You Look Pretty Happy: Attractiveness Moderates Emotion Perception

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You look pretty happy: Attractiveness moderates emotion perception

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Abstract

A happy face advantage has consistently been shown in emotion categorization tasks; happy faces are categorized as happy faster than angry faces as angry. Furthermore, social category cues, such as facial sex and race, moderate the happy face advantage in evaluatively congruent ways with a larger happy face advantage for more positively evaluated faces. We investigated whether attractiveness, a facial attribute unrelated to more defined social categories, would moderate the happy face advantage consistent with the evaluative congruence account. A larger happy face advantage for the more positively evaluated attractive faces than for unattractive faces was predicted. Across 4 experiments participants categorized attractive and unattractive faces as happy or angry as quickly and accurately as possible. As predicted, when female faces were categorized separately, a happy face advantage emerged for the attractive females but not for the unattractive females. Corresponding results were only found in the error rates for male faces. This pattern was confirmed when female and male faces were categorized together, indicating that attractiveness may have a stronger influence on emotion perception for female faces. Attractiveness is shown to moderate emotion perception in line with the evaluative congruence account and is suggested to have a stronger influence on emotion perception than facial sex cues in contexts where attractiveness is a salient evaluative dimension.

Keywords: attractiveness, emotion categorization, happy face advantage, emotional expressions, evaluative congruence account

Faces are an important source of information. How we perceive the wealth of social information available on a face influences how we relate to and interact with others. For instance, cues signalling sex, race, or emotion communicate information that has the potential to inhibit or facilitate social interaction. Influential theoretical models of face perception (Bruce & Young, 1986; Haxby, Hoffman, & Gobbini, 2000), offer a framework for studying how different facial attributes interact in face perception. Although relatively invariant cues (e.g., identity, sex, and race) and changeable facial attributes (e.g., emotional expressions) have been suggested to be processed by separate neural networks (Haxby et al., 2000), it has repeatedly been demonstrated that there is a bidirectional relationship between them in behavioral studies. For instance, race cues influence emotion perception (Hugenberg & Bodenhausen, 2003) and emotional expressions influence race perception (Hugenberg & Bodenhausen, 2004).

Within the emotion perception literature, there is a well-established phenomenon called "the happy face advantage," which refers to the faster categorization of happy faces as happy than, for instance, angry faces as angry, and the effect extends to other negative and neutral expressions as well (e.g., Leppänen & Hietanen, 2003, 2004). Invariant facial cues, such as sex and race, have been shown to moderate the happy face advantage. The happy face advantage has been shown to be larger for female faces when categorized together with male faces (Bijlstra, Holland, & Wigboldus, 2010; Craig, Koch, & Lipp, 2017; Craig & Lipp, 2017; Craig, Zhang, & Lipp, 2017; Hugenberg & Sczesny, 2006; Lipp, Craig, & Dat, 2015; Lipp, Karnadewi, Craig, & Cronin, 2015), and is sometimes reversed for the male faces, with angry expressions being recognized faster (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007). Conversely, the happy face advantage is evident for male own-race faces when categorized together with male other-race faces (Bijlstra et al., 2010; Craig, Koch, & Lipp, 2017; Craig, Mallan, & Lipp, 2012; Lipp, Craig, & Dat, 2015), and sometimes a reversed

pattern has been observed on the male other-race faces, where the negative expression has been categorized faster than happy expressions (Craig et al., 2012; Hugenberg, 2005).

A study by Lipp, Craig, and Dat (2015; also see Craig, Koch, & Lipp, 2017) demonstrated that the effects of face sex and race on the happy face advantage are unlikely to be attributed to stimulus driven factors or to the facial features that distinguish happy faces from other expressions (see Adolphs, 2002; also Leppänen & Hietanen, 2004) since the size and presence of a happy face advantage for the same set of Caucasian male faces varied as a function of the other faces they were presented with. It is observed when the Caucasian male faces are presented with other-race (African American) male faces, but absent when they were presented with both own- and other-race female faces. Similar results have been reported by Bijlstra et al. (2010). Hugenberg (2005) and Hugenberg and Sczesny (2006) compared stereotype and evaluation accounts to explain the effects of social category cues on the happy face advantage and found evidence for a role of evaluations. Participants categorized happy versus angry faces as well as happy versus sad faces. Although sadness is more strongly associated with females (Plant, Kling, & Smith, 2004) and anger with males and African American males (Devine, 1989; also see Bijlstra et al., 2010), they found that sex and race had the same influence on emotion categorization speed regardless of the negative expression used. This did not support the stereotype congruency explanation, which would predict different patterns of results depending on the degree of consistency between the emotional expression and stereotype expectancies regarding the group. Hugenberg (2005) and Hugenberg and Sczesny's (2006) results, as well as the reviewed literature, did however support the evaluative congruency account. The evaluative congruency account holds that effects of face sex and race on the happy face advantage reflect whether the social category the face represents is evaluated positively or negatively. Females (Eagly, Mladinic, & Otto, 1991) and own-race members (Degner & Wentura, 2010) are evaluated more favourably than

males and other-race members, respectively, and the evaluative congruency between face and expression is suggested to facilitate categorization. The social category cues are proposed to provide an evaluative context in which the emotional expression is perceived. As has been highlighted by others (Bijlstra et al., 2010; Craig & Lipp, 2017; Lipp, Craig, & Dat, 2015), the wider context, including the faces presented on other trials and in previous tasks, determines which evaluative dimension becomes salient and how social category cues influence emotion categorization.

The influence of sex cues on emotion perception varies across different circumstances and depends on the evaluative information made salient within a particular context (Craig & Lipp, 2017). Attractiveness is another evaluative dimension that has considerable importance in everyday life (Maestripieri, Henry, & Nickels, 2017) and might account for some variance in the way sex influences emotion categorization. Attractiveness is a dimension that intersects social categories and is a basic social inference we make when encountering a face (Sutherland et al., 2013). Consensus on who is attractive is high, both within and across cultures (Langlois et al., 2000). However, attractiveness varies substantially across different photographs of the same individual, and who is perceived to be attractive has as much to do with which photograph is chosen than the individual depicted in it (Jenkins, White, Van Montfort, & Burton, 2011). The emotional expression portrayed on the face largely contributes to the variance in attractiveness judgements for the same individual (Sutherland, Young, & Rhodes, 2017), and happy faces are perceived as more attractive than faces displaying negative expressions (e.g., Mueser, Grau, Sussman, & Rosen, 1984). Consequently, facial attractiveness does not fit nicely within the theoretical models, as it cannot be categorized as an invariant or changeable attribute of a face. It is clear though, that attractiveness is not as stable across situations as might be expected and differs significantly from relatively invariant attributes, such as race and sex, which previous research has focused

on. Emotional expressions influence attractiveness judgements, but whether the relationship is reciprocal, and facial attractiveness moderates emotion perception as well, or more specifically the happy face advantage, is uncertain. It is also unclear whether the potential moderating effect of attractiveness on emotion processing will be consistent with the evaluative congruence account, as seen with social category cues. Attractive people are evaluated more favorably than less attractive people (Dion, Berscheid, & Walster, 1972; Langlois et al., 2000), and therefore attractiveness could be expected to moderate emotion categorization in line with the evaluative congruence account. If attractiveness moderates emotion categorization in the same way as social category cues, then the happy face advantage should emerge for the attractive faces, but should be reduced or absent for the unattractive faces.

