

Women remember more faces than men do

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Abstract

Women have been found to outperform men on face recognition tasks, specifically in the recognition of female faces. Men do not seem to exhibit a corresponding own-sex bias. To examine the generality and possible reasons for these patterns, 107 men and 112 women viewed faces of both children and adults of either Swedish or Bangladeshi origin, for later recognition. As expected, women were especially good at remembering female faces, but also outperformed men on male faces. Men did not show an own-sex bias. Thus, regardless of age and ethnicity of the faces, women performed at a higher level than men on both female and male faces, possibly reflecting enhanced interest in faces, and in particular, female faces.

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1. Introduction

Recent research has demonstrated reliable sex differences favoring women in episodic memory (i.e., the autobiographical records of unique events in the individual's experience encoded in a particular temporal-spatial context; Tulving, 1983, 1993), throughout the

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lifespan (de Frias, Nilsson, & Herlitz, 2005; Kramer, Delis, Kaplan, O'Donnell, & Prifitera, 1997; Lindholm & Christianson, 1998). Typically, women excel over men when the material is verbal (i.e., words, objects, concrete pictures), whereas the opposite is true when the material to be remembered involves a substantial visuospatial component (e.g., Astur, Ortiz, & Sutherland, 1998; Lewin, Wolgers, & Herlitz, 2001; Ruff, Light, & Quayhagen, 1988). Women are also reported to show a modest advantage over men for non-verbal material, such as abstract pictures (Goldstein et al., 1998; Stumpf, 1998). However, although women outperform men in the recognition of previously presented objects and pictures (e.g., Bradbard & Endsley, 1983; McGivern et al., 1997), men have been found to excel on object recognition in which the material to be remembered consisted of so called male-oriented objects (McGivern et al., 1997; McKelvie, Standing, St. Jean, & Law, 1993). Thus, factors such as interest and prior knowledge may influence the presence and magnitude of sex differences in episodic memory.

Besides the reliable advantage on verbal, and the modest advantage on non-verbal, episodic memory tasks, women typically outperform men on face recognition (Shapiro & Penrod, 1986). Information regarding a person's sex, if he or she is young or old (Bruce & Young, 1986), and whether you share the same ethnicity, is processed rapidly and automatically (Ito & Urland, 2003). Moreover, it is easier to remember a person's face if it belongs to the same ethnicity as your own, a well-documented effect labeled own-race or own-ethnicity bias (e.g. Meissner & Brigham, 2001; Sporer, 2001). A similar effect has been noted with age, where differences in memory performance between young and old adults have been moderated by the age of the face (Fulton & Bartlett, 1991). Although the explanation for own-group biases are under debate, they have been hypothesized to depend upon quality of contact and attitudes towards the other group (e.g. Meissner & Brigham, 2001; Sporer, 2001), and can thus both enhance and worsen our memory for faces.

Similarly, a person's gender could be expected to affect men and women's face recognition performance, strengthening men's recognition of male faces and women's recognition of female faces. Indeed, previous research shows that women and girls exhibit an own-sex bias, performing at a higher level for female faces than for male faces (Cross, Cross, & Daly, 1971; Lewin & Herlitz, 2002; Sugisaki & Brown, 1916; Temple & Cornish, 1993; Wright & Sladden, 2003). Men and boys, on the other hand, do not appear to show a corresponding own-sex bias for male faces. The majority of studies have found that men perform at a similar level for both male and female faces (Cross et al., 1971; Lewin & Herlitz, 2002; Rehnman & Herlitz, 2006) or that men, much like women, perform at a higher level for female faces than for male faces (Feinman & Entwisle, 1976; McKelvie et al., 1993; Rehnman & Herlitz, 2006). Only two studies have reported an own-sex bias for male faces, so that boys (Ellis, Shepherd, & Bruce, 1973) and men (Wright & Sladden, 2003) recognized more male faces than female faces.

Although related, a second question concerns to what extent men and women differ in their ability to recognize faces of the opposite sex. There are no studies reporting that men and boys perform at a higher level than women and girls on female faces, although there are some studies showing that men perform at a higher level than women on male faces (Sugisaki & Brown, 1916; Wright & Sladden, 2003). However, other researchers have found that women also outperform men on male faces, indicating that women's higher face recognition performance is more general and not constrained to female faces (Ellis et al., 1973; McKelvie, 1981; Rehnman & Herlitz, 2006). Still, other studies have found

that no sex differences exist for male faces (Going & Read, 1974; Lewin & Herlitz, 2002; Temple & Cornish, 1993; Vokey & Read, 1988).

Taken together, the previous research seems to indicate that the often reported overall face recognition superiority seen in women (e.g., Herlitz, Nilsson, & Bäckman, 1997; Hill et al., 1995; Whalin et al., 1993) to a great extent is a result of women's higher performance on female faces (Lewin & Herlitz, 2002). In addition, some findings indicate that the female advantage in face recognition may not be constrained to female faces, but also exist for male faces, indicating a general female advantage in face recognition to complement the own-sex bias (Ellis et al., 1973; Rehnman & Herlitz, 2006).

