confirm the participant's response.

In the expression-rating block, the procedure was similar with the attractiveness-rating block. After the participants finished viewing the presented face, they were first instructed to judge the expression type and then rate the expression intensity and expression naturalness, using a keyboard. The participants selected the expression type from six options (smiling, angry, sad, scared, disgusted and blank expressions), in which the sad, disgusted, and scared expression options were distractors. The use of distractors is to prevent the subjects from judging the expression type using only a two-alternative forced-choice strategy between smiling and angry expressions, without carefully inspecting them. A total of 180 facial images (60 photo subjects × 3 expressions) were subsequently presented on the center of the screen. The order of images was randomized across subjects, alternatively changing from a smiling expression, to a blank expression, to an angry expression, then to a blank expression, and again to a smiling expression. We used the blank expression between the smiling and angry expressions to minimize the effect of expression adaptation (Webster, Kaping, Mizokami, & Duhamel, 2004), in which exposure to a certain expression (e.g., viewing a smiling expression) will significantly bias the perception of the opposite direction (e.g., tending to perceive the subsequent expression as an angry expression). The participants selected the expression type from six options (smiling, angry, sad, scared, disgusted, and blank expressions). A blank face between a smiling expression and an angry expression largely reduced this adaptation effect. The participants learned the task through written instructions, oral explanations, and a short practice session of eight trials before the experiment.

In the second session, we used Thurstone's (1927) method of paired-comparison to further verify the result of attractiveness rating by the magnitude estimation method. Blank expression images of 12 faces were randomly selected from the original set of 60 faces, in which each face was paired with each of the other 11 faces, resulting in a total of 66 combinations for comparison ($12 \times 11/2 = 66$). In

this session, the participants were simultaneously shown two faces of each combination and were asked to judge which was more attractive. The selected face received one point per participant, and 165 points (15 participants × 11 combinations) was the maximum possible score.

### Data Analysis

An attractiveness score, as an independent rating value, was directly used in the data analysis. The responses for expression intensity and expression naturalness were associated with judgment, and the rating values were translated in the following way: (a) The rating values were directly used if the participant correctly judged the expression; and (b) the rating values of expression intensity and expression naturalness were assigned to 0 regardless of original rating values, if a smiling or angry expression was judged as a "blank expression." Finally, the responses of misjudged expressions were excluded from further analysis.

To prevent the distorted results caused by the responses of the participants who rated very high or low scores, we normalized the original data. Each rating score was divided by the average of the corresponding dimension in all photo subjects, including all smiling, blank, and angry expressions for one participant. The mean and standard error of the mean of the facial attractiveness, expression intensity, and expression naturalness for each photo subject were calculated by averaging the normalized rating scores among all 20 participants.

All statistical analyses were performed on SPSS 21.0 software, and significance level was set at $p < .05$. We used a two-way mixed-design analysis of variance (ANOVA), with the expression intensity and expression naturalness of each photo subject as dependent variables, EXPRESSION TYPE (2 levels, smile vs. anger) as a within-subject factor, and ATTRACTIVENESS (two levels, unattractive group vs. attractive group) as a between-subjects factor. Significant interactions were followed up with a simple effect analysis with the least-significant difference adjustment. The effect sizes were indicated by $\eta_p^2$ for main effect in the ANOVA, and by Cohen's $d$ for mean comparison in the simple effect analysis.

### Results

The attractiveness rating was obtained by the Likert estimation method and Thurstone's (1927) method of paired comparisons. A Pearson correlation analysis showed that the results of these two methods are highly related ($r = 0.92$, $p < .001$), validating the reliability of the attractiveness rating. We subdivided 60 photo subjects into an attractive group and an unattractive group in terms of the attractiveness rating, with each group including 30 photo subjects. The distinction of attractiveness strength between these two groups was significant, $F(1, 58) = 120.31$, $p < .001$, $\eta_p^2 = .675$ The results from 20 participants rating the expression intensity and expression naturalness of 60 photo subjects are shown in Figure 1, and the descriptive statistics between the unattractive and attractive groups are shown in Table 1.

