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Understanding gender bias in face recognition: Effects of divided attention at encoding

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A B S T R A C T

Prior research has demonstrated a female own-gender bias in face recognition, with females better at recognizing female faces than male faces. We explored the basis for this effect by examining the effect of divided attention during encoding on females' and males' recognition of female and male faces. For female participants, divided attention impaired recognition performance for female faces to a greater extent than male faces in a face recognition paradigm (Study 1; $N = 113$) and an eyewitness identification paradigm (Study 2; $N = 502$). Analysis of remember–know judgments (Study 2) indicated that divided attention at encoding selectively reduced female participants' recollection of female faces at test. For male participants, divided attention selectively reduced recognition performance (and recollection) for male stimuli in Study 2, but had similar effects on recognition of male and female faces in Study 1. Overall, the results suggest that attention at encoding contributes to the female own-gender bias by facilitating the later recollection of female faces.

1. Introduction

A substantial literature demonstrates own group biases in recognition memory tasks. For example, people are better at recognizing faces of their own race versus another race (i.e., the own-race bias; e.g., Hugenberg, Young, Bernstein, & Sacco, 2010; Malpass & Kravitz, 1969; Meissner & Brigham, 2001; Sporer, 2001), and their own age versus older or younger faces (i.e., the own-age bias; e.g., Anastasi & Rhodes, 2005; Perfect & Harris, 2003; Wright & Stroud, 2002). One variation of own group bias that has received relatively little attention is the *own-gender bias*. Prior research points to an asymmetry in the own-gender bias. Although female participants have been consistently found to be better at recognizing female faces than male faces (e.g., Cross, Cross, & Daly, 1971; Lewin & Herlitz, 2002; Rehnman & Herlitz, 2006, 2007; Wright & Sladden, 2003), the results for male participants vary. Two studies have found that male participants better recognized male faces than female faces (Ellis, Shepherd, & Bruce, 1973; Wright & Sladden, 2003), but other studies have found that males recognized female faces better than male faces (Feinman & Entwisle, 1976; McKelvie, Standing, St. Jean, & Law, 1993; Rehnman & Herlitz, 2007), or that males recognized male and female faces equally well (Cross et al., 1971; Going & Read, 1974; Lewin & Herlitz, 2002; Rehnman & Herlitz, 2006).

1.1. The role of attention in the female own-gender bias

We investigated one factor that might contribute to these patterns of own-gender bias in face recognition: attention during encoding. Most theoretical models of own-group biases in face recognition focus on processes that occur during encoding, rather than storage or retrieval (for reviews, see Hugenberg et al., 2010; Meissner & Brigham, 2001; Sporer, 2001). Further, there is empirical evidence that own-group biases rely on encoding factors (e.g., Goldinger, He, & Papesh, 2009; Van Bavel, Packer, & Cunningham, 2008; Young, Bernstein, & Hugenberg, 2010). One idea central to several models (Hugenberg et al., 2010; Levin, 2000; Rodin, 1987; Sporer, 2001) is that people selectively attend to own-group faces at encoding. Although this idea has been discussed most often in the context of the own-race bias, some researchers have suggested that the female own-gender bias may arise because females pay more attention to female faces than to male faces (Cross et al., 1971; Ellis et al., 1973; Herlitz & Rehnman, 2008; McKelvie, 1981; Rehnman & Herlitz, 2006, 2007).

Why might females but not males attend more to faces of their own gender? Two types of explanations have been offered. The first is a developmental one, and rests on the notion that females and

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males have different length histories of selectively attending to own-gender faces (Herlitz & Rehnman, 2008). Female and male infants show a preference for looking at female faces over male faces (Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002), perhaps because infants experience more social interaction with female adults than male adults (Ramsey, Langlois, & Marti, 2005). As a result, female and male infants are better at recognizing female faces than male faces (Quinn et al., 2002). Thus, if adult males do have an attentional preference for male faces, any advantage this affords for recognition may be undermined by an early history of selective attention for female faces. The second type of explanation is social, and holds that women are more attentive to female than male faces because they are more socially interested in other women than in men (Rehnman & Herlitz, 2007). This might reflect the fact that relationships between females tend to be of longer duration (Parker & de Vries, 1993) and involve a greater degree of intimacy (Davidson & Duberman, 1982) than relationships between males (for a review, see Sherman, De Vries, & Lansford, 2000). Other researchers have suggested that females may be more interested in female faces due to the high value placed by society on female attractiveness (Cross et al., 1971; Ellis et al., 1973). Note that, like the aforementioned developmental account, these social explanations do not suggest that males attend more to male faces than female faces.