Attempts have been made to explain the sex difference in face recognition, one suggestion being that women's higher verbal ability influence their face recognition performance (Lewin & Herlitz, 2002). No support for this hypothesis has been found, as faces were found to be encoded non-verbally (Lewin & Herlitz, 2002). Another possible explanation concerns the notion that faces, as other types of stimuli, can evoke more or less interest in one gender as compared to the other. In line with this, women are reported to be more interested in work involving a "people-dimension" (Lippa, 1998) and to have a better "social memory" than men (Kaplan, 1978). If faces evoke more interest in women than in men, higher face recognition performance should be expected for women. However, such hypothesis does not explain why women, as opposed to men, show a strong own-sex bias in face recognition, as an explanation must predict greater social interest in female faces than in male faces.

Previous studies investigating sex differences in face recognition have not explored the influence of personality related factors, such as femininity and masculinity, as classified by Bem (1981a). According to Bem's sex-role inventory, both men and women can vary in their degree of femininity and masculinity and therefore be classified as sex-typed (e.g., a man with high masculinity scores and low femininity scores) or as non-sex-typed (e.g., a woman with low femininity scores and high masculinity scores). Studies on episodic memory have shown that individuals' gender schemas affect their memory performance, so that individuals classified as having a feminine or masculine gender schema remember information in concordance with that schema (e.g., Bem, 1981b; Signorella & Liben, 1984). As noted earlier, faces could be viewed as stimuli bearing more interest to women than to men, and faces may therefore be in concordance with a feminine gender schema. Thus, it could be hypothesized that both men and women classified as having a feminine gender schemata (Bem, 1981b), should remember more faces than men and women with other gender schemata.

While it is clear that women show an own-sex bias to a greater extent than men, information is lacking with regard to the generality of these results. For example, it is an open question whether women show an own-sex bias for girls, and whether the female own-sex bias extends to unfamiliar faces (i.e., of different ethnicity). Thus, in order to examine the own-sex bias in the context of faces varying in age and ethnicity, we created a stimulus set consisting of faces depicting male and female Swedish or Bangladeshi children and adults. As previous research has indicated that the female own-sex bias is general (i.e., girls recognize more adult female faces than male faces; Rehnman & Herlitz, 2006), we hypothesized that women would show an own-sex bias, irrespective of the age and the ethnicity of the recognized female faces, whereas men were not expected to show an own-sex bias. For male faces, we expected to find smaller or no sex differences. Both men and women were predicted to be similarly affected by the age and ethnicity of the faces, with more familiar

faces yielding higher performance. In addition, we anticipated differences in face recognition performance as a result of men and women's gender schemas, with a feminine gender schema being associated with a better face recognition performance.

2. Method

2.1. Participants

Altogether 219 native Swedish speaking adults, 107 men and 112 women, age 30.2 years ($SD = 5.6$), voluntarily participated in the study. Of these, 111 participants viewed faces of Bangladeshi children and adults and 108 viewed faces of Swedish children and adults. As can be seen in Table 1, there were no age differences between men and women or between participants viewing either Bangladeshi or Swedish faces, although men and women differed with regard to education so that men had more years at university. Thirty men and 32 women had children. Differences between participants with and without children were evaluated using ANOVA with hits and false alarm rates converted into d' scores as the dependent variable (Hochhaus, 1972). No significant differences were found.

The majority of participants were recruited through advertisements in a local daily newspaper ($n = 185$) and a few ($n = 34$) were recruited by posters at the University of Stockholm. No information was given stating that potential sex differences were to be studied. Participants were informed about the possibility of receiving information about their results. The study was approved by the ethical committee at the Karolinska Institute, Stockholm, Sweden.

2.2. Procedure and material

Participants were tested in groups of up to 10 people who were seated to avoid overlooking others. Participants completed two face recognition tasks and three other cognitive tasks. The cognitive tasks served as filler tasks, and more importantly, were included to control for potential cognitive differences between men and women and between the groups viewing Bangladeshi or Swedish faces. The total testing time per subject was approximately 60 min. The test order was as follows: (1) presentation of the first

Table 1

Mean ($\pm$ SE) age, years at university, and performance on tasks assessing word comprehension, mental rotation, and episodic word recognition in men and women viewing either Bangladeshi or Swedish faces

	Bangladeshi faces		Swedish faces	
	Men ($N = 56$) $M \pm SE$	Women ($N = 55$) $M \pm SE$	Men ($N = 51$) $M \pm SE$	Women ($N = 57$) $M \pm SE$
Age	30.71 (0.76)	30.29 (0.74)	30.94 (0.79)	29.03 (0.73)
Years at university*	3.11 (0.27)	2.40 (0.24)	2.74 (0.31)	2.25 (0.27)
Word comprehension**	25.73 (0.26)	24.85 (0.38)	25.27 (0.28)	24.65 (0.39)
Mental rotation***	15.80 (0.58)	12.30 (0.58)	15.59 (0.63)	12.12 (0.60)
Episodic word recognition	19.63 (0.57)	20.16 (0.63)	19.59 (0.65)	21.09 (0.44)

* Men had more university years than women, $p < 0.05$.

