The other-race effect in children from a multiracial population: A cross-cultural comparison

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Research Highlights

- Examines the ORE in children from a monoracial vs. a multiracial population.
- British-White children showed an ORE to all other-race faces.
- Malaysian-Chinese children showed an ORE to one other-race face only.
- 5-6-year-old Malaysian-Chinese children showed no ORE for female faces.

Abstract

The role of experience with other-race faces on the development of the ORE was investigated through a cross-cultural comparison between 5- to 6-year-old (*n* = 83) and 13- to 14-year-old (*n* = 66) children raised in a monoracial (British-White) and a multiracial (Malaysian-Chinese) population. British-White children showed an ORE to three other-race faces (Chinese, Malay, and African-Black) that was stable across age. Malaysian-Chinese children showed recognition deficit for less experienced faces (African-Black) but showed a recognition advantage for faces of which they have direct or indirect experience. Interestingly, younger (Malaysian-Chinese) children showed no ORE for female faces such that they can recognize all female faces regardless of race. These findings point to the importance of early race and gender experiences in re-organizing the face representation to accommodate changes in experience across development.

Keywords: other-race effect; face processing; face recognition; cross-cultural; children

Introduction

The other-race effect (ORE) is a robust finding in adult face recognition, reflected in superior recognition of own-race than other-race faces. The basis for the other-race effect has been explained within several theoretical frameworks, all sharing the principle that intergroup contact has some influence on its magnitude. Specifically, authors have argued that the other-race effect is due to formation of different mental representations of own-race and other-race faces (Valentine, 1991), leading to difficulty in generalizing expertise gained from own-race faces to other-race faces (Chance, Turner, & Goldstein, 1982; Michel, Rossion, Han, Chung, & Caldara, 2006; Rhodes, Brake, Taylor, & Tan, 1989; Tanaka, Kiefer, & Bukach, 2004). Recently an integrative framework has been proposed where both social-cognitive variables and perceptual expertise interact in contributing to face perception (Hugenberg, Young, Bernstein, & Sacco, 2010; Sporer, 2001; Young, Hugenberg, Bernstein, & Sacco, 2012). These accounts suggest that the recognition advantage for own-race faces is dependent on social categorization mechanisms determining the in-group or out-group status of a face, perceiver motivation to individuate in-group faces, and perceiver experience with faces belonging to the relevant category (e.g., Lebrecht, Pierce, Tarr, & Tanaka, 2009; Short & Mondloch, 2010; Young & Hugenberg, 2012).

The other-race effect becomes finely tuned very early in life (Ferguson et al., 2009; Hayden et al., 2007; Kelly et al., 2007; 2009, Sangrigoli & de Schonen, 2004a; Tham, Bremner & Hay, 2015). For example, Kelly et al. (2007) found that Caucasian-White 3-month-olds could discriminate between faces within four racial groups (Caucasian-White, Middle Eastern, Chinese, and African-Black), but this ability became specialized to two racial groups by 6 months of age (Caucasian-White, and

Chinese) and to own-race faces only by 9 months of age (Caucasian-White). Studies with children from 3 years onwards suggest a fairly stable other-race effect during childhood, particularly those from a monoracial population (Anzures et al., 2014; Chiroro, Tredoux, Radaelli, & Meissner, 2008; Chiroro & Valentine, 1995; Cross, Cross, & Daly, 1971; Feinman & Entwisle, 1976; Pezdek, Blandon-Gitlin, & Moore, 2003; Suhrke et al., 2014) and has been replicated in individuals from different racial backgrounds, including individuals with Caucasian-White, African-Black, and Chinese parentage (for reviews, see Hancock & Rhodes, 2008; Meissner & Brigham, 2001).