1.2. Overview of studies

The attentional explanation of the female own-gender bias provides the basis for specific predictions about the effects of divided attention on female and male participants' recognition of female and male faces. If females selectively attend to female faces during encoding, a divided attention manipulation at encoding should impair females' later recognition to a greater extent for female faces than male faces. As a result, the magnitude of the female own-gender bias will be reduced. In contrast, assuming that males do not selectively attend to male faces during encoding, the effects of a divided attention manipulation on males' face recognition performance should be similar for male and female faces.

We tested these predictions in two studies involving different types of recognition decisions. In Study 1, female and male participants completed simple face recognition tests for female and male faces that had been studied under full or divided attention conditions. In Study 2, we re-analyzed data from an eyewitness memory experiment in which female and male participants attempted to identify a female and male culprit who had been viewed under full or divided attention conditions (Palmer, Brewer, McKinnon, & Weber, 2010). After reporting the results of these studies, we outline a potential mechanism for the effects of attention on females' recognition memory performance (based on dual process theories of recognition memory; Yonelinas, 2002) and explore the viability of this mechanism by re-analyzing additional data from Palmer, Brewer, McKinnon, et al. (2010). We then compare our results and methodology with those of recent research in this area (Lovén, Herlitz, & Rehnman, 2011).

2. Study 1: The own-gender bias in face recognition

2.1. Outline

In Study 1, male and female participants completed a face recognition experiment in which attention at encoding (full vs. divided) and gender of target face (female vs. male) were manipulated within-subjects. Male and female participants completed two blocks of face recognition trials. In one block, faces were studied under full attention conditions; in the other, participants performed a secondary tone-monitoring task (Parkin, Reid, & Russo, 1990) during study.

2.2. Method

2.2.1. Participants

Participants were 113 undergraduate students (68 females; aged 17 to 39 years, $M = 19.70$, $SD = 3.00$) with normal or corrected-to-normal vision who were paid an honorarium for their time. Four additional participants were excluded for failing to follow experimental instructions.

2.2.2. Procedure and materials

After being informed of their rights, participants were seated at an individual computer. All instructions were administered on screen and progress through the study was self-paced. Participants were told that there would be two blocks of face recognition questions; in each block, they would view some faces, complete a short visual memory task, and then make recognition judgments about a series of faces.

Face stimuli comprised head-and-neck color photographs of 80 individuals (40 female) obtained from the Face-Place Face Database Project (Tarr, 2011). These were randomly divided into four sets of 20 faces (10 females). For each recognition block, one set of faces served as targets and the other as foils. The use of faces was counterbalanced such that each face was used equally often (a) as a target and a foil, and (b) in the full and divided attention blocks.

During the study phase of each block, participants viewed a series of 20 target faces (10 female) in random order, each presented for 2 s with an inter-stimulus interval of 250 ms. Following the study phase in each block, participants completed a 3-minute distractor task. (On each trial of the distractor task, participants were presented with a pattern of black and white squares. After 3 s, the pattern would disappear, and then re-appear another 3 s later with one black square changed to white. Participants were asked to click on the square that had changed color.) Participants then completed the test phase for that block. Participants viewed a series of 40 faces (the 20 targets mixed with 20 foils). To minimize the chance that participants were recognizing pictures rather than faces (Bruce, 1982), the photos used at study and test were not identical. There were two photos of each stimulus face, one taken with the person looking straight at the camera (used during study phases) the other with the person looking slightly away from the camera (used during test phases). For each face in the test phase, participants indicated whether it had appeared during the study phase for that block and rated their confidence (from 50% to 100%) that their decision was correct. At the end of each block, participants were informed that they had now completed all questions for that set of faces, and that no more questions would be asked about the faces they had seen during that block. Participants then completed the study phase, distractor task, and test phase for the second block.

2.2.3. Divided attention manipulation

Each participant completed the study phase for one block under full attention conditions and the other under divided attention conditions (counterbalanced so that half of the participants studied faces under divided attention during their first block). The divided attention manipulation was based on a tone-monitoring task used by Palmer, Brewer, McKinnon, et al. (2010). In the divided attention condition, the study phase was accompanied by a pre-recorded soundtrack of tones randomized for pitch (high and low) and intervening interval (1 s or 2 s). Participants were asked to respond to low and high pitch tones by pressing keys marked low or high with their left or right index finger, respectively. In the full attention condition, the study phase was not accompanied by a soundtrack.

2.3. Results

Face recognition performance was indexed by d' values, calculated from hit and false alarm rates. Cohen's f was used to estimate effect