SHORT REPORT

Individuation training with other-race faces reduces preschoolers' implicit racial bias: a link between perceptual and social representation of faces in children

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Abstract

The present study examined whether perceptual individuation training with other-race faces could reduce preschool children's implicit racial bias. We used an 'angry = outgroup' paradigm to measure Chinese children's implicit racial bias against African individuals before and after training. In Experiment 1, children between 4 and 6 years were presented with angry or happy racially ambiguous faces that were morphed between Chinese and African faces. Initially, Chinese children demonstrated implicit racial bias: they categorized happy racially ambiguous faces as own-race (Chinese) and angry racially ambiguous faces as other-race (African). Then, the children participated in a training session where they learned to individuate African faces. Children's implicit racial bias was significantly reduced after training relative to that before training. Experiment 2 used the same procedure as Experiment 1, except that Chinese children were trained with own-race Chinese faces. These children did not display a significant reduction in implicit racial bias. Our results demonstrate that early implicit racial bias can be reduced by presenting children with other-race face individuation training, and support a linkage between perceptual and social representations of face information in children.

Research highlights

- An 'angry = outgroup' paradigm measured Chinese children's implicit racial bias towards African individuals before and after training.
- Chinese 4- to 6-year-olds initially categorized happy racially ambiguous faces as own-race (Chinese) and angry racially ambiguous faces as other-race (African).
- Following training in which the Chinese children learned to individuate African faces, implicit racial bias was significantly reduced.
- Other-race face individuation training reduces early implicit racial bias, supporting a link between perceptual and social representation of faces in children.

Introduction

Prejudice and discrimination against members of other racial groups are major social problems in modern societies. Racial prejudice, a tendency to respond in an unfavorable manner to members of another racial group, is often investigated with adult participants. There has also been increasing interest in studying the acquisition and change of prejudiced attitudes and behaviors from a developmental perspective (Raabe & Beelmann, 2011). Understanding the developmental origins of prejudice is imperative given that the foundation of prejudice may be laid in childhood or even earlier (Quinn, Anzures, Lee, Pascalis, Slater & Tanaka, 2013), and prejudice can have a serious impact on a wide range of behaviors throughout life (Banaji & Greenwald,

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2013; Dovidio, Kawakami & Gaertner, 2002; Hardin & Banaji, 2013). For example, individuals with higher implicit pro-White bias tend to have less friendly social interactions with Blacks (McConnell & Leibold, 2001), make unfavorable economic decisions towards Blacks (Stanley, Sokol-Hessner, Banaji & Phelps, 2011), and allocate fewer medical resources to Blacks seeking health care (Green, Carney, Pallin, Ngo, Raymond, Iezzoni & Banaji, 2007).

Existing studies have shown that the preschool period is formative in the development of intergroup attitudes (Bigler & Liben, 2007). As children approach the age of 5, those growing up in mono-racial families begin to show explicit racial biases (Aboud & Amato, 2001; Kinzler, Shutts, DeJesus & Spelke, 2009; Kinzler & Spelke, 2011), and with increased age, children increasingly draw on racial information when perceiving the world and making social judgments (Killen & Stangor, 2001; Ruble, Alvarez, Bachman, Cameron, Fuligni, Garcia Coll & Rhee, 2004). Recently, Dunham, Chen and Banaji (2013) found that children as young as 3 years begin to show implicit racial biases. Given these findings, it is crucial to investigate timely intervention methods to reduce or eliminate early implicit racial biases. While extensive studies have been devoted to reducing explicit racial biases, no study has examined whether implicit racial biases in young children can also be reduced. The present study aimed to bridge this significant gap in the literature.

Data from measurements of implicit attitudes have revealed that racial biases, once formed in the preschool years, do not change with increased age (Banaji, Baron, Dunham & Olson, 2008; Baron & Banaji, 2006; Dunham *et al.*, 2013). For example, Dunham *et al.* (2013) used the 'angry = outgroup' paradigm to measure the implicit racial biases of White American children and adults, and found that angry faces were categorized as Black more frequently than happy faces. More importantly, the magnitude of this bias did not change from 3 years to adulthood. These results suggest that implicit prejudice is stable and resistant to age-related influences (e.g. cognitive maturation, explicit teaching). Nevertheless, on the assumption that newly formed beliefs may be more malleable than beliefs of long standing, attempts to reduce implicit racial bias that begin in early childhood might conceivably have a greater likelihood of success.

