

## Development of own-race biases

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This review examines the emergence and development of perceptual and social biases towards own-race individuals. We first discuss evidence regarding the early emergence of an own-race bias in facial preferences and face recognition abilities demonstrated by infants with an abundance of visual experience with own-race individuals, but little to no experience with other-race individuals. We then consider perceptual categorization of face race, visual scanning, and differential processing of own- and other-race faces in relation to recognition of face identity. Finally, we review evidence regarding own-race preferences for social partners and own-race biases in social evaluations that emerge during early childhood. Implications of the existing evidence for understanding the role of experience in perceptual development and the emergence of racial preferences and stereotypes are discussed.

**Keywords:** Face recognition; Own-race bias; Race-based social preference.

At birth, infants already show a visual preference for faces or face-like configurations over nonface objects (Fantz, 1963; Goren, Sarty, & Wu, 1975; Johnson, Dziurawiec, Ellis, & Morton, 1991; Johnson & Morton, 1991; Macchi Cassia, Simion, & Umiltà, 2001; Maurer, 1985; Maurer & Young, 1983; Mondloch et al., 1999). This general bias to attend to faces becomes

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increasingly specific with age as infants gain more and more experience with faces. For example, by 1 month of age, infants show a visual preference for a schematic face structure over a nonface structure, and, by 2 months, Caucasian infants show a visual preference for faces showing a positive contrast (i.e., darker features on a lighter-coloured face) over faces showing a negative contrast (i.e., lighter features on a darker-coloured face; Mondloch et al., 1999). Further studies show that accumulating experience with faces shapes not only infants' preferences for the most basic features that characterize faces, but also their preference for and recognition of faces from different racial categories.

This paper will review the development of own- and other-race face perception from infancy to adulthood. We first discuss the visual preference for own-race faces and the "other-race effect" in face recognition—both of which emerge during infancy with differential experience with own- and other-race individuals. We then discuss how developmental changes in categorization abilities and in own- and other-race face scanning might help in understanding the mechanisms underlying the development of the own-race recognition bias. Finally, we discuss the development of race-based social preferences and social stereotypes that emerge during early childhood.

## DEVELOPMENT OF OWN-RACE VISUAL PREFERENCE AND RECOGNITION BIAS

Although newborns prefer to look at faces over nonface objects (reviewed in Lee, Anzures, Quinn, Pascalis, & Slater, 2011), they show no preference when looking at faces from different racial groups (Kelly et al., 2005). However, as infants gain more visual experience with faces from a particular racial group, they begin to show a visual preference for the familiar race. For example, infants prefer to look at own-race over other-race faces by 3 months of age (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly, Liu, et al., 2007; Kelly et al., 2005). This developed visual preference for a given race class most likely stems from infants' abundance of experience with own-race individuals and their simultaneous lack of experience with other-race individuals (Rennels & Davis, 2008). The important role of visual experience in shaping facial preferences is supported by the finding that, when infants have regular exposure to individuals from their own race as well as individuals from another race, 3-month-olds show no preference when looking at faces from either racial group (Bar-Haim et al., 2006).

At around the same age that infants show a visual preference for own-race faces, some infants also begin to show an own-race face recognition bias—sometimes referred to as the other-race effect (ORE) in face recognition. Better recognition of own-race faces compared to recognition of other-race

faces has been documented in infants as young as 3 months of age (Hayden, Bhatt, Joseph, & Tanaka, 2007; Sangrigoli & de Schonen, 2004b). Other findings suggest that the own-race bias in face recognition does not begin to emerge until 6 months of age (Kelly et al., 2009; Kelly, Quinn, et al., 2007).

