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An own-age bias in face recognition for children and older adults

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In the present study, we examined whether children and older adults exhibit an own-age face recognition bias. Participants studied photographs of children, younger adults, middle-aged adults, and older adults and were administered a recognition test. Results showed that both children and older adults more accurately recognized own-age faces than other-age faces. These data suggest that individuals may acquire expertise for identifying faces from their own age group and are discussed in terms of Sporer's (2001) in-group/out-group model of face recognition.

A number of studies have demonstrated that older adults and children exhibit poorer memory for faces than do younger adults (e.g., Adams-Price, 1992; Chance & Goldstein, 1984; Fulton & Bartlett, 1991; List, 1986; Searcy, Bartlett, & Memon, 2000; Searcy, Bartlett, Memon, & Swanson, 2001). However, this difference may, in part, result from the stimuli typically used in face recognition studies. Specifically, the majority of studies have asked college-aged participants to remember the faces of similar-aged targets. Thus, much of the prior work on age differences in face recognition has ignored whether participants may demonstrate superior recognition of faces from their own age group (i.e., an own-age bias; Wright & Stroud, 2002).

Several investigators have examined this issue by manipulating the age of the photographed individuals studied by participants (e.g., Bäckman, 1991; Bartlett & Leslie, 1986; Fulton & Bartlett, 1991; List, 1986; Mason, 1986; Perfect & Harris, 2003; Wright & Stroud, 2002; Yarmey, 1993; see Perfect & Moon, 2005, for a review). For example, Wright and Stroud presented younger (18- to 25-year-old) and middle-aged (35- to 55-year-old) adults with videos depicting a theft by a younger or a middle-aged perpetrator. Results showed that younger participants were more likely to correctly identify the perpetrator in a lineup when the culprit was also young. Middle-aged participants, in contrast, did not exhibit a significant own-age bias. Fulton and Bartlett reported a similar pattern, since younger adults in their study exhibited better recognition of younger than of older adult faces, whereas older adults demonstrated equivalent levels of accuracy for younger and older faces. On the basis of these data, Fulton and Bartlett suggested that an own-age bias exists for younger adults but is less reliable for older adults.

Contrary to Fulton and Bartlett (1991), an own-age bias has been demonstrated in several cases for older adults (Bäckman, 1991; Perfect & Harris, 2003). For example, Bäckman found that face recognition accuracy was enhanced when older adults were presented with older faces. In addition, Perfect and Harris reported that older adults were nearly three times more likely to correctly identify an older adult than to identify a younger adult from a lineup.

Far fewer studies have examined whether children exhibit a similar own-age bias (Chung, 1997; see also Lindholm, 2005; List, 1986). Chung conducted the only face recognition study that, to our knowledge, has investigated the own-age bias in children. Specifically, Chung presented children (7–12 years of age) and adults with photographs from those two age groups. Results showed that, in addition to demonstrating superior recognition of faces than did children, adults also exhibited an own-age bias. No such bias was reported for children.

Thus, it appears that an own-age bias is not consistently evident for older adults and is nonexistent for children. However, none of the previous research has tested both children and older adults in the same study. This is important, since the specific manipulations used in previous studies have varied considerably, making comparisons across studies difficult. Given the paucity of studies for both groups, particularly those with children, further research is needed. Thus, the primary purpose of the present study was to investigate the own-age bias in children

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and older adults, using a single experiment with the same procedures for both groups. Specifically, both groups of participants attempted to recognize photographs of children, young adults, middle-aged adults, and older adults. If an own-age bias exists, participants should be most accurate when identifying individuals from their own age group and less accurate when identifying individuals from different age groups.

METHOD

Participants

The participants were 70 individuals from two age groups: 40 children, 5–8 years of age (M = 6.9, SD = 0.91) and 30 older adults, 55–89 years of age (M = 71.6, SD = 10.4). The children were tested at local elementary schools and at facilities offering after-school programs in the Phoenix area and received small toys or stickers for their participation. Older adults were recruited from retirement communities and activity centers in the Phoenix area and received $5 for their participation. All participants were active and healthy and reported no physical or mental health problems. The participants were tested individually or in groups of up to 4 individuals. Data from 1 child and 1 older adult were excluded because they did not follow instructions.

Materials

The materials consisted of 128 digital photographs of 64 individuals, taken in the Phoenix metropolitan area.[1] Photographs were taken of each individual in two poses (smiling and not smiling) with the same white background and consisted of only their heads and shoulders. The photographs were split into four groups of 32 photographs. Each group consisted of 8 photographs from each age range (5–8, 18–25, 35–45, and 55–75 years), divided equally among males and females. Half of the photographs from each age range were of individuals smiling, and half were of individuals not smiling. The approximate size of the photographic image on the computer monitor for both the study and the test phases was 7.5 × 6 in.