Previous studies have shown that more contact with other-race individuals is effective in reducing prejudiced attitudes in adults (Meissner & Brigham, 2001) and adolescents (Binder, Zagefka, Brown, Funke, Kessler, Mummendey, Maquil, Demoulin & Leyens, 2009). Additional evidence indicates that training adults to individuate other-race faces significantly reduces their implicit racial biases (Lebrecht, Pierce, Tarr & Tanaka, 2009). These findings suggest that processing of other-race faces at a perceptual level may contribute to processing of other-race faces at a social level. Thus, training individuals to recognize faces from another race may not only increase their ability to recognize the other-race faces, but also concurrently reduce their implicit prejudice against the other-race individuals.

Regarding the methods used to reduce children's *explicit racial bias*, the existing literature suggests that increasing children's public self-focus by explicitly informing children of being videotaped while completing racial attitude measures can decrease their out-group prejudice (Rutland, Cameron, Milne & McGeorge, 2005b). In addition, children in racially mixed areas have been found to display less in-group favor on explicit intergroup attitude measures, suggesting that racial intergroup bias amongst 3- to 5-year-old children may be reduced through the promotion of interracial contact (McGlothlin & Killen, 2006; Rutland, Cameron, Bennett & Ferrell, 2005a). Also, higher-prejudice children become less prejudiced after talking about race with lower-prejudice children (Aboud & Doyle, 1996). Moreover, developmental intergroup theory (DIT), which addresses the causal mechanisms of stereotyping and prejudice (Bigler & Liben, 2007), suggests that explicit biases are significantly affected by environmental factors and thus may be changed via educational, social, and legal policies.

With regard to *implicit racial bias*, as noted, other-race face individuation training has been shown to be effective in reducing implicit racial bias in adults (LeBrecht *et al.*, 2009). However, it is entirely unclear whether training of this nature would be effective in reducing implicit racial bias in children, a developmental population in which the relation between perceptual and more meaningful conceptual and social categories has been controversial. That is, in the literature on the development of object categorization, some investigators have argued for a close linkage between perceptually and conceptually based categories (e.g. Jones & Smith, 1993; Quinn, 2011), whereas others have proposed more of a dual representational system in which conceptual and perceptual knowledge are dissociated (e.g. Keil, 1989; Mandler, 2004). The present study derives significance in part because it is relevant to the question of whether there is linkage or dissociation between perceptual and social representation of faces in young children (see also Ramsey, Langlois, Hoss, Rubenstein & Griffin, 2004).

The current study examined the effectiveness of perceptual training to reduce implicit racial bias in Chinese kindergarten children. We focused on Chinese children because previous research has focused mainly on White and Black populations in the West, and the development of racial bias against Africans in a Chinese sample is relatively understudied. However, the existing, albeit limited evidence suggests that Asian children and adults have pervasive explicit racial prejudice against Africans (e.g. Dunham, Baron & Banaji, 2006; Dunham *et al.*, 2013; Johnson, 2007). In addition, Chinese society differs from many Western countries in racial homogeneity in that over 99% of the population are Han Chinese and the facial physiognomy of ethnic minority groups (e.g. Koreans, Mongolians) resembles that of Han Chinese.

We used the 'angry = outgroup' paradigm to measure Chinese children's implicit racial bias against Africans (Dunham, 2011; Hugenberg & Bodenhausen, 2004). In this paradigm, Chinese participants saw racially ambiguous faces morphed between prototypical Chinese and African faces, and categorized each face as Chinese or African in a forced-choice manner. Each face displayed happy versus angry facial expressions. Previous research has shown that the tendency to categorize angry Caucasian-African morphed faces to be Black, and happy Caucasian-African morphed faces to be White was significantly correlated with Caucasian participants' performance on the Implicit Association Test that measured their implicit attitudes towards Africans (Dunham, 2011; Hutchings & Haddock, 2008), establishing the new paradigm as a reliable measure of implicit racial attitudes. In Experiment 1, after conducting a pretest using the 'angry = outgroup' paradigm, we asked children to learn the names of novel African faces. After training, we performed a posttest using the same paradigm to ascertain whether children's implicit racial bias would be lessened due to training. Based on the existing studies (Dunham, 2011; Lebrecht *et al.*, 2009), we hypothesized that Chinese children would be more likely to categorize angry than happy faces as African. Further, if there exists a close linkage between perceptually and conceptually based categories regarding face race, after perceptual individuation training with the other-race African faces, children's implicit racial bias against Africans should significantly decrease (Experiment 1). In contrast, if perceptually and conceptually based categories are dissociated, perceptual training should not reduce children's implicit racial bias against Africans. We also conducted Experiment 2 with the same procedure used in Experiment 1, except that Chinese children were trained to individuate Chinese faces. This follow-up experiment aimed to rule out the possibility

that any observed bias reduction effect in Experiment 1 was due to generic training to recognize individual faces *per se.*

Experiment 1

Experiment 1 investigated whether training Chinese kindergarten children to individuate African faces would reduce implicit racial bias against Africans. Implicit racial bias was measured using an 'angry = outgroup' paradigm before and after training. During the training, participants were asked to remember individual African faces.

