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BRIEF REPORT

Gender Moderates the Relationship Between Emotion and Perceived Gaze

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Recent evidence shows that gender modulates the morphology of facial expressions and might thus alter the meaning of those expressions. Consequently, we hypothesized that gender would moderate the relationship between facial expressions and the perception of direct gaze. In Study 1, participants viewed male and female faces exhibiting joy, anger, fear, and neutral expressions displayed with direct and averted gazes. Perceptions of direct gaze were most likely for male faces expressing anger or joy and for female faces expressing joy. Study 2 established that these results were due to facial morphology and not to gender stereotypes. Thus, the morphology of male and female faces amplifies or constrains emotional signals and accordingly alters gaze perception.

Keywords: approach-avoidance, emotion expression, face perception, gaze, gender

Eye contact can be both pleasurable and disconcerting for a perceiver, as a direct gaze signals impending interaction (e.g., Cary, 1978). Unsurprisingly, then, the attribution of direct eye gaze to other people has important consequences. People who direct eye gaze at perceivers are remembered better than others (Adams, Pauker, & Weisbuch, 2010; Hood, Macrae, Cole-Davies, & Dias, 2003; Mason, Hood, & Macrae, 2004), seem especially likable and attractive (Ewing, Rhodes, & Pellicano, 2010; Kleinke, 1986; Mason, Tatkow, & Macrae, 2005), yet also seem especially threatening when they sustain eye contact (Kleinke, 1986). The immediate visual perception of eye gaze thus has important implications for social judgment.

Here, we argue that the perception of eye gaze is biased by the facial configurations that frame gaze. In particular, facial configuration and emotions can share signals such that approach-oriented emotion expressions like anger and joy are *actually* more likely to include direct gaze than are other facial configurations (neutral, fear; Adams & Kleck, 2003, 2005). We argue that people have adapted to the co-occurrence of gaze and facial emotion such that perception of one shapes perception of the other. Accordingly, people should be more likely to perceive direct gaze on angry and joyful faces than other faces.

Existing literature on the role of facial emotion in gaze perception has emphasized the role of perceiver motives (Ewbank, Jennings, & Calder, 2009; Lobmaier, Tiddeman, & Perrett, 2008). Without discounting the influence of motivation in gaze perception, we want to emphasize that emotion−gaze coupling is a fundamental perceptual bias that is quickly evoked by facial configurations signaling particular emotions. Hence, we expected face configurations signaling approach-oriented emotions to facilitate direct-gaze perception and that this effect would be framed by (gender-related) facial appearance.

The basic perceptual relationship between emotional face configuration and eye gaze might be shaped by constraints on facial morphology. Specifically, facial expressions of emotion refer to canonical physical configurations of the face and some faces portray this canonical structure better than other faces. In particular, morphological constraints imposed on the face by gender can facilitate the expression of certain emotions (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007; Hess, Adams, & Kleck, 2004, 2005; Zebrowitz, Kikuchi, & Fellous, 2010). For instance, Becker, Kenrick, Neuberg, Blackwell, and Smith (2007) found that anger is more readily perceived on male faces and that joy is more readily perceived on female faces. In support of the role of facial features (as opposed to gender stereotypes), male and female features caused faces to appear angrier and happier, respectively, but male and female clothing did not have this effect. Additionally, in studies utilizing neural networks trained to detect specific emotions, male faces seemed to share features with both angry expressions (e.g., pronounced brow, thin lips) and joyful expressions (larger lower-half of face; Zebrowitz et al., 2010). Others have also noted that female faces share features with joyful, surprise, and

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fear expressions (full lips, rounded face; Hess, Adams, Grammer, & Kleck, 2009). These morphological constraints on facial emotion might constrain the perceptual coupling of facial emotion and eye gaze. In particular, angry and joyful male faces should appear to exhibit direct gaze more than neutral and fearful male faces. Moreover, joyful female faces should appear to exhibit direct gaze more than neutral and angry female faces, which might in turn appear to exhibit more direct gaze than fearful female faces.

In general, we expected the relationship between emotion expression and direct-gaze perception to differ for male and female faces.[1] We tested these predictions across two studies. In Study 1, participants were presented with images of angry, fearful, joyful, and neutral male and female faces and were asked to indicate gaze-direction (direct or averted). In Study 2, we used androgynous faces with gendered hair to examine whether the results of the first study were due to facial morphology or gender stereotypes.

