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Perceptual Individuation Training (but not Mere Exposure) Reduces Implicit Racial Bias in Preschool Children

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Abstract

Two studies with preschool-age children examined the effectiveness of perceptual individuation training at reducing racial bias (Study 1, $N = 32$; Study 2, $N = 56$). We found that training preschool-age children to individuate other-race faces resulted in a reduction in implicit racial bias while mere exposure to other-race faces produced no such effect. We also showed that neither individuation training nor mere exposure reduced explicit racial bias. Theoretically, our findings provide strong evidence for a causal link between individual-level face processing and implicit racial bias, and are consistent with the newly proposed Perceptual-Social Linkage Hypothesis. Practically, our findings suggest that offering children experiences that allow them to increase their expertise in processing individual other-race faces will help reduce their implicit racial bias.

Keywords

race bias; face processing; development; individuation; categorization; implicit bias; explicit bias

Racial biases are pervasive in all human societies. When left unchecked, these biases can have far-reaching negative consequences in all spheres of human life including education, healthcare, employment, justice, finance, dating, and politics (Dovidio, Kawakami, & Gaertner, 2002; Green et al., 2007; Hardin & Banaji, 2013; Pearson, Dovidio, & Gaertner, 2009; see Pascoe & Richman, 2009, for a review). Consequently, significant resources have been invested worldwide in media campaigns and educational programs aimed at reducing racism and its negative effects (Engberg, 2004; Loyd & Williams, 2016). The present research investigates how to reduce racial bias among young children.

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Existing studies have shown that early childhood is formative in the development of racial bias (Bigler & Liben, 2007). There are two distinct forms of racial bias. One is implicit racial bias, which refers to unconscious stereotypes, prejudices, and discriminatory behaviors based on race (Greenwald & Banaji, 1995). The other is explicit racial bias, which refers to consciously accessible racial stereotypes, prejudice, and discriminatory behaviors (Aboud, 1988, 2003; Dovidio et al., 2002). Both of these forms of bias are already in place by the time children are 3 years of age (Dunham, Chen, & Banaji, 2013; Qian et al., 2016; Xiao et al., 2015; see Raabe & Beelmann, 2011, for a meta-analysis) and become consolidated and highly resistant to change with development (Dunham, Baron, & Banaji, 2008; Gonzalez, Dunlop, & Baron, 2016; Newheiser & Olson, 2012). Thus, it has been recognized that efforts to reduce racial bias must be implemented earlier rather than later in childhood to have greater and more lasting effects (Killen, Rutland, & Ruck, 2011; Lai et al., 2016; Xiao et al., 2015).

Developmental studies have focused almost exclusively on reducing children's explicit racial bias (Aboud & Doyle, 1996; Rutland, Cameron, Milne, & McGeorge, 2005; see Aboud et al., 2012, for a review), perhaps due to the fact that reliable measures of children's implicit racial bias were only constructed recently (Baron & Banaji, 2006; Dunham, Baron, & Banaji, 2006; Dunham, Baron, & Carey, 2011; Dunham et al., 2013; Qian et al., 2016; Xiao et al., 2015). As a result, the current literature offers little guidance about how to reduce implicit racial bias in young children (but see Gonzalez, Steele, & Baron, 2016), and leaves open the question of whether any interventions that might lead to a reduction in implicit bias might also affect explicit bias. To fill this significant gap in the literature, we investigated the effects of a novel intervention that involves teaching children to individuate other-race faces.

Our approach is adapted from work showing that individuation training significantly reduces implicit racial bias in adults, whereas mere exposure to other-race faces does not (Lebrecht, Pierce, Tarr, & Tanaka, 2009). *Individuation* refers to the tendency to treat targets not according to their category membership (e.g., race, gender), but rather according to their person-specific unique traits and characteristics (Hugenberg, Miller, & Claypool, 2007). In contrast, *mere exposure* refers to any experience that just makes a given stimulus more accessible to perception (Zajonc, 1968). Although both of these forms of training involve providing experience with other-race faces, only the individuation training calls upon participants to recognize other-race members as specific individuals (see Lebrecht et al., 2009). The reason that individuation training has been hypothesized to reduce implicit racial bias in adults is that adults are known, by default, to automatically respond to own-race faces at the individual level of identity but other-race faces at the categorical level of race (Ge et al., 2009; Levin, 2000; Liu et al., 2014; Tanaka, Heptonstall, & Hagen, 2013). Consequently, the face recognition system of adults is less well-tuned to the visual features that are diagnostic for individuating other-race faces. Poorer individuation due to less effective feature tuning leads to greater similarity between other-race individuals, which makes their faces look “the same”, and in turn makes it easier to generalize social attitudes and prejudice across them (Banaji & Greenwald, 2013; Bigler & Liben, 1993; MacLin & Malpass, 2001; Ratliff & Nosek, 2011). This framework for thinking about implicit racial bias has recently been termed the Perceptual-Social Linkage Hypothesis (Lee, Quinn, & Heyman, in press; Quinn et al., 2013). If correct, to reduce bias, adults require experience individuating other-race faces to counter this "sameness" processing. In contrast, mere exposure to other-race faces without a specific focus on individuating among them does not counter the tendency toward "sameness" processing and may even reinforce it.

Although the effects of individuation training on adults can be understood from the perspective of perceptual-social linkage, it is unclear whether the effects of such training would be the same for children. One reason why it is unclear is because young children might show a different pattern of face processing: Although adults show the default pattern of automatically processing other-race faces at the category level of race (Ge et al., 2009; Levin, 2000; Liu et al., 2014), the evidence to suggest that young children do so is less clear (Dunham, Stepanova, Dotsch, & Todorov, 2015). Another possible reason is that perceptual processing of faces and social responding to people might not be as tightly coupled in children as in adults (Kinzler, Shutts, DeJesus, & Spelke, 2009).

However, a recent study by Xiao et al. (2015) provides some evidence that individuation training may indeed be effective at reducing implicit racial bias in children. Using an angry = outgroup paradigm (Dunham, 2011; Hugenberg & Bodenhausen, 2004), Xiao et al. (2015) found that Chinese children between 4 and 6 years were initially biased to classify angry racially ambiguous faces as Black and happy racially ambiguous faces as Chinese. Chinese children who were subsequently trained to recognize other-race Black faces displayed significantly reduced bias, whereas those who learned to recognize own-race Chinese faces did not. Unfortunately, because the research did not include a Black face exposure condition (without individuation training), the study did not rule out the possibility that the training effect could have been the result of mere exposure to other-race faces. Furthermore, Xiao et al. (2015) did not test the effect of training on children's explicit racial bias, and it is therefore unclear whether the training effects are specific to implicit racial bias.

Here we investigated whether training Chinese preschool children to individuate other-race faces would lead to a reduction in racial bias. In two studies, we specifically compared the effects of individuation training, in which preschoolers learned to distinguish individual other-race faces, to the effects of mere exposure, in which preschoolers were presented with the same individual faces without having to distinguish between them. We did so by randomly assigning Chinese preschoolers to one of two training conditions. In the Black individuation and White mere exposure condition, we asked children to associate a different label with each Black face, and associate the same label with all White faces. In the White individuation and Black mere exposure condition, children were asked to do the opposite. By adding the contrast of both Black and White faces in each condition, children were made to individuate one other-race, while just being exposed to another other-race. The method was thus similar to that used in the only existing adult training study (Lebrecht et al., 2009), but was not employed in the child training study (Xiao et al., 2015). The advantage of this procedure lies in the power of the within-subject design to optimally differentiate the effect of individuation training from that of mere exposure. Further, testing the effects of individuation training on reducing implicit racial bias against two other-races in the same design allows for assessing the robustness of any potential effects of such training.

Children's implicit racial bias was assessed by the Implicit Racial Bias Test (IRBT: Qian et al., 2016), a preschooler friendly implicit association test adapted from Cvencek, Greenwald, and Meltzoff (2011a). The IRBT measures positive and negative associations with own- versus other-races by directly looking at associations between faces of different races and positive versus negative attributes that are represented by smiling or frowning faces (Cvencek et al., 2011a; Cvencek, Greenwald, & Meltzoff, 2016). Explicit racial bias was measured by a forced-choice task in which children were asked to report preferences between own- and other-race individuals (Baron & Banaji, 2006; Shutts, Kinzler, Katz, Tredoux, & Spelke, 2011) in Studies 1 and 2, and also by a trait attribution task in which children were asked to attribute positive versus negative traits to own- and other-race individuals in Study 2 (Doyle & Aboud, 1995).

Based on the evidence from Xiao et al. (2015) and the proposed link between perceptual and social processing (Lee et al., in press), we anticipated that individuation training in children would reduce implicit racial bias, but not necessarily explicit racial bias. Given the lack of existing studies with children on mere exposure, we had no specific predictions about its effect on implicit or explicit racial bias. Instead, we assessed three possible hypotheses. First, if mere exposure is all that matters, children's biases against both Black and Whites should decrease in both conditions (the Mere Exposure Hypothesis). Second, if individuation training is required, we should observe a significant reduction of racial bias against Blacks only in the Black individuation and White mere exposure condition, and against Whites only in the White individuation and Black mere exposure condition (the Individuation Hypothesis). A third possibility is that neither training nor exposure is effective, in which case children's racial bias should not change in response to either form of training (the Null Hypothesis).

