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Brief report

Infant preference for individual women's faces extends to girl prototype faces

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ABSTRACT

Three- to 4-month-old infants reared by female caregivers display a spontaneous preference for individual adult women's over men's faces. Here we report that this preference extends to prototype girl over boy faces. The findings suggest transfer of gender-diagnostic facial information from individual adult to prototype child faces.

Young infants, 3–4 months of age, demonstrate a preference for individual women's over men's faces (Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002). The preference is not based on low-level perceptual image characteristics that might be related to hair length or cosmetic usage (i.e., it is observed with upright but not inverted faces that have hair cues removed). Instead, it appears to be based on the higher-order cognitive variable of familiarity. That is, it is observed only for infants reared with female primary caregivers and is reversed in infants reared with male caregivers. In addition, the preference is not observed in newborn infants (Quinn et al., 2008). Infant looking at faces may therefore follow a similarity principle (a principle known to be applied to non-face objects) in which fixations are directed toward faces that look more like their representation of a face. This representation may be weighted toward female faces, based on experience with a female caregiver, possibly in combination with exposure to non-caregiver adult female faces that are seen more frequently than adult male faces in their everyday environment (Rennels & Davis, 2008). Thus, just as infants may rely on a "like me" representation when imitating the behavior of others (Meltzoff, 2007), they may also follow a "like caregiver" representation when looking at the faces of others.

The familiarity hypothesis for the female face preference is in accord with infant preference for mother over female stranger (e.g., Bushnell, Sai, & Mullen, 1989), and findings that have emerged on the development of perception of other social categories, including race and emotion (reviewed in Lee, Quinn, Pascalis, & Slater, in press). For example, in the case of race, infants show a preference for same-race faces by 3 months of age (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly et al., 2005,

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Fig. 1. The girl and boy prototype stimuli presented to the infants.

2007), and in the case of emotion, children who have been physically abused more readily tune into anger in emotionally ambiguous faces than children without a history of such abuse (Pollak & Kistler, 2002). All of these data indicate that how infants and children respond to social category information in faces is at least in part determined by the early experience that they have with faces.

To further understand how infants organize the domain of social experience, investigators have begun to explore the limits of category-specific infant face preferences. For example, Quinn et al. (2008) asked whether the preference that infants display for female over male faces would extend to female over male faces from other races. This question was left open because the infant participants and the stimulus faces in the original Quinn et al. (2002) study demonstrating the female preference were predominantly Caucasian. The results were that 3-month-old Caucasian infants reared by Caucasian female caregivers preferred adult female over male Caucasian faces, but not adult female over male Asian faces. A change in the race of the faces from same-race to other-race was thus sufficient to block the female face preference, a result that is in accord with data in adults demonstrating that gender information is more efficiently extracted from same- than other-race faces (O'Toole, Peterson, & Deffenbacher, 1996).

The present paper continues the exploration into the limits of the female face preference in infants, examining in particular whether it would extend to same-race child faces. Wild et al. (2000) investigated whether adults and children could identify the gender of child faces based on facial structure cues, and found that the task was more difficult (especially for young children) than when identifying the gender of adult faces, suggesting that the cues used to distinguish gender in child faces are similar, but more subtle, relative to the cues that signal gender in adult faces. The current study will therefore inform whether infants are sensitive to such cues. A group of 3- to 4-month-old infants was presented with a spontaneous preference test that paired a girl versus boy prototype face in their upright orientations. The stimuli are depicted in Fig. 1. Prototypes were used instead of individual faces because prior research has shown the gender diagnostic cues to be more robustly perceived in the prototypes than the individual faces by both adults and children (Wild et al., 2000). To insure that any preference for the upright faces was not due to low-level image characteristics, a control group of infants was presented with the girl versus boy prototype pairing in an inverted stimulus orientation.

1. Method

1.1. Participants

Participants were 48 healthy 3- to 4-month-olds (22 males) with mean age = 110.54 days, *SD* = 9.89 days. Three additional infants were tested, but one did not complete the procedure due to fussiness, and two were excluded from the data analysis because of failure to compare the stimuli ($n = 1$) and side preference, i.e., greater than 95% looking to one side of the display ($n = 1$). To determine how any observed preference for the girl prototype face might be affected by the presence of a sibling in the same age range from which the prototype faces were created (i.e., 7–10 years of age), recruitment of participants was limited to infants from families with no child sibling between 7 and 10 years of age (and no other siblings), those with a girl sibling between 7 and 10 years of age (and no other siblings), and those with a boy sibling between 7 and 10 years of age (and no other siblings). Participants were all Caucasian, reared by a female primary caregiver, and from middle-class backgrounds.

1.2. Stimuli

Stimuli were the girl and boy prototypes previously used by Wild et al. (2000). Each prototype was produced by applying the morphing methods of Yamaguchi, Hirukawa, and Kanazawa (1995) to 24 individual Caucasian faces from children between 7 and 10 years of age from a given gender. Sixteen adult raters (eight male, eight female) judged the two prototypes

on a 5-point scale of attractiveness with 5 being 'extremely attractive' and 1 being 'extremely unattractive'. The girl face had a mean rating of 3.00 ($SD = 0.89$) and the boy face had a mean rating of 3.13 ($SD = 0.72$), a difference that was not significant, $t(15) = -.52$, $p > .20$.

1.3. Apparatus and procedure

Infants were tested in a visual preference apparatus, modeled after that of Fagan (1970). Half the infants were presented with the upright girl versus boy prototype and the other half with the inverted stimuli in a left-right arrangement on two 10-s trials. For both orientations, left-right positioning of the stimuli was counterbalanced across infants on the first trial and reversed on the second trial. Infant looking times were recorded by trained observers who were naive to the hypotheses under investigation. Inter-observer agreement, as determined by comparing the looking times measured by an observer using a peephole in the apparatus, and an additional naive observer measuring looking times offline from videotape records, was calculated for the test trials of 12 infants. Average level of agreement was 97.62% ($SD = 1.51$).

