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In infancy the timing of emergence of the other-race effect is dependent on face gender

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ABSTRACT

Poorer recognition of other-race faces relative to own-race faces is well documented from late infancy to adulthood. Research has revealed an increase in the other-race effect (ORE) during the first year of life, but there is some disagreement regarding the age at which it emerges. Using cropped faces to eliminate discrimination based on external features, visual paired comparison and spontaneous visual preference measures were used to investigate the relationship between ORE and face gender at 3–4 and 8–9 months. Caucasian-White 3- to 4-month-olds' discrimination of Chinese, Malay, and Caucasian-White faces showed an own-race advantage for female faces alone whereas at 8–9 months the own-race advantage was general across gender. This developmental effect is accompanied by a preference for female over male faces at 4 months and no gender preference at 9 months. The pattern of recognition advantage and preference suggests that there is a shift from a female-based own-race recognition advantage to a general own-race recognition advantage, in keeping with a visual and social experience-based account of ORE.

1. Introduction

Faces are perhaps one of the most important categories of visual stimuli in our environment. However, recognition ability is far from uniform across faces, being subject to variation across races in particular. The consistent finding that adults show better recognition for own-race than other-race faces is referred to as the *other-race effect* (ORE; see Meissner & Brigham, 2001 for a review). One of the most influential theories explaining the ORE and other face processing advantages is Valentine's (1991) multidimensional face-space (MDS) model. According to it, familiarity with a given face type (e.g., own-race) provides the opportunity to learn to differentiate between exemplars within this familiar category (Quinn & Tanaka, 2007), whereas such within-category discrimination is not possible for unfamiliar face types (e.g., other-race). Thus, the ORE is assumed to be a consequence of predominant experience with faces of individuals' own-race.

However, this effect is believed to be initially absent in infants, developing during the first year of life. This is consistent with the notion of 'perceptual narrowing' (Nelson, 2001). Specifically, infants begin life with a face perception system with a broad tuning that allows the processing of faces in general. Then, as they experience more faces, the face system narrows to specialize for the type(s) of face that they encounter most (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly et al., 2007a, 2007b, 2009; Quinn et al., 2008; Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002).

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There is increasing evidence that infants' spontaneous preference and enhanced discrimination of a specific category (i.e., own-race, female gender) is strongly influenced by their visual and social environment. For example, newborns show no racial or gender preference but by 3 months, infants show a visual preference for both the gender (Quinn et al., 2002, 2008) and race (Kelly et al., 2005) of their primary caregiver. In contrast, there is inconsistent evidence regarding age of onset for own-race recognition advantage. Although investigators generally agree that the ORE develops within the first year, some studies found that 3-month-olds showed an own-race recognition advantage (Barrera & Maurer, 1981; Hayden, Bhatt, Joseph, & Tanaka, 2007; Sangrigoli & de Schonen, 2004), whereas others (Ferguson, Kulkofsky, Cashon, & Casasola, 2009; Kelly et al., 2007b, 2009) found ORE developing between 6 and 9 months. The different findings of these studies could be explained by two differences in the stimuli used. First, studies that demonstrated broad recognition ability at 3 months and an onset of ORE between 6 and 9 months presented faces with external information (Ferguson et al., 2009; Kelly et al., 2007b, 2009) whereas studies that found an onset of ORE at 3 months presented faces without external information (Hayden et al., 2007; Sangrigoli & de Schonen, 2004). There is evidence that very young infants tend to process the external features of faces (low-level sensory cues) more easily than their internal details (Bartrip, Morton, & de Schonen, 2001; Hainline, 1978; Haith, Bergman, & Moore, 1977; Maurer & Salapatek, 1976; Pascalis, de Schonen, Morton, Deruelle, & Fabre-Grenet, 1995; Rose, Jankowski, & Feldman, 2008; Turati, Cassia, Simion, & Leo, 2006). Young infants are less likely than older ones to scan the inner features of faces (Maurer & Salapatek, 1976; Turati et al., 2006) and a shift away from the tendency to use external facial information is found between 5 and 9 months (Rose et al., 2008). Therefore, the inclusion of external facial information in both Ferguson et al. (2009) and Kelly et al. (2007b, 2009) may have permitted face identification on the basis of low-level external contour cues. It can be argued (e.g., Rose et al., 2008; Turati et al., 2006) that the ORE is linked to higher-level configurational coding of faces and so its absence in 3-month-olds when external information was presented may have been due to their tendency to rely on external cues when these are available. The findings from these studies of a developing ORE in older infants may be due to the shift to configurational processing more than the development of ORE. And the possibility remains that other studies revealed an ORE in 3-month-olds because infants were compelled to process internal configuration.