Method

Participants

The sample consisted of 69 Han Chinese kindergarten children (34 girls) from a southeastern city in the PR China. There were three age groups: 10 (6 girls) 4-year-olds ($M = 4.29$, $SD = 0.45$, range: 3.98–4.96), 30 (15 girls) 5-year-olds ($M = 5.22$, $SD = 0.41$, range: 4.93–5.96), and 29 (13 girls) 6-year-olds ($M = 6.36$, $SD = 0.46$, range: 5.97–6.96). Informed consent was obtained from the children's parents or legal guardians. Children also gave oral assent prior to participation. The children had never previously interacted with any African individuals.

Procedure and stimuli

Children participated in the study individually in a quiet room in the kindergarten.

Pretest (implicit measure of racial bias). Children viewed faces on a 17-inch computer screen and categorized them as either own-race ('Chinese') or other-race ('African') by speaking aloud. Viewing distance was 60 cm. Children first completed a practice phase in which they categorized the race of four racially unambiguous faces. Feedback was given in a practice phase and all participants answered correctly (i.e. own-race responses for typical Chinese faces and other-race responses for typical African faces) before they continued to the test phase. In the pretest, we used 30 test faces: 10 typical African faces (five females), 10 typical Asian faces (five females), and 10 race-ambiguous morphed faces (five females). We used FaceGen Modeller to generate the four practice and 30 test faces. The racially ambiguous faces were intermediately (50%–50%) morphed faces between prototypical Asian and

African faces (600 × 600 pixels; see Figure 1). All face images were frontal view and without hair to prevent children from using hair color and style to judge face race. The 20 typical faces (African or Asian) displayed a neutral facial expression, whereas the 10 racially ambiguous faces displayed two facial expressions: happy (smiling) versus angry. In other words, each child saw the same racially ambiguous face twice, once with a happy expression and once with an angry expression. This design was to ensure that any difference in responses between conditions could be attributed solely to the manipulation of facial expressions, and not to facial identity differences. Thus, in addition to the practice trials, the pretest phase consisted of 40 test trials, with each trial displaying one of the face test stimuli in a random order.

Training. After the pretest, children participated in a face individuation training task. The stimuli consisted of five color images of true African males between 20 and 35 years of age. All faces had the same hairstyle and exhibited neutral expressions. The same training faces were used in Lebrecht *et al.* (2009). Images were presented on a Microsoft Surface Pro Tablet (10.6-inch display screen) and formatted as 600 × 480 pixels. A number from 1 to 5 was randomly assigned to each face. Children were prompted to touch the corresponding keys on the tablet as responses. To begin the first training block, two African faces with corresponding numbers underneath were displayed in random order. Children were asked to remember each face and its corresponding number. Following learning, children completed a naming task, during which the stimuli from the learning task were randomly displayed, with the numbers from 1 to 5 presented underneath the faces as response options. Children responded by touching on the screen the corresponding number associated with the learned face. Feedback was given after each response. Thus, each block involved a learning task and a naming task. For each of the subsequent training blocks, one new face was added. To proceed to the next block, children had to label the faces with 100% accuracy; otherwise, the block was repeated until they reached 100% accuracy. The training session stopped when all five faces were learned and labeled correctly.

Posttest (implicit measure of racial bias). Following training, children completed the posttest with the identical procedure as in the pretest with a new set of face stimuli created with FaceGen Modeller.

Data analysis strategy. It has previously been pointed out in the literature that 50% is not an appropriate chance level for the 'angry = outgroup' paradigm (Dunham, 2011; Dunham *et al.*, 2013). Relatedly, one cannot consider participants' 'other-race' responses to

