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Brief Report

Adults with siblings like children's faces more than those without

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ABSTRACT

Humans cross-culturally find infant faces both cute and highly likeable. Their so-called "baby schema" features have clear adaptive value by likely serving as an innate releasing mechanism that elicits caretaking behaviors from adults. However, we do not know whether experience with young children during social development might act to further facilitate this. Here we investigated the potential impact of having siblings on adult likeability judgments of children's faces. In this study, 73 adult men and women (40 with siblings and 33 without) were shown 148 different face pictures of young children (1 month to 6.5 years) and judged them for likeability. Results showed that both groups found faces of infants (<7 months) as equally likeable. However, for faces more than 7 months of age, whereas the no-sibling group showed a reduced liking for faces with increasing age, the sibling group found faces of all ages as equally likeable. Furthermore, for adults with siblings, the closer in age they were to their siblings, the stronger their likeability was for young children's faces. Our results are the first to show that having siblings can extend the influence of baby schema to children as well as infants.

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Introduction

Among all of the social stimuli we encounter in our environment, some have special privileged status in that they particularly engage the attention of other conspecifics due to their adaptive significance (Taylor, 1991; Öhman & Mineka, 2001). The faces of young children are an example of this. Lorenz (1943) first proposed the concept of Kindchenschema (or baby schema), a set of specific visual features common to babies that adults find attractive and elicit strong protective responses. These features include a large head, a round face, big eyes, a small nose and mouth, and a high prominent forehead, which act as an innate releasing mechanism to evoke positive emotional reactions and caretaking behaviors (Glocker et al., 2009; Lobmaier, Sprengelmeyer, Wiffen, & Perrett, 2010; Lorenz, 1943; Luo, Li, & Lee, 2011), thereby aiding a young child's survival (Parsons, Young, Murray, Stein, & Kringelbach, 2010).

Many studies have established the positive effects of facial baby schema, with infants displaying these features rated to be cuter, healthier, friendlier, and more attractive and adoptable (Chin, Wade, & French, 2006; Karraker & Stern, 1990; Ritter, Casey, & Langlois, 1991). Few studies have worked on child faces with these effects. Recent evidence suggests that this baby schema effect can extend beyond infant faces to those of children up to 4.5 years of age (Luo et al., 2011). After 4.5 years, however, we treat faces of children similarly to those of adults, suggesting that by the middle preschool years baby schema features eliciting innate responses may have become less prominent due to facio-cranial growth (Luo et al., 2011). In the current study, we also focused on the effects of baby schema as well as its extending to child faces.

Moreover, to date no research has investigated whether early social experience plays any role in the extent to which we find young children's faces likeable and, therefore, display protective and caretaking responses toward them. Our face processing ability is generally known to be highly susceptible to the influence of early experience (Lee, Quinn, Pascalis, & Slater, 2013; Pascalis, de Haan, & Nelson, 2002). In addition, a study examining experiential effects on perceptions of resemblance showed that actively caring for one's infant (via infant massage) increases paternal perceptions of parent–infant resemblance when compared with a control group (Volk, Darrell-Cheng, & Marini, 2010). More relevant to the current article, several studies have found that the experience of being raised together with a sibling would influence face recognition expertise (Macchi Cassia, 2011; Macchi Cassia, Kuefner, Picozzi, & Vescovo, 2009). For example, new mothers who had siblings showed expert recognition for infant faces, whereas those without siblings did not. These findings suggest that experience gained with sibling faces as children resulted in long-lasting effects that could be revived during adulthood (Macchi Cassia et al., 2009). In addition, evidence suggests that being raised together with a sibling during childhood has other advantages in terms of improved social cognition (McAlister & Peterson, 2013) and maturity (Hasnain & Adlakha, 2012). On the other hand, parents' judgments of their own children are influenced by birth order. For example, parents significantly underestimated their youngest children's heights, whereas their estimates of their elder siblings were generally accurate (Kaufman et al., 2014). The number of siblings also has an influence on measures such as IQ, educational attainment, status of current job, and current earnings (Heer, 1985). Recent studies have further revealed a number of sibling effects such as the influence of birth order on gender identity (VanderLaan, Blanchard, Wood, & Zucker, 2014), the influence of sibling age and age difference on social understanding (Taumoepeau & Reese, 2014), and the influence of sibling influence on status attainment (Zhang, 2014).