Study 1

Method

Participants—The final sample consisted of 32 Han Chinese kindergarten children (16 girls). Thirty-eight participants were originally recruited but 6 did not finish training and were excluded from the data analyses. They were assigned to two conditions: 16 (7 girls) in the Black individuation and White mere exposure condition (M = 5.69, SD = .52) and 16 (9 girls) in the White individuation and Black mere exposure condition (M = 5.83, SD = .58). According to the children's parents or legal guardians, none of the children had previously interacted with any non-Chinese individuals. Sample size for each condition was determined based on existing studies (e.g., Xiao et al., 2015), and participant recruitment was terminated when children who completed the experiment reached 32 (N = 16 in each condition).

Participants were from a city in southeastern China with a population of 5 million, in which Han Chinese make up 99.99% of the population. We focused on Chinese children because Han Chinese faces are highly differentiated from Black and White faces in facial physiognomy. The racial homogeneity, along with the facial physiognomic differences between Chinese and non-Chinese faces, creates a fertile environment for developing implicit racial bias (Dunham et al., 2013; Qian et al., 2016; Xiao et al., 2015), which makes China an ideal setting for the present research. The study was approved by the university research ethics committee, and children participated after receiving informed consent from their legal guardians and providing their own oral assent.

Procedure and Stimuli—Children participated in the study individually in a quiet room at their school. We used a pre- and post-test design, with children being assessed for both implicit and explicit racial bias at both pre-test and post-test. After the pre-test, children were administered either the Black individuation and White exposure training, or the White individuation and Black exposure training. The implicit measure was always presented first because it was of greatest theoretical interest and because prior research suggests that there are no order effects on measures of implicit and explicit racial bias (Nosek, Greenwald, & Banaji, 2007).

Measure of implicit racial bias: To measure implicit racial bias against Blacks or Whites, both before and after training, we tested Chinese children using the Implicit Racial Bias Test (IRBT: Qian et al., 2016), which is a preschooler friendly implicit association test, modeled after a preschool friendly gender bias test developed by Cvencek et al. (2011a). Like the Implicit Association Test (IAT), the IRBT assesses how quickly positive and negative attributes are associated with own- versus other-races (Greenwald, McGhee, & Schwartz, 1998; Greenwald, Nosek, & Banaji, 2003).

Unlike the prior Implicit Association Test (IAT), which relies extensively on lexical processing, the lexical processing demands of the IRBT are minimal, thereby helping to rule out language specific effects, which can influence IAT performance (Danziger & Ward, 2010). This feature of the IRBT, as well as its simple instructions, make it appropriate for young children. Children only have to learn one set of associations at a time and can respond with intuitively labeled buttons on a touchscreen. In addition, the inclusion of only pictorial stimuli eliminates the need for participants to read any test materials (Cvencek et al., 2011a, 2016; Cvencek, Meltzoff, & Greenwald, 2011b; Thomas, Burton Smith, & Ball, 2007). The adaptations are similar to what other researchers have done to examine other kinds of implicit association in young children, such as the association between gender and mathematics (Cvencek et al., 2011b, 2016) and between positive words and thin body shape (Thomas et al., 2007). Also, the IRBT has been cross-validated by yielding results in both China and Africa that are consistent with the prior literature (Qian et al., 2016). Chinese and African preschoolers displayed low error rates (less than 10%), indicating that they understood the instructions and have sufficient cognitive ability for task shifting between congruent versus incongruent pairings. In other words, the existing studies have established the appropriateness of using the IRBT for young children. Also, large effect size (Cohen's d = .40) indicates the effectiveness of the IRBT for revealing implicit racial bias in young children.

For the present study, the IRBT examines differences in reaction time to map faces of different races onto line drawings of smiles or frowns in order to examine the positive and negative associations that Chinese children have with Chinese (own-race) versus Blacks (other-race) and Chinese (own-race) versus Whites (other-race). For example, in the "Black" task, participants viewed Black faces and Chinese faces on a 17-inch computer screen, using E-prime 2.0 (Psychology Software Tools, Sharpsburg, PA). They were instructed to touch either the smile or frown symbol when they saw a face of a particular race. For “congruent” pairings, participants were told to touch the smile symbol when they saw a Chinese face and to touch the frown symbol when they saw a Black face, while for “incongruent” pairings, they were told to touch the frown symbol when they saw a Chinese face and to touch the smile symbol when they saw a Black face. Half of the children started with congruent pairings and the other half started with incongruent pairings. The “White” task was identical to the “Black” task except that 20 White faces (10 females) replaced the Black faces.

Color photos of 20 Chinese faces (10 females and 10 males) and 20 Black faces (10 females and 10 males) were used as stimuli in the Chinese-Black IRBT. Color photos of 20 Chinese faces (10 females and 10 males) and 20 White faces (10 females and 10 males) were used as stimuli in the Chinese-White IRBT. All photographs were chosen from an existing face database (Ge et al., 2009), standardized at 480 pixels (17 cm) wide and 600 pixels (21 cm) high, and had a resolution of 72 pixels per inch. The face images were frontal view without obvious marks such as beards, glasses, or facial makeup. All faces were overlaid with the same elliptical shape so that hair was not visible, and were matched in terms of attractiveness and distinctiveness by Chinese adults who did not participate in the current study.

Measure of explicit racial bias: Before and after training, children's explicit racial bias was assessed using a task modeled after Kinzler et al. (2009; see also Baron & Banaji, 2006; Dunham et al., 2006) in which children were asked to report their preference for interacting with an own-race or other-race individual. In this task, three contexts were presented in a random order for each participant: summer camp counselor in Scenario 1, swimming coach in Scenario 2, and tour guide in Scenario 3 (e.g., *this summer, your mother will take you to a swimming class. In the class, you could choose one person to coach you to swim, which one would you like to choose?*). They selected between an own-race Chinese and an other-race Black in the Chinese-Black set, and between an own-race Chinese and an other-race White in the Chinese-White set (see Figure 1). The order of the Chinese-Black set and Chinese-White set was counterbalanced across participants.

Children's choice of the own-race adult over the other-race adult was coded as 1 and their choice of the other-race adult over the own-race adult was coded as 0 for each of the three scenarios in each condition. The scores were added up and divided by 3 to derive a proportion score, with .50 as the no-bias score.

Training: After the pre-tests to assess both implicit and explicit racial biases, children's D scores were arranged from lowest to highest, with the closest D scores grouped into pairs. We matched on implicit racial bias scores because implicit racial bias was of greatest theoretical interest in the present study. Children in the same pair were assigned randomly to either the Black individuation and White mere exposure condition, or the White individuation and Black mere exposure condition. “Individuation” was instantiated by assigning different numbers from 1 to 4 to four different other-race faces. To succeed in this task, children needed to attend closely to individual characteristics differentiating one particular face from another face of the same race. In contrast, “mere exposure” was instantiated by asking children to associate all other-race faces with the digit “0”. In this case, in keeping with the classic definition of “mere exposure” (Zajonc, 1968), the faces were made more accessible to perception without asking the children to respond to the faces as individuals.

In the Black individuation and White exposure condition (Figure 2), the stimuli consisted of four color photos of Black males and four color photos of White males between 20 and 35 years of age. These photos were different from those used in the IRBT or explicit racial bias tasks. All faces had the same hairstyle and exhibited neutral expressions. Images (600 × 480 pixels) were presented on a Microsoft Surface Pro Tablet (17 inch display screen).

A number from 1 to 4 was randomly assigned to each Black face, and the number 0 was assigned to all White faces. Children were prompted to touch the corresponding numbers on the tablet to respond. To begin the first training block, two Black faces and two White faces were displayed in a random order above their corresponding number labels. Children were asked to remember each face and its corresponding number (See Figure 2). Following learning, children completed a naming task, during which the stimuli from the learning task were randomly displayed, with the numbers from 0 to 4 presented underneath the faces as response options. Children responded by touching on the number that was associated with the learned face. Feedback was given after each response. Thus, each block involved a learning task and a naming test. 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 100% accuracy was reached. The training session stopped when all eight faces were learned and labeled correctly.

The White individuation and Black exposure condition was identical to the Black individuation and White exposure condition except that the Black faces were associated with a single number “0” whereas the White faces were associated with distinct individual numbers from 1 to 4 (Figure 2).

Results and Discussion

We used D scores to indicate whether participants showed a systematic bias towards Black and White faces. The D score is the difference between the mean response latencies of the contrasted conditions divided by the standard deviation of response latencies across the conditions (Greenwald et al., 2003). Consistent with previous IAT studies on children, data were excluded from participants based on three criteria: (a) ≥ 10% of responses faster than 300 ms, (b) ≥ error rate of 30%, or (c) average response latency 3 *SD*s above the mean response latency for the whole sample. Practice trials were excluded, as were response latencies above 10,000 ms (Greenwald et al., 1998). Given these exclusion criteria, 6 participants were excluded either due to an error rate above 30%, or extreme values above 3 *SD*s of the mean D value. Preliminary analyses revealed no significant effects of participant sex and the data were thus combined on this factor in the subsequent analyses.

We first examined the training time needed for children to achieve the termination criterion. On average, children in the Black individuation and White exposure condition required 21 minutes ($M = 21.38$, $SD = 5.67$) and children in the White individuation and Black exposure condition required 18 minutes (M = 18.44, SD = 5.46). The difference between the two conditions was not significant, $t(30) = 1.49$, $p = .143$, Cohen's $d = .54$.