We observed significant interaction effects of EXPRESSION TYPE × ATTRACTIVENESS on expression intensity, $F(1, 58) = 4.57$, $p < .04$, $\eta_p^2 = .07$, and expression naturalness, $F(1, 58) = 5.71$, $p < .02$, $\eta_p^2 = .09$ (Figure 1c); however, the main effects of ATTRACTIVENESS on expression intensity and expression naturalness were not significant, both $p > .05$. Simple effect analyses were performed to further explore the source of the interaction. For the angry expression, the attractive group had significantly stronger expression intensity, $F(1, 58) = 11.07$, $p < .002$, $d = 0.84$, and expression naturalness, $F(1, 58) = 6.42$, $p < .01$, $d = 0.66$, than the unattractive group, whereas, for the smiling expression, there were no significant differences between the attractiveness groups for expression intensity and expression naturalness, both $p > .05$. In addition, we observed significant main effects of EXPRESSION TYPE on the expression intensity, $F(1, 58) = 26.57$, $p < .001$, $\eta_p^2 = .31$, and expression naturalness, $F(1, 58) = 16.37$, $p < .001$, $\eta_p^2 = .22$, with the rating values of the

smiling expression being higher than those of the angry expression.

Many faces are clustered around the middle attractiveness level, as shown in Figure 1, which are not typical attractive or unattractive faces. One may question whether the above observations are simply because of the data pollution of these normal faces rather than the