Study 1

Participants viewed images of male and female faces expressing angry, fearful, joyful, and neutral expressions exhibiting direct and averted gazes. Participants viewed each target (four males and four females) expressing each emotion with both direct and averted gazes. Participants indicated whether they perceived each target to be looking at them.

Method

Participants

Forty-nine undergraduates (59% female) from a private university in the United States participated in exchange for partial course credit.

Experimental Stimuli

Stimuli were created from a set of standardized grayscale images, sized at 250 × 320 pixels, of eight targets, four White males and four White females, each displaying an angry, fearful, joyful, and neutral expression, creating a total set of 32 images. These images were taken from the NimStim stimulus set (Tottenham et al., 2009) and the Montreal Set of Facial Displays of Emotions (Beaupré & Hess, 2005). To select particular identities for this study, 36 targets were prerated on attractiveness (from 0 [*unattractive*] to 6 [*attractive*]) by 19 undergraduate volunteers. We selected four faces of each gender that were approximately equal in attractiveness, $M_{Male} = 2.75$, $M_{Female} = 2.61$. To confirm whether these faces were prototypically male and female, each face was cropped so that only the facial interior remained (i.e., no hair). Fifteen undergraduate volunteers categorized these images as either male or female, and only a single pilot participant had less than 100% agreement with the intended gender categories. For each of these eight identities, we selected three additional emotion expression images (joy, anger, fear) each of which could be correctly identified by at least 86% of participants in another pilot study. These 32 (uncropped) images, which made up our direct-gaze stimuli, were edited in Adobe Photoshop to create four averted-gaze images per each direct-gaze stimulus. The iris was shifted to the left to correspond to a 4° and an 8° shift of gaze (rotation of the eyeball) to the right. Similarly, the iris was shifted to the right to correspond to a 4° and an 8° shift of gaze to the left. The 8° shift was subtle, but visible, while the 4° shift was more ambiguous (see Figure 1).

Procedure Participants were seated at a computer and informed that a series of faces would be presented and that their task was to indicate whether the face was looking at them. For each of the 32 faces viewed, participants saw a direct-gaze stimulus and averted-gaze stimuli of both 4° and 8° (both in the same direction, right or left), totaling 96 trials. For each participant, half of the male faces and half of the female faces included left-averted gaze whereas the other half included right-averted gaze; this was counterbalanced across participants so that each face identity exhibited an equal number of averted-left and averted-right gazes across participants. All stimuli were randomly presented via DirectRT software. For each trial, participants viewed a fixation point, replaced by a face that stayed onscreen for 750 ms, which was followed by a prompt asking participants whether the face was looking at them.

Results

An initial 2 (Target Sex) × 4 (Emotion) × 3 (Gaze Angle) × 2 (Participant-Gender) mixed-model analysis of variance (ANOVA) with repeated-measures on the first three factors and gaze-attributions as the dependent measure revealed a significant main effect of gaze-angle, $F(2, 94) = 346.30$, $p < .001$, $\eta_p^2 = 0.88$, whereby 0°-targets evoked more direct-gaze attributions, $M = 80\%$, than 4°-targets, $M = 64\%$, $t(48) = 10.53$, $p < .001$, which in turn evoked more direct-gaze attributions than 8°-targets, $M = 28\%$, $t(48) = 20.49$, $p < .001$.[2] Additionally (as in prior research; e.g., Lobmaier et al., 2008), a main effect of participant-gender emerged, in which males reported more direct gaze, $M = 63\%$, than females, $M = 54\%$, $F(1, 47) = 4.80$, $p = .03$, $\eta_p^2 = 0.10$. Neither factor interacted with any others. To simplify analytic presentation, the main analyses were collapsed across gender and gaze-angle.

A subsequent 2 × 4 (Target Sex × Emotion) repeated-measures (ANOVA) revealed a main effect of target-gender, whereby female targets evoked more direct-gaze attributions, $M = 60\%$, than male targets, $M = 55\%$, $F(1, 48) = 6.20$, $p = .02$, $\eta_p^2 = 0.11$, and a main effect of emotion, $F(3, 144) = 22.07$, $p < .001$, $\eta_p^2 = 0.32$, with direct-gaze attributions most likely for joyful faces, $M = 65\%$, followed by angry, $M = 60\%$, neutral, $M = 55\%$, and fearful faces, $M = 50\%$, with significant differences between all emotions, all $t(48)$ values > 2.36, all p values $< .03$. Critically, the observed effects were qualified by the predicted interaction between target-gender and emotion, $F(3, 144) = 4.68$, $p = .004$, $\eta_p^2 = 0.19$ (see Figure 2).