Given the importance of sibling experience outlined above, our hypothesis here was that experience with a sibling may influence how the baby schema was manifested and, therefore, that adults raised together with a sibling not only would show the typical baby schema effect but also would extend the effect to child faces. More specifically, we hypothesized that those with siblings may like baby faces the same as those without, but for young children's faces they may show higher likeability regardless of the normal gradual decrease with face age.

To test this hypothesis we gave adults with and without siblings a large number of face pictures of different-aged infants and young children and asked them to judge their likeability. To test this hypothesis further, we examined the effects of the age difference between the adults and their

siblings, the number of siblings, and sibling sex on their likeability judgments of young children's faces. Meanwhile, studies have shown that perceived age could influence people's judgments of faces. For example, the more attractive faces were, the younger they were perceived to be (Tatarunaite, Playle, Hood, Shaw, & Richmond, 2005). To test whether this hypothesis of difference between those with siblings and those without siblings on likeability judgments was related to perceived age, we then asked participants to judge the age of the faces as well.

Method

Participants

A total of 73 single Chinese undergraduate students (35 male and 38 female; $M = 21.26$ years, $SD = 1.44$, range = 18–25) participated. None had children of their own or worked with infants and children. Among this sample, 40 participants (18 male and 22 female; $M = 21.45$ years, $SD = 1.48$) had siblings (22 male and 32 female; $M = 21.63$ years, $SD = 14.65$, range = 11–32). Of these 40 adults, 31 had one sibling, 6 had two siblings, 1 had three siblings, and 2 had four siblings. In terms of older or younger siblings, 18 of those participants had older siblings, 18 had younger siblings, and 4 had both older and younger siblings. Their siblings did not participate in the study. The age difference between participants and siblings ranged from 1 to 10 years ($M = 3.80$, $SD = 2.16$). All participants with siblings reported that they had been raised together with them in the same household until their entry to the university, whereas the no-sibling participants were all raised in households where they were the only children.

Face stimuli

Face pictures were 148 images (pixel size: 210 × 300) of male and female Chinese children ranging from 1 month to 6.5 years of age from an existing database. Faces were presented in color and centered on a black background (Fig. 1). All faces had neutral emotional expressions, confirmed by an additional group of 36 adult raters (for details, see Luo et al., 2011).

Experimental procedures

Participants completed two sessions. During the first session, participants judged likeability of all the faces ("How do you like the face?") on a 7-point Likert scale ranging from 1 (*dislike it very much*) to 4 (*not sure*) to 7 (*like it very much*). During the second session, they judged the age of the faces ("How old is the face?") in years and months. During each session, participants sat 60 cm away from a