Previous research examining the influence of facial attractiveness on emotion perception is limited. Golle, Mast, and Lobmaier (2014) demonstrated that attractiveness facilitated correct judgements of the relatively happier face when compared to a less happy or neutral face. Furthermore, Taylor and Bryant (2016) attempted to investigate if attractiveness has an effect on emotion categorization. They reported that emotional expressions were categorized faster than neutral expressions on attractive compared to unattractive faces but did not find an interactive influence of attractiveness on emotion perception. It is possible that attractiveness does moderate emotion perception, but this experiment was not designed to maximize the likelihood of detecting this effect, as they selected faces from a small set, which limited the range of attractiveness of the faces, the results were reported collapsed over face sex, a known moderator of emotion categorization speed, and were based on a relatively small sample.

The overall aim of the present series of experiments was to examine whether attractiveness, a facial attribute unrelated to more defined social categories, would moderate

the happy face advantage consistent with the evaluative congruence account. In line with the evaluative congruence account, we predicted a happy face advantage for the more favourably evaluated attractive faces, but a reduced or absent one for the unattractive faces. Participants categorized attractive and unattractive faces as happy or angry as quickly and accurately as possible. In the first two experiments, faces of only one sex were presented to avoid the previously discussed influence of sex on emotion categorization. In Experiments 3 and 4, we examined if sex and attractiveness interact to influence the happy face advantage and presented attractive and unattractive, female and male faces within the same emotion categorization task.

Experiment 1

Method

Participants. Previous studies have observed reliable effects of facial attributes such as sex and race on the happy face advantage with around 30 participants (e.g., Lipp, Craig, & Dat, 2015). Due to the uncertainty of whether a potential attractiveness effect might be weaker, a conservative approach was taken and twice as many participants were recruited. Sixty-one participants (35 males, 2 participants did not provide demographic information, *M* = 35.97 years, *SD* = 11.81 years) were recruited from Amazon Mechanical Turk and received 1.80 USD for completing the experiment. Forty-nine participants identified themselves as White/Caucasian, two as Black/African American, five as Hispanic, two as Asian, and one as "other".

Stimulus materials. The stimulus materials were selected from a pilot study where 167 Caucasian faces with neutral expressions were taken from the Chicago Face Database (Ma, Correll, & Wittenbrink, 2015; 37 female and 34 male), the FACES database (Ebner, Riediger, & Lindenberger, 2010; 29 female and 29 male), and the Radboud Faces Database (Langner et al., 2010; 19 female and 19 male), and rated on attractiveness on a 7-point Likert

scale. The study was completed online via Qualtrics Survey Software by 46 undergraduate students (32 female, M = 20.80 years, SD = 3.15 years) in exchange for partial course credit. The ratings are available on https://osf.io/hjbvt/. The six female and six male models with the highest and lowest attractiveness ratings who met inclusion criteria were selected. Two models were excluded because there was no happy expression with an open mouth available in the database and one model because he appeared much older in comparison to the rest of the stimuli. Two separate paired-samples t tests confirmed that the attractive female (M = 5.53, SD = 0.60; Models 12, 22, 24, and 27 from the Chicago Face Database; Models 115 and 152 from the FACES database) and unattractive female models (M = 3.01, SD = 0.92; Models 8, 10, 26, 28, and 34 from the Chicago Face Database; Model 22 from the Radboud Faces Database), and the attractive male (M = 4.94, SD = 0.68; Models 4 and 29 from the Chicago Face Database; Models 16, 31, 72, and 89 from the FACES database) and unattractive male models (M = 2.64, SD = 0.91; Models 10, 17, 34, and 35 from the Chicago Face Database; Models 28 and 47 from the Radboud Faces Database) differed in rated attractiveness, $t(44) = 16.08$, $p < .001$, and, $t(44) = 13.35$, $p < .001$, respectively. Pictures of each model displaying an open mouthed happy and angry expression were edited to remove clothes and background, resized, and dropped in the centre of a white background 600 × 630 pixels in size. In Experiment 1, the six attractive and six unattractive female models were utilized, each displaying a happy and an angry expression, yielding a total of 24 pictures.

Procedure. The experiment was run online using Millisecond's Inquisit 4 Web. Participants completed an emotion categorization task where they indicated whether the face presented was displaying a happy or angry expression as quickly and accurately as possible, using the *S* and *L* keys on their keyboard. Response mapping was counterbalanced across participants. The task consisted of eight practice trials with error feedback and 96 task trials without feedback. Reminders of which key was assigned to "happy" or "angry" judgements

were displayed throughout the task on the corresponding side of the screen. The face stimuli were presented one at a time in a randomized sequence in blocks of 24, each picture was thus presented four times. Before each face, a fixation cross was presented centred on the screen for 500 ms, immediately followed by the face which was presented for 3,000 ms or until the participant made a response. The interstimulus interval was 1,000 ms. After completion of the emotion categorization task, participants rated the happy and angry faces on attractiveness using a 7-point Likert scale in a randomized sequence and provided demographic information. The procedures were approved by the Curtin University Human Research Ethics Committee.

Analysis. Attractiveness ratings, response times, and error rates were subjected to separate 2 (Attractiveness: attractive vs. unattractive) × 2 (Expression: happy vs. angry) repeated measures analyses of variance (ANOVAs) with follow-up pairwise comparisons. For all experiments, interactions are followed-up with the theoretically relevant assessment of the happy face advantage (comparisons between happy and angry) within attractiveness conditions, but for completeness, comparisons within expressions and between attractiveness conditions are reported in the Supplementary Material 1. Errors (i.e., incorrect button presses; 5.98% of trials), invalid responses (i.e., trials with response times faster than 100 ms; 0.32% of trials), and outliers (i.e., response times which deviated from an individuals' mean by more than 3 *SD*; 1.49% of trials) were excluded from the response time analysis. Additionally, participants with an error rate higher than 25% or a mean response time more than 3 *SD* above the mean response time across all participants were excluded from analyses. Two participants were excluded from the analyses due to an error rate higher than 25% (36.46 and 76.04% respectively); however, preliminary analyses including these participants yielded the same pattern of results. For all experiments, participant gender was included as a between-subjects factor in a preliminary analysis. Unless reported, participant gender did not

significantly influence any of the results and the results are reported collapsed across this factor. Further, preliminary analyses yielded the same pattern of results when only the Caucasian participants were included for all experiments so the results are reported including all participants.

Results and Discussion

Manipulation check. Fifty-nine participants provided attractiveness ratings depicted in Table 1, and the analysis confirmed the allocation of faces to conditions. There were main effects of attractiveness, $F(1, 58) = 208.61$, $p < .001$, $\eta_p^2 = .78$, and expression, $F(1, 58) = 91.08$, $p < .001$, $\eta_p^2 = .61$, confirming that the attractive and happy females overall were rated as more attractive than the unattractive and angry females. The main effects were moderated by an Attractiveness × Expression interaction, $F(1, 58) = 44.70$, $p < .001$, $\eta_p^2 = .44$. Follow-up pairwise comparisons demonstrated that faces with happy expressions were rated as more attractive than faces with angry expressions for both the attractive, $t(58) = 10.53$, $p < .001$, and the unattractive females, $t(58) = 7.49$, $p < .001$, however, this happy advantage was significantly larger for the attractive females, $t(58) = 6.69$, $p < .001$.