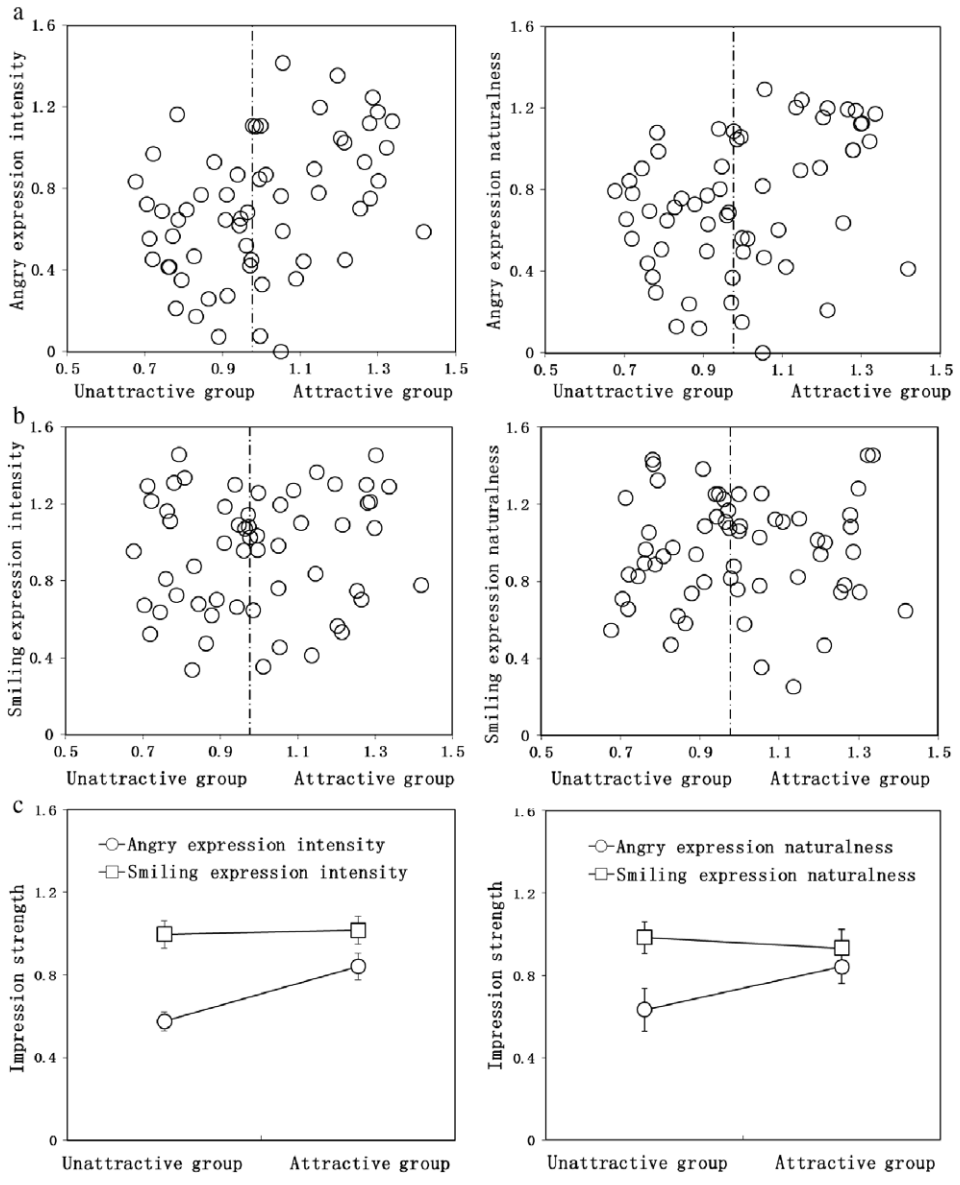


**Figure 1** Results of experiment 1. The normalized expression intensity (left panels) and the expression naturalness (right panels) of the (a) angry expressions and (b) smiling expressions as the function of attractiveness, with the vertical dotted line indicating the group distinction according to attractiveness strength. Solid lines denote the least-square linear regression. (c) The mean of the expression intensity (left panel) and the expression naturalness (right panel) for the unattractive group and the attractive group in smiling and angry faces, with the error bars denoting ±1*SEM*.

**Table 1** Mean (and *SD*s), effect sizes, and confidence intervals (CIs) of expression intensity and expression naturalness for smiling and angry expressions in experiment 1

| | | Unattractive group (mean ± *SD*) | Attractive group (mean ± *SD*) | 95% CI for group difference | Effect size (Cohen's *d*) | 95% CI for effect size |
|---|---|---|---|---|---|---|
| Smile | Intensity | 0.99 ± 0.35 | 1.01 ± 0.37 | [−0.17, 0.21] | 0.06 | [−0.45, 0.56] |
| | Naturalness | 0.98 ± 0.27 | 0.93 ± 0.29 | [−0.19, 0.09] | −0.18 | [−0.68, 0.33] |
| Anger | Intensity | 0.58 ± 0.25 | 0.84 ± 0.36 | [−0.31, 0.19] | 0.84 | [0.30, 1.36] |
| | Naturalness | 0.63 ± 0.26 | 0.84 ± 0.37 | [−0.27, 0.23] | 0.66 | [0.17, 0.68] |

effects of attractiveness. We further analyzed the data of the top 15 attractive and top 15 unattractive faces using the same analysis method. The results were similar to those obtained for the 30-faces groups. The results also revealed significant interaction effects of EXPRESSION TYPE × ATTRACTIVENESS on expression intensity, $F(1, 58) = 7.72$, $p < .01$, $\eta_p^2 = .22$, and expression naturalness, $F(1, 58) = 4.97$, $p < .03$, $\eta_p^2 = .15$. The attractive persons were perceived to have stronger expression intensity, $F(1, 28) = 15.14$, $p < .001$, $d = 1.08$, and stronger expression naturalness, $F(1, 28) = 8.43$, $p < .007$, $d = 1.41$, than the unattractive persons. In contrast, there were no significant differences in the expression intensity and expression naturalness between the attractive and unattractive groups for smiling expression, both $p > .05$.

### Discussion

There are two observations worth noting in experiment 1. On one hand, the results show that facial attractiveness influences smiling and angry expressions in different ways. There is a positive correlation between facial attractiveness and angry expression impression; however, there was no apparent effect from facial attractiveness on smiling expressions. On the other hand, the rating values of smiling expressions were significantly higher than those for angry expressions. This observation may reflect the different expressive abilities of humans showing a smiling or an angry expression. Because a smile is the most commonly used expression in social interactions, humans can present smiling expressions more naturally and convincingly than angry expressions, resulting in the relatively high rating values for smiling expressions.

## Experiment 2

The results of experiment 1 indicate that facial attractiveness affects the expression impressions for angry expressions, but not for smiling expressions. The reason for this observation is still unclear. As described previously, expression impressions are affected by facial attractiveness not only via the perception bias of the expression receiver, but also via the expressing habit of the expression sender. To exclude the influence of the expressing habits of different photo subjects, we used artificial expression images with the same expression configuration in experiment 2. Because the expression prototype would be the same for different subjects, if there were still a difference in expression impressions between the unattractive and attractive groups, it could only be attributed to the attractiveness bias of the expression receiver.

### Participants

A total of 20 participants (age = 24.8 ± 5.9 years, three females) from Kochi University of Technology in Japan and Shanghai Maritime University in China participated in experiment 2. None of them had participated in experiment 1. All participants reported normal or corrected-to-normal vision and were naive to the purpose of the experiments.