Implicit racial bias—To examine whether individuation training or mere exposure reduced children's implicit racial bias against the other-race faces, we performed a 2 (training type: individuation vs. exposure) × 2 (test: pre-test vs. post-test) repeated measures ANOVA with both factors as within-subject factors on children's D scores. Only the crucial interaction between training type and test was significant, $F(1, 31) = 5.12$, $p = .031$, partial $\eta^2 = .14$. A post-hoc power analysis with the program *G*Power* (Erdfelder, Faul, & Buchner, 1996) revealed that on the basis of within-subject comparison, the power to detect an effect size in the present study (partial $\eta^2 = .14$) at $\alpha = .05$ level with a sample size of 32 was .93.

As shown in Figure 3a, children's implicit bias against other-race faces decreased significantly only after receiving individuation training. This was confirmed by simple effect analyses: The mean D scores for the two conditions (individuation vs. exposure) before training were not significantly different, $t(31) = .44$, $p = .662$, Cohen's $d = .07$. However, after training, the mean D scores between the two conditions (individuation vs. exposure) were significantly different, $t(31) = - 2.24$, $p = .033$, Cohen's $d = .60$. Thus, individuation training significantly reduced Chinese children's racial bias against other-race faces, but mere exposure did not.

To further explore this significant interaction (Figure 3a), we conducted one-sample t-tests to compare the mean D scores before and after training to zero (no bias) for other-race faces in each training condition. Before training, the mean D scores were significantly different from zero (no bias), $t(31) = 8.10$, $p < .001$, Cohen's $d = 1.42$, and $t(31) = 10.58$, $p < .001$, Cohen's $d = 1.83$, for the individuation and mere exposure conditions, respectively. After training, the D score was not significantly different from zero in the individuation training condition, $t(31) = .88$, $p = .38$, Cohen's $d = .16$, but it was still biased against other-race faces in the mere exposure condition, $t(31) = 4.78$, $p < .001$, Cohen's $d = .84$. Thus, after individuation training, Chinese children no longer displayed implicit racial bias against other-race faces, but there was no corresponding effect for mere exposure.

Explicit racial bias—We used Cronbach's alpha score to estimate the internal consistency of the Choice Task and found that the task had a borderline reliability with $\alpha = .63$.

For each child, we obtained pre- and post-test explicit bias scores against other-races (Figure 3b). To examine training effects on children's explicit racial bias scores, we performed a 2 (training type: individuation vs. exposure) × 2 (test: pre-test vs. post-test) repeated measures ANOVA with both factors as within-subject factors. Unlike the results with implicit racial bias, neither the test effect nor the crucial training type and test interaction were significant, all p's > .10 (Figure 3b). To examine whether the non-significant training effects on reducing explicit bias were due to a lack of statistical power, we conducted a post-hoc power analysis with power set at .80 and $\alpha = .05$. We found that the sample size would have to increase to $N = 3607$ to reach significance. Thus, it was unlikely that our non-significant results were due to the relatively small sample size.

To further explore whether children showed explicit racial bias before and after training, we conducted one-sample *t*-tests to compare their explicit percentage of own-race chosen to .50 (no bias). We found that children's explicit percentage of own-race chosen was significantly higher than .50, all *t*'s > 4.70, *p*'s < .001, indicating that children showed explicit bias against other-race before and after training, in each training condition.

To further examine the difference in explicit bias scores in each scenario, we separated the explicit bias scores by scenarios. A McNemar Test indicated that for each scenario, there was no difference in explicit racial bias performance pre- and post-training for either training condition, all *p*'s > .655. In addition, a non-parametric Friedman test indicated that there was no significant difference among the three scenarios at both pretest and posttest in either the individuation training group, all χ^2's < .35, *p*'s > .838, or mere exposure training group, χ^2's < .38, *p*'s > .827. The detailed results are presented in Table 1.

The results of Study 1 provided evidence that other-race individuation training, but not mere exposure, reduces implicit racial bias among Chinese 3- to 5-year olds. In contrast, such training did not alter their explicit racial bias. However, it is possible that the lack of a training effect on explicit racial bias was due to the use of a specific explicit racial bias measure that was not sufficiently sensitive to assess changes in explicit racial bias (e.g., its reliability was borderline). In Study 2, we made two modifications to the measurement of explicit racial bias relative to Study 1, and recruited a larger sample of preschool children.

Study 2

In Study 2, we sought to determine whether the findings of Study 1 were replicable, and to verify whether our training effects were indeed specific to implicit bias, not explicit racial bias, by using more reliable explicit bias measures. In Study 1, explicit racial bias was measured in three scenarios asking participants to indicate their social preference. In Study 2, to increase reliability, we added two more scenarios to the measure. We also added a trait attribution task, which is an explicit racial bias measure, to rule out the possibility that the null effects from Study 1 were due to the particular task used to assess explicit racial bias.

Method

Participants—The final sample consisted of 56 Han Chinese kindergarten children (18 girls) from a southeastern city in the PR China (66 were originally recruited but 10 did not finish training and were excluded from the data analyses). They were assigned to two conditions: 28 (11 girls) in the Black individuation and White exposure condition (*M* = 5.91, *SD* = .53) and 28 (17 girls) in the White individuation and Black exposure condition (*M* = 6.03, *SD* = .55). According to children's parents or legal guardians, none of the children had previously interacted with any non-Chinese individuals.

Procedure, stimuli, and analyses—The procedure was the same as in Study 1, except that two explicit measures were used. In particular, before and after training, children were assessed with two explicit tasks: the Choice Task and the Trait Attribution Task. The Choice Task was identical to that used in Study 1 except that children had to make two more choices: a dentist in Scenario 4 and a music teacher in Scenario 5. In this task, five contexts were presented in a random order for each participant. Children's choice of the own-race adult over the other-race adult was coded as 1 and their choice of the other-race adult over the own-race adult was coded as 0 for each of the five scenarios in each condition. The scores were added up and divided by 5 to derive a proportion score, with .50 as the no-bias score.

The Trait Attribution Task was new. We developed it based on the Multi-Response Racial Attitude measure (MRA) by Doyle and Aboud (1995). On the MRA, Doyle and Aboud (1995) asked participants to sort positive, negative, and neutral trait descriptions into three boxes, labeled as belonging to different races. For example, one item read, “Some children are naughty. They often do things like drawing on the wall with crayons. Who is naughty?” The cards depicted an apartment wall with crayon marks on it. Our task was similar, but we modified the specific items, questions, and choices. Children were asked to perform 30 sorting trials presented in an order that was randomly determined for each participant. On each trial, children received a 15 × 15 cm card with an illustration and the experimenter read aloud a question about the illustration. Each question was about a particular evaluative trait and the illustration provided a concrete behavioral example of the trait. For instance, for the clean trait, participants were presented with an illustration of a bathtub and a shower nozzle on a card, and the experimenter read them the following, “One child is clean and tidy. He or she takes a shower every day. Who is clean and tidy? Is it the Black child, the White child, or the Chinese child?” Participants were asked to place this card in one of three boxes: One box showed a Black face, one a Chinese face, and one a White face. Other items were as: not clean (doesn't wash every day); generous (shares a book); selfish (doesn't share books with others); lie teller (always tells lies); truth teller (doesn't ever tell lies); untrustworthy (says bad things behind people's backs); trustworthy (speaks highly of others); cruel (throws a stone at a cat); kind (takes care of an injured cat).

After children placed all 30 cards in one of the three boxes, we counted up the total number of negative cards and the total number of positive cards in each box. Thus, for each child, we obtained six scores, one positive and one negative for each box. The total positive or negative scores for each box, theoretically, would range from 0 to 15. These scores were then used to compute racial attribution scores, which were created by subtracting the total negative scores from the total positive scores for each of the three races. The explicit racial attribution scores thus ranged from -15 to 15. Because the scores for Chinese could be deduced from the scores for the other two races (i.e., they were not independent), we only used the explicit racial attribution scores for Blacks and Whites. The trait attribution task was always presented after the choice task.

Results and Discussion

Preliminary analyses revealed no significant effects of participant sex and the data were thus combined on this factor in the subsequent analyses.

We first examined the training time needed for children to achieve the termination criterion. On average, children in the Black individuation and White exposure condition required 17 minutes (M = 16.50, SD = 5.39) and children in the White individuation and Black exposure condition required 19 minutes (M = 18.53, SD = 6.38). No significant difference was observed between the two conditions, $t(54) = 1.29$, $p = .203$, Cohen's $d = .26$.

Implicit racial bias—To examine training effects on children's implicit racial bias, we performed 2 (training type: individuation vs. mere exposure) × 2 (test: pre-test vs. post-test) repeated measures ANOVA with both factors as within-subject factors on children's D scores. The crucial training type and test interaction was significant, $F(1, 55) = 9.02$, $p = .004$, partial $\eta^2 = .14$. A post-hoc power analysis with the program *G*Power* revealed that on the basis of within-subject comparison, the power to detect an effect size in the present study (partial $\eta^2 = .14$) at $\alpha = .05$ level with a sample size of 56 was .99.

As shown in Figure 4a, children's implicit biases against other-race faces decreased significantly only after receiving individuation training. This was confirmed by simple effect analyses: the mean D scores for these two conditions before training were not significantly different, $t(55)= -.78$, $p =.44$, Cohen's $d = .15$. However, the mean D scores for these two conditions after training were significantly different, $t(55)= - 3.68$, $p < .001$, Cohen's $d = .65$. Thus, individuation training significantly reduced Chinese children's implicit racial bias against Blacks and Whites, but mere exposure did not.