Table 1.

Attractiveness ratings for happy and angry female and male faces in Experiments 1-4.

	Female		Male	
Experiment	Happy	Angry	Happy	Angry
Experiment 1				
Attractive	6.03 (0.61)	4.57 (1.02)		
Unattractive	3.34 (1.18)	2.42 (0.70)		
Experiment 2				
Attractive			5.22 (0.88)	3.98 (1.07)

Unattractive			3.60 (0.89)	2.84 (0.72)
Experiment 3				
Attractive	6.05 (0.65)	4.83 (1.15)	4.99 (1.18)	3.88 (1.33)
Unattractive	3.25 (1.22)	2.57 (0.95)	3.42 (1.09)	2.84 (0.93)
Experiment 4				
Attractive	5.48 (1.03)	4.35 (1.09)	4.72 (1.08)	3.84 (1.19)
Unattractive	3.28 (1.18)	2.72 (0.76)	3.29 (1.07)	2.95 (0.88)

Note. Values in parentheses represent 1 *SD*.

Categorization times. Figure 1 summarizes the categorization times for the happy and angry female faces as a function of attractiveness. Overall, happy faces were categorized faster than angry faces, $F(1, 58) = 10.21$, $p = .002$, $\eta_p^2 = .15$, but this main effect was qualified by the predicted Attractiveness × Expression interaction, $F(1, 58) = 10.18$, $p = .002$, $\eta_p^2 = .15$. Follow-up pairwise comparisons demonstrate a significant happy face advantage for the attractive females, $t(58) = 4.27$, $p < .001$, with the happy attractive female faces being categorized faster than the angry attractive female faces. There was no difference in categorization times for the happy and angry unattractive female faces, $t(58) = 0.38$, $p = .703$.

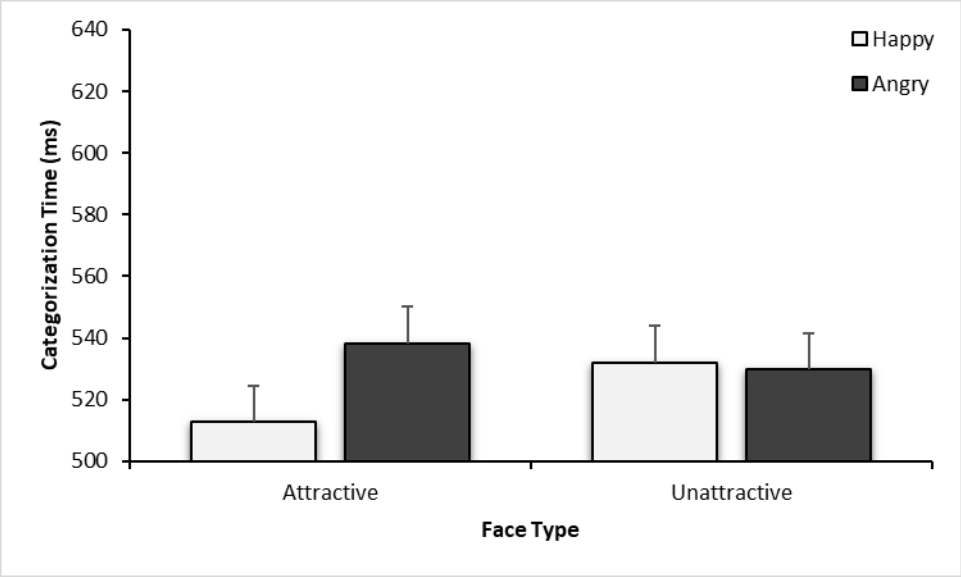

Figure 1. Categorization times for happy and angry expressions on female faces as a function of attractiveness in Experiment 1. Errors bars represent 1 *SEM*.

Accuracy. The pattern of results for the error rates (see Table 2) is in line with that of the categorization times, fewer errors were made categorizing happy than angry faces, $F(1, 58) = 4.68$, $p = .035$, $\eta_p^2 = .08$, and a significant Attractiveness × Expression interaction emerged, $F(1, 58) = 10.18$, $p = .002$, $\eta_p^2 = .15$. Follow-up comparisons revealed a lower error rate for happy compared to angry attractive females, $t(58) = 4.92$, $p < .001$, but there was no difference in error rates for the happy and angry unattractive female faces, $t(58) = 0.75$, $p = .454$.

Experiment 1 demonstrated that attractiveness moderated emotion categorization for female faces, which is a novel finding. Furthermore, attractiveness seems to influence emotion categorization in a way that is similar to other social category cues. In line with the evaluative congruence account, a happy face advantage emerged for the more positively evaluated attractive females but not for the unattractive females.

Table 2.

Mean error percentages for categorizing happy and angry expressions on female and male faces as a function of attractiveness in Experiments 1-4.

	Female		Male	
Experiment	Happy	Angry	Happy	Angry
Experiment 1				
Attractive	4.10 (4.54)	7.42 (5.31)		
Unattractive	6.92 (7.68)	6.14 (5.86)		
Experiment 2				
Attractive			4.51 (4.12)	6.69 (6.51)
Unattractive			9.29 (7.62)	8.47 (5.89)
Experiment 3				
Attractive	3.47 (6.19)	7.22 (8.19)	5.56 (6.26)	7.92 (9.13)
Unattractive	6.25 (7.30)	6.67 (8.23)	12.36 (9.27)	9.17 (8.77)
Experiment 4				
Attractive	5.06 (7.57)	7.29 (8.11)	7.74 (10.52)	7.74 (9.11)
Unattractive	7.59 (9.44)	4.46 (6.55)	13.39 (12.58)	9.23 (9.62)

Note. Values in parentheses represent 1 *SD*.

Experiment 2

Experiment 2 was designed to examine whether the attractiveness effect on emotion categorization, as demonstrated in Experiment 1, extends to male faces as well. Attractive and unattractive male faces displaying both happiness and anger were categorized by their emotional expression. In line with the evaluative congruence account and the results from Experiment 1, a happy face advantage was predicted for the attractive male faces but a reduced or absent one for the unattractive male faces.

Method

Participants. Sixty-two participants (37 males, 1 participant did not provide demographic information, *M* = 35.56 years, *SD* = 11.07 years) were recruited from Amazon Mechanical Turk and received 1.80 USD for completing the experiment. Forty-six participants identified themselves as White/Caucasian, three as Black/African American, two as Hispanic, seven as Asian, one as Native American, and two as "other".