** Men performed at a higher level than women, $p < 0.05$.

*** Men performed at a higher level than women, $p < 0.001$.

set of faces, (2) paper and pencil word comprehension synonym task (Nilsson, Bäckman, Erngrund, & Nyberg, 1997), (3) first face recognition test, (4) auditory and visual presentation of 24 common, unrelated nouns for a later episodic memory test, (5) presentation of the second set of faces, (6) a modified version of the Shepard–Metzler mental rotation task for group administration, with 10 target figures (Lewin & Herlitz, 2002; Vandenberg, 1971), (7) second face recognition test, (8) yes–no paper and pencil episodic word recognition test, consisting of the 24 presented words, together with 24 new words, (9) Bem Sex Role Inventory (Bem, 1981a).

Face recognition. All 60 faces were presented with a PC projector and were in view during 3 s each, one after the other, without a blank interval. Faces were in color, in full frontal view, and free of facial hair and glasses. Portrayed people had a neutral expression. Swedish faces would fit the description of Caucasian faces and the Bangladeshi faces as South Asian. Bangladeshi faces were chosen as participants presumably had limited knowledge of these faces. Swedish children, 7–10 years old, and adults, 20–40 years old, were all photographed at schools and workplaces in Stockholm, Sweden. Bangladeshi children, 7–10 years old and Bangladeshi adults, 20–40 years old, were all photographed in Dhaka, Bangladesh. The Bangladeshi children went to a UN-supported school and the adults were recruited locally in Dhaka.

All participants completed two face recognition tasks, one with adult faces and one with faces of children. Order of the face recognition tasks was counterbalanced, whereas ethnicity of the faces (i.e., Bangladeshi, Swedish) was kept constant across testing session. The two sets of faces (i.e., Bangladeshi, Swedish) were prepared in two versions and approximately half of the participants ($n = 117$) were shown the first version and the other half ($n = 102$) was shown the second. The 30 faces that acted as target faces in the first version were distracter faces in the second, and vice versa. Fifty percent of the pictures in each task depicted females. Male and female faces were presented randomly intermixed.

Participants were instructed to closely watch the faces and were told that they later would be tested on their ability to recognize them. Eight minutes after presentation of faces, participants were shown the 30 earlier presented faces, together with 30 new faces, randomly intermixed. Faces were in view for 5 s during which participants, in writing, completed a forced yes–no recognition task. Four participants failed to indicate whether they previously had seen a face or not on one of the altogether 120 presented faces in the recognition task. Therefore, 0.5 points were deducted from these participants' hits score or added to the false alarm scores, depending on which item they had failed to mark.

Bem Sex Role Inventory. To assess the participant's gender schema, participants were asked to complete the short form of Bem Sex Role Inventory (Bem, 1981a). The inventory consists of 30 adjectives, 10 classified as feminine (e.g., affectionate), 10 classified as masculine (e.g., aggressive), and 10 as gender neutral (e.g., conventional). The participants were asked to indicate on a seven-graded scale whether the adjectives described her/him well or not. Three participants, 2 men and 1 woman did not complete the inventory and were therefore not included in the Bem analyses. Classifying participants according to Bem's gender schema was done by median split across men and women (Bem, 1981a), (median femininity score = 5.30; median masculinity score = 4.70). A person was classified as having a feminine gender schema if he or she was scoring above median on the femininity scale and below the median on the masculinity scale. The same proce-

ture, but reversed, was used when classifying individuals with a masculine gender schema. Thirty-two men and 25 women were classified as having a masculine gender schema and 19 men and 37 women were classified as having a feminine gender schema. Participants with an androgynous ($n = 53$) or undifferentiated ($n = 51$) gender schema were not included in the Bem analysis.

3. Results

First, potential differences between men and women, and between participants viewing Bangladeshi and Swedish faces, with respect to scores on the three cognitive tasks were evaluated in a MANOVA. Ethnicity of the viewed face (i.e. Bangladeshi and Swedish) and sex of participant constituted between group variables. A main effect of sex was found, Wilks's $\lambda = 0.82$, $F(3, 213) = 15.52$, $p < 0.001$. Univariate F -tests showed that men outperformed women on the mental rotation task, $F(1, 211) = 33.97$, $p < 0.001$, and on the word comprehension task, $F(1, 211) = 4.93$, $p < 0.05$, and that women performed at a marginally significant higher level than men on the verbal episodic memory task, $F(1, 211) = 3.17$, $p = 0.08$. Means and standard errors can be seen in Table 1. None of the other differences between groups reached statistical significance, demonstrating that cognitive differences between participants viewing Bangladeshi or Swedish faces were not present.