### Stimuli

To ensure sufficient distinction of attractiveness strength, the top 15 attractive faces and the top 15 unattractive faces from the original photo set in experiment 1 were selected for the stimuli creation in experiment 2. For each face, we generated the smiling and angry expressions with an identical expression template using FaceFilter

Studio 2.0, resulting in a total of 60 artificial expression images (for an example, see Figure 2).

Because FaceFilter Studio may generate the artificial expression based on a Caucasian face prototype, we tested whether FaceFilter Studio works well with Asian female faces by comparing the recognition accuracies of artificial expressions with those of the original natural expressions. Ten participants were instructed to perform an expression-recognition task on the artificial and original expression images of the top 15 attractive and 15 unattractive faces. The recognition accuracy of the artificial smiling expression (90.6%) and angry expression (81.2%) was pretty high, compared to the natural smiling expression (93.3%) and angry expression (79.3%), indicating that the artificial expressions made by FaceFilter Studio could work.

Additionally, previous studies have suggested that attractive faces are closer to an average face than unattractive faces (Komori, Kawamura, & Ishihara, 2009; Langlois & Roggman, 1990). If the FaceFilter Studio software could only work well on faces close to the average face, the physical expression strength would not be the same between the two groups. In order to exclude this possibility, 20 participants who did not attend either experiment were instructed to rate the "artificialness" of the morphed expressions used in the experiments. The Independent-sample $t$ test suggests that the artificialness of the unattractive group did not significantly differ from that of the attractive group in either the morphed smile expression, $M_{\text{attractive}} = 0.95 \pm 0.11$ $SD$; $M_{\text{unattractive}} = 0.99 \pm 0.13$ $SD$, $t$ (28) = 0.95, $p = .35$, or the morphed angry expression, $M_{\text{attractive}} = 1.04 \pm 0.11$ $SD$; $M_{\text{unattractive}} = 1.01 \pm 0.12$ $SD$, $t$ (28) = 0.80, $p = .43$. We computed the Bayes factor (Dienes, 2011; Gallistel, 2009) to compare the alternative hypothesis that the artificialness of morphed expressions significantly differs between unattractive and attractive groups, to the null hypothesis that the artificialness is approximately the same for the two groups. The Bayes factor was 0.43 for morphed angry expressions and 0.48 for morphed smiling expressions in favor of the null hypothesis that morphing software could generate approximately the same effects for the two groups.

## Method

The same methods of experiment 1 were used for experiment 2, except that the attractiveness rating sessions were not performed.

## Results

The results from the 10 participants who rated the expression intensity and expression naturalness of the artificial expressions of 30 photo subjects are shown in Figure 3, and the descriptive statistics between the unattractive and attractive groups are shown in Table 2.

The ANOVA results revealed significant interaction effects of EXPRESSION TYPE × ATTRACTIVENESS on expression intensity, $F(1, 28) = 5.60$, $p < .03$, $\eta_p^2 = .17$, and expression naturalness, $F(1, 28) = 5.86$, $p < .02$, $\eta_p^2 = .17$ (Figure 3c). The results of experiment 2 were, however, inconsistent with experiment


**Figure 2** Illustration of the method used to construct the artificial expression. (a) The original blank expression face with white points and curves indicating morphing marks and morphing facial contours, respectively. (b) The expression prototypes of smiling and angry expressions. (c) The artificial expressions constructed by applying (b) to (a).

1. For the angry expression, we did not observe significant effects from attractiveness on the expression impressions, with the expression naturalness and the expression intensity approximately the same in the two groups, both $p > .05$. While, for the smiling expression, the attractive group was perceived to have stronger expression intensity,