Happy ambiguous face

Typical Chinese face

Typical African face

Angry ambiguous face
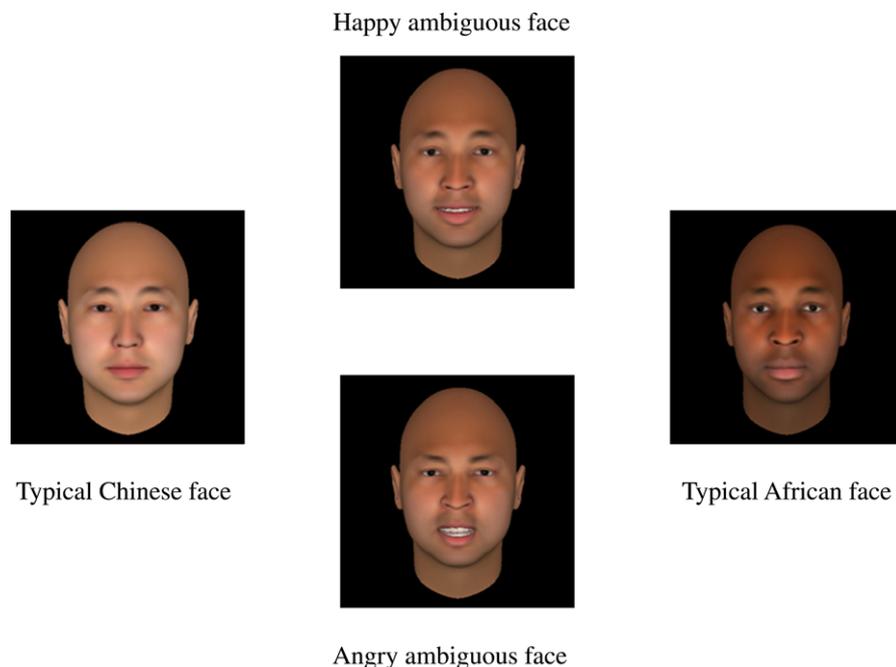
Figure 1   *Examples of one ambiguous face displaying angry and happy affect, one typical Asian face, and one typical African face, created by FaceGen Modeller. The ambiguous face is a 50%–50% hybrid of the typical African and Asian faces.*

the angry faces separately from their 'other-race' responses to the happy faces when deciding whether they have a racial bias. The reason for this is that each participant may have a general response bias towards a racially ambiguous face regardless of emotional expression. For example, suppose that we have three participants. One participant is generally more inclined to categorize racially ambiguous faces as other-race faces regardless of emotional expression (e.g. mean other-race response rate = 70%). Nevertheless, the participant may still show a bias to categorize the angry faces more frequently as other-race faces than the happy faces (e.g. angry = 80% vs. happy = 60%). Another participant may not have a general bias to categorize the racially ambiguous faces as own- or other-race (mean other-race response rate = 50%). Yet this participant may still show a racial bias because he or she may categorize angry faces more as other-race faces than happy faces (e.g. angry = 60% vs. happy = 40%). Still another participant may generally categorize the racially ambiguous faces as other-race 30% of the time regardless of emotional expression, yet the person may still show a bias (e.g. angry = 40% vs. happy = 20%). If we only consider the participants' responses to the angry faces separately from those to the happy faces, and compare the mean 'other-race' response rates of each face type (50%) against 50%, we would erroneously conclude that the participants as a group do not show any bias. Yet, the three participants consistently show that they are 20% more likely to categorize angry faces as other-race than own-race. For this reason, previous studies (Dunham, 2011; Dunham et al., 2013) have not used the 50% level as the criterion to determine whether participants do or do not show a racial bias in the 'angry = outgroup' paradigm. Rather, they measure racial biases by comparing participants' 'other-race' responses to the angry faces to their 'other-race' responses to the happy faces. Thus, in the present study, we followed the method used by Dunham (2011) and Dunham et al. (2013) to determine whether children displayed an implicit racial bias.

Results and discussion

For the race categorization task, we calculated the proportion of other-race responses for happy and angry African-Asian racially ambiguous faces. We first conducted a 3 (age group: 4-, 5-, and 6-year-olds) × 2 (affect: happy vs. angry) × 2 (test order: pretest vs. posttest) repeated measures ANOVA and found that neither the main effect of age nor its interactions with the other variables were significant. Because of the null effect of age, we combined data from the three age groups to

examine the effect of African individuation training with a 2 (test order: pretest vs. posttest) × 2 (affect: happy vs. angry) repeated measures ANOVA. We found a significant main effect of affect and an interaction between test order and affect, $F(1, 68) = 4.49$, $p = .038$, partial $\eta^2 = .06$, and $F(1, 68) = 4.63$, $p = .035$, partial $\eta^2 = .06$. A simple main effect test showed that children were more likely to categorize angry faces as other race ($M = .53$) than happy faces ($M = .46$) before training, $t(68) = 3.13$, $p = .003$. After training, the same children were no more likely to categorize angry faces as other race ($M = .46$) than happy faces ($M = .45$), $t(68) = 0.37$, $p = .72$. The results suggest that African individuation training significantly reduced Chinese children's implicit racial biases (Figure 2).