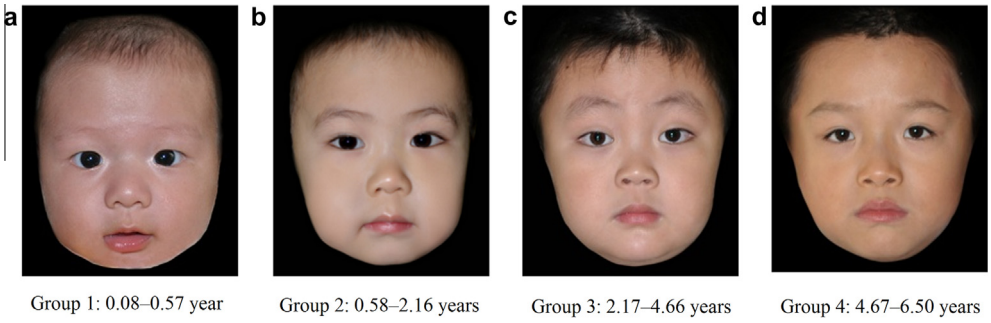

Fig. 1. Examples of children's faces in four different face age groups: (a) Group 1 ($M = 0.30$ year, $SD = 0.09$, range = 0.08–0.57); (b) Group 2 ($M = 1.57$ years, $SD = 0.52$, range = 0.58–2.16); (c) Group 3 ($M = 3.67$ years, $SD = 0.83$, range = 2.17–4.66); (d) Group 4 ($M = 5.48$ years, $SD = 0.55$, range = 4.67–6.50).

17-inch LCD screen and viewed faces individually in a random order. For each trial, a fixation was first shown for 1000 ms, followed by the face image for a maximum of 3000 ms. Face presentation was terminated when participants pressed the rating key and so could be less than 3000 ms. Participants were asked to judge as quickly and accurately as possible. Each session consisted of two blocks with a 1-min break between them.

Results

We first averaged the likeability and age judgments of all participants with or without siblings for a particular face to obtain a mean likeability score and a mean perceived age score for each face. Using these scores, we conducted linear regression analyses using the actual age of the faces as the predictor and the likeability scores and perceived ages as the predicted variables, respectively. We did the regression analyses separately on data from the participants with and without siblings to examine whether participants' experience with siblings would affect their judgments of the children's faces (Fig. 2A: likeability; Fig. 2B: perceived age). We found that the actual face age of children significantly and negatively predicted likeability judgments of participants without siblings ($t = -6.37$, $p < .001$, $R^2 = .22$). The older the face age, the less likeable the participants judged the faces to be, confirming previous findings (Luo et al., 2011). However, no significant face age effect was found for participants with siblings ($t = -1.75$, $p = .082$, $R^2 = .02$), who failed to show a face age-related decline in likeability judgments (Fig. 2A), suggesting a sibling effect on likeability judgments.

In addition, the actual face age of children could significantly and positively predict the age judgments of participants (with siblings: $t = 26.99$, $p < .001$, $R^2 = .83$; without siblings: $t = 25.61$, $p < .001$, $R^2 = .82$). Thus, regardless of experience with siblings, the participants' face age judgments corresponded closely with the actual ages of the children's faces, although both groups of participants tended to perceive ages of the faces as slightly older than the actual ages for infants and younger children (Fig. 2B). Thus, the sibling effect on likeability judgments might not be due to different age judgments by participants with siblings versus without siblings.

To explore the sibling effect further, we divided the children's faces into four face age groups according to whether their actual ages fell into one of the four quartiles of the entire age range of the faces. Thus, approximately equal numbers of face images were included in each of the following four face age groups: (a) Group 1 ($M = 0.30$ year, $SD = 0.09$, range = 0.08–0.57) consisting of 36 faces, (b) Group 2 ($M = 1.57$ years, $SD = 0.52$, range = 0.58–2.16) consisting of 37 faces, (c) Group 3 ($M = 3.67$ years, $SD = 0.83$, range = 2.17–4.66) consisting of 37 faces, and (d) Group 4 ($M = 5.48$, $SD = 0.55$, range = 4.67–6.50) consisting of 38 faces. We used repeated-measures analyses of variance (ANOVAs) with both judgments on four different face age groups as a within-participant factor

