Integrating gaze direction and expression in preferences for attractive faces

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Word count: 2,567 words (including front sheet, abstract, main text, references and figure captions)

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Abstract

Few studies have investigated how different facial cues, physical and social, are integrated when forming face preferences. Here we show that effects of gaze direction and expression on preferences for attractive faces interact to determine face preferences. For example, 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 faces with neutral expressions. By contrast, for judgments of faces with averted gaze, attractiveness preferences were stronger for faces with neutral expressions than smiling faces. Because expressions can differ in meaning when directed at you, rather than away from you, it is only by integrating gaze direction, facial expression and physical attractiveness that we can unambiguously identify the most attractive individuals to engage with who are most likely to reciprocate our own social interest.

Introduction

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 et al., 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 the faces have neutral expressions (O'Doherty et al., 2003). Furthermore, the magnitude of the difference in activity in the ventral thalamus when viewing attractive and 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. While it is known that faces with direct gaze are preferred to faces with averted gaze (Mason et al., 2005), and that smiling faces are preferred to faces with neutral expressions (Clark and Mills, 1993), we know of no behavioral evidence that facial cues signalling social interest and pro-social regard qualify preferences for attractive faces.

Intriguingly, 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. Since expressions can differ in meaning when directed at you, rather than away from you (Adams et al., 2003; Adams and 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, here we assessed the strength of preferences for attractive faces under 4 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 Figure1).

Methods

Stimuli manufacture

First, two composite female face images with neutral expression and direct gaze were manufactured by averaging the shape, color and texture information from images of 6 individual women (3 in each composite) using established methods (see Tiddeman et al., 2001 and Rowland and Perrett, 1996 for technical details of this method; see Perrett et al., 1998, Penton-Voak et al., 1999, Jones et al., 2005for examples of this method in studies of face preferences). Smiling images of the same 6 women were used to manufacture two smiling composites (3 faces each) with direct gaze. The same 3 identities were used in each composite as for the neutral expression composites. All digital face images used to manufacture these composites were obtained under the same lighting conditions and had been aligned to a standard interpupillary distance prior to manufacturing composite images.

Next, an attractive female prototype was manufactured by averaging (Tiddeman et al., 2001; Rowland and Perrett, 1996) the shape, color and texture information from the 15 female face images rated the most attractive in a sample of 60female face images by a group of 20 independent judges (inter-rater agreement for attractiveness ratings of all 60 images: Cronbach's alpha = .83). An unattractive female prototype was manufactured by averaging the shape, color and texture information from the 15 female face images rated the least attractive in the same sample of 60 female face images by the same independent judges. All of the 60 female face images rated for attractiveness had neutral expressions and direct gaze and had been photographed under standardized lighting conditions. Attractive and unattractive versions of the neutral expression and smiling composite faces were manufactured by applying ±50% of the differences in color and texture between the attractive and unattractive prototype faces to the neutral and smiling prototypes (see Tiddeman et al., 2001; Rowland and Perrett, 1996 for technical details of this method). These prototype-based methods for transforming facial appearance independent of identity have been widely used in studies of face perception (Perrett et al., 1998; Penton-Voak et al., 1999; Jones et al., 2005). 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 terms of 2D face shape (see also Tiddeman et al., 2001; Jones et al., 2005). Only color and texture cues associated with attractiveness were manipulated in the faces to control for the possibility that aspects of 2D face shape may affect the visibility of expression or gaze direction. By contrast with previous studies that have investigated effects of gaze direction or expression on responses that differentiated attractive and unattractive faces O'Doherty et al., 2003; Kampe et al., 2001), in which attractiveness was varied between identities, in the present experiment physical attractiveness was manipulated so that identity remained constant (see Tiddeman et al., 2001,Rowland and Perrett, 1996, and Perrett et al., 1998 for discussions about the importance of manipulating facial characteristics independent of identity in face perception research).

Versions of the composite faces with averted gaze were manufactured by transforming the irises relative to an average of faces with direct gaze and an average of faces with gaze averted to the left. This ensured that the magnitude of the change in gaze direction is identical when applied to attractive and unattractive versions of faces and versions with neutral and smiling expressions (see Tiddeman et al., 2001; Rowland and Perrett, 1996). Hairstyle and clothing were masked in all face images viewed by participants.

Procedure

Stimulus conditions reflected all 4 possible combinations of gaze direction and expression (see Figure 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. For each condition, pairs of faces that were identical in terms of identity, gaze direction and expression and differed only in color and texture cues associated with attractiveness were presented onscreen. Participants (N = 269, age: M = 23.57, SD = 5.14 years, 165 female) were instructed to choose the face in each pair they thought was more attractive and were also instructed to indicate by 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 for all 4 conditions. Order of presentation and side of the screen on which any particular face image was presented was fully randomized.