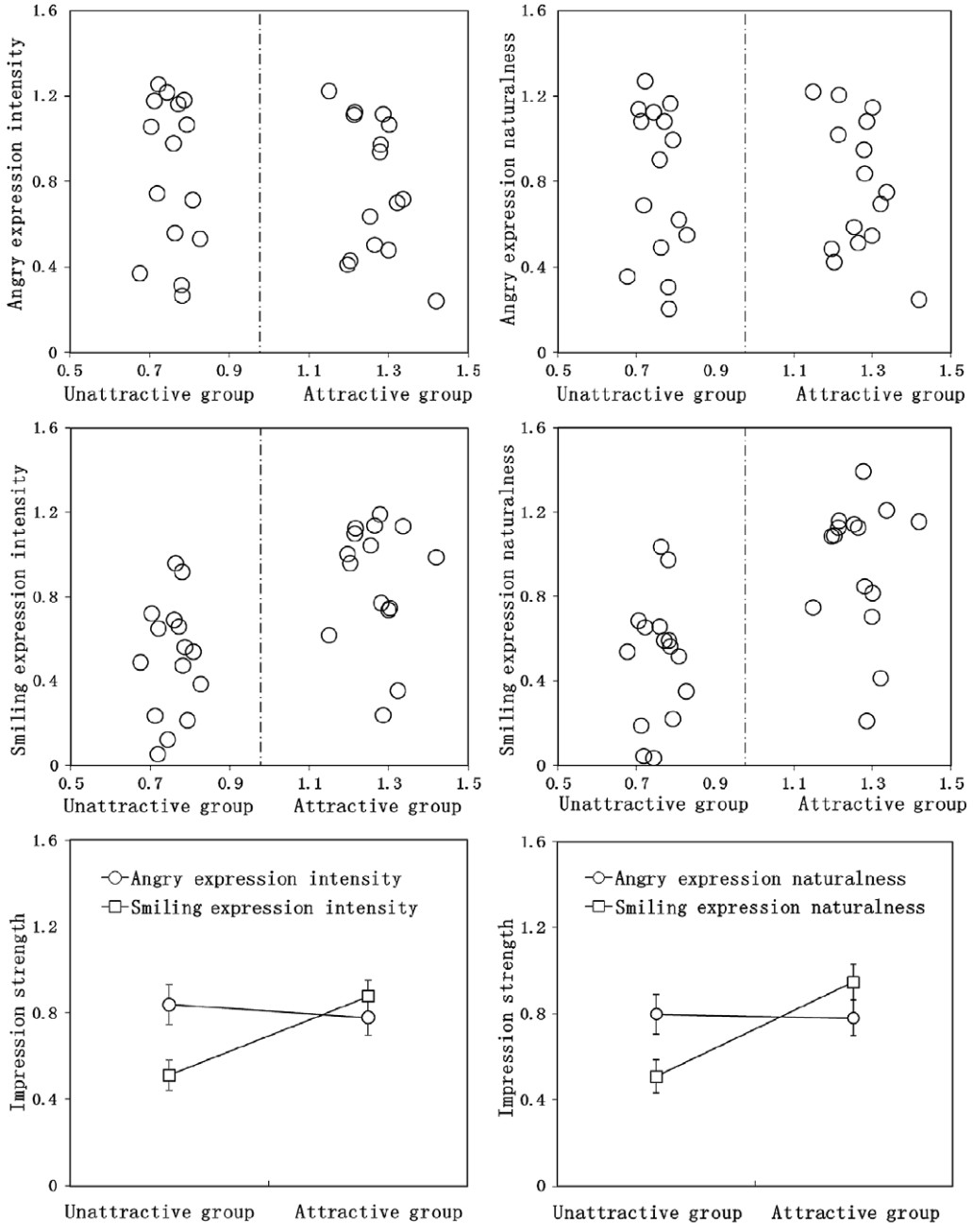


**Figure 3** Results of experiment 2. All other details are the same as in Figure 1.

**Table 2** Mean (and *SD*s), effect sizes, and confidence intervals (CIs) of expression intensity and expression naturalness for smiling and angry expressions in experiment 2

| | | Unattractive group (mean ± *SD*) | Attractive group (mean ± *SD*) | 95% CI for group difference | Effect size (Cohen's *d*) | 95% CI for effect size |
|---|---|---|---|---|---|---|
| Smile | Intensity | 0.51 ± 0.27 | 0.88 ± 0.29 | [0.16, 0.58] | 1.32 | [0.58, 2.18] |
| | Naturalness | 0.51 ± 0.30 | 0.95 ± 0.32 | [0.21, 0.67] | 1.42 | [0.50, 2.07] |
| Anger | Intensity | 0.84 ± 0.36 | 0.78 ± 0.32 | [−0.31, 0.19] | 0.18 | [−0.88, 0.53] |
| | Naturalness | 0.80 ± 0.36 | 0.78 ± 0.31 | [−0.27, 0.23] | 0.06 | [−0.77, 0.66] |

$F(1, 28) = 12.56$, $p < .01$, $d = 1.28$, and stronger expression naturalness, $F(1, 28) = 15.05$, $p < .01$, $d = 1.38$, than the unattractive group (See Figure 3a,c). In addition, the main effects of expression type on the expression intensity and expression naturalness were not significant, both $p > .05$, with the rating values of smiling expressions approximately the same as those of the angry expressions.