To further explore this significant interaction (Figure 4a), we conducted one-sample t-tests to compare the mean D scores before and after training to zero (no bias) for other-race faces in each training condition. Before training, the mean D scores were significantly different from zero (no bias), $t(55) = 12.70$, $p < .001$, Cohen's $d = 1.70$, and $t(55) = 10.31$, $p < .001$, Cohen's $d = 1.38$, for the individuation and mere exposure conditions, respectively. After training, the D score was significantly different from zero in the individuation training condition, $t(55) = 10.32$, $p < .001$, Cohen's $d = .59$, and the mere exposure condition, $t(55) = 11.37$, $p < .001$, Cohen's $d = 1.53$, respectively.

Study 2 with a larger sample size revealed that other-race individuation training, but not mere exposure, reduced children's implicit racial bias against other-races significantly, replicating the results of Study 1. However, unlike in Study 1, implicit racial bias was not completely eliminated.

Explicit racial bias—We used Cronbach's alpha score to estimate the internal consistency of the modified Choice Task. The modified task had a reliability with $\alpha = .70$, which was higher than that in the old Choice Task used in Study 1. The Trait Attribution Task had a good reliability with $\alpha = .83$.

In the Choice Task, for each child, we obtained pre- and post-test explicit bias scores against Blacks and Whites. To examine training effects on children's explicit racial bias scores we performed 2 (training type: individuation vs. exposure) × 2 (test: pre-test vs. post-test) repeated measures ANOVA with both factors as within-subject factors. Unlike the results for implicit racial bias, neither the test effect nor the crucial training type and test interaction was significant, all p's > .20 (Figure 4b). To examine whether the non-significant training effects on reducing explicit bias were due to a lack of statistical power, we conducted a post-hoc power analysis with power set at .80 and $\alpha = .05$. We found that the sample size would have to increase to $N = 4987$ to reach significance. Thus, it was unlikely that our non-significant results were due to the relatively small sample size.

To further explore whether children showed explicit racial bias before and after training, we conducted one-sample *t*-tests to compare their explicit percentage of own-race chosen to .50 (no bias). Children's explicit percentage of own-race chosen was significant higher above .50 (no bias), all *t*'s > 2.94, *p*'s < .01, indicating that they showed explicit bias against other-race before training and after training, in each training condition.

To further examine the difference in explicit bias scores in each scenario, we separated the explicit bias scores by scenarios. A McNemar Test indicated that for each scenario, there was no difference in explicit racial bias performance pre- and post-training for either training condition, all *p*'s > .063. In addition, a non-parametric Friedman test of difference among different scenarios indicated that was no significant difference among the five scenarios at both pretest and posttest in either the individuation training group, all χ's < 1.35, *p*'s > .850, or in the mere exposure training group, χ's < 1.17, *p*'s > .882. The detailed results are shown in Table 2.

In the Trait Attribution Task, we obtained pre- and post-test explicit bias scores for Chinese, Blacks, and Whites. To examine training effects on explicit racial attribution scores, we performed the same repeated measures ANOVA on children's explicit racial attribution scores in the Trait Attribution Task. Neither the test effect nor the crucial training type and test interaction were significant, all *p*'s > .11 (See Figure 4c).

We also conducted one-sample *t*-tests to compare children's explicit attribution scores to zero (no bias) before and after training and found that children's explicit racial attribution scores were significantly above zero, all *t*'s > 2.04, *p*'s < .05, indicating explicit biases against other-race before and after training, in each training condition.

Thus, the major results of Study 2 replicated those of Study 1. However, the individuation training did not fully eliminate implicit racial bias in Study 2 as it did in Study 1. Although the implicit racial bias of the participants in the pre-test was similar across the two studies, there might be considerable individual differences in how readily each child's implicit bias can be reduced that resulted in relatively greater resistance to change among Study 2 participants. Future studies taking an individual differences approach could address this possibility directly.

Additional Analyses: Data from Studies 1 and 2 Combined

We combined the data from both studies to increase the statistical power to test (a) whether children had differential implicit and explicit racial biases against Blacks versus Whites, and (b) whether individuation training or mere exposure affected the implicit and explicit racial biases of children against Blacks versus Whites differently.

Effects of Black Versus White Individuation Training on Implicit Bias

To examine whether *individuation training* differentially reduced children's implicit anti-Black versus anti-White bias, we performed a 2 (race: Black individuation vs. White individuation) × 2 (test: pre-test vs. post-test) repeated ANOVA with race as a between-subjects variable and test as a within-subjects variable. We found a main effect of test, $F(1, 86) = 14.94$, $p < .001$, partial $\eta^2 = .15$, indicating a significant decrease in implicit bias against other-races from pre-test (D = .48, $SE = .03$) to post-test (D = .23, $SE = .06$). We also found a main effect of race, $F(1, 86) = 7.99$, $p < .001$, partial $\eta^2 = .09$, indicating a significantly stronger bias against Blacks (D = .45, $SE = .05$) than against Whites (D = .26, $SE = .05$). There was no significant interaction between test and race, $F(1, 86) = 3.50$, $p = .065$, partial $\eta^2 = .04$ (See Figure 5a). Thus, both White individuation training and Black individuation training significantly reduced Chinese children's implicit bias against Whites and Blacks, respectively, although the White individuation training was more successful at reducing implicit bias against Whites than the Black individuation training was at reducing implicit bias against Blacks.

To explore further children's implicit bias against Blacks and Whites separately, we conducted one-sample *t*-tests to compare the anti-Black and anti-White D scores before and after training to zero (no bias) in the individuation training condition. As shown in Figure 5a, before and after Black individuation training, the implicit anti-Black D scores were significantly higher than zero (no bias), all *t*'s > 5.96, *p*'s < .001. By contrast, before White individuation training, the anti-White D scores were significantly higher than zero (no bias), $t(43) = 9.78$, $p < .001$, Cohen's $d = 1.47$, whereas after training, the anti-White D scores were no longer significantly different from zero (no bias), $t(43) = .81$, $p = .42$, Cohen's $d = .13$. Thus, consistent with the prior analysis, White individuation training eliminated Chinese children's implicit anti-White bias, whereas Black individuation training significantly reduced but did not eliminate Chinese children's implicit anti-Black bias.

Effects of Black Versus White Exposure Training on Implicit Bias

To examine whether *mere exposure* had any differential effects on children's anti-Black and anti-White implicit racial bias, we performed a 2 (race: Black exposure vs. White exposure) × 2 (test: pre-test vs. post-test) repeated ANOVA with race as a between-subjects variable and test as a within-subjects variable. We found a main effect of race, $F(1, 86) = 22.94$, $p < .001$, partial $\eta^2 = .21$, suggesting that children showed stronger anti-Black bias (D = .40, $SE = .04$) than anti-White bias (D = .66, $SE = .04$). Also, we found a significant interaction between race and test, $F(1, 86) = 5.80$, $p = .018$, partial $\eta^2 = .06$. As shown in Figure 5b, simple analyses showed that children's implicit anti-Black bias was significantly higher after Black exposure (D = .75, $SE = .06$) than before Black exposure (D = .58, $SE = .05$), $p = .015$, partial $\eta^2 = .07$. However, there was no significant change in children's implicit anti-White bias before (D = .41, $SE = .05$) and after White exposure (D = .35, $SE = .06$), $p = .353$, partial $\eta^2 = .01$. Thus, Black exposure significantly increased Chinese children's implicit anti-Black bias, whereas White exposure did not change Chinese children's implicit anti-White bias.

We also conducted one-sample *t*-tests to compare the anti-White and anti-Black D scores before and after training to zero (no bias) in the exposure condition. Both children's implicit anti-White bias and implicit anti-Black bias were significantly higher than zero (no bias) at pre-test and post-test, all *t*'s > 4.90, *p*'s < .001. Thus, children in the mere exposure conditions continued to show significant implicit racial bias against the other-race of faces to which they were exposed.

Effects of Black Versus White Individuation Training on Explicit Bias

To examine whether *individuation training* differentially reduced children's explicit anti-Black versus anti-White bias, we performed a 2 (race: Black individuation vs. White individuation) × 2 (test: pre-test vs. post-test) repeated measures ANOVA on children's explicit anti-Black versus anti-White bias in the Choice task, with race as between-subjects variable and test as with-subjects variable. We found a significant main effect of race, $F(1, 86) = 21.74$, $p < .001$, partial $\eta^2 = .20$, indicating a significantly stronger explicit bias against Blacks ($M = .78$, $SE = .03$) than against Whites ($M = .60$, $SE = .03$) (See Figure 5c). This finding differed from the finding of Qian et al. (2016) who reported that Chinese 3-5-year-old preschoolers showed the same level of implicit racial bias against Blacks and Whites. One possible reason might be that Chinese children become sensitive to social status difference of other races when they grow older, because participants in the current study ranged in age from 5 to 6 years with a mean age 5.76 years, which was older than the oldest age group of Qian et al. (2016). The Chinese children in the present studies, like older children in prior studies (e.g., Baron & Banaji, 2006), might already have sufficient knowledge that Whites have higher social status than Blacks and thus have shown less implicit bias against the former than the latter.

There was no main effect of test, $F(1, 86) = .22$, $p = .64$, partial $\eta^2 = .003$, nor significant interaction between test and race, $F(1, 86) = .08$, $p = .779$, partial $\eta^2 = .001$. Thus, neither Black individuation training nor White individuation training significantly reduced Chinese children's explicit bias against Blacks or Whites, respectively.