To examine potential differences between men and women on the face recognition tasks, a 2 (Sex of viewer: man, woman) $\times$ 2 (Face ethnicity: Bangladeshi, Swedish) $\times$ 2 (Sex of face: female, male) $\times$ 2 (Age of face: child, adult) ANCOVA was computed. Sex of the viewer and face ethnicity constituted between-group variables, and sex and age of the viewed faces were within-group variables. As years of education consistently have been found to influence cognitive performance (Lövdén et al., 2004) and there were differences between men and women with regard to number of years at university, it was included as covariate in the analyses. The dependent variable was the number of correctly (i.e., hits) and number of falsely (i.e., false alarms) identified faces converted into d' scores (Hochhaus, 1972).

The ANCOVA revealed a main effect of the sex of the viewer, $F(1, 208) = 20.41$, $p < 0.001$, showing that women remembered more faces than men. Also, a main effect of ethnicity, $F(1, 208) = 20.04$, $p < 0.001$, demonstrated that it was easier to remember Swedish than Bangladeshi faces, and a main effect of sex of the viewed face indicated that it was easier to recognize female than male faces, $F(1, 208) = 15.42$, $p < 0.001$. No main effect of age of viewed face was found, $F(1, 208) = 0.78$, $p = 0.38$.

As can be seen in Fig. 1, a significant interaction between sex of viewer and sex of viewed face, $F(1, 208) = 11.75$, $p < 0.001$, indicated that the difference between men and women was larger for female faces than for male faces. When investigating the simple effects with t -tests and the magnitude of the differences with effect size, d (Cohen, 1977), it was demonstrated that women performed at a higher level than men on female faces $t(217) = 4.88$, $p < 0.001$, ($d = 0.72$), and also on male faces, $t(217) = 2.39$, $p < 0.05$, ($d = 0.36$).

A significant interaction between age and ethnicity of the viewed face, $F(1, 208) = 6.53$, $p < 0.05$, indicated that faces of Swedish adults and children were equally well remembered, whereas it was easier to remember Bangladeshi adults than children. Lastly, a significant interaction between the sex of the viewed faces and ethnicity of the viewed faces, $F(1, 208) = 15.74$, $p < 0.001$, showed that although it was easier to remember female faces in general, the effect was more pronounced for Swedish faces.

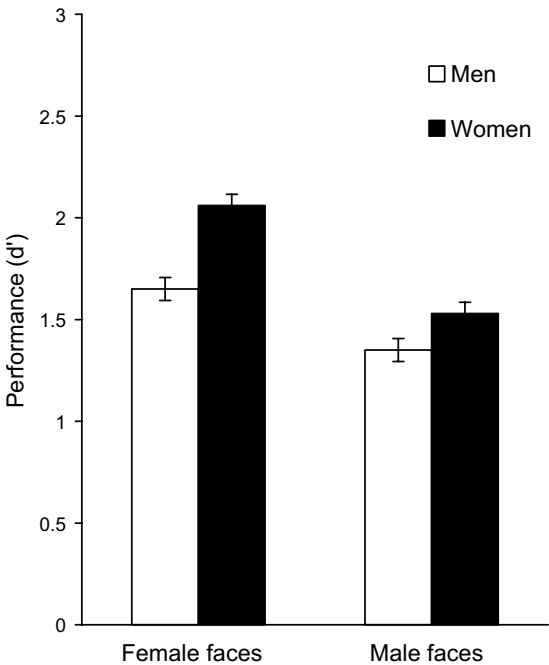


Fig. 1. Estimated mean number ($\pm$ SE) of recognized faces (d') in men ($n = 107$) and women ($n = 112$), viewing female and male faces.

As we were specifically interested in evaluating the magnitude of sex differences as a function of age, ethnicity, and sex of faces, simple effects were computed using t -tests for independent samples. For means, standard errors, and effect sizes, d (Cohen, 1977), see Table 2. The analyses revealed significant sex differences for all female faces; Swedish girls, $t(106) = 3.49$, $p < 0.001$, ($d = 0.71$), Swedish women, $t(106) = 3.24$, $p < 0.05$, ($d = 0.64$), Bangladeshi girls, $t(109) = 2.15$, $p < 0.05$, ($d = 0.43$), and Bangladeshi women, $t(109) = 3.12$, $p < 0.05$, ($d = 0.55$). The difference between men and women on male faces did not reach conventional statistical significance levels, although there were tendencies in the same direction for all male faces; Swedish boys, $t(106) = 1.60$, $p = 0.12$, ($d = 0.39$),

Table 2
Estimated mean number ($\pm$ SE) of recognized faces (d') and effect sizes (d) for men and women viewing either Bangladeshi or Swedish faces, with years at university as covariate