Despite the mixed findings regarding its initial emergence, evidence of an age-related increase in the robustness of the own-race face recognition bias in infants is more consistent across studies. Two lines of evidence are suggestive of a stronger own-race face recognition bias in older infants compared to younger infants. First, a more exclusive own-race bias is observed among Caucasian 9-month-olds who show above-chance recognition only for own-race faces (Kelly, Quinn, et al., 2007) compared to Caucasian 6-month-olds who are at chance in recognizing faces from certain race groups (e.g., African faces) but are, nonetheless, above chance in recognizing faces from other race groups (e.g., Chinese faces: Heron-Delaney et al., 2011; Kelly, Quinn, et al., 2007, but see Kelly et al., 2009, for evidence of a more robust own-race face recognition bias in 6-month-olds). Second, greater exposure to other-race faces is required to enhance other-race face recognition among 9- to 10-month-old infants (Anzures et al., 2012) compared to the brief exposure necessary to enhance other-race face recognition among 3-month-old infants (Sangrigoli & de Schonen, 2004b).

Overall, results across different studies suggest that the own-race bias in face recognition emerges between 3 and 6 months of age and is relatively more robust by 9 months of age. This developmental pattern is akin to the perceptual narrowing effect observed in infants' initial abilities to discriminate between phonemes from any language, which is later followed by greater selectivity in their discriminatory abilities—that is, infants maintain the ability to discriminate between different native phonemes but gradually decline in their ability to discriminate between different nonnative phonemes from 6 to 10 months of age (Polka & Werker, 1994; Werker & Tees, 1984). Thus, across different modalities, engagement with ambient visual and auditory cues in the environment maintain one's abilities to discriminate between instances from familiar categories (reviewed in Scott, Pascalis, & Nelson, 2007).

Studies with older age groups show that the own-race recognition bias is maintained throughout the childhood and adulthood years with continued experience with own-race individuals and lack of experience with other-race individuals (Chance, Turner, & Goldstein, 1982; Corenblum & Meissner, 2006; de Heering, de Liedekerke, Deboni, & Rossion, 2010; Feinman & Entwisle, 1976; Goodman et al., 2007; Kelly et al., 2011; Pezdek, Blandon-Gitlin, & Moore, 2003; Sangrigoli & de Schonen, 2004a; Walker & Hewstone, 2006a, 2006b; also reviewed in Meissner & Brigham, 2001). The size of the own-race face recognition bias also appears to remain stable

throughout the childhood and early adulthood years (Anzures et al., [in press](#); de Heering et al., [2010](#); Pezdek et al., [2003](#)).

However, it should be noted that, despite the prevalence of an own-race face recognition advantage, experience with other-race individuals can modulate the ability to recognize other-race faces. Thus, early experience with other-race faces can prevent the development of an own-race recognition advantage (Heron-Delaney et al., [2011](#)). Later experience with other-race faces can improve other-race face recognition (Anzures et al., [2012](#); de Heering et al., [2010](#); Goldstein & Chance, [1985](#); Hills & Lewis, [2006](#); Rhodes, Locke, Ewing, & Evangelista, [2009](#); Tanaka & Pierce, [2009](#); see also Tanaka, Heptonstall, & Hagen, [in press](#)) and even reverse the recognition advantage if own-race face experience ceases (Sangrigoli, Pallier, Argenti, Ventureyra, & de Schonen, [2005](#)).

## FACE SPACE, CATEGORIZATION, AND DIFFERENTIAL PROCESSING OF OWN- AND OTHER-RACE FACES IN INFANTS

Differential experience with own- and other-race faces creates the foundation for an own-race face recognition advantage, but the specific mechanisms underlying such recognition biases are subject to continued research and examination. A review of the findings to date suggests that early differential experience with own- and other-race faces most likely cultivates the development of (1) a biased face space architecture, (2) discrete visual categories, and (3) differential processing styles for own- and other-race faces.

