Reading the Look of Love: Sexually Dimorphic Cues in Opposite-Sex Faces Influence Gaze Categorization

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Gaze cues have powerful effects on person perception, influencing face recognition (Hood, Macrae, Cole-Davies, & Dias, 2003), sex categorization (Macrae, Hood, Milne, Rowe, & Mason, 2002), emotion perception (Adams & Kleck, 2003), and attraction (Jones, DeBruine, Little, Conway, & Feinberg, 2006; Mason, Tatkow, & Macrae, 2005). We demonstrate that sexually dimorphic shape cues in opposite-sex, but not own-sex, faces influence gaze categorization. Given that exaggerated sex-typical facial cues are associated with indices of long-term health (e.g., Thornhill & Gangestad, 2006), our findings suggest that gaze-processing mechanisms are sensitive to global configural cues to the quality of potential mates.

Previous research on gaze categorization has emphasized the importance of low-level features (e.g., luminance ratios; Sinha, 2000) or component information (e.g., simple geometric properties; Schwaninger, Lobmaier, & Fischer, 2005) in the eye region. By contrast, there is very little evidence that global configural cues affect gaze categorization.

From an evolutionary perspective, observers may be particularly sensitive to gaze cues in high-quality potential mates. Previous research has demonstrated that people form stable impressions of others' attractiveness very rapidly (i.e., within 100 ms of stimulus onset; Willis & Todorov, 2006) and that gaze cues influence attraction, particularly in judgments of opposite-sex faces (Conway, Jones, DeBruine, & Little, 2008; Mason et al., 2005). Given the speed with which people form stable impressions of others' attractiveness, relatively rapid categorization of gaze cues when viewing high-quality potential mates may support efficient allocation of initial mating effort by promoting allocation of more effort to high-quality potential mates who are directing their attention toward the viewer than to either low-quality potential mates in general or to high-quality potential mates who are directing their attention away from the viewer.

We investigated the effects of exaggerating or reducing sex-typical cues on participants' gaze categorization when they viewed opposite- and own-sex faces. Because inverting faces disrupts processing of configural information, but has little effect on processing of low-level features (e.g., Murray, Yong, & Rhodes, 2000), we analyzed reaction time (RT) savings for judgments of upright relative to inverted faces. We hypothesized that such analyses may reveal effects of sexual dimorphism that are not dependent on low-level features.

Method

Participants viewed male and female prototypes who demonstrated either direct or averted gaze. Sex-typical shape cues had been either exaggerated or reduced (see Fig. 1a) by 75% of the vector differences in shape between male and female prototypes, using well-established computer graphic methods (e.g., Perrett et al., 1998). On each trial, participants (9 male, 11 female; mean age = 24.30 years, SD = 2.13; all heterosexual) first fixated on a centrally presented cross. After this fixation period (500 ms or 800 ms), a face with direct, left-averted, or right-averted gaze was presented. Participants were instructed to indicate as quickly as possible whether the image was looking at them or away from them by pressing the "1" or "7" key on a number pad. The specific response-key mapping was counterbalanced across participants.

Participants completed 1,280 randomly ordered trials in which the factors of shape (exaggerated sex-typical shape cues, reduced sex-typical shape cues), sex (own sex, opposite sex), orientation (upright, inverted), direction of gaze (direct, averted), and fixation duration (500 ms, 800 ms) were fully counterbalanced. Half of the averted-gaze trials showed left-averted gaze, and half showed right-averted gaze.

We discarded 5.1% of trials because the response was incorrect or because the RT was more than 3 standard deviations