Stimulus materials, procedure, and analysis. Experiment 2 was identical to Experiment 1 except for the face stimuli, which now comprised the six attractive and six unattractive male models from the pilot study. Errors (5.61% of trials), invalid responses (<0.01% of trials), and outliers (1.63% of trials), defined as for Experiment 1, were excluded from analysis of the response times. Attractiveness ratings, response times, and error rates were subjected to separate 2 (Attractiveness: attractive vs. unattractive) × 2 (Expression: happy vs. angry) repeated measures ANOVAs with follow-up pairwise comparisons. One participant with a mean response time more than 3 *SD* above the mean response time across all participants (*M* = 1,083 ms) was excluded from analyses. Preliminary analyses demonstrated that this exclusion did not alter the pattern of results.

Results and Discussion

Manipulation check. Three participants were deemed not to have engaged in the rating task (i.e., provided the same response for all faces), and thus were excluded from analysis. However, preliminary analysis demonstrated that their exclusion did not alter the pattern of results. Analysis confirmed the allocation of faces to conditions (see Table 1). There were main effects of attractiveness, $F(1, 58) = 160.17$, $p < .001$, $\eta_p^2 = .73$, and expression, $F(1, 58) = 58.59$, $p < .001$, $\eta_p^2 = .50$, demonstrating that the attractive and happy males overall were rated as more attractive than the unattractive and angry males. The Attractiveness × Expression interaction, $F(1, 58) = 17.69$, $p < .001$, $\eta_p^2 = .23$, reflected that happy expressions were rated as more attractive than the angry expressions for both the

attractive, $t(58) = 7.59$, $p < .001$, and the unattractive males, $t(58) = 6.51$, $p < .001$, but the happy advantage was larger for the attractive males, $t(58) = 4.21$, $p < .001$.

Categorization times. Figure 2 summarizes the categorization times for the happy and angry male faces as a function of attractiveness. Happy faces were categorized faster than angry faces regardless of attractiveness, $F(1, 60) = 7.68$, $p = .007$, $\eta_p^2 = .11$, and attractive male faces were overall categorized faster than the unattractive male faces, $F(1, 60) = 36.05$, $p < .001$, $\eta_p^2 = .38$. The predicted Attractiveness × Expression interaction was not significant, $F(1, 60) = 0.17$, $p = .682$, $\eta_p^2 < .01$.

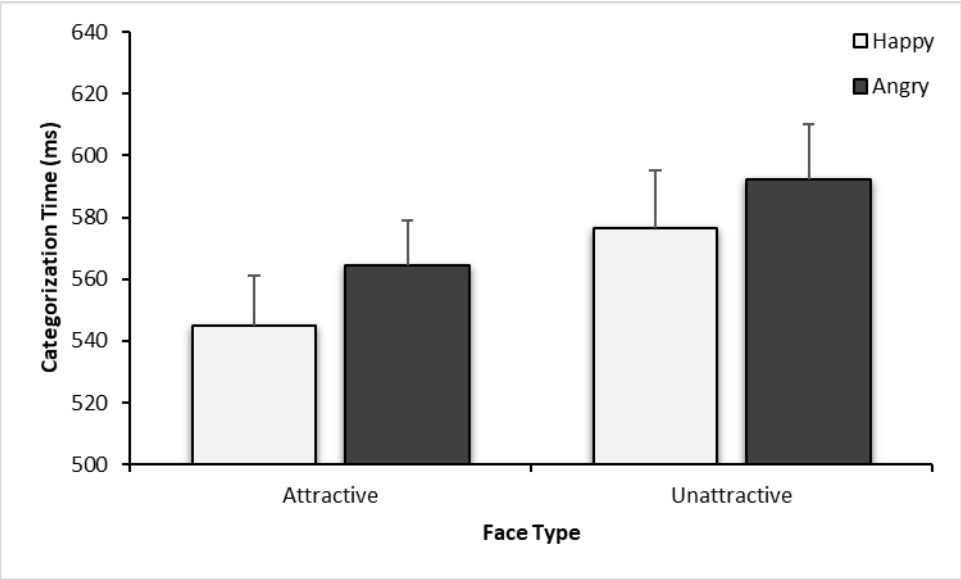

Figure 2. Categorization times for happy and angry expressions on male faces as a function of attractiveness in Experiment 2. Errors bars represent 1 *SEM*.

Accuracy. Analysis of error rates (see Table 2) indicated that attractiveness interacted with facial expression for male faces. Fewer errors were made categorizing attractive than unattractive faces, $F(1, 60) = 16.10$, $p < .001$, $\eta_p^2 = .21$, but this effect was qualified by an Attractiveness × Expression interaction, $F(1, 60) = 5.98$, $p = .017$, $\eta_p^2 = .09$. Follow-up

comparisons revealed that fewer errors were made for the happy attractive males compared to the angry attractive males, $t(60) = 2.56$, $p = .013$. There was no difference in error rates for the happy and angry unattractive male faces, $t(60) = 0.71$, $p = .483$.

Although the Attractiveness × Expression interaction was not significant for the categorization times, a main effect of attractiveness was observed, indicating that attractiveness has some influence on emotion categorization for male faces. The error data, however, suggest there is an interactive effect of attractiveness on the processing of male emotional expressions in line with the evaluative congruence account. It might be possible that the attractiveness effect is weaker for male faces, which was tested in Experiment 3, where both female and male faces were presented in the same task.

Experiment 3

Previous studies have mainly focused on how a single social category cue influences emotion perception. Given that several social category cues are simultaneously present on a face, it is important to examine how they interact. Past studies have investigated how multiple social category cues, sex and race (Craig & Lipp, 2018; Smith, LaFrance, & Dovidio, 2017), sex and age (Craig & Lipp, 2018), and race and age cues (Kang & Chasteen, 2009) simultaneously moderate emotion perception, and found evidence for a combined influence of these social cues on emotion perception. To get a more complete picture of how attractiveness influences emotion perception, the combined influence of sex and attractiveness needs to be taken into consideration. Attractiveness moderated the happy face advantage for female (Experiment 1) and male faces (Experiment 2) separately, although this was only evident in the error data for the male faces. Whether attractiveness will still have an effect on emotion categorization when both male and female faces are encountered within a single task and the influence of face sex (e.g., Becker et al., 2007; Hugenberg & Sczesny, 2006) is taken into account is unclear. If face sex is a more prominent or salient social cue

than attractiveness, it could override the attractiveness effect observed in Experiments 1 and 2. In this case, the usual pattern of a happy face advantage for female faces and a reduced or absent one for male faces is predicted. Attractiveness could also moderate emotion categorization independently in the absence of an influence of sex. In this case, a happy face advantage is expected for the attractive faces and a reduced or absent one for the unattractive faces regardless of the sex of the face. If both the sex and attractiveness of the face moderate emotion perception, the largest happy face advantage might be predicted for the attractive females. As such, the aim of Experiment 3 was to examine if and how attractiveness and sex might combine to influence the happy face advantage. To this aim, participants were presented with female and male faces that varied in attractiveness and emotional expression, and categorized them by their emotional expression (happy and angry).

Method

Participants. Craig and Lipp (2018) observed effects of two different social category cues on emotion perception across tasks with around 30 participants. Although the extra factor of face sex is introduced in Experiment 3, the current study utilizes a fully repeated measures design and previous research indicates that the moderating influence of sex on emotion categorization is large. As such, a sample size similar to Experiments 1 and 2 was deemed to be sufficient to investigate the influence of sex and attractiveness on emotion categorization. Sixty-two participants (35 males, 2 participants did not provide demographic information, M = 33.85 years, SD = 8.89 years) were recruited from Amazon Mechanical Turk and received 1.80 USD for completing the experiment. Forty-eight participants identified themselves as White/Caucasian, five as Black/African American, four as Hispanic, and three as Asian.