Pairwise comparisons revealed that joyful female targets evoked more direct-gaze attributions than all other female targets (all p values $< .01$). Fearful female targets, evoked more averted-gaze

[1] A separate hypothesis would be that the relationship between gender and direct-gaze perception should depend on emotion. Although quite reasonable, this was not the hypothesis under investigation. We focused on differences between emotions within each gender and thus whether these differences varied by gender.

[2] All reported comparisons in Study 1 and 2 are Bonferroni-adjusted.

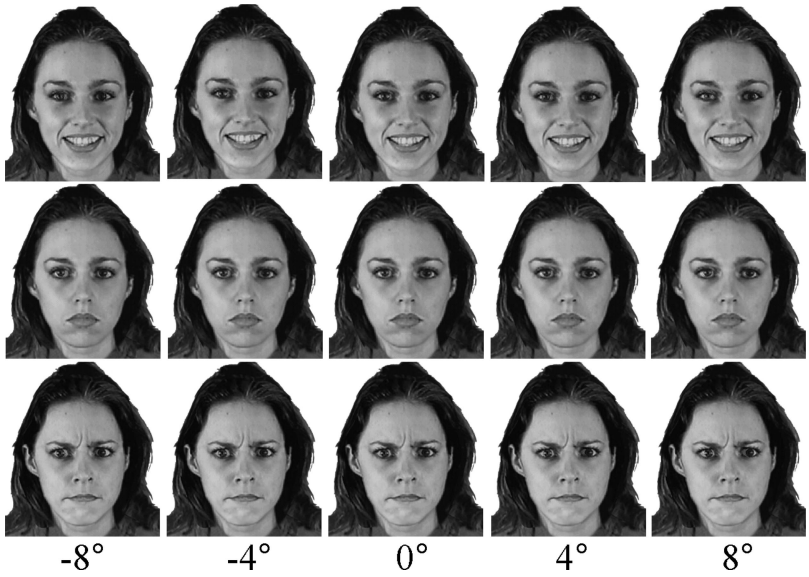

Figure 1. Example of stimuli used in Study 1 and Study 2. Depicted is one prototypical female showing joyful, neutral, and angry expressions with direct gaze (0°), and averted gazes to the left (−4° and −8°) and to the right (4° and 8°).

attributions than neutral and angry female targets (all p values $<$ .05), which did not differ from each other ($p = .84$). Among male targets, angry and joyful expressions did not differ from each other ($p = .83$), but evoked more direct-gaze attributions than neutral or fearful expressions (all p values $< .001$), and the latter expressions also did not differ from each other ($p = .41$).

Discussion

The overall pattern of findings is consistent with the shared signal framework (Adams & Kleck, 2003, 2005), whereby direct-gaze perception was heightened by the presence of emotional face configurations consistent with approach intentions. However, the perceptual coupling of gaze and emotional face configuration was offset by gender-related facial morphology resembling certain facial emotions. Among female faces, direct-gaze attributions were heightened only for joy whereas those for fear were reduced relative to neutral and angry expressions (which did not differ). These findings are consistent with the fact that female faces share perceptual features with both joyful and fearful (but not angry) expressions. Among male targets, both anger and joy amplified direct-gaze attributions relative to neutral and fearful male faces. Gender-related facial morphology thus seemed to constrain the relationship between emotional face configurations and direct-gaze perception.

An important alternative to our explanation is that gender stereotypes, and not the morphology of the faces, biased direct-gaze attributions. In particular, females are believed to be happy more than males, and males to be angry more than females (Fabes & Martin, 1991; LaFrance, Hecht, & Levy Paluck, 2003). Hence, these stereotypes may have led to expectancies of how males and females look to perceivers, and thus may have biased judgments. In Study 2, we controlled for the facial features of males and females while retaining their apparent gender. If stereotypes explain the reported effects, this manipulation should lead to the same pattern of results observed in Study 1. Moreover, controlling for male and female facial features should produce a more pure and controlled test of the relationship between facial emotion and direct-gaze attribution.

Study 2

Participants viewed images of apparent male and female faces and of prototypical male and female faces. Each facial identity expressed angry, fearful, joyful, and neutral expressions while displaying direct gaze in some images and averted gazes in other images. Participants viewed each target (three apparent-males, three apparent-females, three prototypical-males, three-prototypical females) expressing each emotion with both direct and averted gazes. Participants indicated whether they perceived each target to be looking at them.