	Bangladeshi faces			Swedish faces		
	Men ($N = 56$) $M \pm SE$	Women ($N = 55$) $M \pm SE$	(d)	Men ($N = 51$) $M \pm SE$	Women ($N = 57$) $M \pm SE$	(d)
Women's faces	1.50 (0.10)	1.91 (0.10)	(0.55)	1.84 (0.10)	2.32 (0.10)	(0.64)
Men's faces	1.40 (0.09)	1.54 (0.09)	(0.21)	1.38 (0.09)	1.57 (0.09)	(0.29)
Girls' faces	1.43 (0.09)	1.73 (0.10)	(0.43)	1.82 (0.10)	2.30 (0.09)	(0.71)
Boys' faces	1.16 (0.08)	1.34 (0.09)	(0.28)	1.45 (0.09)	1.69 (0.08)	(0.39)

Note: For effect size, $d = (M_{\text{women}} - M_{\text{men}})/SD_{\text{pooled}}$. A positive value of d indicates that women performed at a higher level than men; a negative value indicates that men performed at a higher level than women.

Swedish men, $t(106) = 1.30$, $p = 0.20$, ($d = 0.29$), Bangladeshi boys, $t(109) = 1.62$, $p = 0.10$, ($d = 0.28$); Bangladeshi men, $t(109) = 1.00$, $p = 0.32$ ($d = 0.21$).

Hits and false alarms were evaluated separately, again using ANCOVA with number of years at university as covariate. Sex of participant and ethnicity of face constituted between group variables, whereas sex and age of face constituted within group variables. For hits, a main effect of sex was noted, $F(1, 209) = 29.03$, $p < 0.001$, showing that women made more correct identifications of faces than men did. A main effect of ethnicity, $F(1, 209) = 5.00$, $p < 0.05$, showed that Swedish faces were correctly identified more often than Bangladeshi faces. A significant interaction between the sex of the viewer and the sex of the viewed face, $F(1, 209) = 4.51$, $p < 0.05$, indicated that the difference between men and women was more pronounced for female faces than male faces. In addition, more correct identifications were done of men's than boy's faces, as demonstrated in the interaction between sex and age of the viewed face, $F(1, 209) = 6.17$, $p < 0.05$. For false alarms, there was a main effect of ethnicity, $F(1, 209) = 9.09$, $p < 0.05$, showing that fewer false alarms were made for Swedish faces, and a main effect of the sex of the viewed face, $F(1, 209) = 75.52$, $p < 0.001$, indicating that fewer false alarms were made for female than male faces. In addition, there was a significant interaction, $F(1, 209) = 4.08$, $p < 0.05$, indicating that women made less false identifications of female faces than men did. Lastly, an interaction between age and ethnicity of the viewed face showed that more false alarms were made for Bangladeshi than Swedish children, $F(1, 209) = 4.88$, $p < 0.05$ (Table 3).

In order to assess the influence an individual's gender schema (i.e. feminine or masculine) may have on their face recognition performance, t -tests for independent samples were conducted separately for men ($n = 51$) and women ($n = 62$), contrasting participants with feminine and masculine gender schemas. Participants with an androgynous ($n = 51$) or undifferentiated ($n = 53$) gender schema, as defined by Bem (1981a), were not included in the analysis. The result showed that men and women with a feminine gender schema performed at a similar level as men and women with a masculine gender schema with regard to face recognition in general, women, $t(60) = 1.29$, $p = 0.20$, ($d = 0.33$), men, $t(49) = 0.25$, $p = 0.80$, ($d = -0.07$).

Table 3

Estimated mean number ($\pm$ SE) of hits and false alarms for men and women viewing either Bangladeshi or Swedish faces, with years at University as covariate (maximum score was 15)

	Hits		False alarms	
	Men ($N = 56$) $M \pm SE$	Women ($N = 55$) $M \pm SE$	Men ($N = 51$) $M \pm SE$	Women ($N = 57$) $M \pm SE$
<i>Bangladeshi faces</i>				
Women's faces	10.66 (0.32)	12.17 (0.32)	2.86 (0.27)	2.48 (0.27)
Men's faces	10.86 (0.29)	11.19 (0.29)	3.58 (0.30)	3.12 (0.30)
Girls' faces	10.22 (0.33)	11.42 (0.33)	2.80 (0.25)	2.44 (.26)
Boys' faces	10.55 (0.28)	11.43 (0.29)	4.22 (0.32)	4.16 (0.33)
<i>Swedish faces</i>				
Women's faces	11.39 (0.33)	12.56 (0.32)	2.28 (0.28)	1.61 (0.27)
Men's faces	10.59 (0.30)	11.75 (0.29)	3.08 (0.31)	3.22 (0.30)
Girls' faces	10.56 (0.34)	12.71 (0.33)	1.79 (0.27)	1.61 (0.25)
Boys' faces	10.55 (0.30)	12.12 (0.28)	3.18 (0.33)	3.36 (0.32)

4. Discussion

We found that women remembered more male and female faces than men, and that the female advantage was especially pronounced for female faces, indicating a strong own-sex bias in women. Men did not show a corresponding own-sex bias for male faces. In addition, our results revealed that female faces were recognized to a higher degree than male faces by both men and women. Further, men and women were similarly affected by the ethnicity and age of faces, so that Swedish faces were easier to remember than Bangladeshi faces, and Bangladeshi adult faces were easier to remember than faces of Bangladeshi children. Finally, individuals with a feminine gender schema did not reliably outperform participants with a masculine gender schema. The implications of these findings will be discussed in turn.