The results of experiment 2 were opposite to those of experiment 1. We performed a paired comparison of the initial rating values for each participant of the attractive and unattractive groups between experiment 1 and experiment 2, respectively (Figure 4). For the smiling expressions in the unattractive group, we observed a significant increase in the expression intensity from the artificial expressions in experiment 2 to the natural expressions in experiment 1, $t(14) = 2.78$, $p < .01$, $d = 3.28$. For the angry expressions in the unattractive group, we observed a significant decrease in the expression intensity from the artificial expressions in experiment 2 to the natural expressions in experiment 1, $t(14) = 3.71$, $p < .002$, $d = 5.27$. On the contrary, there was no significant difference between experiments 1 and 2 for the smiling or angry expressions in the attractive group.

## Discussion

The results of experiment 2 indicate that facial attractiveness affected the smiling expression, and that angry expression impressions were, however, not correlated to facial attractiveness. Moreover, using a paired comparison of the initial rating values, we found that an increase in smile intensity and a decrease in anger intensity between experiment 1 and experiment 2 only occurred in the unattractive group, not in the attractive group. Because the physical intensity in the attractive and unattractive groups was the same in experiment 2, the current observation indicates that, for natural expression in experiment 1, the attractive group had a higher physical intensity when smiling, but a lower physical intensity when angry than the unattractive group.

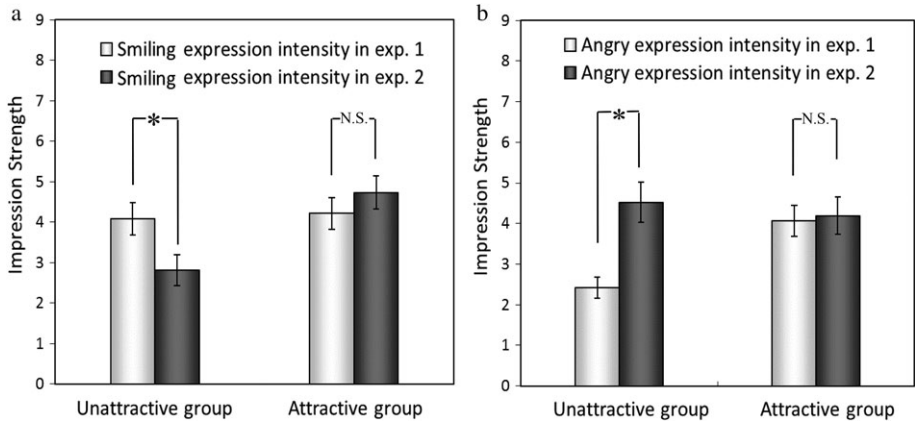


**Figure 4** The comparison of expression intensity for (a) smiling and (b) angry expressions between experiments 1 and 2. Error bars indicate ±1*SEM*.

## General Discussion

The results of the two experiments reported here appear to be contradictory. Experiment 1, using natural expressions, demonstrated that facial attractiveness affects impressions of the angry expression but not the smiling expression. However, for experiment 2, using artificial expressions, facial attractiveness influenced impressions of the smiling expression but not the angry expression. What is responsible for the discrepancy between these two experiments?