To further examine the above effects while considering the categorical nature of the outcome variable (dichotomous group categorization judgments), we entered the pre- and post-test data respectively into two separate multilevel logistic regressions (with trials nested within participants), predicting the probability of categorizing the racially ambiguous faces as Chinese or African as a function of facial expression before and after the training. Results revealed that before training, children were significantly more likely to categorize racially ambiguous angry faces as Africans and racially ambiguous happy faces as Chinese, $\chi^2(df = 1) = 8.32$, $p = .004$, Odds ratio = 1.44. Thus, before training, children were 1.44 times more likely to categorize angry faces as other-race than own-race, and happy faces as own-race than other-race. However, after training, the effect of the facial emotion was no longer significant, $\chi^2(df = 1) = .09$, ns, Odds ratio = 1.04. Thus, after individuation training with African faces, Chinese children were equally likely
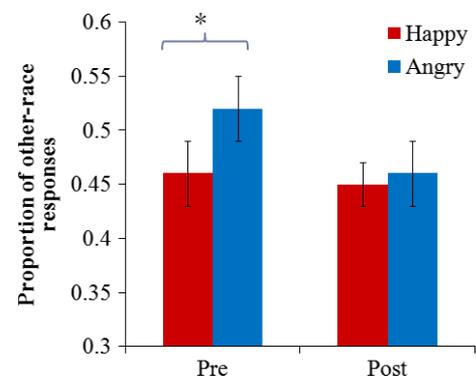
Figure 2 *Mean proportion of other-race ('African') responses for happy and angry ambiguous faces as a function of test order in African face training (Experiment 1). Significant differences between happy and angry faces from paired-sample t-tests are indicated with asterisks. Error bars show ± 1 SEM.*

to categorize the racially ambiguous angry or happy faces as own-race or other-race.

Experiment 2

Experiment 2 investigated whether the decrease in implicit racial bias against Africans in Experiment 1 was due to the type of faces used in training, or simply due to recognizing faces *per se*. A different group of Chinese participants were trained in this case to individuate own-race Chinese faces and their implicit racial bias against Africans before and after training was measured using the same tasks as in Experiment 1.

Method

Participants

The sample consisted of 61 Han Chinese kindergarten children (34 girls) from a southeastern city in the PR China. There were three age groups: 11 (7 girls) 4-year-olds ($M = 4.35$, $SD = 0.25$, range: 3.97–4.67), 25 (14 girls) 5-year-olds ($M = 5.34$, $SD = 0.30$, range: 4.83–5.87), and 25 (10 girls) 6-year-olds ($M = 6.28$, $SD = 0.27$, range: 5.80–6.75).

Procedure and stimuli

For the Chinese training condition, different children completed exactly the same procedure of pretest, training, and posttest as those in the African training condition in Experiment 1 except that the face stimuli in the training session were five Chinese males.

Results and discussion

We first conducted a 3 (age group: 4-, 5-, and 6-year-olds) × 2 (affect: happy vs. angry) × 2 (test order: pretest vs. posttest) repeated measures ANOVA with the other-race response proportion and found that the main effect of age and its interactions with the other variables were not significant. Therefore, data were collapsed across the three age groups and submitted to a 2 (test order: pretest vs. posttest) × 2 (affect: happy vs. angry) repeated measures ANOVA to examine the effect of Chinese individuation training. In contrast to the significant interaction between affect and test order in African individuation training, we found only a significant main effect of affect, $F(1, 60) = 11.56$, $p = .001$, partial $\eta^2 = .16$. Before training, children categorized angry faces to be other-race significantly more ($M = .47$) than happy faces ($M = .40$). After training, the same participants still

made significantly more other-race responses for angry faces ($M = .48$) than for happy faces ($M = .43$). Thus, Chinese individuation training did not change children's implicit racial bias against African faces. In other words, training to recognize any individual faces alone could not reduce Chinese children's implicit racial bias against Africans (Figure 3).

To further examine the above effects, we entered the pre- and post-test data, respectively, into two separate multilevel logistic regressions (with trials nested within participants), predicting the probability of categorizing the racially ambiguous faces as Chinese or African as a function of facial expression before and after training. Results revealed that before training, children were significantly more likely to categorize racially ambiguous angry faces as Africans and racially ambiguous happy faces as Chinese, $\chi^2(df = 1) = 5.77$, $p = .016$, Odds ratio = 1.34. Thus, before training, children were 1.34 times more likely to categorize angry faces as other-race than own-race, and happy faces as own-race than other-race. After training, the effect of the facial emotion was still significant, $\chi^2(df = 1) = 3.90$, $p = .049$, Odds ratio = 1.30. Thus, even after individuation training with own-race faces, children were still 1.30 times more likely to categorize angry faces as other-race than own-race, and happy faces as own-race than other-race.