To explore further children's explicit bias against Blacks and Whites separately, we conducted one-sample t-tests to compare the anti-Black and anti-White explicit bias scores before and after individuation training to .50 (no bias). As shown in Figure 5c, explicit anti-Black bias and anti-White bias were significantly higher than .50 (no bias), indicating that the children showed explicit anti-Black and anti-White bias both before and after individuation training.

Effects of Black Versus White Exposure Training on Explicit Bias

To examine whether *mere exposure* had any differential effects on children's anti-Black and anti-White explicit racial biases, we performed a 2 (race: Black exposure vs. White exposure) × 2 (test: pre-test vs. post-test) repeated ANOVA on children's explicit anti-Black versus anti-White bias, with condition as a between-subjects variable and test as a within-subjects variable. As shown in Figure 5d, there were no main effects of test or condition, or interaction between test and condition, all p's > .115, indicating that neither Black exposure training nor White exposure significantly reduced Chinese children's explicit bias against Blacks or Whites, respectively.

We conducted the same one-sample t-tests to compare the anti-Black and anti-White explicit bias scores before and after exposure training to .50 (no bias). We found that children's explicit anti-Black bias and anti-White bias were significantly higher than .50 (no bias), indicating explicit anti-Black and anti-White biases both before and after exposure training.

Thus, the combined results from Studies 1 and 2 revealed that: (1) individuation training, but not mere exposure, reduced Chinese children's implicit racial bias against other-race Whites and Blacks; (2) White individuation training was more effective at reducing anti-White bias than Black individuation training was at reducing anti-Black bias; (3) Black mere exposure increased Chinese children's implicit anti-Black bias; and (4) neither individuation training nor mere exposure reduced children's explicit bias against Blacks or Whites.

General Discussion

The present study used a within-subject design to examine the effectiveness of perceptual individuation training for reducing racial biases against Whites and Blacks by Chinese preschool children. The overall results indicated that training preschoolers to individuate other-race faces specifically caused reduction of implicit racial bias while mere exposure to other-race faces had no impact on implicit racial bias.

The present findings provide direct support for the Perceptual-Social Linkage Hypothesis (Lebrecht et al., 2009; Quinn et al., 2013; Lee et al., in press), which posits that implicit racial bias in favor of own-race and against other-race individuals are a social consequence of differential processing experience of own-race versus other-race faces. To date, most of the support for the Perceptual-Social Linkage Hypothesis has come from research on adults (Doyle & Aboud, 1995; Katz, 2003; Katz, Sohn, & Zalk, 1975; Lebrecht et al., 2009; MacLin & Malpass, 2001; Meissner & Brigham, 2001; Richeson & Shelton, 2003)

Only one previous study has attempted to establish a perceptual-social causal linkage in preschool children (Xiao et al., 2015). In that study, Chinese preschoolers learned to recognize either other-race Black faces or own-race Chinese faces. It was found that the Black face training significantly reduced children's implicit racial bias against Blacks, but that the Chinese face training did not. This finding is consistent with the idea that individuation training may reduce implicit racial bias in children. Unfortunately, because the earlier study did not include a mere exposure condition, its findings were also consistent with the hypothesis that mere exposure might be sufficient to reduce implicit racial bias in preschool children. In the present study, we directly compared individuation and mere exposure, and found that individuation is critical to reduce children's implicit racial bias. Our current findings, thus, provide the first unequivocal evidence to suggest that individuation training, not mere exposure, reduces implicit racial bias in preschoolers. Further, our findings suggest that the effectiveness of individuation training on reducing implicit racial bias is robust because such training reduced implicit racial bias in Chinese preschoolers against both Whites and Blacks.

The present findings and those of Lebrecht et al. (2009) provide the strongest evidence to date for the Perceptual-Social Linkage Hypothesis by demonstrating that there is a causal linkage between perceptual experience and social biases only when that perceptual experience involves individuation, and not mere exposure. The distinction between exposure and individuation is significant because with development, humans become experts at processing faces, and one of the hallmarks of face expertise is the ability to process faces at the specific level of identity (Tanaka et al., 2013). As suggested by Dunham, Baron, and Banaji (2008), since perceptual familiarity generally “breeds” liking, greater exposure to one face category (e.g., own-race faces) over another category (e.g., other-race faces) should lead children to develop more positive attitudes towards the familiar category than the unfamiliar category. Thus, increasing familiarity with an otherwise unfamiliar category should lead to a decrease in negative attitudes towards this category. However, the results from the mere exposure condition suggest that increasing familiarity alone is insufficient to reduce implicit racial bias. Rather, our results point to the crucial role of the increased ability to individuate other-race faces. The reason for this is that in addition to increased liking due to increased familiarity, the individuation training leads to increased ability to perceive other-race faces as individuals. Perceiving other-race persons as individuals in turn prevents children from lumping them together, thereby making it less likely that negative stereotypes can be broadly applied to the other-race category as a whole.

Our results indicating that White individuation training reduced Chinese children's anti-White bias extends previous studies which have almost exclusively focused on interventions reducing anti-Black bias (Lebrecht et al., 2009; Xiao et al., 2015). Furthermore, we for the first time, showed that White individuation training was more effective at reducing anti-White bias than Black individuation training was at reducing implicit anti-Black bias. One possible explanation is that Chinese children in the present research had stronger implicit racial bias against Blacks than Whites before training. Thus, the equivalent amount of training that we provided across races might be sufficient to eliminate their anti-White implicit bias but not anti-Black implicit bias.

Another new finding is that mere exposure to Black faces increased Chinese children's implicit anti-Black bias, but mere exposure to White faces did not increase their implicit anti-White bias. The children's initial stronger implicit bias against Blacks than Whites might also explain this finding. It is possible that the amount of exposure we provided was sufficient to reinforce children's existing tendency to respond to individual Black faces as if they were the same (Dunham et al., 2008). However, this amount of exposure was insufficient to achieve the same change for White faces. These new findings taken together imply that relative to a weaker implicit racial bias, a stronger bias is harder to reduce, but easier to reinforce. Future specifically designed studies are needed to test this intriguing hypothesis.

As noted above, our results regarding implicit racial bias are consistent with those of Lebrecht et al. (2009), who found that individuation training reduced implicit biases against other-race faces in adults. However, one major difference between the present child study and the previous adult study is that the training with adults was highly intensive, taking five sessions (one session every other day over 10 days) with 45 minutes for each session. In contrast, we obtained significant reductions in implicit racial bias with only one session lasting less than 30 minutes. There is no denying that the difference in individuation training effectiveness between our study and that of Lebrecht et al. (2009) might stem from method-related factors such as the sensitivity of child versus adult implicit tests. However, it is worth noting that both our study and that of Lebrecht et al. (2009) used almost identical training methods. It is therefore possible that the difference in individuation training effectiveness between the two studies is because it is easier to reduce implicit racial bias in young children than in adults. This could reflect the fact that preschool children's implicit racial bias is newly formed, has yet to consolidate, and is consequently more malleable. In contrast, implicit bias in adults may have become consolidated over many years during the course of development. For this reason, it is likely that more intensive individuation training is needed to reduce implicit racial bias in adults. However, this possibility will need to be confirmed in a study in which both age groups are included and directly compared with equivalent methods. Relatedly, because individuation training can be administered to children before biases have a chance to consolidate during adolescence and adulthood, it is conceivable that individuation training in childhood might produce longer-term effects than the generally short-term effects that have been observed with various bias reduction methods that have been attempted with adults (Lai et al., 2016). Future studies are needed to examine this possibility.

Further studies are also needed to address whether simply asking children to remember each other-race face would achieve the same effect in reducing implicit racial bias as our training method that required participants not only to remember each other-race face but also associate a label with it. There is reason to believe that it would since memorizing other-race faces would serve to activate individuation through encoding the face identities for memory storage, which in turn should reduce implicit racial bias. Similarly, it is important to test whether our method can be modified to be even more child friendly (e.g., embedding remembering individual other-race faces in a storybook or a game) and whether such modifications would produce similar effects.

It should be noted that the present study only examined implicit racial bias in a cultural context where it is racially highly homogeneous and Chinese children have little actual physical contact with other-race individuals, especially Black faces. Future research is needed to examine whether the effectiveness of individuation training would vary depending on children's past other-race experience and thus vary from one child population to another. For example, will individuation training be more effective with children from racially homogeneous versus heterogeneous environments? At least two possibilities exist. One possibility is that children in a homogeneous culture might need larger doses of individuation training to reduce racial bias. This is because children in a homogeneous culture have stronger racial bias due to lack of contact with other-race individuals from birth, when compared to those in a more heterogeneous culture (Lee et al., in press; Pettigrew & Tropp, 2006; Raabe & Beelman, 2011). By the same reasoning, children in a heterogeneous culture might have some experience already with individuating other-race individuals due to contact or exposure to members of other races. A smaller dosage of individuation training could be enough to reduce their implicit racial bias, if any exists. Alternatively, children in a homogeneous culture might need the same amount of individuation training as those in a heterogeneous context because children living in a heterogeneous context might still lack experience in individuating other-race individuals. These two possibilities need to be tested in future studies.

Our study only focused on the reduction of race-based attitudinal bias. To date, no developmental study has examined whether reducing such bias in young children would also lead to reduction in their race-based discriminatory behaviors. Given the fact that implicit racial bias is known to predict race-based discrimination (Greenwald, Poehlman, Uhlmann, & Banaji, 2009), it is likely that individuation training will reduce not only children's implicit racial bias but also their race-based discriminatory behaviors. This hypothesis needs to be tested with specifically designed studies in the future. Last but not least, although intervention studies to reduce implicit bias in adults produced immediate reductions of implicit attitudes, many such reductions did not last for even 24 hours (Lai et al., 2014, 2016). Such findings call for not only intervention studies involving young children such as in the present study, but also long-term follow-up studies. To date, no such long-term follow-up study exists involving young children, which is a major gap in the current literature that must be bridged for early intervention programs to have meaningful real world impacts.