Second, Hayden et al. (2007) and Sangrigoli and de Schonen (2004), who showed the ORE in infancy at 3 months, presented only female faces whereas Kelly et al. (2007b, 2009) used both female and male faces. Because 3-month-old infants show a preference and processing advantage for female faces when their primary caregiver is female (Quinn et al., 2002, 2008), it is possible that the own-race recognition advantage develops first for female faces and later for male faces when their primary caregiver is female. For example, newborns can discriminate their mother's face from another female face (Bushnell, Sai, & Mullin, 1989; Pascalis et al., 1995; Walton, Bower, & Bower, 1992), two unfamiliar female faces when external features are available (Turati et al., 2006), and by 3 months, two unfamiliar female faces when external features are not available (Hayden et al., 2007; Sangrigoli & de Schonen, 2004). However, they do not have the same discrimination abilities when it comes to their father's face. Newborns (Walton et al., 1992) and 4-month-olds (Ward, 1998) are not able to discriminate their father's face from another unfamiliar male face. Even by the age of 7 months, infants still have difficulty discriminating among unfamiliar male faces (Fagan, 1976). This may be related to the developmental task of forming an attachment relationship in infancy (e.g., Scherf & Scott, 2012) whereby the need to perceptually discriminate primary caregiver(s) from all other individuals induces the emergence of recognition advantages for faces of the same race, gender, and age of the primary caregiver. Note that the absence of face gender differences at 3 months in work by Kelly et al. (2007b, 2009) could be because 3-month-old infants were able to rely on external facial information, a level of identification at which an experience-based female face advantage might not emerge.

The aim of the work that we report here is to investigate the possible interaction between face gender and face race in the emergence of the ORE. Mindful of the considerations above, we presented faces on a black background and cropped out the overall shape of the head. This step was taken to ensure that infants were not using hairstyle/hair shape cues; forcing them to process more subtle cues and so providing circumstances under which we would expect to see evidence of face specialization if it has occurred. Second, focusing on knowledge that young infants show a processing advantage for female faces that is likely related to the characteristics of their primary caregiver (Quinn et al., 2002; Scherf & Scott, 2012), we specifically investigated infants with female (own-race) primary caregivers. We used two measures to assess face recognition and face preference of 3- to 4-month-old and 8- to 9-month-old Caucasian-White infants, recognition through the visual paired comparison (VPC) procedure used by Kelly et al. (2007, 2009) and preference through the visual preference (VP) procedure used by Quinn et al. (2002, 2008).

On the basis of a caregiver-primacy model in which young infants primarily experience and form their principal attachment to female caregivers, our prediction was that young infants would be better able to recognize own-race female faces and prefer them in comparison with own-race male faces and other-race faces, but that there would be no such effects in the case of male faces. On the other hand, we expected that older infants' cumulative experience extending the effect beyond the primary caregiver would result in a processing advantage for own race faces that is applied to male as well as female faces.

2. Experiment 1

In Experiment 1, we investigated the relation between face gender and the ORE. Three- to 4-month-old and 8- to 9-month-old Caucasian-White infants were presented with a VPC test similar to the one by Kelly et al. (2007, 2009) but with cropped female and male Caucasian-White, Chinese, and Malay faces. If the cropped faces meant that specialization could