Despite the prevalence of an own-race face recognition advantage, experience with other-race individuals (due to exposure training or immersion in natural multiracial environments) can enhance the ability to recognize other-race faces. Laboratory exposure studies have been successful in reducing the other-race effect in infant, child, and adult face recognition (Anzures et al., 2012; Heron-Delaney et al., 2011; Lebrecht et al., 2009; Sangrigoli & de Schonen, 2004a; Tanaka & Pierce, 2009). Additionally, experience effects have been shown in the case of children adopted into families of a different race. For example, de Heering et al. (2010) studied 6- to 14-year-old Asian children who were adopted by Caucasian-White families in Europe between the ages of 2 and 26 months. Age-matched (Asian) controls showed a clear other-race effect in favor of own-race faces, whereas the adopted participants performed equally well with all faces (Caucasian-White and Asian faces). In another study, a complete reversal of the other-race effect can be seen in adults that have been adopted for approximately 23 years (Sangrigoli, Pallier, Argenti, Ventureyra, & de Schonen, 2005) Thus face representations remain plastic enough to incorporate faces from another race when experience is acquired with the new facial type.

As most studies of the other-race effect have been with individuals from monoracial populations, an important theoretical question remains unanswered. How does consistent exposure to a variety of face races influences the development of the other-race effect? Although training and adoption studies provide important information regarding the flexibility of the other-race effect and the plasticity of children's face recognition system, the effect from training studies is transitory (e.g., Hills & Lewis, 2011) and evidence from adoption studies is retrospective. These studies do not assess the effects of permanent immersion in multiracial environments.

To date, there are a few rather inconclusive studies of the other-race effect in individuals born and raised from multiracial environments. Three-month-old single-race infants (both parents of the same race) living in a multiracial environment showed no visual preference for own-race and other experienced race faces (Bar-Haim, Ziv, Lamy, & Hodes, 2006), and no evidence of recognition of faces belonging to either group (Gaither, Pauker, & Johnson, 2012). Work with children (between 6 and 12 years) in a multiracial environment showed comparable recognition for own-race and other experienced race (e.g., Cross, et al., 1971; Feinman & Entwisle, 1976). Work with adults with multiracial experience suggested that high levels of contact are associated with a reduced other-race effect for experienced races (Hancock & Rhodes, 2008; Tan, Stephen, Whitehead, & Sheppard, 2012). More recently, Tan et al. (2012) found that Chinese adults (from Malaysia, a multiracial population) showed a recognition advantage for own-race Chinese faces and other-race Caucasian-White faces but the other-race effect for less experienced African-Black faces. They suggested that reduced other-race effect in Caucasian-White faces may be explained by the high exposure to Western people, directly because the participants were studying in a branch campus of a British university, and indirectly through media because there was a prevalence of Western movies shown in the cinema.

Despite evidence of specialization for own-race and experienced other-race faces in adults of these populations, the development of specialization in children in multiracial populations has not yet been properly investigated. This is mainly due to the stimuli used. Studies of children from multiracial populations used faces from races with which the children had experience and excluded faces from races with which children had less experience (Cross, et al., 1971; de Heering et al., 2010; Feinman & Entwisle, 1976). For example, Cross et al. (1971) tested 7-, 12-, and 17-year-olds, and adult Caucasian-White participants using faces of experienced races only (Caucasian-White and African-Black faces). Although all age groups demonstrated comparable recognition for both own-race and experienced other-race faces, this does not indicate whether there is evidence of the other-race effect for non-experienced races in children from the multiracial population. Thus, the first aim of the present work is to understand how the other-race effect develops for children born and raised in a multiracial environment. It is unclear whether these children develop the usual other-race effect for non-experienced faces as seen in adults or whether they maintain a broad representation of faces such that they can recognize faces of all racial groups regardless of experience, with narrowing to experienced races occurring only in adulthood.

A second aim is to investigate whether the greater degree of perceptual narrowing encountered in children raised in monoracial cultures carries any advantages in terms of recognition accuracy. Recently, Rossion and Michel (2011) predicted a trade-off between breadth of face representation and accuracy of own-race recognition. There is indirect evidence for this in some research on the other-age effect in adults. For example, de Heering and Rossion (2008) found that adult preschool teachers (child and adult expert) processed children's faces better than did adults with limited visual experience with child faces (adult expert). However, there was a reverse effect with adult faces, with better face processing by the adult expert group than the child and adult expert group, suggesting a trade-off, in this case between age-breadth and accuracy.

