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Orienting to face expression during encoding improves men's recognition of own gender faces

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ABSTRACT

It is unclear why women have superior episodic memory of faces, but the benefit may be partially the result of women engaging in superior processing of facial expressions. Therefore, we hypothesized that orienting instructions to attend to facial expression at encoding would significantly improve men's memory of faces and possibly reduce gender differences. We directed 203 college students (122 women) to study 120 faces under instructions to orient to either the person's gender or their emotional expression. They later took a recognition test of these faces by either judging whether they had previously studied the same person or that person with the exact same expression; the latter test evaluated recollection of specific facial details. Orienting to facial expressions during encoding significantly improved men's recognition of own-gender faces and eliminated the advantage that women had for male faces under gender orienting instructions. Although gender differences in spontaneous strategy use when orienting to faces cannot fully account for gender differences in face recognition, orienting men to facial expression during encoding is one way to significantly improve their episodic memory for male faces.

1. Introduction

Successful human social interaction depends on accurate face recognition. For instance, faces serve as retrieval cues for qualities of an individual that are relevant to social exchange (Nachson, 1995; Riggio, 1992). However, there are individual differences in face recognition speed and accuracy (Guillem & Mograss, 2005; Hall, Hutton, & Morgan, 2010; Herlitz & Rehnman, 2008; Herlitz & Yonker, 2002; Hofmann, Suvak, & Litz, 2006; Lewin & Herlitz, 2002; Lewin, Wolgers, & Herlitz, 2001; McBain, Norton, & Chen, 2009; Rehnman & Herlitz, 2007; Vuilleumier, George, Lister, Armony, & Driver, 2005), some of which have relatively serious consequences. Impaired episodic memory of faces is seen in disorders such as schizophrenia (Calkins, Gur, Ragland, & Gur, 2005; Silver et al., 2006), autism (Weigelt, Koldewyn, & Kanwisher, 2012), and prosopagnosia (Kress & Daum, 2003), and is part of a general episodic memory disorder in Alzheimer's disease (Hawley & Cherry, 2004; Plaza, López-Crespo, Antúnez, Fuentes, & Estévez, 2012). Understanding the factors that lead to superior face recognition could support the development of training and treatments to improve face recognition in these and other populations. It could even inform the development of software that could emulate human facial recognition, which has multiple applications (e.g., Hu, Klare, Bonnen, & Jain, 2013; Konen, 1996).

One way to understand the factors that lead to superior facial recognition is to examine gender differences therein, which are commonly found (Bengner et al., 2006; Guillem & Mograss, 2005; Herlitz & Rehnman, 2008; Lewin & Herlitz, 2002; Megreya, Bindemann, & Havard, 2011; Rehnman & Herlitz, 2007; Yonker, Eriksson, Nilsson, & Herlitz, 2003). A recent meta-analysis by Herlitz and Lovén (2013) reported that women are better at recognizing faces (Hedges' $g = .36$), with the advantage seen primarily for female faces. Several explanations have been offered for women's advantage, such as their superior face perception (Megreya et al., 2011), greater self-reported social engagement (Sommer, Hildebrandt, Kunina-Habenicht, Schacht, & Wilhelm, 2013), increased encoding specificity of faces (Guillem & Mograss, 2005; Lovén, Herlitz, & Rehnman, 2011), and superior recognition or detection of facial expression (Hall et al., 2010). Women's face recognition may also benefit from better use of increased encoding time (McKelvie, 1981), higher circulating estradiol (Yonker et al., 2003) and own-gender faces (Herlitz & Lovén, 2013; Lewin & Herlitz, 2002; Lovén, Svärd, Ebner, Herlitz, & Fischer, 2014; Lovén et al., 2011; McKelvie, 1981; Megreya et al., 2011; Wolff, Kemter, Schweinberger, & Wiese, 2014; Wright & Sladden, 2003). Although a complicated interplay of biological and social factors likely accounts for gender differences in face recognition, much of the existing research suggests that women excel at face

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recognition because they process faces differently (e.g., Everhart, Shucard, Quatrin, & Shucard, 2001; Lovén et al., 2011; Lovén et al., 2014; Megreya et al., 2011).

Herlitz and Lovén (2013) suggest that women's advantage in face recognition may arise because they allocate attention during encoding differently from men. The authors showed that women's advantage is primarily for female faces when a mix of female and male faces is shown, but that women also outperform men when only male faces are shown ($g = .22$). Women, they suggested, may focus more attentional resources on remembering female faces when presented with a mix of male and female faces, but when only male faces are to be remembered they can outperform men because all attentional resources can be devoted to male faces. If this account is correct, then we can ask to what, specifically, women allocate more attentional resources that allows them to better recognize faces.