Regarding explicit racial bias, we demonstrated that neither individuation training nor mere exposure to other-race faces is effective in reducing it. One account of this result is that implicit and explicit biases share core origins in perceptual experience, and that perceptual training may produce differential effects depending on the nature of the training. For example, Prestwich, Kenworthy, Wilson, and Kwan-Tat (2008) have shown that contact *quality* with other-race faces, like intergroup friendship, better predicts explicit racial bias, whereas contact *quantity* with other-race faces has been associated with more positive implicit racial bias. Because our training method only increased other-race face experience quantitatively via photographic exposure, implicit, but not explicit, racial bias was affected. Had we exposed children to real other-race individuals engaging in positive social interactions, it is possible that explicit racial bias would have been reduced as well.

Another possible explanation for the lack of training effects on explicit racial bias is that there may be different developmental origins for these two forms of prejudice. Implicit biases may stem from early differential experiences of perceptually processing own- versus other-race faces (e.g., recognition vs. categorization). In contrast, explicit biases may be learned from differential social experiences about own- versus other-race people (e.g., social learning from adults and peers). If this possibility is true, then different strategies may be needed to reduce the two types of biases: perceptual means to reduce implicit biases and social means such as explicit instruction, peer pressure, and social interactions with other-race individuals to reduce explicit biases (Gawronski & Bodenhausen, 2006; Pettigrew & Tropp, 2006).

A third possibility for the lack of training effects on explicit racial bias might be due to the measurements used. Although individuation training did not significantly change children's explicit racial bias as measured by two different measures (Study 2), neither measure might be sufficiently sensitive to reveal the effects of training. For example, our forced-choice paradigm required children to choose either an own- or other-race individual, without an option of choosing no preference. Future studies using a modified procedure that gives children a third option might be more sensitive to reveal changes due to individuation training.

Furthermore, in the present study, we did not specifically separate young children's pro-own-race bias from their anti-other-race bias. It is possible that our training was insufficient to sway children to change their pro-own-race bias, but sufficient to change their anti-other-race bias. This is because their pro-own-race bias might be stronger than their anti-other-race bias, given their extensive and mostly positive interactions with own-race individuals and limited, if any, contact with other-race individuals. To address this question specifically, future studies need to use explicit racial bias measures that assess both types of bias.

In summary, the present study examined the effects of individuation training on reduction of implicit and explicit racial biases. Among its strengths, first, we used a unique design including individuation and exposure training as within-subject conditions to obtain clear effects of individuation training in reducing children's implicit racial bias towards a specific other-race. Second, our study was the first to assess the effects of individuation training on both implicit and explicit racial biases, revealing specific bias reduction effects in implicit racial bias but not explicit racial bias. Third, we examined the differential effects of intervention at reducing anti-Black and anti-White bias. This aspect of our work provided new insights regarding whether the same training methods can reduce biases against different racial groups equally or differentially. Finally, from a translational perspective, our findings suggest a practical and effective training method for reducing implicit racial bias in young children in a wide range of environments where the opportunity to directly interact with other-race individuals may be limited.

Because the present study was one of the first to study the effects of individuation training on the reduction of implicit and explicit racial biases, it has several limitations. One major limitation was that we only focused on the immediate effects of individuation training, leaving it unknown as to whether our individuation training would have any lasting effects in reducing children's implicit racial bias. Another limitation is the use of only Chinese preschoolers being raised in a racially homogeneous environment, leaving open the question of whether our findings can be generalized to children in other cultural contexts where there is extensive exposure to other-race individuals or the children themselves are racial minorities.

These limitations notwithstanding, the present study showed that individuation training of other-race faces reduces young children's implicit bias against other races, but mere exposure does not. Theoretically, our findings provide strong support for a causal link between individual-level face processing and implicit racial bias as well as the Perceptual-Social Linkage Hypothesis more generally. Practically, our findings provide compelling evidence for the effectiveness of other-race perceptual individuation training in reducing implicit racial bias in young children.

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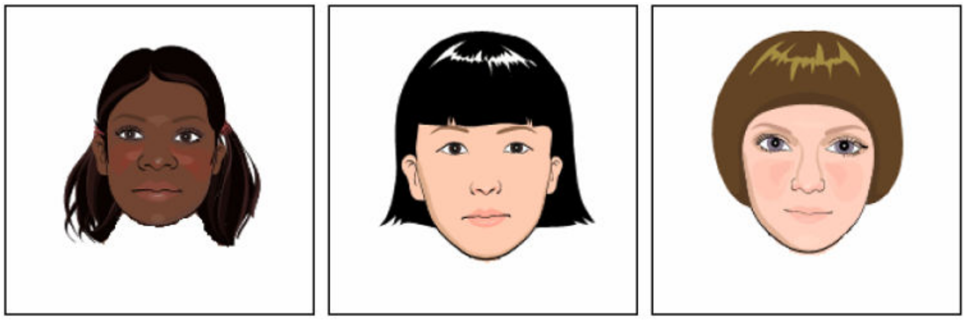

Figure 1.
Exemplar faces of Black, Chinese, and White adults.

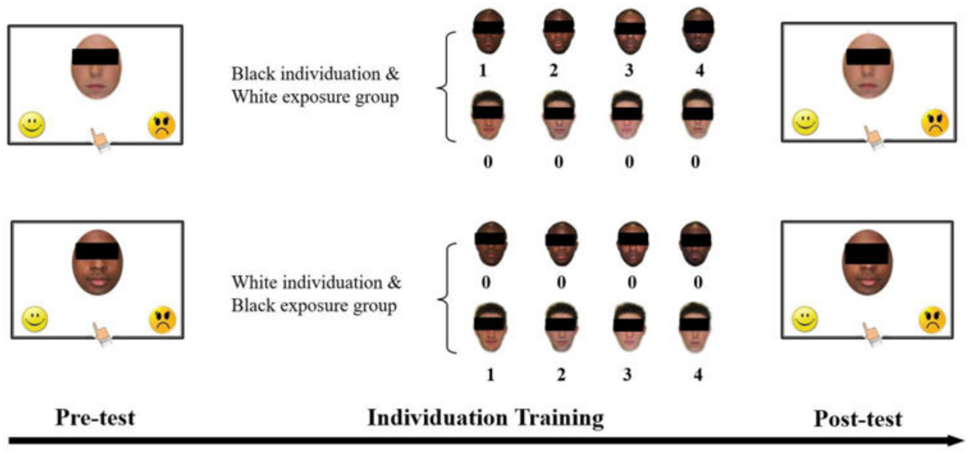

Figure 2.
Study procedure: In the Black individuation and White exposure condition, children learned to associate four individual Black faces with four individual numbers, but touched the number 0 when seeing White faces. In the White individuation and Black exposure condition, children learned to associate four individual White faces with four individual numbers, but touched the number 0 when seeing Black faces. We have included a black bar on each face to conceal the identities of the individuals whose faces were used as stimuli. In the actual training and testing, however, each face was presented without a black bar.

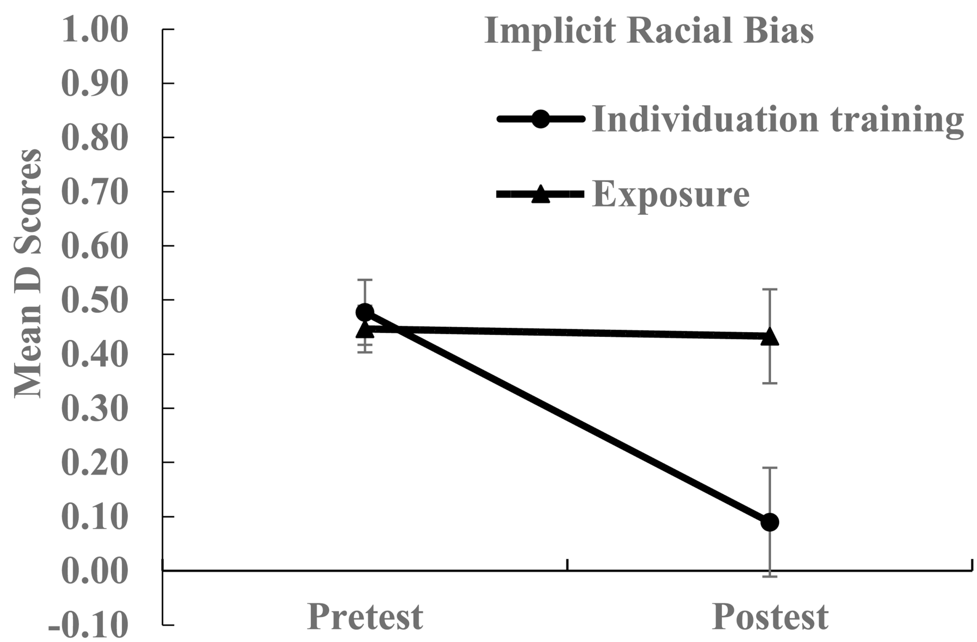

Figure 3a.

Implicit racial bias before and after individuation training or mere exposure. A positive value of D indicates a preference for own-race faces (Chinese) relative to other-race faces (Black and White). A score of zero represents no bias. Error bars represent standard errors.