Method

Participants. Fifty-two undergraduates (60% female) from a private university in the United States participated in exchange for partial course credit.

Experimental stimuli. The same gender-prototypical images used in Study 1 were used in Study 2, though one male and female target were excluded to accommodate the larger design.[3] As before, each target displayed an angry, fearful, joyful, and neutral expression, and either had a 0° (direct gaze), a 4°, or an 8° shift of gaze to the right or left (averted gaze). In addition to these stimuli,

[3] Study 2 retained attractiveness-matched and highly prototypical targets from both NimStim (Tottenham et al., 2009) and Montreal Set of Facial Displays of Emotions (Beaupré & Hess, 2005).

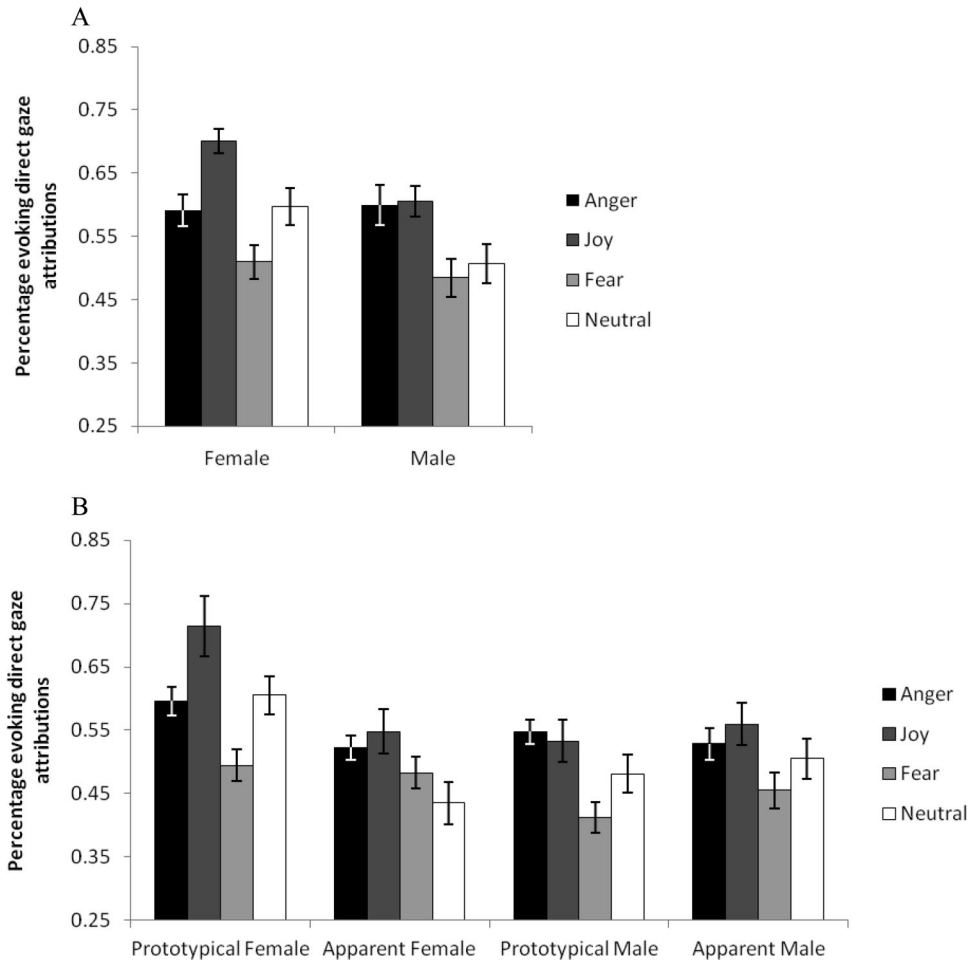

Figure 2. Mean percentage of evoked direct-gaze attributions by targets in Study 1 (A) and Study 2 (B).

another set of six targets (also 250 × 320 pixel grayscale images) were included. These consisted of six androgynous (i.e., sex-ambiguous) faces framed by either the hairstyle of a man or woman. When framed by a male hairstyle, the faces appeared to be male but when framed by a female hairstyle the faces appeared to be female. This observation was confirmed in a pilot test involving 15 undergraduate students who were paid to indicate the gender of each apparent male and female. Only a single pilot participant had less than 100% agreement with the a priori gender categories for every face; thus, the apparent males and females did appear to be males and females, respectively, despite the androgynous facial features.