One possibility is that women allocate more attentional resources to the emotional expressions of faces. Women excel at the recognition of emotional expression in faces (Hall et al., 2010), performing more accurately (Hampson, van Anders, & Mullin, 2006; Sasson et al., 2010; Thayer & Johnsen, 2000) and efficiently (Hampson et al., 2006; Vassallo, Cooper, & Douglas, 2009) than men, especially with subtle variations in facial expressions (Hoffmann, Kessler, Eppel, Rukavina, & Traue, 2010; Montagne, Kessels, Frigerio, de Haan, & Perrett, 2005). Furthermore, processing emotional expression involves particular attention to eyes (Beaudry, Roy-Charland, Perron, Cormier, & Tapp, 2014; Gupta & Srinivasan, 2009; Hall et al., 2010), and women are more likely to focus on these features (Everhart et al., 2001; Hall et al., 2010), paying more attention to eyes than males as early as infancy (Ashear & Snortum, 1971; R. Exline, Gray, & Schuette, 1965; R. V. Exline, 1963; Hall et al., 2010; Hittelman & Dickes, 1979; Leeb & Rejskind, 2004; Levine & Sutton-Smith, 1973; Sæther, Van Belle, Laeng, Brennen, & Øvervoll, 2009). There are gender differences in face recognition even for neutral faces, so female superiority in this domain is not dependent upon the presence of emotional expressions in faces (see Herlitz & Lovén, 2013; e.g., McBain et al., 2009).

The present study tested the hypothesis that gender differences in attention to facial expression explain at least some of the gender difference in face recognition. Specifically, we hypothesized that women's superior face recognition memory is due to a higher likelihood of *spontaneously* using the strategy of attending to emotional expression. Women mimic more facial expressions (Dimberg & Lundquist, 1990), show more emotional contagions (Doherty, Orimoto, Singelis, Hatfield, & Hebb, 1995), show greater affective priming to happy faces (Donges, Kersting, & Suslow, 2012), and are faster in labeling a happy expression (Hampson et al., 2006; Vassallo et al., 2009). The specific expression displayed (e.g. happy or neutral) may have a small (but significant) effect on recognition accuracy (Patel, Girard, & Green, 2012; Wang, 2013) but greater attention to any facial expression may support subsequent face recognition accuracy.

To test our hypothesis, we instructed men and women to encode faces in one of two ways under incidental learning conditions (participants were unaware of the memory test that followed). Participants were briefly shown a face and asked to either report the gender of the face (male or female) or its emotional valence (happy or neutral). The underlying premise was that if women are more likely to use the strategy of attending to emotional expression when viewing faces, then guiding men to orient to facial expressions would improve their encoding of facial features, thereby differentially benefiting males' face recognition and reducing the size of the gender difference. Orienting to a face's gender can result in more global or holistic facial processing (Tanaka & Farah, 1993), which should not affect gender differences in facial recognition. Orienting to a face's emotional expression, however, requires more local feature processing (Martin, Slessor, Allen, Phillips, & Darling, 2012), which women may do more effectively than men. Gender differences might not be reduced by our manipulation if both women and men experience additional benefit from explicit instruction to orient to expression during encoding, but expression orienting instructions were at least expected to significantly improve men's facial recognition accuracy.

We also expected to replicate women's own-gender bias in face recognition, originally shown by McKelvie (1981) and recently reviewed by Herlitz and Lovén (2013), but were curious whether our manipulation would affect men's relative recognition rates for male and female faces. Social-cognitive accounts explain the own-gender effect in terms of increased individuation when encoding faces from one's ingroup (Hugenberg, Young, Bernstein, & Sacco, 2010). Therefore, an open question was whether orienting men to expression might not only improve their face recognition overall but provide a larger boost in accuracy for male faces. One study previously showed that men recognize male faces better than female faces (Wright & Sladden, 2003), so if expression orienting boosts face recognition it may do so for own-gender faces more than other-gender faces.

We also hypothesized that women outperform men in face recognition because they have access at test to more encoded detail of the faces. In order to evaluate this possibility we used a test of recognition memory that focuses on participants' discrimination of generic person-recognition (I've seen that person before) from recognition of the person with the same prior facial expression (I've seen that facial expression on that person before). Adapting work by Koutstaal (2003, 2006), our recognition test varied in whether participants were to judge if the face was simply of the same person they had seen at study (Same Person) or of the same person with the exact same expression they had seen at study (Exact Face; see the Method section for details). When the discrimination required determining whether the same person with the exact same expression was seen at study, we assumed that greater recollection of specific facial feature information was required. Thus, we hypothesized that if women have higher recollection of specific facial features at test, gender differences would be largest when memory for the exact facial expression was required after gender orienting instructions at encoding (which can be done on the basis of more global features). We expected gender differences to be reduced if instructions during encoding required men to evaluate the emotion expressed by the face.

2. Method

2.1. Design and participants

The study was a 2 (participant gender: male, female) × 2 (encoding task: gender orienting, expression orienting) × 2 (recognition task: same person, exact face) between-subjects design. The sample consisted of 203 students (122 women), ages 18–25, who volunteered to participate for extra credit in a psychology class. Students under 18 years of age or who reported having received an Asperger's Syndrome diagnosis were excluded from the study.

2.2. Materials and procedure

All stimuli were presented on Samsung LCD 15-inch displays controlled by Dell 4660 computers with 1024 × 768 screen resolution. Instructions were presented in black, 18 pt., centered, Courier New font on a white background. Face stimuli (240) were drawn from the Center for Vital Longevity Face Database (Minear & Park, 2004) and presented in color at 100% of screen size. The faces in this database are diverse in ethnicity and gender. There were 240 pictures of faces used in the study. Half of the selected faces were male and half showed either a happy or neutral expression, distributed equally across gender. The database contained an insufficient number of available faces with negative emotional expressions to afford contrasting happy versus negative expressions. Half of the faces (120) were presented to each participant at both encoding and test. At test, each person also saw 60 completely