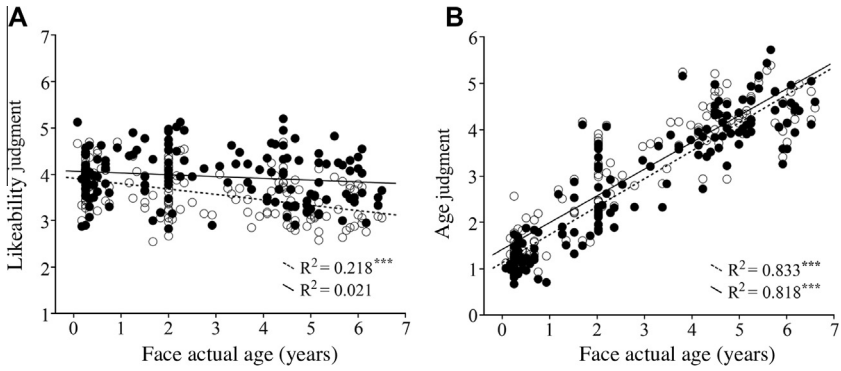

Fig. 2. Scatter plots and regression of likeability judgment (A) and age judgment (B) as a function of the actual ages of faces presented. Participants with siblings are represented by filled dots and a solid line with its regression value, whereas participants without siblings are represented by unfilled dots and a dotted line. ***$p < .001$.

separately, and we used sibling experience as a between-participants factor. Because an independent-samples t test showed no significant difference between males and females (all $ps > .30$), we combined the data from both sexes. For likeability judgments, we found significant main effects of age group, $F(3,213) = 8.52$, $p < .001$, $\eta^2 = .11$, and sibling, $F(1,71) = 4.06$, $p = .048$, $\eta^2 = .05$, as well as a significant interaction between them, $F(3,213) = 3.65$, $p = .014$, $\eta^2 = .05$. Post hoc analyses revealed that this significant effect was due to the fact that participants with siblings had significantly higher judgments of likeability than participants without siblings in each age group except for the youngest one (Fig. 3A).

For age judgments, we found a significant main effect of face age group, $F(3,213) = 390.70$, $p < .001$, $\eta^2 = .85$. Post hoc analysis showed that adults, regardless of whether they had siblings, judged the ages of the youngest group the youngest, followed by the second, third, and fourth face age groups, consistent with the regression findings (Fig. 3B). Adults with and without siblings made age judgments similarly in each face age group (Group 1: $t_1 = -1.42$, $p_1 = .161$; Group 2: $t_2 = -0.90$, $p_2 = .372$; Group 3: $t_3 = -1.06$, $p_3 = .291$; Group 4: $t_4 = -0.19$, $p_4 = .847$).

We also conducted repeated-measures ANOVAs on response time of both judgments with the same factors. No significant effects were found on likeability judgments (all $ps > .05$). But on age judgments, there was a significant main effect of face age group, $F(3,213) = 16.32$, $p < .001$, $\eta^2 = .19$. Post hoc analysis showed that participants found that it was more difficult to recognize the ages in the third group than in the other groups ($p < .001$). No gender differences were found.

Based on the existing finding of the age difference between siblings, and to better understand the sibling effect, we then focused on the data from the 40 participants with siblings by calculating the absolute values of mean age differences between them and each of their siblings. If a participant had more than one sibling, we averaged the age differences between the participants and all of their siblings. We conducted Pearson correlation analyses to examine whether participants' likeability judgments were significantly related to the age differences. In addition, we used independent-samples t tests to examine the effects of the number of siblings, whether the siblings were older or younger, and sibling gender on participants' likeability judgments.

Correlation analysis on judgments of likeability and mean age differences between participants and their siblings showed a significantly negative correlation in each face age group except for the youngest one (Fig. 4); the smaller the mean age difference was, the greater the likeability judgments were. We used the absolute values of the mean age differences in this analysis because there was no significant difference in each face age group observed for participants who had older siblings as opposed to younger siblings (Group 1: $t_1 = 1.75$, $p_1 = .088$; Group 2: $t_2 = 1.89$, $p_2 = .067$; Group 3: $t_3 = 0.56$, $p_3 = .578$; Group 4: $t_4 = 0.64$, $p_4 = .523$). There was also no significant influence of the number of siblings (1 vs. >1) (Group 1: $t_1 = 0.36$, $p_1 = .723$; Group 2: $t_2 = 0.86$, $p_2 = .401$; Group 3: $t_3 = 1.19$, $p_3 = .250$; Group 4: $t_4 = 1.26$, $p_4 = .227$) or the gender of the nearest sibling (same vs. different) (Group 1: $t_1 = -0.64$, $p_1 = .530$; Group 2: $t_2 = 0.30$, $p_2 = .767$; Group 3: $t_3 = 1.42$, $p_3 = .164$; Group 4: $t_4 = 1.79$, $p_4 = .081$) on participants' likeability judgments of the male and female children's faces across the