Stimulus materials, procedure, and analysis. Experiment 3 was identical to Experiments 1 and 2 except as follows. Both the female and male models from the previous

experiments were included (a total of 48 pictures). Each picture was only presented twice in order to maintain a total of 96 trials in the emotion categorization task. Errors (5.54% of trials), invalid responses (<0.01% of trials), and outliers (1.75% of trials) were excluded from analysis of the response times. Attractiveness ratings, response times, and error rates were subjected to separate 2 (Target sex: female vs. male) × 2 (Attractiveness: attractive vs. unattractive) × 2 (Expression: happy vs. angry) repeated measures ANOVAs with follow-up pairwise comparisons. Two participants with a mean response time more than 3 *SD* above the mean response time across all participants (*M* = 1,222 and 1,499 ms respectively) were excluded from analyses. Preliminary analysis including these participants yielded the same pattern of results.

Results and Discussion

Manipulation check. One participant was excluded from analysis of the attractiveness ratings due to undifferentiated ratings of all faces. Preliminary analysis before exclusion yielded the same pattern of results. Analysis confirmed the allocation of faces to conditions (see Table 1). Main effects of sex, $F(1, 58) = 19.20$, $p < .001$, $\eta_p^2 = .25$, attractiveness, $F(1, 58) = 273.26$, $p < .001$, $\eta_p^2 = .83$, and expression, $F(1, 58) = 48.95$, $p < .001$, $\eta_p^2 = .46$, emerged, where female, attractive, and happy faces overall were rated as more attractive than male, unattractive, and angry faces. The Sex × Attractiveness interaction, $F(1, 58) = 85.48$, $p < .001$, $\eta_p^2 = .60$, confirmed that the attractive faces were rated as more attractive than the unattractive faces for both females, $t(58) = 17.11$, $p < .001$, and males, $t(58) = 11.09$, $p < .001$, however, the difference was larger for the female faces, $t(58) = 9.25$, $p < .001$. An Attractiveness × Expression interaction, $F(1, 58) = 51.26$, $p < .001$, $\eta_p^2 = .47$, reflected that happy expressions were rated as more attractive than angry expressions for both the attractive, $t(58) = 7.90$, $p < .001$, and the unattractive faces, $t(58) = 5.29$, $p < .001$, but the

happy advantage was larger for the attractive faces, $t(58) = 7.16$, $p < .001$. The three-way Sex × Attractiveness × Expression interaction was not significant, $F(1, 58) = 0.00$, $p = 1.00$, $\eta_p^2 = .00$.

Categorization times. Figure 3 summarizes the categorization times for happy and angry expressions on female and male faces as a function of attractiveness. The analysis yielded a main effect of expression, $F(1, 59) = 9.01$, $p = .004$, $\eta_p^2 = .13$, where happy faces overall were categorized faster than angry faces. A main effect of attractiveness, $F(1, 59) = 27.03$, $p < .001$, $\eta_p^2 = .31$, indicated that the attractive faces overall were categorized faster than the unattractive faces. The main effects were qualified by an Attractiveness × Expression interaction, $F(1, 59) = 6.96$, $p = .011$, $\eta_p^2 = .11$. Follow-up comparisons demonstrate a happy face advantage for the attractive faces, $t(59) = 3.95$, $p < .001$, but no difference in categorization times for the unattractive faces, $t(59) = 0.76$, $p = .448$. The three-way Sex × Attractiveness × Expression interaction did not reach significance, $F(1, 59) = 2.24$, $p = .140$, $\eta_p^2 = .04$.

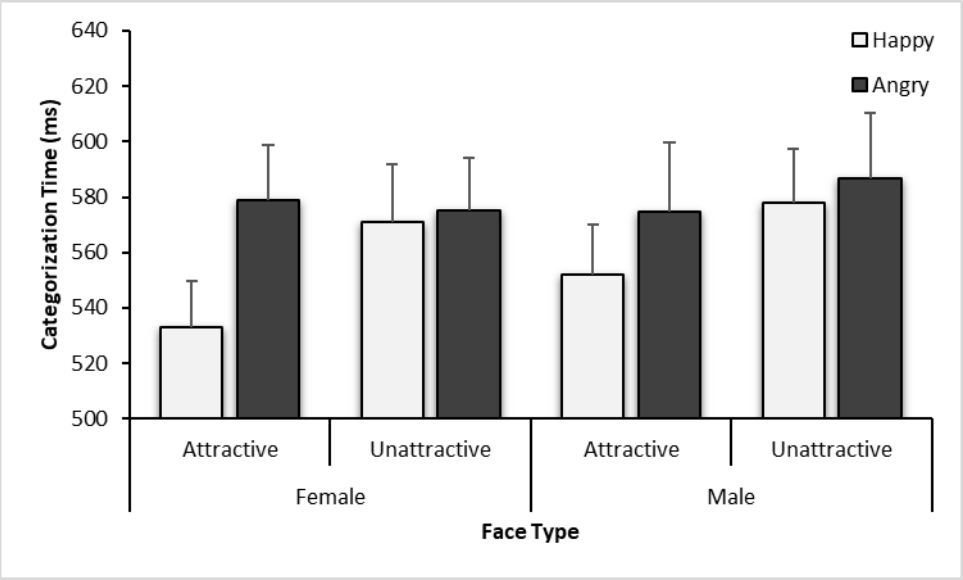

Figure 3. Categorization times for happy and angry expressions on female and male faces as a function of attractiveness in Experiment 3. Errors bars represent 1 *SEM*.

Overall, the pattern of results in Experiment 3, where female and male faces were categorized together, appears to be consistent with those of Experiments 1 and 2, where female and male faces were categorized separately. To further examine whether the theoretically relevant interactions from Experiment 3 were consistent with the results of Experiments 1 and 2, data from the first two experiments were combined in a 2 (Target sex: female vs. male) × 2 (Attractiveness: attractive vs. unattractive) × 2 (Expression: happy vs. angry) mixed ANOVA with target sex as a between-subjects factor. The Attractiveness × Expression interaction, $F(1, 118) = 6.15$, $p = .015$, $\eta_p^2 = .05$, still emerged, and follow-up comparisons demonstrate a happy face advantage for the attractive faces, $t(118) = 4.83$, $p < .001$, but no difference in categorization times for the unattractive faces, $t(118) = 1.35$, $p = .180$, consistent with the results of Experiment 3. The three-way Sex × Attractiveness × Expression interaction trended towards significance, $F(1, 118) = 3.54$, $p = .062$, $\eta_p^2 = .03$, likely reflecting the Attractiveness × Expression interaction for females in Experiment 1, but lack thereof for males in Experiment 2. The Sex × Expression interaction did not reach significance in Experiment 3, $F(1, 59) = 0.45$, $p = .503$, $\eta_p^2 = .01$, nor in the combined analysis of Experiments 1 and 2, $F(1, 118) = 0.63$, $p = .431$, $\eta_p^2 = .01$.