With these questions in mind, we tested face recognition in Malaysian-Chinese and British-White children. Like Tan et al. (2012), the country selected for the multiracial population was Malaysia, specifically Chinese participants from Kuala Lumpur (population estimate: 45.2% Malays, 42.3% Chinese, 11% Indians, and 1.5% other minority groups; Department of Statistics Malaysia, 2011). Malaysia is an integrated population in terms of the high proportion of the three main races, and also in terms of exposure to Western cultures, as reflected in the high proportion of Western media (Yahya, 2001). Given its cultural diversity, this country provides an environment that could potentially reduce or even eliminate the other-race effect because of the frequent direct and indirect exposure to various races throughout development. As a comparison, the country selected for the monoracial population was the UK, specifically Caucasian-White participants from Lancaster (population estimate: 95.6% Caucasian-Whites and 4.4% other minority groups; Office for National Statistics, 2011). Across both cultures, we tested recognition accuracy by children from two age groups (5- to 6-year-olds and 13- to 14-year-olds) on four face races (Chinese, Malay, Caucasian-White, African-Black).

Our expectation was that children from the monoracial population are likely to show the typical other-race effect - with superior performance on own-race

Caucasian-White faces and poorer performance on less experienced races (Chinese, Malay, and African-Black). Three possible hypotheses could be generated for the multiracial population. If the other-race effect arises only from direct experiences (i.e., face to face contact), then children will show other-race effect for Caucasian-White and African-Black faces. Alternatively, if the other-race effect arises from both direct and indirect (media) experiences as suggested by Tan et al. (2012), children will show other-race effect only for African-Black faces because such faces are not typically encountered in Malaysia either directly or indirectly through media contact. The third possible hypothesis is that children from the multiracial population will maintain a very broad facial representation, such that they may show comparable recognition for all face races, including those not experienced (African-Black faces).

Method

Participants

Participants were 68 Malaysian-Chinese 5- to 6-years-old (*n* = 37; 15 males) and 13- to 14-years-old (*n* = 31; 17 males) children and 83 British-White 5- to 6-years-old (*n* = 48; 25 males) and 13- to 14-years-old (*n* = 35; 17 males) children recruited from primary and secondary schools in Kuala Lumpur, Malaysia, and in Lancaster, United Kingdom[1]. Participants from Malaysia are of Chinese descent whereas participants from the United Kingdom were of Caucasian-White descent.

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[1] Participants completed a questionnaire that asked them to report exposure to each of the four races (i.e., “How frequently do you see people from these racial groups?"). As expected, the Malaysian-Chinese group were frequently exposed to own-race Chinese (*M* = 84.6%; SD = 26%) and other-race Malay (*M* = 48.3%; SD = 27.4%) whereas children in the British-White group were exposed to own-race Caucasian-White (*M* = 97.9%; SD = 7%) and very minimally exposed to other-races (*M* < 24%; *SD* < 27%). Thus, the Malaysian-Chinese children represent a distinct population that has considerable exposure to another racial group at an early age, in contrast to British-White children and other monoracial populations tested in the past. We also

Stimuli

Stimuli consisted of 64 color photographs of adult faces (20- to 30-year-old) distributed equally by race (Chinese, Malay, Caucasian-White, and African-Black) and gender. The Chinese and Malay faces were faces of students from Sunway University, Malaysia whereas the Caucasian-White and African-Black faces were obtained from the Lancaster University face database. We chose to use adult faces (as opposed to children's faces) to permit comparison with previous research on infant and child face recognition, which has predominantly used adult faces.

These faces were selected based on 20 adult British-White and 20 adult Malaysian-Chinese raters' judgments of own- and other-race faces on a 7-point scale of clarity of photo quality, face typicality, and attractiveness. Faces with the highest scores in clarity and face typicality, but average scores on attractiveness, were selected. The latter criterion was applied because extremes of attractiveness/unattractiveness affect recognition (e.g., Cooper, Geldart, Mondloch, & Maurer, 2006). Each of the selected 64 faces was photographed in two orientations (frontal orientation and a ¾ profile orientation) leading to 128 images in total. A black mask was applied to photographs to eliminate external hairstyle but not hairline information. All photographs measured 3 x 4 inches, had a black background, and were laminated for presentation as picture cards.