### Face space

A most influential theory accounting for differences in face recognition posits that faces are encoded on multiple dimensions (Goldstein & Chance, [1980](#); Rhodes, Brennan, & Carey, [1987](#); Valentine, [1991](#); Valentine & Endo, [1992](#)). However, familiarity with a given stimulus class (e.g., own-race faces) provides one with the opportunity to learn features that reliably act to differentiate between within-category exemplars (Gibson, [1969](#); Quinn & Tanaka, [2007](#)). Thus, early differential experience with own- and other-race faces most likely shapes a multidimensional face space favouring a familiar face category. That is, greater experience with own-race faces should allow one to abstract facial dimensions most useful in discriminating between faces from one's own race group. Indeed, computational models have found that exposing a model to a sufficiently larger subset of faces from one race and a smaller subset of faces from another race leads to better individuation abilities for the more familiarized race category (Furl, Phillips, &

O'Toole, 2002; O'Toole, Deffenbacher, Abdi, & Bartlett, 1991; reviewed in Natu & O'Toole, 2013), at least in part, due to increased reliance on facial dimensions most useful in discriminating between individuals from the more familiar race (Balas, 2012, *in press*). Consistent with these computational results, the development of an own-race face recognition bias in infants, as already described, shows increasingly robust biases with increased age and experience with own-race faces (Hayden et al., 2007; Kelly et al., 2009; Kelly, Quinn, et al., 2007; Sangrigoli & de Schonen, 2004b). In addition to the well-replicated finding of such own-race face recognition biases in adults, Walker and Tanaka (2003) have also shown that adults are more sensitive to smaller differences in the identities of own-race than other-race faces.

### Visual categories

As infants develop a face space increasingly tuned to detect differences in own-race face identities, they are also developing the ability to parse visual items into discrete categories. Developing abilities to categorize faces according to familiar and unfamiliar racial groups may be reflected in the development of differential visual scanning of own- and other-race faces during infancy. Eye-tracking studies have shown that infants gradually adopt or maintain sociocultural conventions in their visual scanning of faces, but they do so only for own-race faces. For example, Caucasian 6- to 10-month-olds show an age-related increase in their visual scanning of the eye region of Caucasian faces (Wheeler et al., 2011)—a scanning pattern that is (1) consistent with the Western cultural convention in maintaining eye contact during social interactions (Argyle & Cook, 1976), (2) similar to how Caucasian children and adults scan faces (Blais, Jack, Scheepers, Fiset, & Caldara, 2008; Kelly et al., 2011), and (3) not generalized to other-race faces (Wheeler et al., 2011). Similarly, Asian 4- to 9-month-olds maintain their degree of visual fixations to the central/nasal regions of Asian faces (Liu et al., 2011)—a fixation pattern that is (1) consistent with the Eastern cultural convention in limiting direct eye contact (Li, 2004), (2) similar to how Asian adults scan own-race faces (Blais et al., 2008; Fu, Hu, Wang, Quinn, & Lee, 2012), and (3) not generalized to other-race faces (Liu et al., 2011). Thus, infants have already begun to adopt sociocultural conventions in face scanning that they generalize only to novel instances of faces from a visually familiar social category.

It remains to be seen how such increasingly differential scanning patterns relate directly to infants' own- and other-race face recognition. Eye-tracking results from North American 3-month-olds reveal that these younger infants scan own- and other-race faces similarly, but greater scanning between the eye and mouth regions during habituation or learning predicted recognition

of own-race, but not other-race, faces (Gaither, Pauker, & Johnson, 2012). Thus, younger infants may be focusing on facial dimensions most useful in discriminating between own-race faces, but the same dimensions may not be as useful in discriminating between other-race faces. A similar examination of the relationship between face scanning and own- and other-race face recognition has yet to be conducted with older infants. However, differential scanning of own- and other-race faces in 6- and 9-month-olds (Xiao, Xiao, Quinn, Anzures & Lee, 2013) might allude to differences in how such faces are processed as a function of race in older infants.