2. Results

Summed looking time to the girl prototype was divided by summed looking time to both prototypes and converted to a percentage score by multiplying by 100. For the upright stimuli, mean preference for the girl prototype was 65.81% ($SD = 16.81$), a value that was reliably different from chance, $t(23) = 4.61$, $p < .001$, two-tailed, and 19 of 24 infants had individual preference scores above 50%, binomial probability < .01. In addition, the mean preference did not vary as a function of whether the infant participants were male [$N = 10$, $M = 63.52\%$, t(vs. chance) = 2.40, $p < .05$, two-tailed] or female [$N = 14$, $M = 67.42\%$, t(vs. chance) = 3.94, $p < .01$, two-tailed], $t(22) = -0.55$, $p > .20$. For the inverted stimuli, by contrast, the corresponding mean preference was 46.51% ($SD = 16.14$), and not different from chance, $t(23) = -1.06$, $p > .20$, two-tailed, and only 11 of 24 infants had above-50% preferences, binomial probability = 0.84. Moreover, the upright and inverted means were reliably different from each other, $t(46) = 4.06$, $p < .001$, two-tailed. The results indicate that the infants preferred the girl over the boy prototype, just as they have been shown to prefer individual female over male adult faces (Quinn et al., 2002, 2008).

Given the idea advanced in the introduction that infant looking is directed more to female over male faces because of their similarity to the faces that infants are more familiar with, we questioned whether the presence of a male or female sibling in the same age range from which the face prototypes were created (i.e., 7–10 years) might have affected the preference for the girl prototype face. For example, might the presence of a female sibling be a critical factor in driving the preference for the girl prototype? Likewise, might the presence of a male sibling be sufficient to reduce or eliminate the preference for the girl prototype? To address these questions, a supplementary analysis was performed on infants presented with the upright stimuli and no child sibling between 7 and 10 years of age (and no other siblings), those with a girl sibling between 7 and 10 years of age (and no other siblings), and those with a boy sibling between 7 and 10 years of age (and no other siblings). This analysis revealed that the preference for the girl prototype remained reliable in families with (1) no child sibling, $n = 9$, $M = 69.70\%$, $SD = 20.23$, $t(8) = 2.92$, $p < .02$, two-tailed, (2) a girl sibling, $n = 8$, $M = 60.33\%$, $SD = 14.17$, $t(7) = 2.06$, $p < .05$, one-tailed, and (3) a boy sibling, $n = 7$, $M = 67.02\%$, $SD = 15.52$, $t(6) = 2.90$, $p < .05$, two-tailed. Although each of the three means was above chance, an analysis of variance did not yield a significant effect of family composition, $F(2, 21) = 0.63$, $p > .50$, indicating that there were no differences among the means. That the preference for the girl prototype remained stable across the different family compositions is consistent with the idea that the effect reflects generalization from familiar adult faces to the prototype child face, rather than from known child faces to the prototype child face.

3. Discussion

Young infants prefer a girl over boy prototype when the faces are presented in an upright, but not inverted, orientation. The null results in the inverted condition suggest that the effect is not attributable to low-level image characteristics. The findings indicate that infants are sensitive to the facial structure cues that signal gender in child faces, cues previously shown to be more subtle than the cues used to signal gender in adult faces (Wild et al., 2000).

That the preference for the girl prototype was unaffected by whether the households in which the infants were reared had a boy, girl, or no sibling, is in agreement with the idea that the effect may be mediated by the gender of the primary caregiver (Quinn et al., 2002), with a possible additional contribution from the gender of the non-caregiver adult female faces experienced (Rennels & Davis, 2008). The fact that the magnitude of the female preference for the child faces in the current article is as strong as it was observed to be for adult faces in prior reports (Quinn et al., 2002, 2008) is also consistent with the idea that adult female faces are mediating the effect. This may be so because even in families with child siblings, infants during the first year of life still experience adult faces on a much higher percentage basis than child faces (Rennels & Davis, 2008). In addition, stronger gender markers in adult faces may allow infants to bootstrap perceptual learning of gender to child faces, a suggestion that is in accord with the recent finding that at least for adult participants, adaptation to adult faces is more effective than adaptation to child faces in activating a gender representation that generalizes across age categories (Barrett & O'Toole, 2009). The transfer of gender-diagnostic cues from the adult to the child faces may have been facilitated in this instance by the fact that the child stimuli were prototypes rather than individual faces.

It is worthy of note that the effect reported here, where the female preference originally observed with adult faces generalizes across age to child faces, stands in contrast with the prior report that the female preference does not generalize across race from adult same-race to adult other-race faces (Quinn et al., 2008). As to why this might be the case, one possibility is that infants may have more experience with same-race child faces than other-race adult faces, thereby increasing the likelihood that transfer will occur across age, but not across race. Another possibility is that while race and gender may be processed by different mechanisms with race processed before gender (Ito & Urland, 2003), age and gender may be processed by similar mechanisms with comparable timing (Mouchetant-Rostaing & Giard, 2003). Yet another possibility is that psychophysically, the difference between one race and another in terms of potency or salience is stronger than the difference between male and female faces, which is in turn stronger than the difference between adult and child faces. Interestingly, any of these possibilities might lead to a processing scheme in which face categories are organized hierarchically, with information about race superseding information about gender and then perhaps age (Quinn et al., 2008). However the relations between gender, age, and race processing come to be explained, the present findings contribute to our understanding of how infants respond to social category information in faces by indicating that there is transfer of gender-diagnostic facial information from individual adult to prototype child faces.

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