Research Report

Integrating Gaze Direction and Expression in Preferences for Attractive Faces

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ABSTRACT—*Few studies have investigated how physical and social facial cues are integrated in the formation of face preferences. Here we show that expression differentially qualifies the strength of attractiveness preferences for faces with direct and averted gaze. For judgments of faces with direct gaze, attractiveness preferences were stronger for smiling faces than for faces with neutral expressions. By contrast, for judgments of faces with averted gaze, attractiveness preferences were stronger for faces with neutral expressions than for smiling faces. Because expressions can differ in meaning depending on whether they are directed toward or away from oneself, it is only by integrating gaze direction, facial expression, and physical attractiveness that one can unambiguously identify the most attractive individuals who are likely to reciprocate one's own social interest.*

Viewing attractive faces causes more activity in brain regions associated with processing rewards than viewing unattractive faces does (Aharon et al., 2001). The reward value of attractive faces is complex, however, and at least qualified by facial cues to the valence or direction of social interest (Kampe, Frith, Dolan, & Frith, 2001; O'Doherty et al., 2003). For example, although activity in the medial orbitofrontal cortex is generally more pronounced when participants view attractive faces than when they view relatively unattractive faces, the magnitude of this difference is greater when the faces are smiling than when they have neutral expressions (O'Doherty et al., 2003). Furthermore, the magnitude of the difference in activity in the ventral thalamus when participants view attractive versus unattractive faces is more pronounced for faces with direct gaze than for the same faces with averted gaze (Kampe et al., 2001). These findings suggest a process that promotes allocation of social effort to attractive individuals who appear likely to reciprocate. Although it is known that faces with direct gaze are preferred to faces with averted gaze (Mason, Tatkow, & Macrae, 2005), and that smiling faces are preferred to faces with neutral expressions (Clark & Mills, 1993), we know of no behavioral evidence that facial cues signaling social interest and prosocial regard qualify preferences for attractive faces.

O'Doherty et al. (2003) and Kampe et al. (2001) investigated effects of either gaze direction or expression on responses to attractive and unattractive faces. Given that expressions can differ in meaning depending on whether they are directed toward or away from oneself (Adams, Gordon, Baird, Ambady, & Kleck, 2003; Adams & Kleck, 2003), however, integrating the direction and valence of cues to social interest would be important for determining allocation of social effort to attractive individuals, and would therefore presumably influence the strength of preferences for attractive individuals. To test for an interaction between the effects of gaze direction and expression on preferences for attractive faces, we assessed the strength of preferences for attractive faces under four conditions: (a) neutral expression with direct gaze, (b) neutral expression with averted gaze, (c) smiling expression with direct gaze, and (d) smiling expression with averted gaze (see Fig. 1).

METHOD

Stimuli

First, to create two composite female face images with neutral expression and direct gaze, we averaged the shape, color, and

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Fig. 1. Examples of paired face images used in the experiment. Images in each pair varied only in color and texture cues associated with attractiveness. Images in the left column were manipulated to be high in attractiveness, and images in the right column were manipulated to be relatively low in attractiveness. The pairs of images shown represent each of the four conditions under which attractiveness preferences were assessed: (a) direct gaze and neutral expression, (b) averted gaze and neutral expression, (c) direct gaze and smiling, (d) averted gaze and smiling.

texture information from images of six individual women (three in each composite) using established methods (see Rowland & Perrett, 1995, and Tiddeman, Perrett, & Burt, 2001, for technical details of this method; see Jones et al., 2005; Penton-Voak et al., 1999; Perrett, May, & Yoshikawa, 1994; and Perrett et al., 1998, for examples of this method in studies of face preferences). Smiling images of the same women were averaged to create two smiling composites. For each smiling composite, we used the same three identities that were used for the corresponding composite with neutral expression. All the digital face images from which these composites were constructed were obtained under the same lighting conditions and had been aligned to a standard interpupillary distance prior to averaging.