Developmental changes in the visual scanning of own- and other-race faces occur alongside developmental changes in infants' categorization of face race. Indeed, the visual preference for own-race faces at 3 months is already indicative of differential treatment of own- and other-race faces. Furthermore, like older infants, 3-month-olds already treat other-race features embedded within a myriad of own-race features as more visually salient than the reverse context (Hayden, Bhatt, Kangas, Zieber, & Joseph, 2012; Hayden, Bhatt, Zieber, & Kangas, 2009)—findings indicative of processing other-race faces at a more superordinate level relative to own-race faces, which are processed at the more subordinate level of individual identity (Levin, 1996, 2000). However, the ability to form discrete categories of faces based on race emerges by 9 months of age (Anzures, Quinn, Pascalis, Slater, & Lee, 2010). During the early stages of visual processing, 9-month-olds also show differential event-related potential responses to race-specific differences in the internal facial features (i.e., eyes, nose, mouth) and skin colour information (Balas, Westerlund, Hung, & Nelson, 2011; see Brebner, Krigolson, Handy, Quadflieg, & Turk, 2011, for similar electrophysiological findings in adults). Such behavioural and electrophysiological findings suggest that, by 9 months of age, infants are engaging in racial categorization of faces.

Given their similar developmental timelines, future studies should directly examine the relationship between infants' racial categorization of faces and their developing own-race face recognition biases. As has been suggested by many researchers, categorization presents the opportunity whereby exemplars from different groups can receive differential treatment (Bigler & Liben, 2007; Levin, 1996, 2000; Maclin & Malpass, 2001; Sporer, 2001; Tanaka et al., *in press*). Thus, an initial categorization of faces as exemplars from one's own race or from another race may, in turn, instigate different ways in which faces are processed. For example, adults show better recognition of faces depicting a single racial marker (e.g., hair) indicative of their own race group and worse recognition of the identical faces depicting a racial marker indicative of another race group (MacLin & Malpass, 2001; but see Rhodes, Lie, Ewing, Evangelista, & Tanaka, 2010, for lack of influence of perceived race on recognition of ambiguous-race faces). As

suggested by several researchers (Ge et al., 2009; Levin, 1996, 2000; Tanaka et al., *in press*), adults most likely process other-race faces at the categorical level of race rather than at the individual level of identity—thereby contributing to the deficit in other-race face recognition. However, it should be noted that such categorization most likely proceeds from a more perceptual process (e.g., use of visual cues to race) during infancy to a combination of perceptual and social-conceptual processes (e.g., ingroup vs. outgroup) with age.

### Processing differences

After an initial categorization period, expertise in individuating between own-race faces has been linked to a number of ways in which own- and other-race faces are differentially perceived. For example, own-race faces compared to other-race faces tend to be perceived in a more holistic manner by adults (Michel, Caldara, & Rossion, 2006; Michel, Rossion, Han, Chung, & Caldara, 2006; but see Mondloch et al., 2010, for comparable holistic processing of own- and other-race faces). This differential use of holistic face processing for own- and other-race faces originates in infancy. Although 4-month-old infants demonstrate holistic face processing of both own- and other-race faces, holistic face processing is reserved only for own-race faces by 8 months of age (Ferguson, Kulkofsky, Cashion, & Casasola, 2009). Thus, the more robust own-race face recognition bias observed at around 9 months of age may be related to infants' exclusive use of holistic processing for own-race faces. It remains to be seen how holistic face processing is used for own- and other-race faces during childhood. However, based on the existing data on infants and adults, use of holistic face processing most likely generalizes to other-race faces at some point during childhood, but such processing may, nonetheless, be utilized to a greater extent for own-race faces.

In addition, adults' recognition of own-race facial features and the spacing between those features is enhanced relative to their recognition of other-race facial features and the corresponding featural spacing information (Hayward, Rhodes, & Schwaninger, 2008; Mondloch et al., 2010; Rhodes, Hayward, & Winkler, 2006). Adults also weigh race-specific skin colour cues more heavily than race-specific featural spacing information in their differential recognition of own- and other-race faces (Brebner et al., 2011). However, face recognition abilities tend to be highest for faces with the features, featural spacing, and skin colour information of one's own race, whereas recognition abilities decrease progressively as more and more of these facial cues take on the characteristics of an other-race group (Bar-Haim, Saidel, & Yovel, 2009).