General discussion

The present studies examined young children's implicit racial bias against Africans, and whether learning about individual other-race African faces could reduce this bias. Several major findings were obtained.
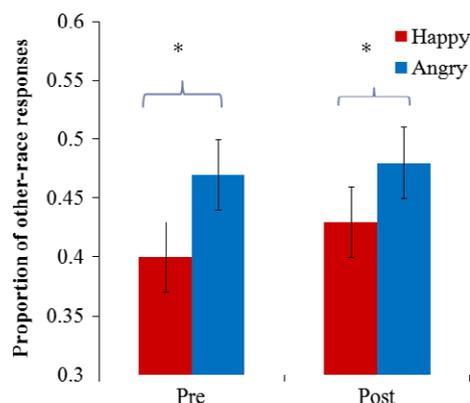
Figure 3   *Mean proportion of other-race ('African') responses for happy and angry ambiguous faces as a function of test order in Chinese face training (Experiment 2). Significant differences between happy and angry faces from paired-sample t-tests are indicated with asterisks. Error bars show ± 1 SEM.*

First, Chinese children as young as 4 years displayed a significant implicit bias against Africans and the magnitude of this bias remained constant from 4 to 6 years. These results are consistent with previous findings involving Caucasian and Asian children when their implicit racial biases were tested with Caucasian versus Asian faces (Dunham *et al.*, 2013). Taken together, our results along with the existing findings suggest that implicit racial bias is a robust phenomenon that emerges early in development and is stable with increased age.

Second and more importantly, we for the first time demonstrated early implicit racial biases to be malleable. In Experiment 1, when Chinese children were trained to individuate African other-race faces, their implicit racial biases were significantly reduced. Moreover, as shown in Experiment 2, learning to individuate faces *per se* could not explain our findings because when Chinese children learned to individuate own-race faces, no change in implicit racial bias against African faces was observed. The results are consistent with those of Lebrecht *et al.* (2009) who trained adults to individuate other-race faces and found a significant reduction in implicit racial bias. However, their training was longer and more intensive than that in the present study. In their study, adult participants received five sessions of behavioral training, each lasting approximately 45 minutes. In our study, child participants were trained for a single 15-minute session. It may be that a smaller dosage of training is sufficient for implicit racial biases to be reduced in younger children, perhaps due to the fact that such biases would be newly formed and not as robustly held as in adults, which may in turn increase their malleability. The new findings with children are especially encouraging because they imply that prejudicial belief systems can be ameliorated before they take hold and guide behavioral responding in innumerable social interactions occurring during the many years of adulthood. Nevertheless, additional studies are needed with children and adults to determine the long-term effects of such training.

Our findings provide support for an account of the relation between perceptual and social categories in which perceptual and social processing of person information are closely linked (Quinn *et al.*, 2013). If individuals in some groups are less differentiated perceptually, it is more likely that the biases associated with some members of this group will be extended to other members. Therefore, implicit racial biases reflect not only socio-cognitive systems, but also perceptual processes. It is, moreover, noteworthy that perceptual training can modulate implicit racial bias in children, a developmental period in which perceptual and more conceptual processing of category information have not been consistently coupled (e.g. Keil, 1989; Mandler, 2004).

One way to interpret the results of individuation training in ameliorating implicit racial bias is to consider the neural consequences of such training. Implicit racial bias has been shown to be related to differences in the neural representations of own- and other-race faces: the greater the bias, the less the similarity in the neural representation of the two face types (Brosch, Bar-David & Phelps, 2012). Other-race face training might act to increase the similarity in the neural representations of own- and other-race faces. A possible consequence of this change in neural representation is the reduction of implicit racial bias given that higher-order processing of category information in the brain relies on lower-level visual input (e.g. Freedman, Riesenhuber, Poggio & Miller, 2001).