Next, we created an attractive female prototype and an unattractive female prototype by averaging (Rowland & Perrett, 1995; Tiddeman et al., 2001) the shape, color, and texture information from the 15 female face images rated the most attractive and the 15 female faces rated the least attractive, respectively, in a sample of 60 female face images. Ratings were made by a group of 20 independent judges, and interrater agreement across the 60 images was high (Cronbach's $\alpha = .83$). All 60 of the images in this sample had neutral expressions and direct gaze and had been photographed under standardized lighting conditions. Attractive and unattractive versions of the neutral-expression and smiling composites were manufactured by applying +50% and −50%, respectively, of the differences in color and texture between the attractive and unattractive prototype faces to the neutral and smiling prototypes (see Rowland & Perrett, 1995, and Tiddeman et al., 2001, for technical details of this method).

These prototype-based methods for transforming facial appearance independently of identity have been widely used in studies of face perception (Jones et al., 2005; Penton-Voak et al., 1999; Perrett et al., 1998). Note that attractive and unattractive versions of the smiling and neutral-expression composites differed only in color and texture cues to attractiveness and were identical in two-dimensional face shape (see also Jones et al., 2005; Tiddeman et al., 2001). Only color and texture cues associated with attractiveness were manipulated in the faces to control for the possibility that aspects of two-dimensional face shape may affect the visibility of expression or gaze direction. In previous studies investigating effects of gaze direction or expression on responses to attractive and unattractive faces (Kampe et al., 2001; O'Doherty et al., 2003), attractiveness was varied between identities; in contrast, in the present experiment, physical attractiveness was manipulated in such a way that identity remained constant (see Perrett et al., 1998; Rowland & Perrett, 1995; and Tiddeman et al., 2001, for discussions about the importance of manipulating facial characteristics independently of identity in face perception research).

Versions of the composite faces with averted gaze were created by transforming the position of the irises by 100% of the differences in shape between an average of faces with direct gaze and an average of the same faces with gaze averted to the left. This method ensures that the magnitude of the change in gaze direction is identical for attractive and unattractive versions of faces and for versions with neutral and smiling expressions (see

Rowland & Perrett, 1995; Tiddeman et al., 2001). Hairstyle and clothing were masked in all face images viewed by participants.

Procedure

On each trial, two full-color faces that were identical in identity, gaze direction, and expression and differed only in color and texture cues associated with attractiveness were presented on a computer monitor. Participants (N = 269; mean age = 23.57 years, SD = 5.14; 165 female) were instructed to choose the face that they thought was more attractive in each pair. They were also instructed to indicate how much they preferred the chosen face, by choosing from the options *slightly more attractive*, *somewhat more attractive*, *more attractive*, and *much more attractive* (following Jones et al., 2005). All participants expressed preferences in all four conditions defined by crossing gaze direction and expression (see Fig. 1): (a) neutral expression with direct gaze, (b) neutral expression with averted gaze, (c) smiling expression with direct gaze, and (d) smiling expression with averted gaze. Order of presentation and side of the screen on which any particular face image was presented were fully randomized.

Initial Processing of Data

Responses were recoded on an 8-point scale with the following endpoints (following Jones et al., 2005): 0 = *responded that the face with color and texture cues associated with low attractiveness was much more attractive*, 7 = *responded that the face with color and texture cues associated with high attractiveness was much more attractive*. For each participant, the average strength of preference for the attractive faces was calculated for each of the four conditions.

RESULTS

In all four conditions, preferences for attractive faces were stronger than chance (one-sample t tests comparing mean preference strengths against chance: all ps $< .001$), indicating that our manipulation of attractive and unattractive color and texture cues influenced face preferences in the predicted way.

To analyze further the strength of preferences for attractive faces, we conducted a repeated measures analysis of variance with within-subjects factors of facial expression (neutral, smiling) and direction of gaze (direct, averted) and the between-subjects factor of sex of participant (male, female). Women tended to have stronger preferences generally for the attractive versions of faces than men did, $F(1, 267) = 3.561$, $p = .06$, $p_{rep} = .862$, $\eta_p^2 = .013$, and attractiveness preferences tended to be stronger in the direct-gaze conditions than the averted-gaze conditions, $F(1, 267) = 2.933$, $p = .088$, $p_{rep} = .826$, $\eta_p^2 = .011$. The repeated measures analysis of variance also revealed an interaction between gaze direction and expression, $F(1, 267) = 9.461$, $p = .002$, $p_{rep} = .984$, $\eta_p^2 = .034$ (Fig. 2). There were no other effects that approached significance (all Fs < 1).