Participants saw three of these faces as apparent-males (male hairstyle) and three as apparent-females (female hairstyle). Half of the participants saw a given target as an apparent-female (apparent-male) while the other half saw that same target as an apparent-male (apparent-female), thus apparent target-gender was counterbalanced across participants.[4] As with the prototypical male and female targets, these targets displayed angry, fearful, joyful, and neutral expressions, and either had a 0° (direct gaze), a 4°, or an 8° shift of gaze to the right or left (averted-gaze). As in Study 1, each participant saw each target by emotion by gaze combination, and half of the targets' averted gazes were to the left and the other half to right.

Procedure. Participants were seated at a computer and informed that a series of faces would be presented and that their task was to indicate whether the face was looking at them. For each of the 48 faces viewed (12 targets × 4 emotions), participants saw a direct-gaze stimulus and averted-gaze stimuli of both 4° and 8° (both in the same direction, either right, or left), totaling 144 trials. All stimuli were presented in a random order via DirectRT software. The direction of the averted gaze was the same across the 4° and 8° images, per target, and this direction was counterbalanced across participants, with half of all averted-gaze stimuli seen looking in each direction. On each trial participants viewed a fixation point, replaced by a face that stayed onscreen for 750 ms, which was followed by a prompt asking participants whether the face was looking at them.

[4] One of the six androgynous faces exhibited direct gaze in a manner that varied with emotion-expression. Consequently, this face was removed for purposes of analysis. However, retaining this face results in identical patterns of significance and relative mean differences.

Results

An initial 2 (Target Sex) × 4 (Emotion) × 2 (Face-Type) × 3 (Gaze-Angle) × 2 (Participant-Gender) mixed-model ANOVA, with repeated-measures on the first four factors, revealed a main effect of gaze-angle, $F(2, 100) = 339.66$, $p < .001$, $\eta_p^2 = 0.87$, with 0°-targets evoking more direct-gaze attributions, $M = 77\%$, than 4°-targets, $M = 58\%$, $t(51) = 10.38$, $p < .001$, which in turn evoked more direct-gaze attributions than 8°-targets, $M = 25\%$, $t(51) = 20.99$, $p < .001$. There was also a main effect of participant-gender, in which males reported more direct gaze, $M = 58\%$, than females, $M = 49\%$, $F(1, 50) = 5.84$, $p = .019$, $\eta_p^2 = 0.11$. Neither factor interacted with any others. To simplify analytic presentation, the main analyses are collapsed across participant-gender and gaze-angle.

A subsequent 2 × 4 × 2 (Target-Gender × Emotion × Face-Type) repeated-measures ANOVA revealed a significant main effect of target-gender, $M_{Female} = 55\%$, $M_{Male} = 50\%$, $F(1, 51) = 7.36$, $p = .01$, $\eta_p^2 = 0.13$, a marginal effect of face-type, $M_{Non\text{-}androygnous} = 54\%$, $M_{Androygnous} = 51\%$, $F(1, 51) = 3.43$, $p = .07$, and a significant main effect of emotion, $F(3, 153) = 25.11$, $p < .001$, $\eta_p^2 = 0.33$, with between-emotion differences significant, all $t(51)$ values > 2.78, all p values $< .01$, (joy > anger > neutral > fear). Two-way interactions were observed between target-gender and face-type, $F(1, 51) = 14.12$, $p < .001$, $\eta_p^2 = 0.20$, and between facial emotion and face-type, $F(3, 153) = 4.37$, $p = .006$, $\eta_p^2 = 0.08$, but both of these interactions and all main effects were qualified by the critical and predicted three-way interaction among face-type, target-gender, and emotion, $F(3, 153) = 4.50$, $p = .005$, $\eta_p^2 = 0.08$.

This three-way interaction supported our argument that gender-related facial morphology constrains the basic relationship between direct-gaze perception and approach-oriented emotional face configurations. We decomposed the three-way interaction by separately analyzing the data for the prototypically gendered faces and the androgynous faces, with pairwise comparisons within each gender. For the prototypical faces, joyful female targets evoked more attributions of direct gaze than all other female targets (all p values $< .001$) as in Study 1. Neutral and angry female targets did not differ from each other ($p > .99$), but received equivalently more direct-gaze attributions than fearful female targets (all p values $< .001$). Also as in Study 1, angry and joyful male targets did not differ from each other ($p > .99$), but received more direct-gaze attributions than neutral and fearful male targets (all p values $< .01$), which themselves did not differ ($p = .38$). The key results, however, were those for faces in which male and female facial features were held constant.