The recognition test consisted of 64 photographs. Following the recommendation of Sporer (2001), alternate-pose photographs were employed so as to test face recognition, rather than picture identification (e.g., recognizing an idiosyncratic feature in a picture of a target, rather than the target itself). Thus, 32 of the photographs (8 from each age range, with an equal number of males and females) were the alternate-pose photographs of individuals viewed during the encoding phase, whereas the remaining 32 photographs (8 from each age range, with an equal number of males and females) had not been studied. All photographs were counterbalanced with respect to old/new status and pose (i.e., smiling or not smiling) and were presented in random order on the recognition test.

Procedure

In the first phase of the experiment, the participants were presented with 32 photographs of both males and females of various ages at a 10-sec rate, using Microsoft PowerPoint. The participants were instructed to categorize the individual in each photograph into one of four age ranges (5–8, 18–25, 35–45, or 55–75 years) by circling the appropriate age range on a form provided. They were not informed about an upcoming memory test.

After completing the photograph ratings, the participants were given a 5-min picture search task (i.e., circling hidden objects in a complex picture). The filler task was selected so that the children would be able to perform the same task as the older adults during the retention interval. Following the filler task, the recognition task was administered. The participants were informed that they would be presented with 64 photographs at a 10-sec rate. They were told that some individuals had been presented earlier, whereas others had not been seen previously. The participants were instructed to indicate whether each individual was presented earlier by circling either *yes* or *no* on a form provided.

RESULTS

All the data reported were first analyzed using a 2 (participant age: children or older adults) × 4 (photograph age: children, young adults, middle-aged adults, or older adults) mixed-factor ANOVA. Given our a priori predictions, these data were then analyzed separately for each age group. Effect sizes are reported using Cohen's (1988) d, where a value of d = .20 is considered small, a value of d = .50 is considered medium, and a value of d = .80 is considered large. The alpha level for all statistical tests was set to .05.

Recognition Data

Recognition data are presented in Table 1. These data indicate that an own-age bias was present, since the participants demonstrated superior recognition of photographs from their own age group. Analyses of corrected recognition scores (i.e., hits minus false alarms) revealed a significant main effect of photograph age [$F(3,198) = 3.81$, $MS_e = 0.05$] but no main effect of participant age, since recognition did not differ between the two age groups [$F(1,66) = 2.03$, $MS_e = 0.18$, $p = .16$]. More important, a significant photograph age × participant age interaction was present [$F(3,198) = 7.47$, $MS_e = 0.05$], indicative of an own-age bias. Planned comparisons on children's corrected recognition scores showed that recognition of photographs of children (M = .46) was significantly higher than recognition of photographs of younger adults [M = .36; $t(38) = 1.99$, $p = .05$; $d = .37$] and middle-aged adults [M = .34; $t(38) = 2.56$; $d = .50$]. Children were marginally more accurate for photographs of children than for photographs of older adults [M = .37; $t(38) = 1.78$, $p = .08$; $d = .36$]. Older adults' corrected recognition scores were significantly higher for photographs of older adults (M = .61) than for photographs of children [M = .36; $t(38) = 5.33$; $d = .88$], younger adults [M = .47; $t(38) = 2.65$; $d = .51$], and middle-aged adults [M = .39; $t(38) = 3.79$; $d = .71$].

Taken together, these data indicate that older adults exhibited a mirror effect (Glanzer & Adams, 1985, 1990), since high levels of hits were accompanied by low levels of false alarms for own-age faces. In contrast, recognition differences for children resulted primarily from higher levels of hits for same-age faces, with false alarms largely equivalent across levels of photograph age. Differences between older adults and children are best characterized in terms of discriminability and response bias, which will be examined next.