Accuracy. Analysis of error rates (see Table 2) suggests that both sex and attractiveness influence the categorization of facial expressions. Overall, fewer errors were made categorizing female, $F(1, 59) = 20.04$, $p < .001$, $\eta_p^2 = .25$, and attractive faces, $F(1, 59) = 15.90$, $p < .001$, $\eta_p^2 = .21$, compared to male and unattractive faces. The Sex ×

Attractiveness interaction, $F(1, 59) = 6.56$, $p = .013$, $\eta_p^2 = .10$, revealed that more errors were made categorizing unattractive male faces, $t(59) = 4.34$, $p < .001$, compared to attractive male faces. There was no difference in error rates for the attractive and unattractive female faces, $t(59) = 1.42$, $p = .162$. The Attractiveness × Expression interaction, $F(1, 59) = 10.78$, $p = .002$, $\eta_p^2 = .15$, showed a pattern consistent with the error rates from Experiments 1 and 2. There were fewer errors made categorizing happy attractive faces, $t(59) = 3.20$, $p = .002$, than angry attractive faces, and no difference in errors made categorizing happy and angry unattractive faces, $t(59) = 1.30$, $p = .197$. The Sex × Expression interaction trended towards significance, $F(1, 59) = 3.79$, $p = .056$, $\eta_p^2 = .06$, and reflected a lower error rate for happy female faces, $t(59) = 2.17$, $p = .034$, than for angry female faces. There was no difference in error rates for the happy and angry male faces, $t(59) = 0.41$, $p = .684$. The three-way Sex × Attractiveness × Expression interaction did not reach significance, $F(1, 59) = 0.63$, $p = .429$, $\eta_p^2 = .01$.

If facial sex cues are more prominent as a moderator of emotion categorization, the Sex × Expression interaction would be expected to reveal a happy face advantage for the female faces and a reduced or absent one for the male faces, which it did not. Somewhat surprisingly, Experiment 3 suggests that face attractiveness might have a stronger influence on emotion categorization than face sex, at least within the context of this task. Like social category cues of sex or race though, attractiveness seems to moderate the happy face advantage in emotion categorization in line with the evaluative congruence account. That is, a happy face advantage emerged for the more positively evaluated attractive faces but not for the unattractive faces.

Experiment 4

Hair is an attribute that influences perception of attractiveness and sex. Mesko and Bereczkei (2004) revealed that adding different hairstyles to female faces rated high or low in attractiveness had a larger influence on perceived attractiveness of faces initially rated as less attractive. Given the interaction between attractiveness and hairstyles, we wanted to rule out the possibility that the results observed in Experiments 1-3 are primarily driven by posers' hairstyles rather than just the information present on the face. Previous studies have used male and female faces with (e.g., Craig & Lipp, 2017) and without (e.g., Lipp, Craig, & Dat, 2015) hair in emotion categorization tasks and demonstrated the same moderating effects of sex cues on the happy face advantage. As facial sex cues influence emotion categorization similarly when faces are presented with or without hair, it is possible that the attractiveness effect will also still be observed when the hair has been removed. Although, if hair has a larger influence on attractiveness judgements than perceptions of sex, it could be expected that sex becomes more salient than attractiveness as an evaluative dimension and overrides the attractiveness effect observed in Experiment 3. This would be indicated by a happy face advantage for the female faces and a reduced or absent one for the male faces. To rule out the possibility that differences in hairstyles might be driving the attractiveness effect in Experiments 1-3, and to establish the generality of the moderating influence of attractiveness across stimulus sets, Experiment 3 was replicated with the faces further edited to remove hair, neck, and ears, leaving just the face. Again, participants were presented with female and male faces that varied in attractiveness and emotional expression, and categorized them by their emotional expression (happy and angry).

Method

Participants. Sixty-four participants (36 males, 2 participants did not provide demographic information, M = 31.72 years, SD = 26.32 years) were recruited from Amazon Mechanical Turk and received 1.80 USD for completing the experiment. Fifty participants

identified themselves as White/Caucasian, three as Black/African American, three as Hispanic, and six as Asian.

Stimulus materials, procedure, and analysis. Experiment 4 was identical to Experiment 3 except for the face stimuli, which were further edited to remove hair, neck, and ears. Errors (9.22% of trials), invalid responses (1.01% of trials), and outliers (1.75% of trials) were excluded from analysis of the response times. Attractiveness ratings, response times, and error rates were subjected to separate 2 (Target sex: female vs. male) × 2 (Attractiveness: attractive vs. unattractive) × 2 (Expression: happy vs. angry) repeated measures ANOVAs with follow-up pairwise comparisons. Sixty-two participants completed the categorization task; one participant with a mean response time more than 3 *SD* above the mean response time across all participants (*M* = 1,101 ms) and five participants with an error rate higher than 25% (27.08, 59.38, 62.50, 66.67, and 84.38% respectively) were excluded from analyses. Preliminary analysis with these participants included yielded the same pattern of results.

Results and Discussion

Manipulation check. Sixty-two participants provided attractiveness ratings and two participants were excluded from analysis due to undifferentiated ratings of all faces. Preliminary analysis before exclusion yielded the same pattern of results. Analysis confirmed the allocation of faces to conditions (see Table 1). Main effects of sex, $F(1, 59) = 13.11$, $p = .001$, $\eta_p^2 = .18$, attractiveness, $F(1, 59) = 160.11$, $p < .001$, $\eta_p^2 = .73$, and expression, $F(1, 59) = 35.27$, $p < .001$, $\eta_p^2 = .37$, emerged, where female, attractive, and happy faces were rated as more attractive than male, unattractive, and angry faces. The Sex × Attractiveness interaction, $F(1, 59) = 62.11$, $p < .001$, $\eta_p^2 = .51$, again confirmed that the attractive faces were rated as more attractive than the unattractive faces for both the females, $t(59) = 12.77$, $p < .001$, and the males, $t(59) = 10.72$, $p < .001$, with a larger difference for the female faces, $t(59) = 7.88$,

$p < .001$. The Sex × Expression interaction, $F(1, 59) = 12.31$, $p = .001$, $\eta_p^2 = .17$, indicated that the happy expressions were rated as more attractive than the angry expressions on both female, $t(59) = 6.85$, $p < .001$, and male faces, $t(59) = 4.66$, $p < .001$, with a larger difference for the happy and angry female faces, $t(59) = 3.51$, $p = .001$. There was also an Attractiveness × Expression interaction, $F(1, 59) = 42.30$, $p < .001$, $\eta_p^2 = .42$, which again demonstrated that the happy expressions were rated as more attractive than the angry expressions for both the attractive, $t(59) = 7.30$, $p < .001$, and the unattractive faces, $t(59) = 3.75$, $p < .001$, with a larger happy advantage for the attractive faces, $t(59) = 6.50$, $p < .001$. The three-way Sex × Attractiveness × Expression interaction was not significant, $F(1, 59) = 0.04$, $p = .839$, $\eta_p^2 < .01$.