Infants' and children's processing of own- versus other-race faces at the featural and featural spacing levels remain largely unexplored. The limited existing findings suggest that 9-month-old infants show similar event-related

potential responses for unaltered own-race faces compared to other-race faces (i.e., with other-race features and feature spacing information) with own-race skin colour (Balas et al., 2011). The own-race face recognition bias in infancy is most likely based on differential face processing driven by a combination of many cues—different features, different feature spacing information, and different skin colour information—that are specific to different races. For example, if race differences in skin colour information are minimized so that own- and other-race faces are given a race-neutral skin colour (e.g., greyscale), 6- and 9-month-old infants rely on featural and featural spacing cues alone and still demonstrate an own-race face recognition bias (Anzures, Pascalis, Quinn, Slater, & Lee, 2011).

### FACE SPACE, CATEGORIZATION, AND DIFFERENTIAL PROCESSING OF OWN- AND OTHER-RACE FACES IN CHILDREN

Overall, it appears that biased face space architecture, categorization, and differential processing styles for own- and other-race faces underlie both infants' and adults' face processing to give rise to an own-race face recognition advantage. Although largely overlooked, the scant evidence available from children suggests that they employ similar cognitive mechanisms. For example, 5- and 8-year-olds also appear to treat own- and other-race faces in a categorical manner (Short, Hatry, & Mondloch, 2011). Such categorization most likely influences their subsequent processing of identity in that 2- to 6-year-olds show better recognition of 50% own-race and 50% other-race morphed faces when such faces are paired with nonmorphed own-race rather than other-race “siblings” (Shutts & Kinzler, 2007).

In addition to the influence of visual cues to race, future studies on children's own- and other-race face recognition would benefit from an examination of children's development of social categories and their perceived categorization of themselves in relation to such categories. As has been proposed in the adult literature, perceived ingroup and outgroup category membership can instigate differential processing of own- and other-race faces to give rise to an own-race recognition bias (Sporer, 2001). Indeed, manipulating adults' perceived membership of ingroup and outgroup own-race individuals (e.g., own vs. other university affiliation) can lead to an ingroup recognition bias despite equivalent perceptual expertise for both groups (Bernstein, Young, & Hugenberg, 2007). Such categorization of individuals as belonging to one's ingroup or outgroup has also been found to mediate the ways in which faces are processed. For example, own-race ingroup faces are processed more holistically than own-race outgroup faces (Hugenberg & Corneille, 2009). Furthermore, both own- and other-race

ingroup face identities are processed more efficiently in upright than inverted orientations compared to own- and other-race outgroup identities (Cassidy, Quinn, & Humphreys, 2011).

Thus, categorization at the perceptual level of familiar/unfamiliar race and categorization at the social-conceptual level of ingroup/outgroup (which may or may not coincide with visual cues to race) both appear to mediate subsequent processing of faces. However, although such perceptual influences have been shown to originate during early infancy, as discussed earlier, it has yet to be determined whether or when children's social category formation and their categorization of themselves in relation to such social categories influence their biases in face recognition. Given the emergence of race-based social preferences and stereotypes between 3 and 5 years of age, as discussed later, perceived social category differences might also begin to influence face identity processing during early childhood. Thus, the developmental origins of the own-race face recognition advantage in infancy stems from visual experience and perceptual expertise. But the later formation of social categories and perceived categorization of the self in relation to such social categories provides additional reinforcement to differentially process own- and other-race faces—perhaps due to increased motivation to individuate between ingroup members and decreased motivation to do so for outgroup members (Hugenberg, Wilson, See, & Young, *in press*; Hugenberg, Young, Bernstein, & Sacco, 2010).