The results of experiment 2 corroborated our hypothesis that facial attractiveness would strengthen the expression impressions of smiling, but not angry, faces. This observation is consistent with Golle et al.'s (2014) study, which found that facial attractiveness enhances the evaluation of happiness. The data presented in the study also support reward theory (Schultz, 2015; Tsukiura & Cabeza, 2011) and the positive reinforcement effect (Agthe et al., 2011; Michael, 2005). From a reward perspective, both a happy expression and an attractive face are stimuli that have positive reward potentials (Aharon et al., 2001; O'Doherty et al., 2003), while an angry expression, as an unrewarding stimulus, would not be affected by facial attractiveness. In support of this hypothesis, previous studies have shown that the brain region that engages in rewards, such as food and monetary gain, can be activated by facial attractiveness (Aharon et al., 2001; Chatterjee, Thomas, Smith, & Aguirre, 2009) or a smiling face (O'Doherty et al., 2003), but not by an angry face (Strauss et al., 2005). Our results appear to contradict Taylor and Bryant's (2016) study, which found that there was no interaction between facial attractiveness and expression in terms of the reaction time to categorize happy or angry expressions. The disagreement may be due to the fact that the reaction time used in Taylor and Bryant's study is a performance-based measurement, while the expression and attractiveness ratings in our experiment are appearance-based measurements. It is likely that facial attractiveness, as the most distinguished feature in facial appearance, would affect other appearance-based measurements, such as the expression rating, but not performance-based measurements, such as the reaction time.

The results of experiment 1 are the opposite of those for experiment 2. The perceived intensity and naturalness of an angry face in the attractive group were stronger than those in the unattractive group, while there was no obvious difference for the smiling expression between the two groups. We suggest that the inconsistency between experiments 1 and 2 reflects a difference of expressing habit between attractive and unattractive persons. Although the perceived expression intensity is related to physical attractiveness to some extent, it is primarily determined by the physical expression intensity (Hess, Blairy, & Kleck, 1997), which depends on the expressing habit of the photo subjects. If physical expression intensities are different between attractive and unattractive groups, they can dominate attractiveness bias and lead to conflicting results. This hypothesis is supported by a paired comparison of the initial rating values shown above; an increase in smile intensity or decrease in anger intensity only occurs in the unattractive group, which shows that unattractive persons tend to present a smile with higher physical intensity but present anger with a lower physical intensity than attractive persons. Larrance and Zuckerman (1981) and Sabatelli and Rubin (1986) reported that attractive persons have stronger sending skills of emotion compared to unattractive persons, indicating that the development of social skills would be affected by facial attractiveness. The current observation was consistent with their results, and further suggests that, not only sending skills, but expressing habits are also affected by facial attractiveness.

Why do attractive and unattractive persons tend to use different expression intensities in social communication? This could possibly be associated with how facial physical attractiveness shapes the development of expressing habits in females. We propose a compensation hypothesis, as follows: during the development of social expertise, females realize that physical attractiveness plays an important role in social interaction, and that a positive expression, such

as a smile, will enhance perceived attractiveness but a negative expression, such as anger, will dampen perceived attractiveness. Subsequently, unattractive females tend to present their smiling expressions more strongly but angry expressions less intensely in communication than attractive persons, to compensate for the attractiveness bias, which is more like a benefiting selection in the sociality context.

In terms of our results, there are various lines for future inquiry. One is to understand the effect of physical attractiveness on other expressions, such as sadness, fear, disgust, and surprise. This examination will help to clarify whether the effects of facial attractiveness on emotional expressions are based on valence of expressions or not. For instance, fear is a negative valence emotion, but surprise can be a positive valence emotion. If the effect of attractiveness depends on the valence of emotion, we may expect that facial attractiveness strengthens impression of surprise, but not fear, expressions. Another inquiry is to examine whether the current results obtained for female photo subjects can be generalized to male targets. Although facial attractiveness is important for both males and females, the female attractive individual is more affected by this physical trait than male individuals in the development of social expertise (Brideau & Allen, 1980; Poling, 1978) or attractiveness perception to others (Graziano, Jensencampbell, Shebilske, & Lundgren, 1993). The final inquiry is associated with the compensation hypothesis we proposed. The current study shows that unattractive females may adopt a compensation strategy compared to attractive persons; it is still important for future research to take the factors of age, sex, ethnicity, and education level into account, providing more extensive and intensive evidence with which to consolidate this hypothesis.

### Conclusion

In conclusion, the present study provided behavioral evidence for differences in the perception and expressing habit of Asian female persons regarding their smiling and angry expressions. More specifically, the results show that, for the expression receiver, facial attractiveness will affect the perception of smiling expression but this is not true of angry expressions. It also seems that, for the expression sender, unattractive female persons tend to present a smile expression more strongly but an angry expression less intensely than attractive persons. These findings have implications for understanding the interactions between attractiveness and expression perception, as well as for the development of social expertise shaped by facial attractiveness.

## Conflict of Interest

The authors have no conflicts of interest directly relevant to the content of this article.

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