Categorization times. Figure 4 summarizes the categorization times for happy and angry expressions on the cropped female and male faces as a function of attractiveness. The analysis yielded main effects of sex, $F(1, 55) = 9.86$, $p = .003$, $\eta_p^2 = .15$, and attractiveness, $F(1, 55) = 30.02$, $p < .001$, $\eta_p^2 = .35$, where female and attractive faces were categorized faster than male and unattractive faces. Replicating the results from Experiment 3, the main effects were qualified by the Attractiveness × Expression interaction, $F(1, 55) = 5.50$, $p = .023$, $\eta_p^2 = .09$, which demonstrated a happy face advantage for the attractive faces, $t(55) = 3.26$, $p = .002$, but no difference in categorization times for the unattractive faces, $t(55) = 0.08$, $p = .939$. The three-way Sex × Attractiveness × Expression interaction trended towards significance, $F(1, 55) = 3.81$, $p = .056$, $\eta_p^2 = .07$, reflecting a happy face advantage for the attractive females, $t(55) = 4.25$, $p < .001$, and no happy advantage for the unattractive

females, $t(55) = 0.23$, $p = .816$, nor the attractive, $t(55) = 0.24$, $p = .813$, and unattractive males, $t(55) = 0.13$, $p = .894$.[1]

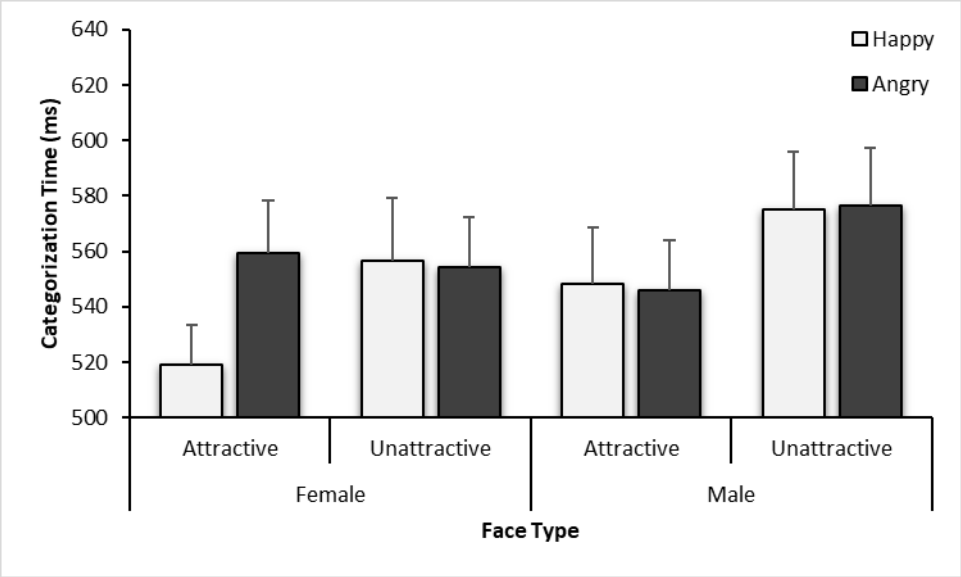

Figure 4. Categorization times for happy and angry expressions on the cropped female and male faces as a function of attractiveness in Experiment 4. Errors bars represent 1 *SEM*.

Accuracy. Analysis of the error rates (see Table 2) yielded main effects of sex, $F(1, 55) = 18.86$, $p < .001$, $\eta_p^2 = .26$, and attractiveness, $F(1, 55) = 8.58$, $p = .005$, $\eta_p^2 = .14$, where fewer errors were made categorizing expressions on female and attractive faces compared to male and unattractive faces. The Sex × Attractiveness interaction, $F(1, 55) = 5.80$, $p = .019$, $\eta_p^2 = .10$, reflected that more errors were made categorizing expressions on unattractive male,

[1] The marginal three-way interaction was further moderated by participant sex, $F(1, 53) = 6.24$, $p = .016$, $\eta_p^2 = .11$. For the female participants, there was a happy face advantage for the attractive female faces, $t(53) = 4.06$, $p < .001$, but no difference for the unattractive female faces, $t(53) = 0.66$, $p = .513$. Furthermore, an unexpected anger advantage emerged for the attractive male faces, $t(53) = 2.46$, $p = .017$, and there was no difference in categorization times for the happy and angry unattractive male faces, $t(53) = 0.53$, $p = .601$. For the male participants, there was a trending happy face advantage for both the attractive female, $t(53) = 1.98$, $p = .053$, and the attractive male faces, $t(53) = 1.86$, $p = .069$. There was no categorization advantage in either direction for the unattractive female, $t(53) = 0.21$, $p = .838$, and unattractive male faces, $t(53) = 0.17$, $p = .867$.

$t(55) = 3.25$, $p = .002$, than to attractive male faces. There was no difference in error rates for the attractive and unattractive female faces, $t(55) = 0.18$, $p = .856$. The Attractiveness × Expression interaction, $F(1, 55) = 9.79$, $p = .003$, $\eta_p^2 = .15$, indicated that more errors were made categorizing the happy unattractive faces, $t(55) = 2.58$, $p = .013$, than the angry unattractive faces. There was no difference in error rates for the happy and angry attractive faces, $t(55) = 1.13$, $p = .263$. The three-way Sex × Attractiveness × Expression interaction did not reach significance, $F(1, 55) = 0.17$, $p = .684$, $\eta_p^2 < .01$.[2]

The attractiveness effect on the happy face advantage observed in Experiment 3 was replicated in Experiment 4, with a happy face advantage for the more positively evaluated attractive faces, but not for the unattractive faces. Interestingly, the previously reported Sex × Expression effect, that is, a happy face advantage for females and the lack thereof or a reduced one for males (e.g., Becker et al., 2007; Hugenberg & Sczesny, 2006), did not emerge when attractiveness is manipulated in Experiment 3 (only a trend emerges in the error rates) nor when data from Experiment 1 and 2 were combined, but was evident in Experiment 4. One possible explanation for the more prominent moderating influence of sex on the happy face advantage in Experiment 4 could be that the faces varied less in attractiveness when their hair was cropped off reducing the salience of attractiveness as an evaluative dimension. Comparing the attractiveness ratings for Experiments 3 and 4 in an overall ANOVA with Experiment as a between-subjects factor confirms this. The Experiment × Sex × Attractiveness interaction, $F(1, 117) = 8.17$, $p = .005$, $\eta_p^2 = .07$, indicated that the attractive females were rated as more attractive in Experiment 3 when they had hair, than in

[2] When participant sex was included as a between-subjects factor, the four-way Participant sex × Target sex × Attractiveness × Expression interaction reached significance, $F(1, 53) = 5.66$, $p = .021$, $\eta_p^2 = .10$. The female participants made more errors categorizing angry compared to happy attractive female faces, $t(53) = 2.99$, $p = .004$, and happy compared to angry unattractive female faces, $t(53) = 2.23$, $p = .030$. There were no other significant effects of participant sex.