Discriminability and Response Bias Data: Chronological Age

The own-age bias observed may reflect differences in sensitivity to own and different-aged faces or may reflect a different decision criterion based on face age. In order

Table 1
Mean Proportions of Hits and False Alarms, Corrected Recognition Scores, and Signal Detection Data, Using the Objective Data

Participant Age	Photograph Age	Hits		False Alarms		Corrected Recognition		d'		C	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Children	Children	.66	.20	.20	.19	.46	.24	1.27	0.70	.21	.47
	Younger adult	.55	.23	.19	.20	.36	.30	1.04	0.85	.37	.44
	Middle-aged adult	.49	.20	.15	.25	.34	.25	1.02	0.73	.55	.54
	Older adult	.55	.24	.19	.20	.37	.26	1.04	0.75	.38	.49
Older adult	Children	.70	.18	.34	.24	.36	.30	0.94	0.82	−.04	.40
	Younger adult	.73	.22	.26	.20	.47	.28	1.28	0.84	.01	.45
	Middle-aged adult	.67	.21	.28	.22	.39	.35	1.03	0.93	.10	.35
	Older adult	.80	.20	.19	.19	.61	.28	1.71	0.89	.03	.40

Note—Corrected recognition scores were derived by subtracting false alarms from hits. d', discrimination index; C, response criterion.

to examine this, a signal detection analysis of these data was performed using d' as an estimate of the ability to discriminate between old and new items and C as an estimate of criterion (i.e., response bias). A neutral response bias produces a value of 0 for C, a conservative response bias results in positive values, and negative values of C are indicative of a liberal response bias. Following Snodgrass and Corwin (1988), all hit and false alarm rates were first adjusted by adding 0.5 to each frequency and dividing by $N + 1$, where N is the number of trials for a particular type of photograph.

Analyses of discriminability (d') indicated that discriminability did not differ between children ($M = 1.09$) and older adults ($M = 1.24$; $F < 1$) but did differ on the basis of photograph age [$F(3,198) = 4.00$, $MS_e = 0.38$]. A significant photograph age × participant age interaction was also present [$F(3,198) = 7.88$, $MS_e = 0.38$]. Follow-up analyses indicated that children's discriminability was marginally better for photographs of children than for photographs of younger adults [$t(38) = 1.74$, $p < .10$; $d = .30$] and middle-aged adults [$t(38) = 1.70$, $p < .10$; $d = .35$]. There was no difference in children's discriminability for photographs of children versus those of older adults [$t(38) = 1.51$, $p = .14$; $d = .32$]. In contrast to the results for children, discriminability differed considerably across levels of photograph age for older adults. Specifically, older adults' discriminability was significantly better for photographs of older adults than for photographs of children [$t(28) = 5.37$; $d = .90$], younger adults [$t(28) = 2.51$; $d = .50$], and middle-aged adults [$t(28) = 3.99$; $d = .75$]. Thus, older adults demonstrated enhanced discriminability of photographs from their own age group, whereas this effect was weaker for children.

Results from analyses of response bias (C) data showed that children ($M = .38$) were significantly more conservative in their responding than were older adults [$M = .02$; $F(1,66) = 16.34$, $MS_e = 0.50$] and that response bias varied on the basis of photograph age [$F(3,198) = 6.27$, $MS_e = 0.11$]. However, a photograph age × participant age interaction was not present [$F(3,198) = 1.07$, $MS_e = 0.11$, $p = .36$]. Follow-up tests indicated that children were significantly less conservative in their responses to photographs of children than in their responses to photographs of young adults [$t(38) = 2.32$; $d = .36$], middle-aged adults [$t(38) = 5.04$; $d = .68$], and older adults [$t(38) = 2.33$; $d = .36$]. Conversely, older adults' response bias did not differ on the basis of photograph age ($F < 1$; ds $\leq .19$). Thus, only children were significantly less conservative in their responses to photographs from their own age group than in their responses to photographs from other age ranges.

DISCUSSION

Overall, the data from the present study are consistent with an own-age bias for older adults and children. Specifically, both age groups exhibited higher levels of recognition accuracy for individuals from their own age group than for individuals from other age groups. Thus, the present study adds to a limited body of work demonstrating an own-age bias for older adults (e.g., Bäckman, 1991; Perfect & Harris, 2003) and, to our knowledge, is the only study that has demonstrated an own-age bias in face recognition for children. Such data also suggest that age-related deficits in face recognition may be exaggerated when participants study faces of individuals from other age groups (cf. Wright & Stroud, 2002).

The own-age bias observed here is similar to the better documented own-race bias (i.e., the finding that participants are more likely to remember individuals from their own race than individuals of another, less familiar race; see Meissner & Brigham, 2001, for a review). One explanation of the own-race bias proposes that memory for individuals from a particular race is positively related to the amount of contact one has with individuals from that race (e.g., Brigham & Malpass, 1985; Slone, Brigham, & Meissner, 2000). In a similar manner, individuals may acquire greater expertise at processing more frequently encountered own-race faces, resulting in better memory for such faces (e.g., Levin, 2000; Valentine, 1991). The own-age bias reported in the present study may result from participants' more frequent exposure to individuals from similar age groups, thus leading to greater expertise in identifying own-age faces. Older adults recruited for the present study came from retirement communities, and children were from after-school programs or daycare centers. Both settings would provide ample exposure and, perhaps, greater familiarity with individuals from the same age group, leading to an own-age bias.