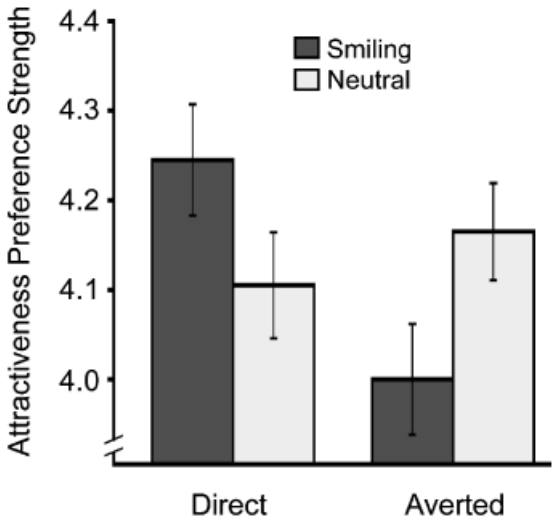

Fig. 2. Mean attractiveness preference strength as a function of gaze direction and expression. Error bars indicate standard error of the means.

Paired-samples t tests were carried out to interpret the interaction between gaze direction and expression. In the direct-gaze conditions, preferences for attractive faces were stronger when the faces were smiling than when the faces had neutral expressions, $t(268) = 2.272$, $p = .024$, $p_{rep} = .922$, $\eta_p^2 = .019$, but this pattern was reversed in the averted-gaze conditions (i.e., preferences for attractiveness were stronger for neutral than smiling faces), $t(268) = -2.397$, $p = .017$, $p_{rep} = .937$, $\eta_p^2 = .021$. In the smiling conditions, preferences for attractive faces were stronger when the faces were shown with direct gaze than when they were shown with averted gaze, $t(268) = 3.608$, $p < .001$, $p_{rep} > .99$, $\eta_p^2 = .046$, but there was no effect of gaze direction on strength of preferences for attractive faces in the neutral-expression conditions, $t(268) = -0.909$, $p = .364$, $p_{rep} = .591$, $\eta_p^2 = .003$.

DISCUSSION

Expression differentially qualified the strength of attractiveness preferences for faces with direct and averted gaze. For judgments of faces with direct gaze, attractiveness preferences were stronger for smiling faces than for faces with neutral expressions. By contrast, for judgments of faces with averted gaze, attractiveness preferences were stronger for faces with neutral expressions than for smiling faces. Additionally, gaze direction qualified the strength of attractiveness preferences for smiling faces, but not faces with neutral expressions: Attractiveness preferences were stronger for faces with direct gaze only if the faces were smiling. Collectively, our findings indicate that attraction is influenced not only by physical beauty, but also by the extent to which a person appears open to engaging the observer. Our findings are the first behavioral evidence we know of that gaze direction and expression qualify the strength of preferences for attractive faces. They complement and extend findings from

brain-imaging studies demonstrating that the reward value of attractive faces is modified by gaze direction and expression (Kampe et al., 2001; O'Doherty et al., 2003).

Although previous studies have demonstrated the separate effects of gaze direction and expression on responses to attractive faces (Kampe et al., 2001; O'Doherty et al., 2003), and general preferences for facial cues to social interest over cues to disinterest (Clark & Mills, 1993; Mason et al., 2005), our findings highlight the complex and integrative processes involved in person perception. The human perceptual system combines information regarding other individuals' physical attractiveness, the direction of their attention, and cues to their emotional state and presumed intentions when forming face preferences. Integrating this information allows the most attractive individuals who are likely to reciprocate one's own social effort to be identified. Identifying such people, in turn, helps to maximize the potential benefits of one's choices about whom to attempt to engage in social interaction, and potentially in partnership.

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