We found that women performed at a superior level than men on both male and female faces, a finding that sometimes has been reported (Ellis et al., 1973; Rehnman & Herlitz, 2006). One reason for women's overall higher face recognition performance may be that women have greater interest in and knowledge of social aspects of the world (Kaplan, 1978). For example, it has been noted in infants that girls spend more time looking at faces than boys do (Connellan, Baron-Cohen, Wheelwright, Batki, & Ahluwalia, 2000), and it is well known that girls and women are superior at identifying other people's emotions when viewing faces (e.g. McClure, 2000). Women are also found to show work-related preferences towards jobs involving personal relations (Lippa, 1998). Based on the assumptions that faces are important social stimuli, and that women are more interested in and knowledgeable of social aspects of the world than men are, higher performance on face recognition tasks should be expected in women.

As expected and previously found, our results clearly showed that women display a strong own-sex bias (e.g. Cross et al., 1971; Lewin & Herlitz, 2002; Rehnman & Herlitz, 2006; Sugisaki & Brown, 1916; Temple & Cornish, 1993; Wright & Sladden, 2003). It was demonstrated that women's own-sex bias is present independent of ethnicity and age of the female faces and is a result of both higher hit rate and lower false alarm rate. Most intriguing is that the female own-sex bias is seen when girls recognize other girls and women (Rehnman & Herlitz, 2006), and, as demonstrated here, when women recognize girls. Thus, women's own-sex bias is robust and of substantial magnitude, and is present also when the faces to be remembered are less familiar (i.e., Bangladeshi women and girls), hence, overriding the effects of age and ethnicity of faces.

Why do women, as opposed to men, show such a strong own positive bias towards their own sex? A suggested explanation for women's own-sex bias is that women's greater social interest is specifically directed towards other women. Support for such a hypothesis come from studies investigating friendship, where it is found that women form longer-lasting and closer relationships with other women as compared to the relationships formed between men (see Sherman, de Vries, & Lansford, 2000, for a review). Women's friendship is often described as "face-to-face" with more of an affective focus on the other, in contrast to men's "side-by side" friendships, which is typically more oriented around external activities and tasks (Wright, 1982). However, further research in this area is needed before a link between women's own-sex bias and quality of friendship can be established.

Based on the present and previous findings, it can be concluded that men do not show a strong own-sex bias (e.g., Cross et al., 1971; Going & Read, 1974; Lewin & Herlitz, 2002;

Rehnman & Herlitz, 2006; Temple & Cornish, 1993). Instead, men correctly identified female and male faces to an equal extent but made more false alarms for male than female faces, resulting in worse performance on male compared to female faces. Following the arguments proposed for women's own-sex bias, it is possible that the less person-focused friendship men experience do not foster specific interest in and knowledge of the same sex. Less interest and knowledge of the same sex, as compared to women, may result in a lack of own-sex bias.

Our notion that a feminine gender schema mediates face recognition performance was not statistically supported. However, there were small differences in the expected direction for women. Whether these differences mirror a true effect or are due to random variation, should be investigated in future research.

Both men and women in this study remembered more female than male faces. The effect was mainly driven by fewer false alarms made for female faces indicating that a stricter criterion was used. It has been suggested that female faces are more distinct than male faces and therefore easier to remember (Feinman & Entwisle, 1976). Notably, the differences between male and female faces in distinctiveness and ease of remembering does, most likely, not explain women's own-sex bias and men's lack thereof, as a large literature on the utilization of cognitive support has demonstrated that groups with differences in performance levels are aided by cognitive support (e.g., abstract vs. concrete words) to the same extent (e.g., Bäckman, Small, & Wahlin, 2001).

As expected, both men and women remembered Swedish faces to a greater extent than Bangladeshi faces. The own-ethnicity bias is well documented, and believed to be mediated by quality of contact (e.g. Sporer, 2001). Here, we demonstrated that the effect is present when adults view adult faces, but also when adults view faces of children. An interaction between ethnicity and gender of the viewed face revealed that it was easier for both men and women to remember Swedish female faces than female Bangladeshi faces. Given that female faces in general were easier to recognize, the effect might be more pronounced when the participants have greater knowledge of the faces, as our participants can be assumed to have of Swedish faces.