However, such familiarity-based explanations have received mixed support within the own-race literature. For example, Meissner and Brigham's (2001) meta-analysis of 39 studies of the own-race bias concluded that contact with members of other races accounted for approximately 2% of the variability in the own-race bias across participants (see also Furl, Phillips, & O'Toole, 2002, for problems in computational models). In addition, a familiarity-based explanation appears to be particularly difficult to apply with respect to age. For example, older adults have been members of other age groups at different points in their lifetime and should have acquired sufficient levels of familiarity with other age groups to make identifications. Thus, it is unclear how older adults would develop a recognition advantage for older faces on the basis of familiarity alone. One possibility is that the own-age bias is not the product of familiarity per se but reflects different processing strategies for in-group versus out-group faces. Such a premise is behind Sporer's (2001) in-group/out-group model (IOM) of face processing. Sporer proposed that in-group faces are processed automatically with configural coding that reflects perceptual expertise for such faces. In contrast, out-group faces are first categorized for out-group status, with the possibility that processing does not extend beyond initial categorization (cf. Rodin, 1987). If additional processing does occur, these processes give "attentional weight to distinguishing out-group from in-group members . . . at the expense of dimensions that may be more suitable to differentiate members of a particular out-group" (Sporer, 2001, pp. 83–84). As Sporer noted, the IOM model predicts recognition differences for individuals within several out-groups, including those based on age.

Thus, the own-age bias reported in the present study may result from different processing strategies applied to in-group and out-group faces. In fact, in-group/out-group distinctions may have been encouraged by the encoding instruction to estimate the age of the individual in each photograph, with the attendant processing differences outlined in Sporer's (2001) IOM model. Furthermore, this suggests that the own-age bias may be eliminated or weakened when encoding instructions do not engender a focus on age. Several studies contradict this assumption. For example, own-age biases have been reported following encoding tasks that require judgments of pleasantness (Bartlett & Leslie, 1986; Fulton & Bartlett, 1991) or attractiveness (Anastasi & Rhodes, 2006) or simply instruct participants to remember faces for a later memory test (Mason, 1986; Wright & Stroud, 2002). These data, showing an own-age bias for several encoding tasks, would seem to be predicted by the IOM model. That is, the IOM model suggests that face processing is preceded by an obligatory judgment of whether a face belongs to an in- or an out-group, which in turn dictates the nature of face processing. Therefore, the specific encoding task may not be as important as the initial judgment that a face belongs to an in- or an out-group. Evidence from research in which the own-age bias was compared directly across different encoding tasks and age groups is presently lacking, so this assumption must be regarded as tentative.

Several caveats must be noted with regard to the data reported in the present study. First, children's recognition of photographs of children was significantly better than their recognition of photographs of younger and middle-aged adults. However, their recognition of children was only marginally better than their recognition of older adults. In contrast, older adults consistently demonstrated superior recognition of photographs of older adults, suggesting that the own-age bias may be less robust for children than for older adults. Effect size estimates confirm this conclusion, since across photograph age conditions, older adults exhibited a stronger own-age bias ($d = .69$) than did children ($d = .41$). Second, children demonstrated moderate differences in discriminability between own-age and different-age faces but did exhibit a significantly less conservative response bias for photographs of children. Older adults exhibited the opposite pattern, showing enhanced discriminability of own-age faces but no difference in response bias.[2] The fact that the own-age bias reflects an effect on discriminability for older adults and on response criterion for children suggests that the nature of the own-age bias may differ between the two age groups. The present study cannot resolve this issue, and further investigation is certainly warranted.

Regardless of the specific mechanisms for the own-age bias, the present study provides important information. Knowledge of the own-race bias has been crucial in the legal system (e.g., Brigham & Malpass, 1985; Meissner & Brigham, 2001; Sporer, 2001), where identification errors have serious consequences. The present study supports a similar memory bias and suggests that accuracy may be diminished when children or older adults must identify individuals of a different age. Thus, both the age of the witness and the age of the perpetrator are crucial factors when an individual's ability to remember previously seen faces is evaluated.

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NOTES

1. None of the participants reported knowing any of the individuals depicted in the photographs when they were asked at the conclusion of the experiment.

2. These data contrast with those showing a small effect, reported in the own-race bias literature, in which in-group faces were accompanied by a more conservative criterion than were out-group faces (Meissner & Brigham, 2001).

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