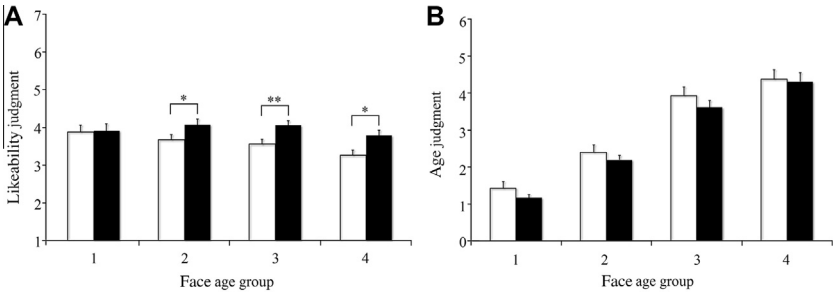

Fig. 3. Likeability judgment (A) and age judgment (B) of participants with siblings (filled bars) and without siblings (unfilled bars) in each face age group: Group 1 ($M = 0.30$ year, $SD = 0.09$, range = 0.08–0.57), Group 2 ($M = 1.57$ years, $SD = 0.52$, range = 0.58–2.16), Group 3 ($M = 3.67$ years, $SD = 0.83$, range = 2.17–4.66), and Group 4 ($M = 5.48$ years, $SD = 0.55$, range = 4.67–6.50). $^{*}p < .05$; $^{**}p < .01$. Error bars show standard errors.

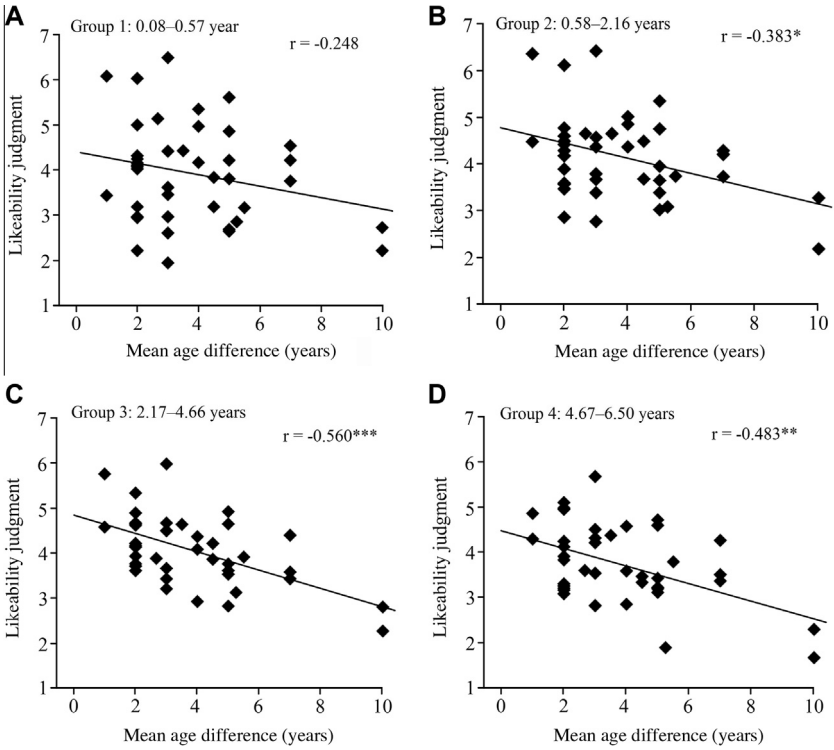

Fig. 4. Scatter plots and Pearson correlations of likeability judgments with absolute mean age differences between participants and their siblings in each face age group: Group 1 (M = 0.30 year, SD = 0.09, range = 0.08–0.57), Group 2 (M = 1.57 years, SD = 0.52, range = 0.58–2.16), Group 3 (M = 3.67 years, SD = 0.83, range = 2.17–4.66), and Group 4 (M = 5.48 years, SD = 0.55, range = 4.67–6.50). $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