Note that our finding of a significant reduction in implicit bias after African face individuation training could possibly be due to simple exposure to other-race faces. This issue cannot be definitively resolved with the current data. Existing evidence suggests that mere exposure plays a limited role in adults' implicit racial biases (e.g. Dasgupta, McGhee, Greenwald & Banaji, 2000; but see Zebrowitz, White & Wieneke, 2008). In addition, a recent study with adults (Lebrecht *et al.*, 2009) showed that individuation is specifically needed to achieve reduction in racial bias. However, it would be premature to conclude the same to be true for young children. Future studies are needed to address this question directly. For example, one could show Chinese children African faces and teach them to individuate the faces in one condition but not in another. This design would allow for ascertaining whether exposure is sufficient to reduce implicit racial bias in young children. Furthermore, future studies could also examine to what extent the current findings can be generalized to populations of children who may have experience with faces from multiple ethnicities, considering that the Chinese children in the current study had never interacted with African individuals.

In summary, we found that young children have implicit racial bias against individuals from an unfamiliar race. However, such racial bias is malleable. It can be ameliorated by perceptual training that requires recognition of individual faces from the unfamiliar race. Our findings therefore provide evidence in support of a theoretical perceptual–social linkage in responding to person categories and also offer a translational strategy for reducing implicit racial bias in early childhood.

Acknowledgements

References

Aboud, F.E., & Amato, M. (2001). Developmental and socialization influences on intergroup bias. In R. Brown & S. Gaertner (Eds.), *Intergroup processes* (pp. 65–89). Oxford: Blackwell Publishing.

Aboud, F.E., & Doyle, A.B. (1996). Does talk of race foster prejudice or tolerance in children? *Canadian Journal of Behavioral Science*, **28**, 161–170.

Banaji, M.R., Baron, A.S., Dunham, Y., & Olson, K. (2008). The development of intergroup social cognition: early emergence, implicit nature, and sensitivity to group status. In S.R. Levy & M. Killen (Eds.), *Intergroup attitudes and relations in childhood through adulthood* (pp. 197–236). New York: Oxford University Press.

Banaji, M.R., & Greenwald, A.G. (2013). *Blindspot: Hidden biases of good people*. New York: Delacorte Press.

Baron, A.S., & Banaji, M.R. (2006). The development of implicit attitudes. *Psychological Science*, **17**, 53–58.

Bigler, R.S., & Liben, L.S. (2007). Developmental intergroup theory: explaining and reducing children's social stereotyping and prejudice. *Current Directions in Psychological Science*, **16**, 162–166.

Binder, J., Zagefka, N., Brown, R., Funke, F., Kessler, T., Mummendey, A., Maquil, A., Demoulin, S., & Leyens, J.P. (2009). Does contact reduce prejudice or does prejudice reduce contact? A longitudinal test of the contact hypothesis among majority and minority groups in three European countries. *Journal of Personality and Social Psychology*, **96**, 843–856.

Brosch, T., Bar-David, E., & Phelps, E.A. (2012). Implicit race bias decreases the similarity of neural representations of black and white faces. *Psychological Science*, **24**, 160–168.

Dasgupta, N., McGhee, D.E., Greenwald, A.G., & Banaji, M.R. (2000). Automatic preference for white Americans: eliminating the familiarity explanation. *Journal of Experimental Social Psychology*, **36**, 316–328.

Dovidio, J.F., Kawakami, K., & Gaertner, S.L. (2002). Implicit and explicit prejudice and interracial interaction. *Journal of Personality and Social Psychology*, **82**, 62–68.

Dunham, Y. (2011). An angry = outgroup effect. *Journal of Experimental Social Psychology*, **47**, 668–671.

Dunham, Y., Baron, A.S., & Banaji, M.R. (2006). From American city to Japanese village: a cross-cultural investigation of implicit race attitudes. *Child Development*, **77**, 1268–1281.

Dunham, Y., Chen, E.E., & Banaji, M.R. (2013). Two signatures of implicit intergroup attitudes: developmental invariance and early enculturation. *Psychological Science*, **24**, 860–868.

Freedman, D.J., Riesenhuber, M., Poggio, T., & Miller, E.K. (2001). Categorical representation of visual stimuli in the primate prefrontal cortex. *Science*, **291**, 312–316.

Green, A.R., Carney, D.R., Pallin, D.J., Ngo, L.H., Raymond, K.L., Iezzoni, L.I., & Banaji, M.R. (2007). Implicit bias among physicians and its prediction of thrombolysis decisions for black and white patients. *Journal of General Internal Medicine*, **22**, 1231–1238.

Hardin, C.D., & Banaji, M.R. (2013). The nature of implicit prejudice: implications for personal and public policy. In E. Shafir (Ed.), *The behavioral foundations of public policy* (pp. 13–31). Princeton, NJ: Princeton University Press.