Procedure

Children were tested individually. Each went through one practice familiarization-test block (feedback was given after each practice response) and four familiarization-test blocks. During the practice familiarization-test block, participants

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assessed children's media contact but did not report this because the younger age group found this question hard to answer, possible because they were predominantly exposed to cartoons and/or animations on television.

were familiarized with 4 pictures that were unrelated to the study (two randomly selected Disney cartoon characters and 1 female and 1 male Indian faces) and tested on 8 faces (4 familiar and 4 new faces).

Within each familiarization-test block, children began with a familiarization phase, followed by a 2-minute unrelated filler task (word search) and a subsequent old/new recognition phase. For each of these, participants were familiarized with a series of 8 pictures (one female and one male exemplar of each of the four face races) of the same orientation (i.e., frontal) and were tested on 16 faces (8 old and 8 new) of a different orientation (i.e., profile). We varied face orientation between familiarization and test phases to ensure that face recognition was tested as opposed to picture recognition (e.g., Bruce & Young, 1986). The new faces were varied in gender and race in the same way as the old. To ensure attention to the images during familiarization, participants were asked to indicate whether each face was attractive or not (these data were not analyzed). At test, participants were asked to indicate whether they "have seen the face before" or "have not seen the face before". Each face was shown individually for 3000ms or until the child provided a verbal response.

Results

Discrimination scores

Discrimination accuracy (A') scores (a non-parametric equivalent of d'), which index both hits and false alarms were calculated to determine children's recognition accuracy for test blocks. A' can range from 0 to 1, with high scores indicating greater recognition accuracy (for calculation, see Stanislaw & Todorov, 1999).

Preliminary analysis of A' revealed no significant effects or interactions associated with test trial block, participant gender, or orientation order, so the data were collapsed across these factors in a subsequent four-way ANOVA with population (multiracial, monoracial) and age (young children, adolescents) as between-participants factors, and face race (Chinese, Malay, Caucasian-White, African-Black) and face gender as within-participants factors.

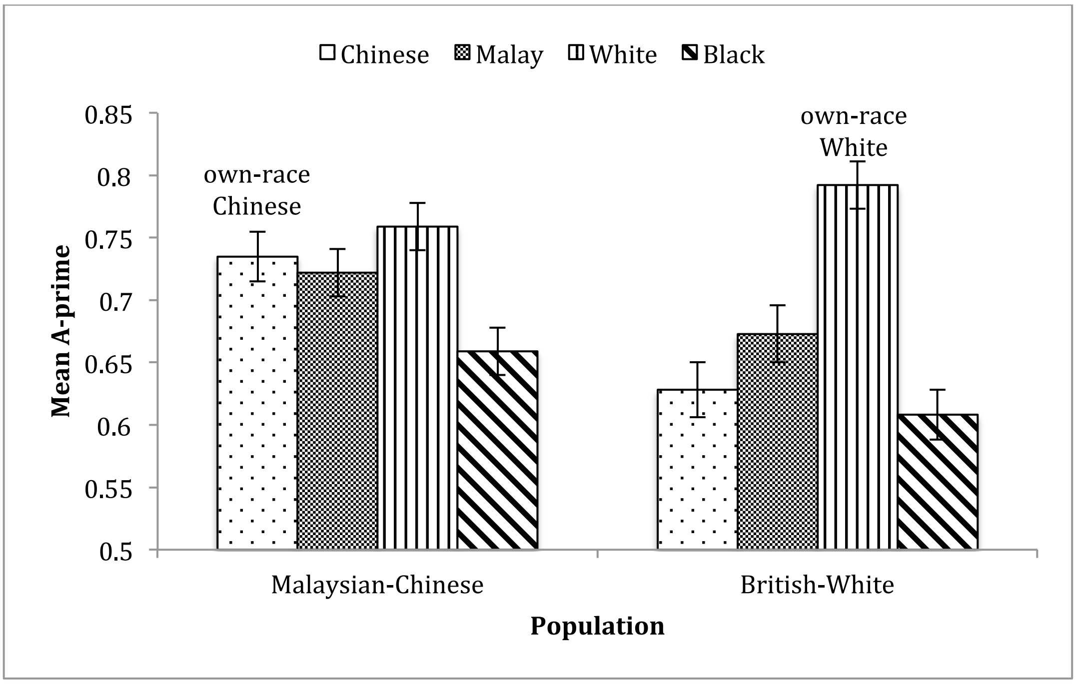
There was a significant effect of age, F (1, 143) = 40.97, $p < .001$, $\eta^2 = .22$, with scores higher for the older age group ($M = .76$, $SD = .11$) than the younger age group ($M = .65$, $SD = .10$). There were also significant effects of face race, F (3, 429) = 21.45, $p < .001$, $\eta^2 = .13$, and population, F (1, 143) = 5.30, $p = .023$, $\eta^2 = .04$, which were qualified by a significant face race x population interaction, F (3, 429) = 5.38, $p < .001$, $\eta^2 = .04$ (see Figure 1). As expected, British-White children recognized Caucasian-White faces better than Chinese, Malay, and African-Black faces ($p < .001$). In contrast, the Malaysian-Chinese children had better recognition of Caucasian-White and Chinese faces ($p \leq .006$), and marginally better recognition of Malay faces ($p = .08$) in comparison with African-Black faces. No differences were found across recognition of Chinese, Malay, and Caucasian-White ($p \geq .55$) faces. The population comparison was significant for Chinese faces, t (149) = 3.50, $p < .001$, and marginally so for African-Black faces t (149) = 1.79, $p = .08$, with better performance on these face races by the Malaysian-Chinese participants. However, there was no population difference in the case of Malay or Caucasian-White faces ($p \geq .12$).