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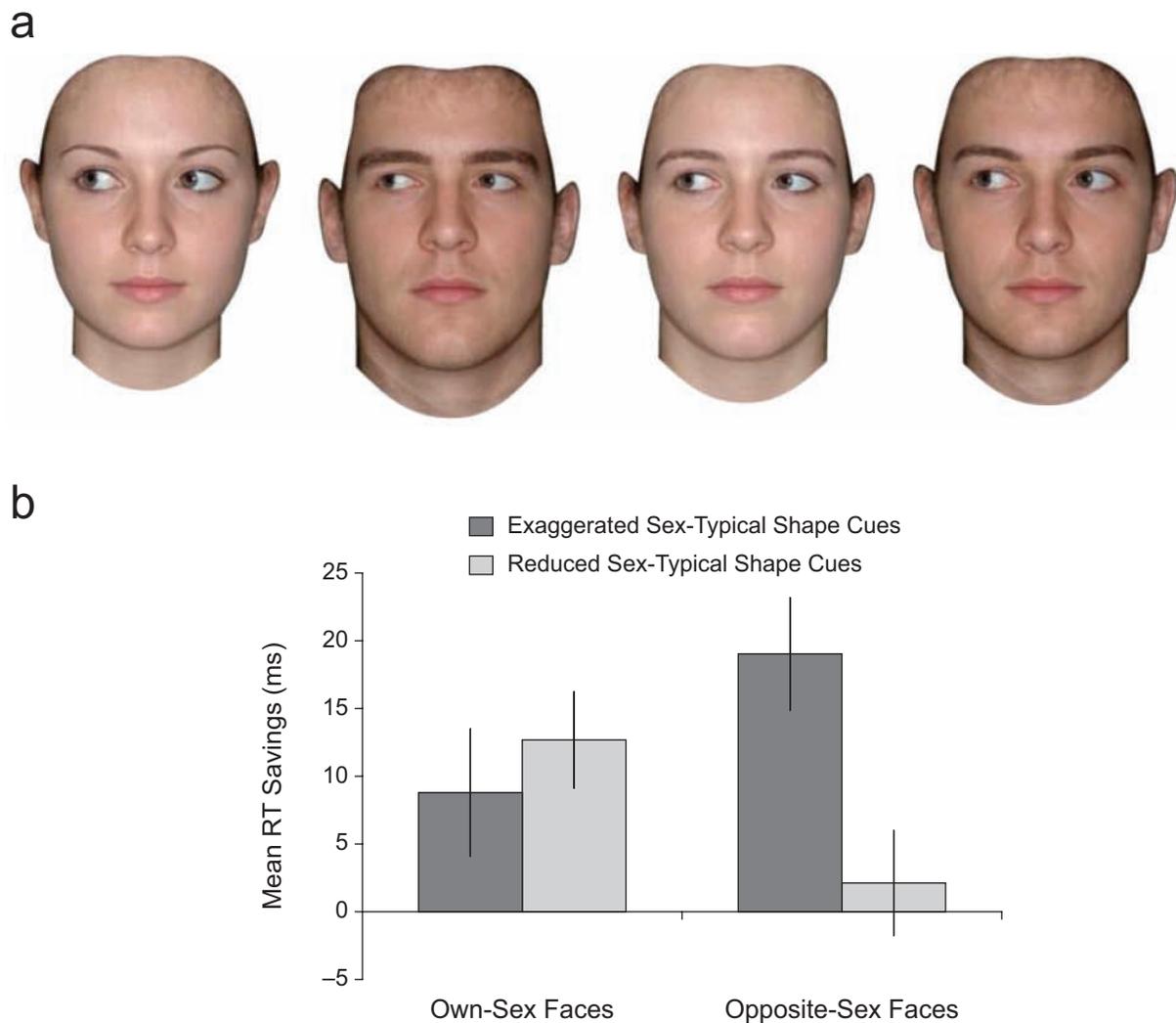
Fig. 1. Examples of the face stimuli (a) and experimental results (b). In (a), the two faces on the left illustrate exaggerated sex-typical shape cues; the two on the right illustrate reduced sex-typical shape cues. The graph (b) presents mean reaction time (RT) savings as a function of sex of face (own sex or opposite sex) and shape (sex-typical shape cues exaggerated or reduced). RT savings were calculated as the difference between RTs to upright and inverted faces. Error bars show standard errors of the mean.

from the mean for that participant. For each participant, we then calculated the mean RT savings for upright faces relative to inverted faces separately for each combination of shape, sex, and gaze direction.

Results and Discussion

We conducted a mixed-design analysis of variance with within-subjects factors of shape (exaggerated sex-typical shape, reduced sex-typical shape), sex (own sex, opposite sex), and direction of gaze (direct, averted) and between-subjects factors of participant's sex (male, female) and response mapping (1 = direct gaze, 7 = direct gaze). Results revealed the predicted interaction between sex and shape, $F(1, 16) = 5.20$, $p = .037$, $\eta_p^2 = .25$ (see Fig. 1b), which was not qualified by any higher-order interactions (all Fs < 2.60, all ps > .11, all η_p^2s < .15). RT savings were greater for faces with

exaggerated sex-typical cues than for faces with reduced sex-typical cues in the case of opposite-sex faces, $t(19) = 3.46$, $p = .003$, $\eta_p^2 = .39$, but not own-sex faces, $t(19) = -0.61$, $p = .55$, $\eta_p^2 = .02$. Separate analyses of mean RTs for upright and inverted faces revealed an interaction between sex and shape for upright faces, $F(1, 19) = 4.96$, $p = .038$, $\eta_p^2 = .21$, but not for inverted faces, $F(1, 19) = 1.82$, $p = .19$, $\eta_p^2 = .09$, showing that nongaze cues influenced RTs for upright faces primarily.

Inverting faces impairs processing of global configural information but has little effect on processing of low-level features (e.g., Murray et al., 2000). Although processing of component information in the eye region is also disrupted by inversion (Schwaninger et al., 2005), the differences in such component information between faces with exaggerated and reduced sex-typical cues were identical in our opposite- and own-sex stimuli (Perrett et al., 1998). Consequently, effects of low-level features or component information in the eye region

cannot explain the fact that we observed an effect of sexually dimorphic shape cues on RT savings in the case of opposite-sex faces only. That the effect of exaggerated sex-typical cues was specific to opposite-sex faces suggests that the effect does not reflect a general processing bias, such that gaze categorization is more difficult for relatively androgynous faces. Thus, our findings suggest that gaze categorization is sensitive to global configural cues in the faces of potential mates. Given that exaggerated sex-typical facial cues are correlated with indices of mate quality (Thornhill & Gangestad, 2006), our findings suggest that cues to the quality of potential mates influence gaze categorization.

Although some researchers have suggested that gaze processing reflects inflexible responses to simple physical properties of the eye region (e.g., Sinha, 2000), our findings demonstrate that biologically relevant global configural information can modulate gaze categorization. Moreover, our findings suggest that the importance of categorizing the gaze direction of high-quality potential mates may have been a significant selection pressure on the evolution of gaze-processing mechanisms. That sexual dimorphism modulated gaze categorization for opposite-sex, but not own-sex, faces suggests that this differential gaze categorization evolved in response to intersexual, rather than intrasexual, interactions. Although the cognitive processes that contribute to differential gaze categorization are unclear, possibilities include differential attention according to faces' biological relevance (Waitt, Gerald, Little, & Kraiselburd, 2006) and effects of social factors on the sensory coding of gaze cues (Teufel et al., 2009).

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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