We did not find an own-age bias for own-ethnicity faces. An own-age bias has typically been reported in samples comparing young and old adults (Bartlett & Leslie, 1986; Fulton & Bartlett, 1991), rather than in the comparison between faces of children and adults. Our data indicate that both men and women recognize Swedish children and adults to an equal extent. In contrast, an own-age bias was found for Bangladeshi faces. Although this could be taken to indicate that an own-age bias is present when viewing less familiar faces, it could also indicate that Bangladeshi children were especially hard to recognize. The latter explanation is supported by the higher degree of false alarms reported for faces of Bangladeshi children than for faces of Bangladeshi adults.

Taken together, the results in the present study show that women outperform men on face recognition independent of age, ethnicity and sex of the recognized faces. The strong own-sex bias seen in women generalizes over categories such as age and ethnicity of the face, whereas men do not show a corresponding own-sex bias. Instead, both men and women remember more female than male faces. The results in the present study did not support the notion that face recognition is mediated by a feminine gender schema. Whether the sex differences in face recognition are a result of women's greater social interest, specifically directed towards other females, needs to be investigated in future research.

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References

- Astur, R. S., Ortiz, M. L., & Sutherland, R. J. (1998). A characterization of performance by men and women in a virtual Morris water task: A large and reliable sex difference. *Behavioural Brain Research*, 93, 185–190.
- Bäckman, L., Small, B. J., & Wahlin, Å. (2001). Aging and memory: Cognitive and biological perspectives. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (5th ed., pp. 349–377). San Diego, CA: Academic Press.
- Bartlett, J. C., & Leslie, J. E. (1986). Aging and memory for faces versus single views of faces. *Memory and Cognition*, 19, 229–238.
- Bem, S. L. (1981a). *Bem sex role inventory: Professional manual*. Palo Alto, CA: Consulting Psychologists Press.
- Bem, S. L. (1981b). Gender schema theory: A cognitive account for sex typing. *Psychological Review*, 88(4), 354–364.
- Bradbard, M. R., & Endsley, R. C. (1983). The effects of sex-typed labeling on preschool children's information-seeking and retention. *Sex Roles*, 9, 247–260.
- Bruce, V., & Young, A. (1986). Understanding face recognition. *British Journal of Psychology*, 77, 305–327.
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences* (Rev. ed.). Hillsdale, NJ: Lawrence Erlbaum.
- Connellan, J., Baron-Cohen, S., Wheelwright, S., Batki, A., & Ahluwalia, J. (2000). Sex differences in human neonatal social perception. *Infant Behavior & Development*, 23(1), 113–118.
- Cross, J. F., Cross, J., & Daly, J. (1971). Sex, race, age and beauty as factors in recognition of faces. *Perception & Psychophysics*, 10, 393–439.
- de Frias, C. M., Nilsson, L.-G., & Herlitz, A. (2005). Sex differences in cognition are stable in adulthood and old age over a 10-year period. *Aging Neuropsychology and Cognition*.
- Ellis, H. D., Shepherd, J., & Bruce, A. (1973). The effects of age and sex upon adolescents' recognition of faces. *The Journal of Genetic Psychology*, 123, 173–174.
- Feinman, S., & Entwisle, D. R. (1976). Children's ability to recognize other children's faces. *Child Development*, 47, 506–510.
- Fulton, A., & Bartlett, J. C. (1991). Young and old faces in young and old heads: The factor of age in face recognition. *Psychology and Aging*, 6, 623–630.
- Going, M., & Read, J. D. (1974). Effects of uniqueness, sex of subject, and sex of photograph on facial recognition. *Perceptual and Motor Skills*, 39, 109–110.
- Goldstein, J. M., Seidman, L. J., Goodman, J. M., Koren, D., Lee, H., Weintraub, S., et al. (1998). Are there sex differences in neuropsychological functions among patients with schizophrenia? *American Journal of Psychiatry*, 155, 1358–1364.
- Herlitz, A., Nilsson, L.-G., & Bäckman, L. (1997). Gender differences in episodic memory. *Memory and Cognition*, 25, 801–811.
- Hill, R. D., Grut, M., Whalin, Å., Herlitz, A., Winblad, B., & Bäckman, L. (1995). Predicting memory performance in optimally healthy very old adults. *Journal of Mental Health and Aging*, 1, 55–65.
- Hochhaus, L. (1972). A table for the calculation of d' and BETA. *Psychological Bulletin*, 77, 375–376.
- Ito, T. A., & Urland, G. R. (2003). Race and gender on the brain: Electro cortical measures of attention to the race and gender of multiply categorizable individuals. *Journal of Personality and Social Psychology*, 85(4), 606–616.
- Kaplan, H. B. (1978). Sex differences in social interest. *Journal of Individual Psychology*, 34(2), 206–209.
- Kramer, J. H., Delis, D. C., Kaplan, E., O'Donnell, L., & Prifitera, A. (1997). Developmental sex differences in verbal learning. *Neuropsychology*, 11, 577–584.