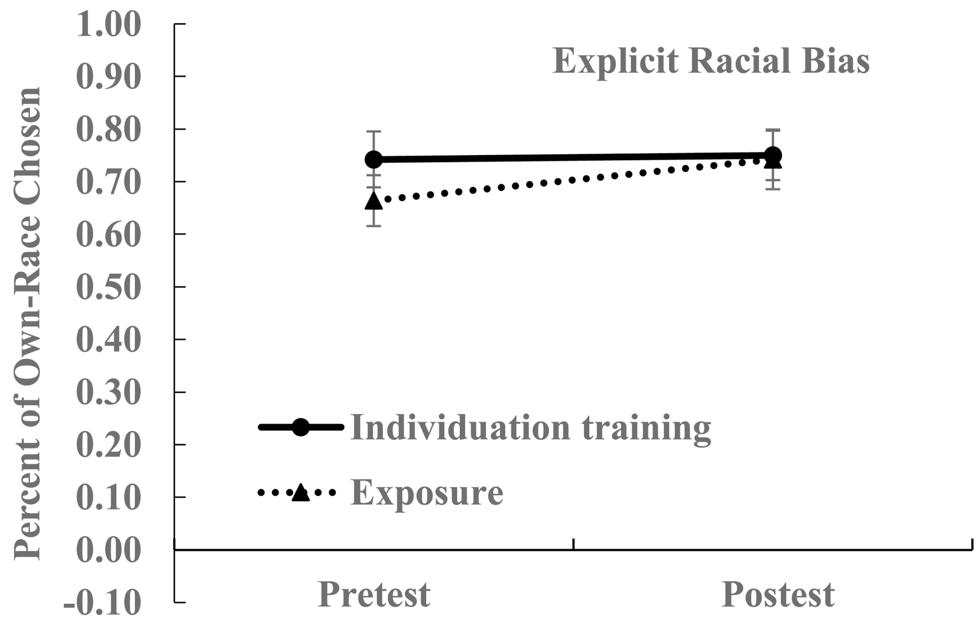

Figure 3b.

Explicit racial bias against Blacks and Whites before and after individuation training or exposure. A score greater than .50 indicates a preference for own-race (Chinese) relative to other-race (Blacks and Whites). A score of .50 indicates no bias. Error bars represent standard errors.

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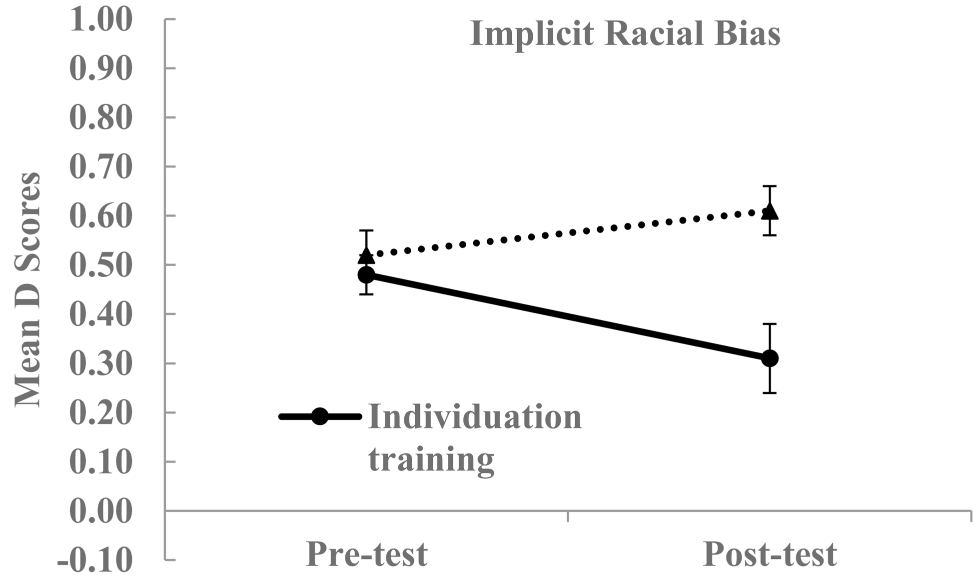

Figure 4a.

Implicit racial bias before and after individuation training or exposure. A positive value of D indicates a preference for own-race faces (Chinese) relative to other-race faces (Black and White). No bias score is zero. Error bars represent standard errors.

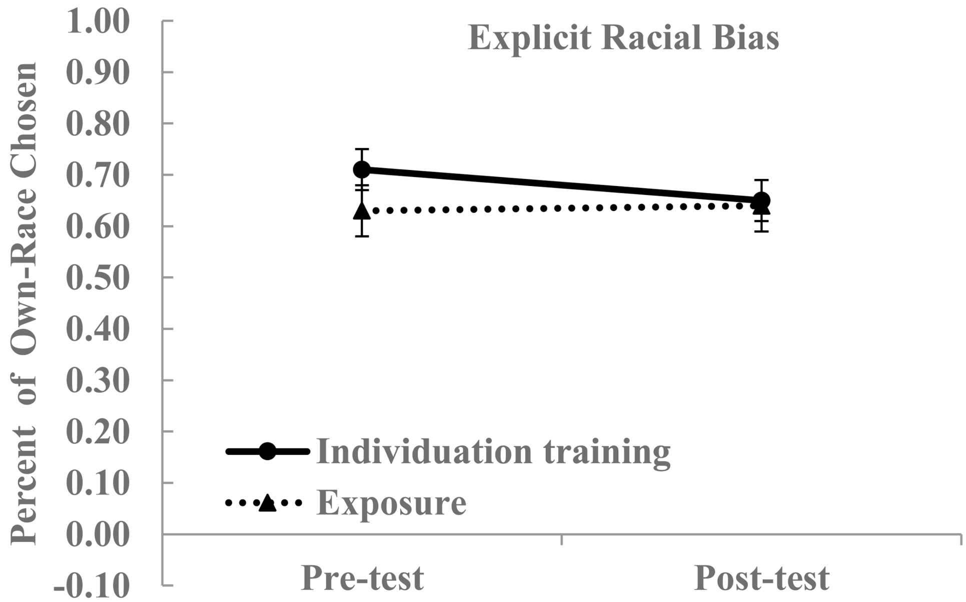

Figure 4b.
Explicit racial bias against other-race before and after indivdiuation training or mere exposure as measured by the Choice Task. A higher than .50 score indicates a preference for own-race (Chinese) relative to other-race (Black and White). No bias score is .50. Error bars represent standard errors.

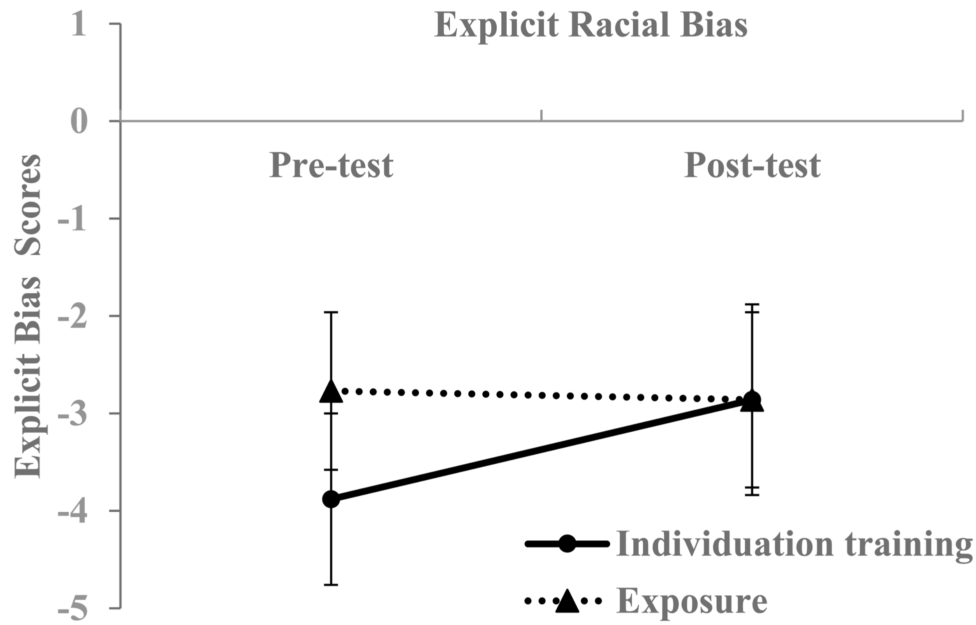

Figure 4c.
Explicit racial bias against Blacks and Whites before and after indivdiuation training or mere exposure as measured by the Trait Attribution Task. A score below zero indicates a preference for own-race (Chinese) relative to other-race (Black and White). A score of zero indicates no bias. Error bars represent standard errors.