As expected, the pattern of results for the *apparent* male and female faces was quite different, suggesting an important role for facial morphology above and beyond stereotypes. Here, we observe only a significant main effect of emotion, $F(3, 153) = 7.38$, $p < .001$, $\eta_p^2 = 0.13$, in the absence of a target-gender by emotion interaction, $F(3, 153) = 1.80$, $p = .15$. Pairwise comparisons revealed that joyful and angry targets received equivalent attributions of direct gaze ($p > .99$), and both received more direct-gaze attributions than neutral and fearful targets (all p values $< .05$), which themselves did not differ ($p > .99$).

Discussion

In Study 2, prototypical male and female faces evoked a pattern of direct gaze that was similar to that observed in Study 1. The crucial advance in Study 2 was the use of faces that had sex-ambiguous facial features, but appeared as males or females when framed by male or female hairstyles, respectively. These images controlled for facial morphology or gender-related facial features. When controlling for morphology, the effects of gender disappeared. Angry and joyful expressions similarly evoked heightened direct-gaze attribution relative to neutral and fearful expressions. These findings support the hypothesis that the visual perception of direct gaze is coupled with emotional face configurations that signal approach—an effect that can be augmented or diminished due to gender-related appearance cues that resemble those expressions.

General Discussion

Prior research has found that perceivers are quite accurate in detecting gaze discrepancies as little as 1° (Cline, 1967; Jenkins & Langton, 2003). Despite this remarkable accuracy, approach-oriented emotional displays bias perception toward direct gaze. Moreover, this bias appears to be modulated by morphological features of male and female faces that resemble these emotions.

In two studies, when collapsing across target-face gender, we observed results similar to prior research (cf. Lobmaier et al., 2008): participants attributed direct gaze most to joyful faces, followed by angry, then neutral and fearful faces. One possible interpretation of these findings is that a perceptual association links facial expression with eye gaze. Specifically, people might form a perceptual association between approach-oriented facial expressions and direct eye gaze, perhaps as a consequence of repeated encounters with that coupling. We argued that gender differences in facial structure obscure this fundamental association between emotion perception and gaze perception. Indeed, when we experimentally corrected for facial gender in Study 2 (or included target gender as a factor in Study 1), results were consistent with a simple effect of approach-oriented emotion expression on gaze perception. For example, with faces that had androgynous facial morphology, we observed that happy and angry facial expressions equally evoked more direct-gaze attributions than neutral and fearful facial expressions. And in analyses with gender-prototypical faces, direct gaze was attributed more often to joyful than angry expressions but *only* for faces that share features with joy but not anger (i.e., on female faces).

A similar perceptual association might exist between *averted* gaze and avoidant-oriented emotion expressions. Relative to neutral faces, fearful faces might thus evoke less direct-gaze attributions. This is exactly what we found for prototypical female faces. Yet there were no differences in direct-gaze attribution to fear and neutral expressions among androgynous faces or among prototypically male faces. Of note, these findings are consistent with prior analyses that collapsed across target-gender (Lobmaier et al., 2008). One possible explanation is that fear does not signal avoidance to the same degree that anger and joy signal approach. In prior work, anger enhanced the ability to detect approach-oriented movement, whereas fear did not enhance detection of avoidance-oriented movement (Adams, Ambady, Macrae, & Kleck, 2006).

More generally, the influence of direct versus averted gaze on anger recognition is more consistently observed than the same influence on fear recognition (Sander et al., 2007; Hadjikhani, Hoge, Snyder, & De Gelder, 2008; Graham & LaBar, 2007). Thus, the addition of female-related facial morphology might disambiguate the avoidance signal-value of fear expressions and give rise to a diminished perception of direct gaze. The precise nature of this relationship between gender-related morphology and perceptions of fear expressions awaits future research efforts.

Facial cues provide perceivers with immediate access to the gender, feelings, and attentional focus of other people. Given the importance of sex, emotion, and theory of mind to human evolution, it is highly adaptive to have immediate access to these cues. Yet the current research demonstrates that these three critical features are linked in perception: the perception of direct eye gaze is promoted by facial features consistent with approach-oriented emotions and these emotional face features are shaped by the structure of male and female faces. Consequently, perceivers tend to think that happy males and females—but also angry males—are looking at them.

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