- Lewin, C., & Herlitz, A. (2002). Sex differences in face recognition: Women's faces make the difference. *Brain and Cognition*, 50, 121–128.
- Lewin, C., Wolgers, G., & Herlitz, A. (2001). Sex differences favoring women in verbal but not in visuospatial episodic memory. *Neuropsychology*, 15, 165–173.
- Lindholm, T., & Christianson, S.-Å. (1998). Gender effects in eyewitness accounts of a violent crime. *Psychology, Crime & Law*, 4, 323–339.
- Lippa, R. (1998). Gender-related individual differences and the structure of vocational interests: The importance of the people-things dimension. *Journal of Personality and Social Psychology*, 74(4), 996–1009.
- Lövdén, M., Rönnlund, M., Wahlin, A., Bäckman, L., Nyberg, L., & Nilsson, L.-G. (2004). The extent of stability and change in episodic and semantic memory in old age: Demographic predictors of level and change. *Journal of Gerontology: Psychological Sciences*, 59, 30–134.
- McClure, E. B. (2000). A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychological Bulletin*, 126(3), 424–453.
- McGivern, R. F., Huston, J. P., Byrd, D., King, T., Siegle, G. J., & Reilly, J. (1997). Sex differences in visual recognition memory: Support for a sex-related difference in attention in adults and children. *Brain and Cognition*, 34, 323–336.
- McKelvie, S. J. (1981). Sex differences in memory for faces. *The Journal of Psychology*, 107, 109–125.
- McKelvie, S. J., Standing, L., St. Jean, D., & Law, J. (1993). Gender differences in recognition memory for faces and cars: Evidence for the interest hypothesis. *Bulletin of the Psychonomic Society*, 31, 447–448.
- Meissner, C. A., & Brigham, J. C. (2001). Thirty years of investigating own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy, and Law*, 7, 3–35.
- Nilsson, L.-G., Bäckman, L., Erngrund, K., Nyberg, L., et al. (1997). The Betula prospective cohort study: Memory, health, and aging. *Aging, Neuropsychology and Cognition*, 4, 1–32.
- Rehnman, J., & Herlitz, A. (2006). Higher face recognition ability in girls: Magnified by own-sex and own-ethnicity bias. *Memory*, 14, 289–296.
- Ruff, R. M., Light, R. H., & Quayhagen, M. (1988). Selective reminding tests: A normative study of verbal learning in adults. *Journal of Clinical and Experimental Neuropsychology*, 11, 539–550.
- Shapiro, P. N., & Penrod, S. (1986). Meta-analysis of facial identification studies. *Psychological Bulletin*, 100, 139–156.
- Sherman, A. M., de Vries, B., & Lansford, J. E. (2000). Friendship in childhood and adulthood: Lessons across the life span. *The International Journal of Aging and Human Development*, 51, 31–51.
- Signorella, M. L., & Liben, L. S. (1984). Recall and reconstruction of gender-related pictures: Effects of attitude, task difficulty, and age. *Child Development*, 55(2), 393–405.
- Sporer, S. L. (2001). Recognizing faces of other ethnic groups: An integration of theories. *Psychology, Public Policy, and Law*, 7, 36–97.
- Stumpf, H. (1998). Gender-related differences in academically talented students' scores and use of time on tests of spatial ability. *Gifted Child Quarterly*, 42, 157–171.
- Sugisaki, Y., & Brown, W. (1916). The correlation between the sex of observers and the sex of pictures recognized. *Journal of Experimental Psychology*, 1, 351–354.
- Temple, C. M., & Cornish, K. M. (1993). Recognition memory for words and faces in schoolchildren: A female advantage for words. *British Journal of Developmental Psychology*, 11, 421–426.
- Tulving, E. (1983). *Elements of episodic memory*. Oxford: Oxford University Press.
- Tulving, E. (1993). Human memory. In O. Hvalby, P. Andersen, B. Hökfelt, & O. Paulsen (Eds.), *Memory concepts: Basic and clinical aspects* (pp. 27–46). Amsterdam: Elsevier.
- Vandenberg, S. G. (1971). *A test of three-dimensional spatial visualization based on the Shepard-Metzler "mental rotation" study*. Boulder: University of Colorado.
- Vokey, J. R., & Read, D. J. (1988). Typicality, familiarity and the recognition of male and female faces. *Canadian Journal of Psychology*, 42, 489–495.
- Whalin, Å., Bäckman, L., Mäntylä, T., Herlitz, A., Viitanen, M., & Winblad, B. (1993). Prior knowledge and face recognition in a community-based sample of healthy, very old adults. *Journal of Gerontology: Psychological Science*, 48, 54–61.
- Wright, D. B., & Sladden, B. (2003). An own gender bias and the importance of hair in face recognition. *Acta Psychologica*, 114, 101–114.
- Wright, P. H. (1982). Men's friendships, women's friendships & the alleged inferiority of the latter. *Sex Roles*, 8, 1–20.