To investigate whether multiracial experience has processing capacity implications, scores for Malaysian-Chinese children's recognition of Chinese faces were compared against scores for British-White children's recognition of Caucasian-

White faces. Own-race recognition was found to be significantly lower in the multiracial population in comparison to the monoracial population, t (149) = -2.12, p = .03.

In summary, the face race by population interaction is explained by the fact that children from the British-White population showed an other-race effect on all other-race faces (Chinese, Malay, and African-Black) whereas children from the Malaysian-Chinese population showed an other-race effect on other-race African-Black faces only. The population comparison was significant for Chinese faces and (marginally so for) African-Black faces with mean scores higher for the multiracial population than the monoracial population but the own-race mean scores (multiracial: Chinese; and monoracial: Caucasian-White) were significantly higher for the monoracial population than the multiracial population.

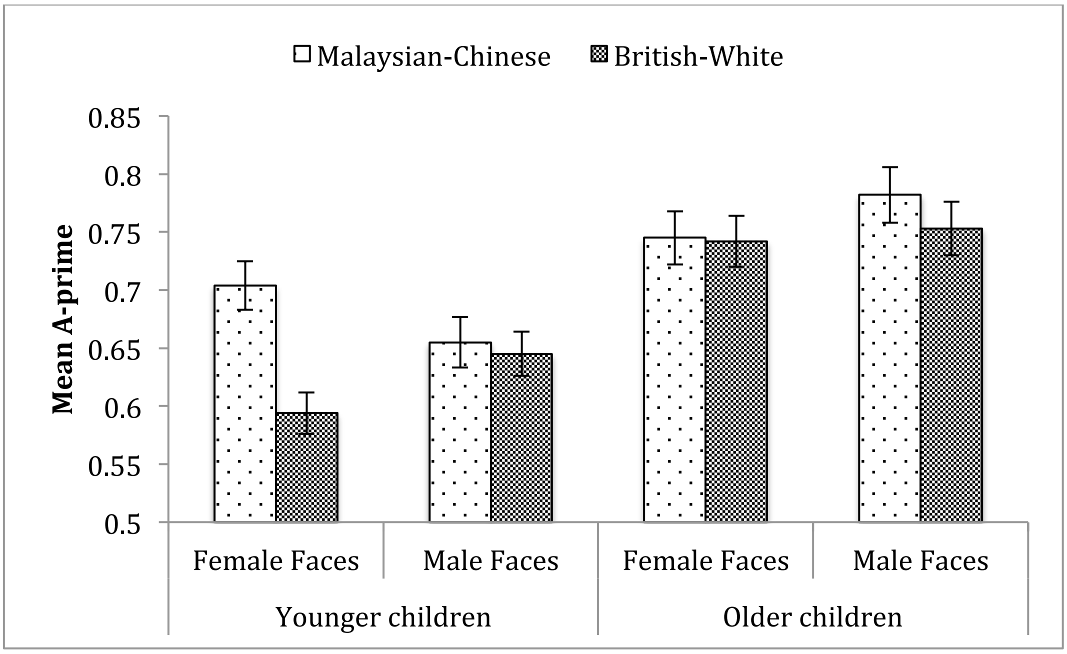
Figure 1**.** Mean A-prime and standard error as a function of population and face race.