Initial processing of data

Responses on the face preference test were recoded on an 8-point scale with these 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 their preference for the attractive face in each pair was calculated for the smiling with direct gaze condition, smiling with averted gaze condition, neutral with direct gaze condition and neutral with averted gaze condition.

Results

In all 4 conditions, preferences for attractive faces were stronger than chance (one sample t-tests comparing mean preference strengths against chance: all $p < .001$), indicating our manipulation of attractive and unattractive color and texture cues influenced face preferences in the predicted way.

Further analysis of the strength of preferences for attractive faces using repeated measures ANOVA [within subject factors: facial expression (neutral, smiling), direction of gaze (direct, averted); between subject factor: sex of participant (male, female)], revealed an interaction between gaze direction and expression ($F=9.461$, $df=1,267$, $p=.002$, p-rep=.984, Partial Eta Squared=.034, Figure 2). Women tended to have stronger preferences generally for the attractive versions of faces ($F=3.561$, $df=1,267$, $p=.060$, p-rep=.862, Partial Eta Squared=.013) and attractiveness preferences tended to be stronger in the direct gaze conditions than the averted gaze conditions ($F=2.933$, $df=1,267$, $p=.088$, p-rep=.826, Partial Eta Squared=.011). There were no other effects that approached significance (all $F<0.75$, all $p>.38$). Preferences for attractive faces were stronger when the faces were smiling than when the faces were shown with neutral expressions in the direct gaze conditions (paired samples t-test: $t=2.272$, $df=268$, $p=.024$, prep=.922, Partial Eta Squared=.019), but this pattern was reversed in the averted gaze conditions (i.e. preferences for attractiveness were stronger for neutral than smiling faces; $t=-2.397$, $df=268$, $p=.017$, p-rep=.937, Partial Eta

Squared=.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 ($t=3.608$, $df=268$, $p<.001$, p-rep>.990, Partial Eta Squared=.046), but there was no effect of gaze direction on strength of preferences for attractive faces in the neutral expression conditions ($t=-0.909$, $df=268$, $p=.364$, p-rep=.591, Partial Eta Squared=.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 faces with neutral expressions. By contrast, for judgments of faces with averted gaze, attractiveness preferences were stronger for faces with neutral expressions than smiling faces. Additionally, gaze direction qualified the strength of attractiveness preferences for smiling faces but not for 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 you. Our findings are the first behavioral evidence we know of that gaze direction and expression qualify the strength of preferences for attractive faces, complementing and extending findings from brain imaging studies demonstrating that the reward value of attractive faces is modified by gaze direction and expression (O'Doherty et al., 2003; Kampe et al., 2002).

While previous studies have demonstrated the separate effects of gaze direction or expression on responses to attractive faces (Kampe et al., 2001; O'Doherty et al., 2003), and general preferences for facial cues to social interest (Mason et al., 2005; Clark and Mills, 1993), our findings highlight the complex and integrative processes involved in person perception. Our perceptual system combines information regarding others' 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 our own social effort to be identified. In turn, this will help to maximize the potential benefits of our own choices about whom we attempt to engage in social interaction, and potentially in partnership.

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Figure captions

Figure 1. Examples of paired face images used in our experiment. Images in each pair varied only in colour 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 4 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.

Figure 2. The interaction between the effects of gaze direction and expression on the strength of preferences for attractive faces. Bars show mean attractiveness preference strength and standard error. Preferences for attractiveness were stronger when the faces were smiling than when the faces were shown with neutral expressions in the direct gaze condition, but attractiveness preferences were stronger for neutral than smiling faces in the averted gaze condition. Preferences for attractiveness were also stronger when the faces were shown with direct gaze than averted gaze in the smiling conditions, but not in the neutral expression conditions.

Figure 1.