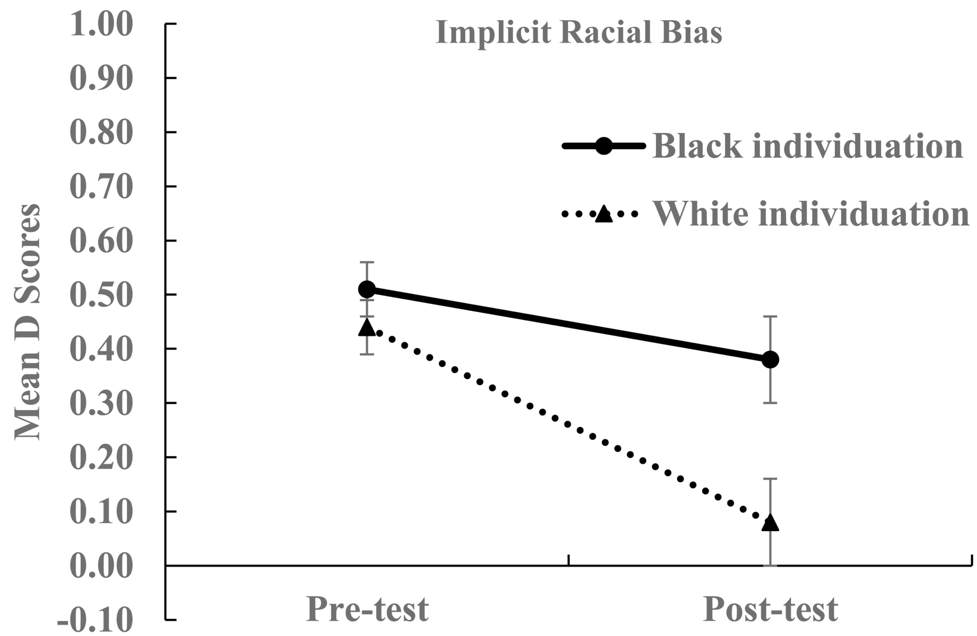

Figure 5a.

Implicit racial bias before and after Black individuation training and White individuation training. A positive value of D indicates a preference for own-race faces (Chinese) relative to other-race faces (Black or White). A score of zero represents no bias. Error bars represent standard errors.

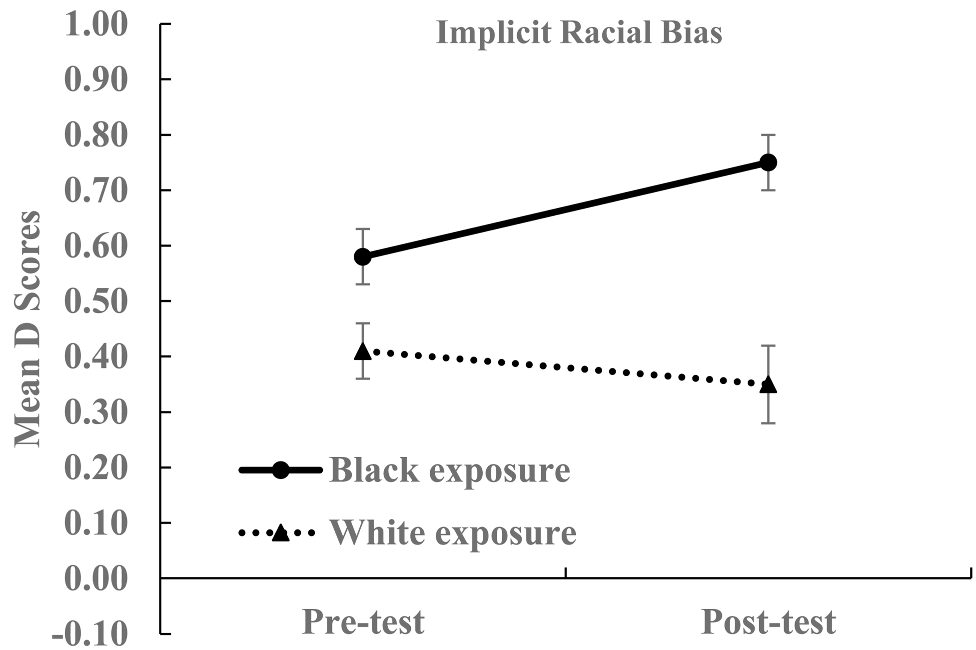

Figure 5b.
Implicit racial bias before and after Black mere exposure training and White mere exposure training. A positive value of D indicates a preference for own-race faces (Chinese) relative to other-race faces (Black or White). A score of zero represents no bias. Error bars represent standard errors.

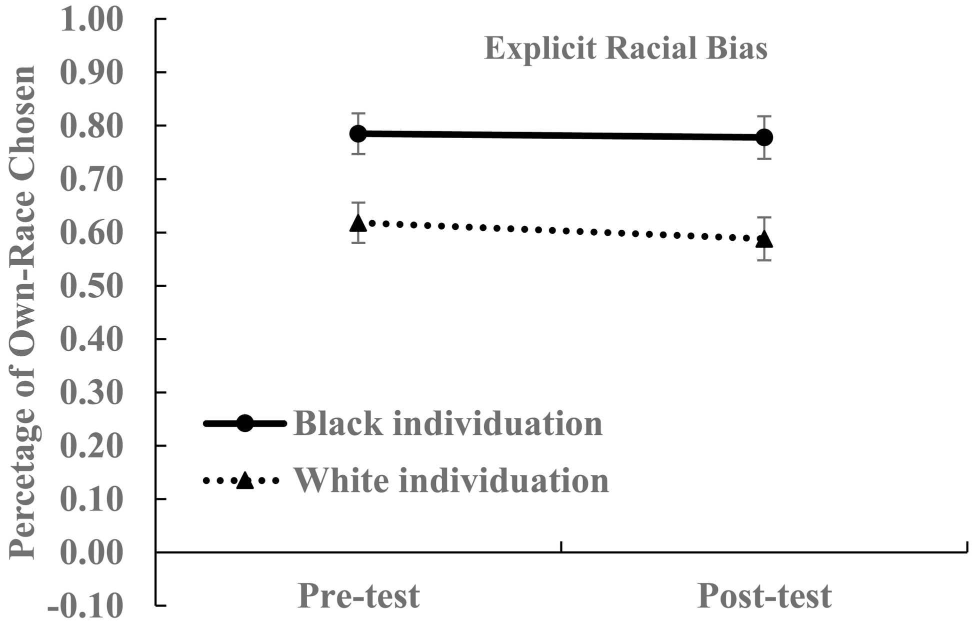

Figure 5c.

Explicit racial bias against Blacks and Whites before and after indivdiuation training as measured by the Choice Task. A higher than .50 score indicates a preference for own-race (Chinese) relative to other-race (Black and White). No bias score is .50. Error bars represent standard errors.

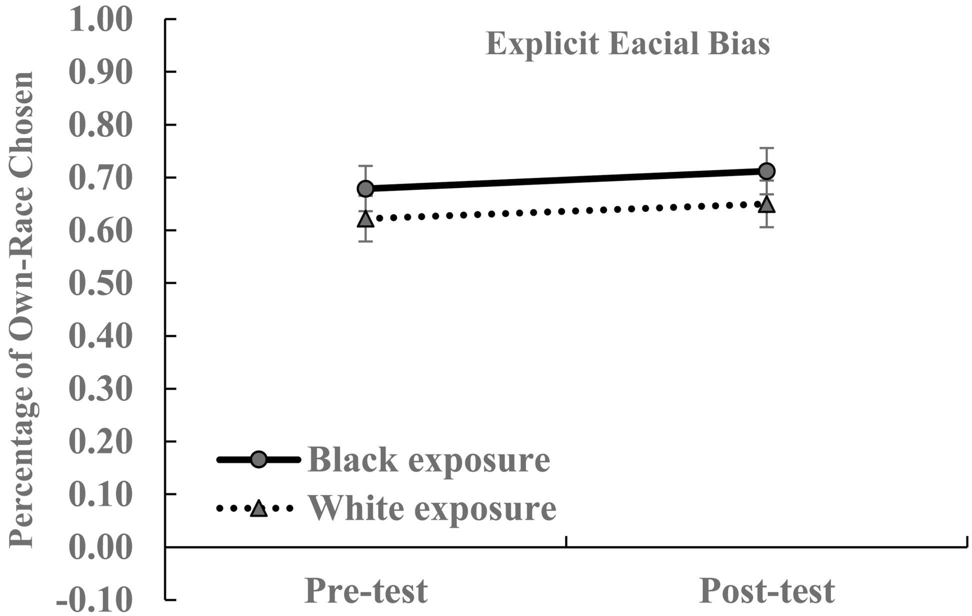

Figure 5d.
Explicit racial bias against Blacks and Whites before and after exposure training as measured by the Choice Task. A higher than .50 score indicates a preference for own-race (Chinese) relative to other-race (Black and White). No bias score is .50. Error bars represent standard errors.

Table 1

Percentage of Own-Race Chosen in the Choice Task Before and After Training (Study 1)

	Individuation (N = 32)			Mere Exposure (N = 32)		
	Pre-test	**Post-test**	***p***	**Pre-test**	**Post-test**	***p***
Coach	75.00	75.00	1.000	71.88	68.75	1.000
Summer camp	71.90	71.90	1.000	62.50	62.50	1.000
Tour guide	75.00	68.80	.655	56.25	56.25	.727
Chi-Square	.13	.35		.38	.12	
p	.936	.838		.827	.943	

Table 2

Percentage of Own-Race Chosen in the Choice Task Before and After Training (Study 2)

	Individuation (N = 56)			Mere Exposure (N = 56)		
	Pre-test	**Post-test**	***p***	**Pre-test**	**Post-test**	***p***
Coach	75.00	67.90	.344	69.60	67.90	1.000
Summer camp	67.90	64.30	.687	66.10	64.30	1.000
Tour guide	73.20	64.30	.063	69.60	64.30	.453
Dentist	69.60	58.90	.070	64.30	58.90	.549
Music teacher	73.20	64.30	.125	71.40	64.30	.219
Chi-Square	1.35	1.12		1.17	1.12	
p	.850	.891		.882	.891	