Interestingly, there was a significant face gender x population x age interaction, F (1, 143) = 4.88, p = .03, η^2 = .03 (see Figure 2). The interaction between age and face gender was found to be significant within the multiracial population, F (1, 66) = 5.19, p = .03 η^2 = .07, but not within the monoracial population (p = .35). Further analyses of this interaction in the multiracial population revealed that within the younger age group, female faces were recognized marginally better than male faces, t (36) = 2.013, p = .05. On the other hand, no face gender difference was found in the older age group, t (30) = -1.236, p = .23. Additional comparison of female recognition between ages indicated that young children in the multiracial group had better recognition of female faces such that performance was comparable with the older age group, t (66) = -1.126, p = .26. Finally, further comparisons of female recognition between population groups showed that young children from the multiracial population group were better at recognizing female faces than young children from the monoracial population group, t (83) = 4.042, $p < .001$.

Although we did not find a four-way interaction with face race, it is worth noting 5- to 6-year-old Malaysian-Chinese children showed no difference in recognition of female Chinese, Malay, Caucasian-White, and African-Black races ($p \geq .29$). In addition, 5- to 6-year-old Malaysian-Chinese children were better than their British-White counterparts in recognition of female Chinese, Malay, and even less experienced, African-Black faces, t (83) ≥ 2.646, $p \leq .01$. However, population differences were not found for female Caucasian-White ($p = .35$) faces. Thus, 5- to 6-year-old Malaysian-Chinese children were better at discriminating female faces than 5- to 6-year-old British-White children regardless of face race. This is a striking result given the overall finding that own-race recognition was significantly poorer for Malaysian-Chinese children compared with British-White children.

Figure 2. Mean A-prime and standard error as a function of face gender, population, and age.



Discussion

Our main finding is that the pattern of the other-race effect differs across populations. Whilst British-White children demonstrated the typical other-race effect found in monoracial populations (Chance et al., 1982; Corenblum, 2003; Corenblum & Meissner, 2006; Cross et al., 1971; Feinman & Entwisle, 1976; Sangrigoli & de Schonen, 2004b), this was not evident amongst Malaysian-Chinese children who reported direct experience with Chinese and Malay faces. The demonstration of higher accuracy for Chinese, Malay, and Caucasian-White faces and lower accuracy for least experienced race (African-Black) confirms the finding with adults (Tan et al., 2012) and extends them to children as young as 5 years. In addition, 5- to 6-year-old Malaysian-Chinese children were better than their British-White counterparts in their female face recognition (regardless of face race) suggesting that there is a developmental change between 5- and 14-years of age in the processing of gender of faces, which we will return to.

Although Malaysian-Chinese children discriminate certain races better than British-White children, we found that discriminative performance for own-race faces was weaker for Malaysian-Chinese children than British-White children. This confirms one possibility outlined in the introduction, namely that the breadth of face representation from multiple races may lead to poorer processing for own-race faces. This could make the perceiver process *own-race* faces less well than another perceiver with a representation that is narrowly tuned to own-race faces only (Rossion & Michel, 2011). This result is consistent with the study on the other-age effect (de Heering & Rossion, 2008) and suggests that there is a trade-off between breadth of face-space and accuracy for face recognition.