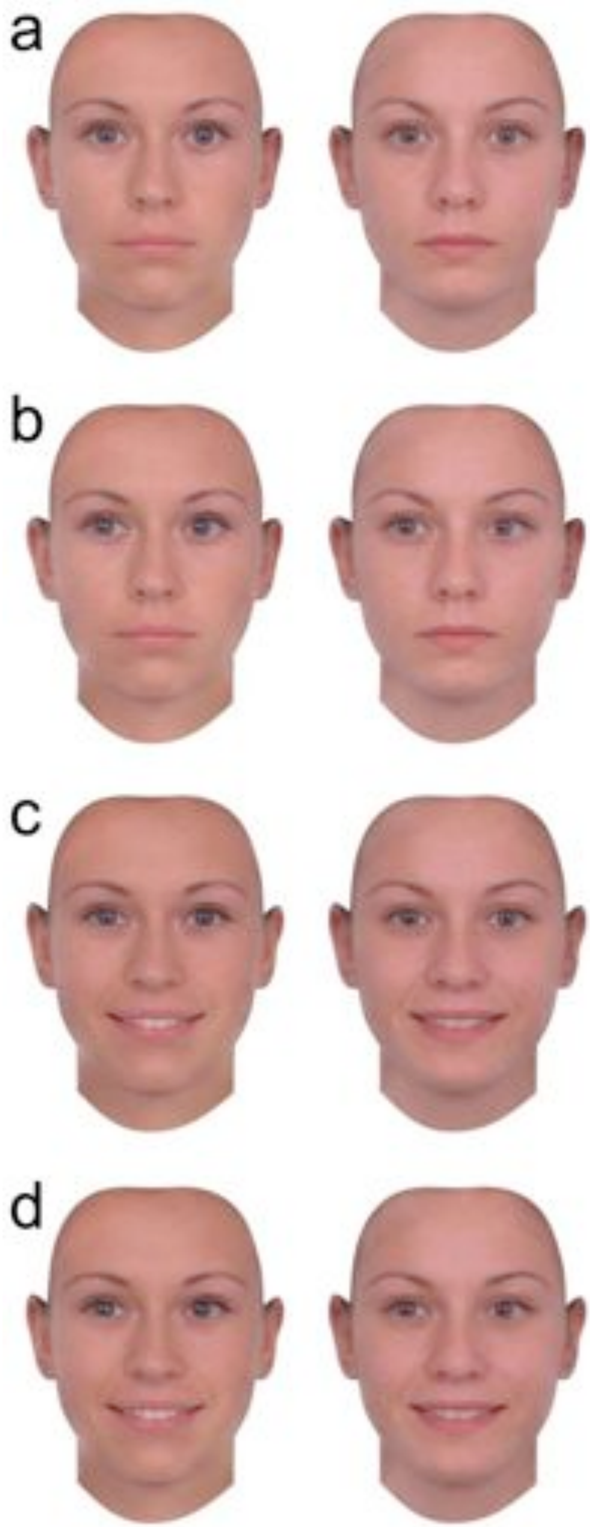
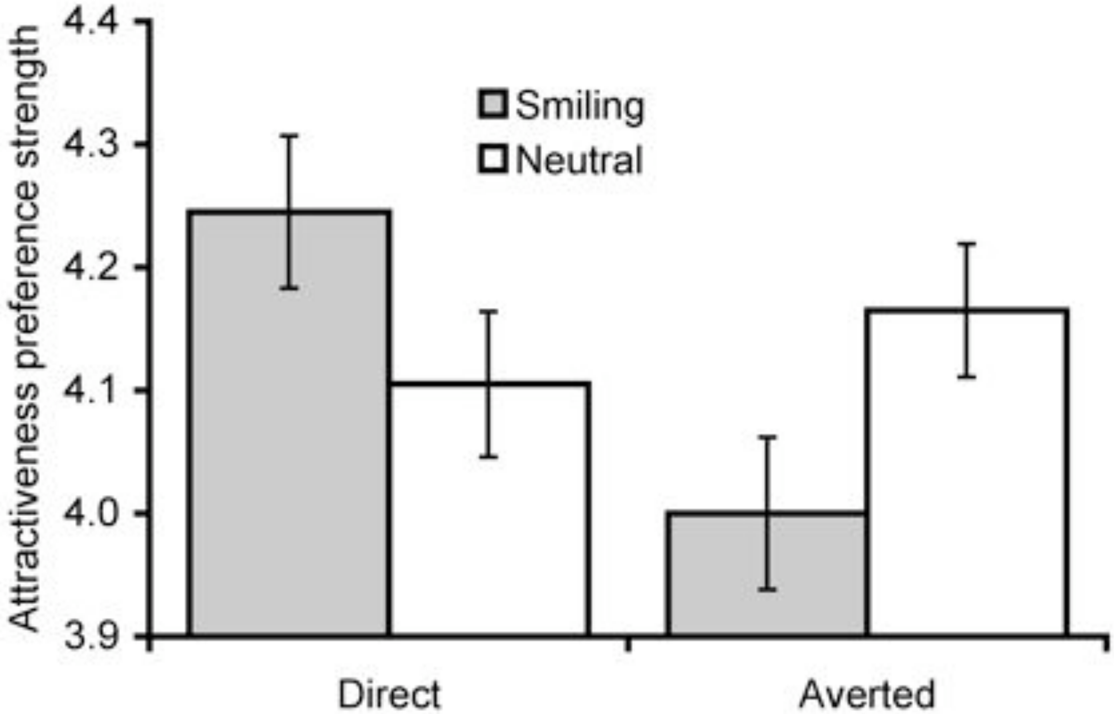


Figure 2.



Attractiveness preference strength
4.4
4.3
4.2
4.1
4.0
3.9
Smiling
Neutral
Direct
Averted