age groups. Furthermore, among the participants with siblings, the mean age differences between them and their siblings were not significantly correlated with their age judgments (Group 1: $r_1 = 0.23$, $p_1 = .149$; Group 2: $r_2 = 0.16$, $p_2 = .330$; Group 3: $r_3 = -0.02$, $p_3 = .886$; Group 4: $r_4 = -0.06$, $p_4 = .705$).

Discussion

The presence of a cross-cultural preference for visual cues from infant faces has been known for more than a century. Various studies have demonstrated the robust effect of baby schema features proposed by Lorenz (1943) on positive adult responses to human infants (Hildebrandt & Fitzgerald, 1978; Langlois, Ritter, Casey, & Sawin, 1995; Sprengelmeyer et al., 2009). Our results showing high likeability judgments in both sibling and no-sibling groups for the faces of infants under 7 months of age also replicated this general finding. This effect of baby schema extends to own-race child faces (Glocker et al., 2009; Lobmaier et al., 2010), other-race human infant faces with which adults are not familiar (Volk, 2009), and faces of other species such as kittens, puppies, and monkeys (Brosch, Sander, & Scherer, 2007; Koda, Sato, & Kato, 2013). There is also evidence for species specificity given that the human brain responds more strongly to human baby faces than other animal infants (Caria et al., 2012). This effect even extends to young children at 3 to 6 years of age. For example, children's viewing time on adult faces with high baby schema features was significantly longer than that on adult faces with low features (Borgi, Cogliati-Dezza, Brelsford, Meints, & Cirulli, 2014). However, all of the existing studies have focused on the innate releasing mechanism of the baby schema itself, including

its decrease with facial age (Luo et al., 2011; Volk, Lukjanczuk, & Quinsey, 2007), but no study to date has examined how experience might modulate the manifestation of the mechanisms.

The current study provides the first empirical evidence to suggest that experience with siblings plays a significant role in our positive responses to young children's faces notwithstanding a limitation of a relatively small number of face stimuli used in the study. In contrast to adults without siblings, whose liking of young children's faces declined with increased face age, adults with siblings maintained their likeability for young children's faces to at least 6.5 years of age. Our finding could not be attributed to differences between the two groups in perceiving the baby schema facial features given that both groups performed equally well in judging the ages of young children's faces. Because neither of the two groups had work-related experience with young children, it is also unlikely that the group differences were attributable to no-sibling-related experiences of children, although we cannot rule out a contribution being exposed to additional children in the home environment (e.g., playmates of siblings). Our finding that the age difference between siblings influences the strength of likeability for children's faces also cannot be simply explained as a familiarity effect due to the differential length of time participants were exposed to siblings. This is because the effect occurred irrespective of whether the siblings were older or younger. Participants with older siblings would have been exposed to faces of other children for a longer time than children with younger siblings.

A more likely explanation for this effect of the age difference between siblings may be how much social interaction they had with their siblings and possibly the strength of the bond between them. The results of the correlation analyses in the current study supported this explanation. We found that the larger the age difference between siblings was, the less likely they were to be involved in mutual activities such as play, and also the bonds between them might not be so strong.

Our finding provides a new way to understand the mechanism of baby schema, shifting from the standard understanding that historically has been described as bottom-up perceptual processes to top-down processes tied to prior experience with infants and infant-like animals (Borgi & Cirulli, 2013; Kaufman et al., 2014). In addition, the current findings are also consistent with those of Volk and his colleagues (2007). They found differences in the extent of baby schema between older community members and undergraduate students, suggesting the role of individual differences. Our results suggested that one of the possible contributors to individual differences in response to infantile facial cues may be the experience with siblings during childhood. Such experience may serve as a facilitator to enhance and maintain baby schema.