The main aim for this study is to understand how the other-race effect develops for children raised in a multiracial environment in comparison to established evidence from studies on children raised in a monoracial environment. As expected, no age-related change was found in the other-race effect in British-White children. However, Malaysian-Chinese children showed an age-related change relating to face gender. There was a female recognition advantage in younger children but no other-race effect. In particular, 5- to 6-year-old Malaysian-Chinese children were more accurate in discriminating female faces than male faces such that performance was comparable with 13- to 14-year-old Malaysian-Chinese children's recognition of female faces. Contrary to the experience hypothesis, the lack of interaction with face race meant that the female recognition advantage was general across all face races, even for the least experienced, African-Black faces. In other words, in the case of young children in the multiracial population, we can speculate that there was no other-race effect for female faces within the range of face races tested. Despite the fact that both the monoracial and multiracial populations had low experience with African-Black faces, population comparisons indicated that 5- to 6-year-old Malaysian-Chinese children were significantly better at recognizing female African-Black faces than British-White children of the same age group. This suggests, for female faces at least, a breadth of face tuning that goes beyond the range of faces typically experienced. Thus, the other-race effect for children raised in a multiracial environment seemed to be initially less tuned to experienced races (particularly in female faces) and narrowly tuned by 13- to 14-years to recognizing races that participants have experience with (regardless of the gender of the faces).

There is one reason why we must be a little cautious regarding our conclusion that children raised in a multi-racial environment have a breadth of face tuning that goes beyond experienced races. Although children in our study reported low contact with Caucasian-White faces, it is uncertain how much indirect experience children have of these faces through watching Western television. Thus, ability with Caucasian-White faces may arise from this sort of indirect experience. However, this does not explain the relatively good performance of young Malaysian children with African-Black faces.

To our knowledge, this is the first study of children born and raised in a multiracial population to demonstrate a developmental trajectory of the other-race effect that is related to face gender. It appears that young children with multiracial experience have a broadly tuned face representation for female faces compared with children with monoracial experience who may have developed a more specific representation tuned to own-race faces. This may relate to gender and racial experiences at different stages of development. As compared with British-White participants, who are largely influenced by faces of their own culture, Malaysian-Chinese individuals have greater exposure to multiple cultural groups from a very early age. Between birth and 4 years, Malaysian parent-workers either send their child to day care centers or have an in-house domestic (other-race from Indonesia, Philippines, and more recently, Cambodia) house helper looking after their child before he or she enters pre-school and primary school (Mahari, 2011; Rokis, 2014). We can speculate that the multiracial experience with female faces of these caregivers means that infants and children may retain a broad representation toward face types that are emotionally important, in this case, adult, female faces (regardless of face race). Thus, the age-related differences in face gender recognition for the multiracial population may be explained by the predominantly female experience of multiple racial groups prior to 5 to 6 years. One of the tasks for future research is to understand how various aspects of face recognition advantage develop and interact. In particular, is the broad representation of female faces only restricted to adult faces and is it also evident in infants and children younger than 5 years?

British-White children may also have a higher level of female exposure, but the lack of multiracial caregiver experience may mean that they have the cognitive resources to process less experienced own-race male faces. It is plausible that British children have face representation tuned to own-race faces at an earlier age regardless of unequal exposure to different face genders. For example, British-White infants showed recognition ability for female own-race faces at 4 months, and at 9 months infants could discriminate both female and male own-race faces (Tham et al., 2015).

The overall pattern in face processing between 5 to 6 years and 13 to 14 years coincides with Scherf & Scott's (2012) explanation of changes in face processing abilities. They predict that specific developmental tasks (e.g., forming an attachment relationship with a caregivers; the social reorientation towards peers in adolescence) influence the goals of the perceptual system, and that the face processing system reorganizes itself according to those developmental tasks that are prominent in the individual's environment. For example, Malaysian-Chinese face processing abilities may have made a transition from a "caregiver-based" gender advantage into a "broader experienced-based" recognition advantage based on changes in what is important to these individuals in their environment. The current results for the multiracial population are in keeping with an experienced-based account of this sort.

To summarize, it appears that children's face representation remains plastic enough to be modified when confronted with faces of different races and genders. As children immerse socially and perceptually in environments where they are exposed to several types of face at a very young age, an interesting developmental trajectory is found between 5 and 14 years. Young children from the multiracial population showed a female recognition advantage in comparison to young children from the monoracial population and, in contrast to adolescents and adults, no other-race effect for that face gender. Changes in race and gender processing in the Malaysian-Chinese population may provide us with a unique opportunity to understand how the face representation organizes itself to accommodate changes in experience (direct and indirect), which may allow us to further specify the processes involved in facial specialization.

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