Experiment 4 without hair, $t(117) = 3.47$, $p = .001$. There was no difference between experiments in rated attractiveness for the other faces. This indicates that the absence of hair reduced attractiveness judgements particularly for attractive female faces but, not for unattractive females or for male faces, which may explain the enhanced salience of face sex relative to attractiveness in Experiment 4. This finding is not inconsistent with Mesko and Bereczkei's (2004) finding that addition of hairstyles increased the perceived attractiveness more for less attractive than for attractive females, in that removal of hair may have a stronger effect for the evaluation of previously attractive females. There are several differences between the studies however, and the hairstyles of the models used in the present experiments were not systematically controlled. Nonetheless, both results indicate that hairstyles are an important factor to consider when examining facial attractiveness.

General Discussion

Across four experiments, novel evidence demonstrated that attractiveness moderates emotion categorization. Consistent with the evaluative congruence account (Hugenberg, 2005; Hugenberg & Sczesny, 2006), we demonstrated a happy face advantage for the more favorably evaluated attractive faces but a reduced or absent one for the unattractive faces. This is thought to be due to the facilitated processing of evaluatively congruent expressions. When female and male faces were categorized separately, the happy advantage for attractive faces was clearly observable for the female faces and only evident in the error data for the male faces. This might suggest that attractiveness has a stronger influence on emotion perception for female faces. Alternatively, it could be interpreted as an additive effect where the relatively positive evaluation of female compared to male faces, combines with the relatively positive evaluation of attractive compared to unattractive faces. This results in the strongest positive evaluation and thus the largest (most statistically robust) happy advantage for attractive female faces. Furthermore, attractiveness still had an effect on emotion

categorization when face sex, which reliably moderates the happy face advantage, was varied (e.g., Becker et al., 2007; Hugenberg & Sczesny, 2006). Attractiveness seems to moderate the happy face advantage in the same way as social category cues; that is, according to the evaluative congruence account, with a happy face advantage for the more favorably evaluated attractive faces but not for the unattractive faces. The moderation of emotion perception is thus not limited to invariant facial social category cues.

Although the current findings are consistent with the evaluative congruence account, there are other factors that could potentially explain the results. One might argue that the attractive and unattractive faces differ in the intensity of their emotional expressions, the perceived femininity/masculinity of the models, or how typically male or female they appear, which may have contributed to the pattern of results obtained in Experiments 1-4. For example, happy expressions might be perceived as more intense on attractive relative to unattractive faces, which could facilitate categorization of happiness (see Golle et al., 2014). Furthermore, the attractive faces could be perceived as more feminine, and as feminine facial structure overlaps with expressions of happiness (Becker et al., 2007), this could potentially explain the larger happy face advantage for attractive females. To address these alternative interpretations, a new sample of participants rated each of the faces used in Experiments 1-3 on expression intensity, femininity/masculinity, and sex typicality on 7-point Likert scales. None of the alternative explanations could adequately account for the observed attractiveness effect on emotion categorization (for a detailed report and discussion of the additional data see Supplementary Material 2). In brief, contrary to predictions, angry expressions were rated as more intense than happy expressions for attractive female and male faces, as well as for unattractive female faces, for which no happy face advantage had been observed. As predicted, the femininity/masculinity ratings demonstrated that attractive female faces were rated as more feminine than the unattractive females, but contrary to what would be expected

given the categorization pattern, there was no difference in rated femininity for the attractive and unattractive male faces. Similarily, attractive faces were rated as more sex typical than the unattractive faces, which could account for the categorization time pattern for female faces, but not for male faces.

Although previous research has given strong support for the evaluative congruence account as an explanation for the effects of social category cues on emotion categorization (Hugenberg, 2005; Hugenberg & Sczesny, 2006), under some circumstances stereotypes seem to influence emotion categorization (Bijlstra et al., 2010). We did not examine the sex- or attractiveness-related stereotypes that our participants held, and thus cannot exclude that stereotypes can account for the effect of attractiveness on emotion perception. It should be noted, however, that previous evidence for the effects of stereotypes on emotion categorization only emerged in single valence categorizations, tasks that required the categorization of two negative expressions, and not in the dual valence task used here (Bijlstra et al., 2010).

Finally, it is possible that the current results reflect differences between the male and female stimuli used in the current study. In the pilot study, which employed over 160 neutral faces, the most attractive female faces were rated as more attractive than the most attractive males and the most unattractive females were rated as more attractive than the most unattractive males. Even though females were rated overall as more attractive, the relative differences between the attractive and unattractive females and males was similar. The ratings of the emotional faces provided after the emotion categorization task in Experiments 3 and 4 revealed that the difference in rated attractiveness was larger for the female than the male faces and that female faces were overall rated as more attractive. It is possible that these differences could have contributed to the weaker attractiveness effect for male faces. Matching female and male faces for attractiveness would require us to select less attractive

female faces for the attractive female category and more attractive males for the unattractive male category. This would have reduced the range of attractiveness represented in the stimuli and potentially led to a smaller attractiveness effect than reported here. In doing so, we would also no longer accurately represent the natural variability in attractiveness present in our initial set of over 160 faces. We chose the more extremely rated faces to maximize our chances of finding an attractiveness effect on emotion categorization if indeed there was one. Future research should examine whether matching females and males on attractiveness alters this pattern of results.

Broader Implications

The current findings have broader implications for the field of emotion perception as they suggest that past studies reporting an influence of social categories (like sex) on emotion perception may have confounded sex with the relative attractiveness of the faces used. The larger happy face advantage observed for female faces may be due to researchers inadvertently selecting female faces that were more attractive than the male faces (though pilot ratings suggest that sex and attractiveness may be naturally confounded). The selection of stimulus material in past studies may exaggerate or underestimate differences between social categories due to systematic, but uncontrolled differences in the attractiveness of the faces representing the different categories. Our findings suggest that attractiveness ratings are important to include in the norming data when developing face databases and/or to pilot when selecting faces as stimuli for emotion recognition studies.

Past studies examining how multiple social category cues influence emotion perception (Craig & Lipp, 2018; Kang & Chasteen, 2009; Smith et al., 2017) indicate that the manner in which the different cues interact to moderate the happy face advantage is complex. The current work adds to this complexity by adding perceived face attractiveness, a cue that is situationally variable (and subject to a bad hair day), as a contributing factor. Particularly,

in situations where attractiveness is contextually relevant, like in the current task where very attractive and unattractive faces were presented intermixed, attractiveness may even outweigh the influence of social category cues such as sex on emotion perception. Further research is needed to determine the nature of the interaction between cues of attractiveness and sex in emotion perception and to assess whether the same pattern would emerge for other social category cues such as race.

The current findings also seem relevant for the broader face processing and social categorization literature. Our findings demonstrate that facial attractiveness is processed quickly and early enough to influence emotion perception and that its influence seemed to interact with that of face sex, a basic characteristic that is processed preferentially and obligatory when encountering a face (e.g., Brewer, 1988).

Conclusion

In conclusion, the current study demonstrates that attractiveness moderates emotion categorization and, more specifically, the happy face advantage, consistent with the evaluative congruence account (see Hugenberg, 2005; Hugenberg & Sczesny, 2006). As for social category cues, a happy face advantage was observed for the relatively more favorably evaluated attractive faces, but not for the unattractive faces. The moderation of emotion perception is thus not limited to invariant facial social category cues (e.g., sex and race), but extends to other more situationally variable facial cues such as attractiveness.

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