Hugenberg, K., & Bodenhausen, G.V. (2004). Ambiguity in social categorization: the role of prejudice and facial affect in race categorization. *Psychological Science*, **15**, 342–345.

Hutchings, P.B., & Haddock, G. (2008). Look Black in anger: the role of implicit prejudice in the categorization and perceived emotional intensity of racially ambiguous faces. *Journal of Experimental Social Psychology*, **44**, 1418–1420.

Johnson, M.D. (2007). *Race and racism in the Chinese: Chinese racial attitudes toward Africans and African-Americans*. Bloomington, IN: AuthorHouse.

Jones, S.S., & Smith, L.B. (1993). The place of perception in children's concepts. *Cognitive Development*, **8**, 113–139.

Keil, F.C. (1989). *Concepts, kinds, and cognitive development*. Cambridge, MA: MIT Press.

Killen, M., & Stangor, C. (2001). Children's social reasoning about inclusion and exclusion in gender and race peer group contexts. *Child Development*, **72**, 174–186.

Kinzler, K.D., Shutts, K., DeJesus, J., & Spelke, E.S. (2009). Accent trumps race in guiding children's social preferences. *Social Cognition*, **27**, 623–634.

Kinzler, K.D., & Spelke, E.S. (2011). Do infants show social preferences for people differing in race? *Cognition*, **119**, 1–9.

Lebrecht, S., Pierce, L.J., Tarr, M.J., & Tanaka, J.W. (2009). Perceptual other-race training reduces implicit racial bias. *PLoS ONE*, **4**, e4215. doi:10.1371/journal.pone.0004215

McConnell, A.R., & Leibold, J.M. (2001). Relations among the Implicit Association Test, discriminatory behavior, and explicit measures of racial attitudes. *Journal of Experimental Social Psychology*, **37**, 435–442.

McGlothlin, H., & Killen, M. (2006). Intergroup attitudes of European American children attending ethnically homogeneous schools. *Child Development*, **77**, 1375–1386.

Mandler, J.M. (2004). *The foundations of mind: The origins of conceptual thought*. New York: Oxford University Press.

Meissner, C.A., & Brigham, J.C. (2001). Thirty years of investigating the own-race bias in memory for faces: a meta-analytic review. *Psychology, Public Policy, and Law*, **7**, 3–35.

Quinn, P.C. (2011). Born to categorize. In U. Goswami (Ed.), *The Wiley-Blackwell handbook of childhood cognitive development* (2nd edn.) (pp. 129–152). Oxford: Wiley-Blackwell.

Quinn, P.C., Anzures, G., Lee, K., Pascalis, O., Slater, A., & Tanaka, J.W. (2013). On the developmental origins of differential responding to social category information. In M.R. Banaji & S.A. Gelman (Eds.), *Navigating the social*

world: What infants, children, and other species can teach us (pp. 286–291). New York: Oxford University Press.

Raabe, T., & Beelmann, A. (2011). Development of ethnic, racial, and national prejudice in childhood and adolescence: a multinational meta-analysis of age differences. *Child Development*, **82**, 1715–1737.

Ramsey, J.L., Langlois, J.H., Hoss, R.A., Rubenstein, A.J., & Griffin, A. (2004). Origins of a stereotype: categorization of facial attractiveness by 6-month-old infants. *Developmental Science*, **7**, 201–211.

Ruble, D.N., Alvarez, J.M., Bachman, M.A., Cameron, J.A., Fuligni, A.J., Garcia Coll, C., & Rhee, E. (2004). The development of a sense of 'we': the emergence and implications of children's collective identity. In M. Bennett & F. Sani (Eds.), *The development of the social self* (pp. 29–76). New York: Psychology Press.

Rutland, A., Cameron, L., Bennett, L., & Ferrell, J. (2005a). Interracial contact and racial constancy: a multi-site study of racial intergroup bias in 3–5 year old Anglo-British children. *Applied Developmental Psychology*, **26**, 699–713.

Rutland, A., Cameron, L., Milne, A., & McGeorge, P. (2005b). Social norms and self-presentation: children's implicit and explicit intergroup attitudes. *Child Development*, **76**, 451–466.

Stanley, D.A., Sokol-Hessner, P., Banaji, M.R., & Phelps, E.A. (2011). Implicit race attitudes predict trustworthiness judgments and economic trust decisions. *Proceedings of the National Academy of Sciences, USA*, **108**, 7710–7715.

Zebrowitz, L.A., White, B., & Wieneke, K. (2008). Mere exposure and racial prejudice: exposure to other-race faces increases liking for strangers of that race. *Social Cognition*, **26**, 259–275.