Our finding suggests that having siblings might have adaptive advantages in the evolution of human societies. A combination of life history theory (e.g., Belsky, Steinberg, & Draper, 1991) and kin recognition (e.g., Lieberman, Tooby, & Cosmides, 2007) may explain how and why evolution would evolve the observed behaviors. The presence of siblings suggests an environment with enough resources to sustain multiple offspring, encouraging prolonged investment in one's future children. The mechanism is the proximity of a sibling that is based on the same mechanisms that determine resemblance (and incest avoidance).

In addition, in the past, humans usually lived together in large social groups that facilitated caretaking of all children irrespective of direct familial relationships. This allowed more flexibility for parents to work for obtaining resources or to raise group members without parents to help further strengthen the group. In these groups, older children would often have been involved in caretaking duties; indeed, in modern families, older children are often more involved with taking care of younger siblings. Therefore, it is interesting that our results do not support a conclusion that older siblings have a greater likeability toward young children during adulthood because of their greater experience of needing to carry out caretaking duties for younger siblings. Instead, what appears to be more important is having a sibling close to one's own age irrespective of whether the sibling is older or younger. Thus, experience of social interactions and bonds with a similar-aged sibling would appear to be one of the most influential factors of the likeability judgment of children's faces.

An important question is whether adults with siblings find both infants' and children's faces equally likeable because they are more responsive to the classical "baby schema" features or whether additional "child schema" features are also being used. The classical baby schema features clearly decline with age (e.g., see Fig. 1), and if these are the primary visual cues influencing likeability judgments, there should be a decline in judgments with age as we observed in the no-sibling group and in

our previous study (Luo et al., 2011). It is possible that the effect of having a sibling is to enhance general sensitivity to baby schema features, but this should have resulted in higher judgments in response to infant faces and a decline with age. Neither of these changes was found. Thus, adults with siblings may find additional facial features that distinguish young children from infants or adults as likeable and may switch from using baby schema to using child schema, thereby resulting in no age-related decline in their judgments. This possibility clearly requires further investigation.

In agreement with our previous study (Luo et al., 2011), we found no evidence for gender differences in likeability judgments of infants' and children's faces. Some other behavioral and neural imaging studies, however, have reported higher responses given by female participants than by male participants (Berman, 1980; Glocker et al., 2009; Proverbio, Brignone, Matarazzo, Del Zotto, & Zani, 2006). We also found no evidence of effects for whether siblings were the same or opposite sex to the participants. Furthermore, it did not seem to matter how many siblings a participant had, although in the current study the majority of participants had only a single sibling.

There are some limitations in the current study. First, the number of face images was relatively small, so that the effect might be stronger with more faces presented. Regarding the sibling effect we found, we cannot exclude the influence of siblings' parents, who might have some influences on those participants with siblings in terms of their affinity for children. Furthermore, it is unclear whether people who just love the very idea of children will tend to have more children. If so, growing up with a sibling could lead one to share this affinity because the family is fond of children. Finally, future studies should consider examining ratings of a child's face as a function of whether or not participants ever had a sibling whose age matches the age of the to-be-rated face. By comparing the ratings of participants with siblings who do or do not have a specific aged sibling, one should be able to pinpoint the specificity of the sibling effect in likeability judgments. These limitations need to be addressed in future studies so as to elucidate the role of early social experience on the emergence, formation, and development of the baby schema.

Conclusions

Our findings revealed that, consistent with Lorenz's (1943) proposal, human adults have a universal affinity toward infant faces. Furthermore, for the first time we revealed that experience with siblings could extend this affinity from faces of infants to faces of children as old as 6.5 years. Thus, our findings demonstrate an interaction between innate releasing mechanisms and postnatal experience in our protective and caretaking responses toward infants and children.

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