## RACE-BASED SOCIAL PREFERENCES AND STEREOTYPES

Given the early visual preference for own-race faces evident by 3 months of age (Bar-Haim et al., 2006; Kelly, Liu, et al., 2007; Kelly et al., 2005), one might wonder whether infants also show a corresponding social preference for own-race individuals. However, evidence to date suggests that infants do not prefer own-race to other-race social partners. For example, 10-month-olds accept toys equally from own- and other-race individuals (Kinzler & Spelke, 2011). Similarly, 2-year-olds give toys equally to own- and other-race individuals (Kinzler & Spelke, 2011). It is not until 3 years of age that race-based social preferences become evident, albeit under certain circumstances. That is, when 3- to 4-year-olds are shown photographs of unfamiliar own-race children paired with other-race children and asked which one they would like to choose as a friend, they show no racial biases in their choices (Abel & Sahinkaya, 1962; Shutts, Roben, & Spelke, 2013). However, when asked to sort photographs of familiar classmates, children as young as 3 to 4 years of age tend to report more other-race than own-race peers as classmates whom they like the least (Ramsey & Myers, 1990). Such early differential preferences for own- and other-race peers appear to be related to

children's tendencies to categorize themselves by race. That is, those who tend to select own-race peers as similar to themselves and other-race peers as different from themselves also tend to report a greater number of other-race peers as classmates whom they like the least (Ramsey & Myers, 1990).

Such race-based social preferences appear more robust among older children, with a tendency for 5-year-olds to choose own-race over other-race individuals as friends or playmates (Abel & Sahinkaya, 1962; Davey & Mullin, 1980; Kinzler, Shutts, DeJesus, & Spelke, 2009; Kinzler & Spelke, 2011). However, this social preference is modulated by additional contextual cues that are informative in making ingroup/outgroup categorizations. For example, English-speaking 5-year-olds tend to choose other-race children portrayed as speaking English with a native accent over own-race children speaking English with a foreign accent (Kinzler et al., 2009). This finding suggests that children's social interactions are influenced by their evaluations of ingroup/outgroup membership, with race being only one of several factors used in their evaluation. Thus, the earlier visual preference for own-race faces during infancy is largely based on their perceptual differentiation between familiar own-race faces and unfamiliar other-race faces. However, later preferences for own-race social partners during early childhood appear to be driven by a combination of perceptually based, as well as more conceptually based race categories (reviewed in Bigler & Liben, 2007).

Around the same time that children begin to show race-based social preferences, racial stereotypes also become more conspicuous. Evidence of implicit racial biases have been found in children as young as 3 to 4 years of age, with those able to correctly categorize faces by race showing a greater likelihood to categorize ambiguous race faces with negative facial expressions as other-race rather than own-race (Dunham, Chen, & Banaji, 2013). Although more overt racial stereotypes have also been reported as early as 3 years of age (Aboud, 1988; Kowalski, 2003), they appear to be more prevalent and stronger by 5 years of age (Aboud, 2003; Clark, Hocevar, & Dembo, 1980). For example, 5- to 7-year-olds show more positive evaluations (e.g., clean, good, friendly) of own-race children and more negative evaluations (e.g., dirty, naughty, unfriendly) of other-race children, whereas younger children show no such biases or weaker biases (Aboud, 2003; Clark et al., 1980). However, it should be noted that such seemingly negative evaluations of other-race individuals are typically observed when children are forced to choose between an own-race and an other-race individual as taking on a particular trait (e.g., which child is naughty?). When 5- to 12-year-olds are asked to rate images of children from different racial backgrounds on a variety of dimensions (e.g., friendliness, cleanliness, etc., with 5 = "very friendly"/"clean" and 1 = "very unfriendly"/"dirty"), they give higher positive ratings for own-race than for other-race children (Griffiths & Nesdale, 2006). Other-race children are nonetheless

rated positively rather than negatively, suggesting that early own-race biases are most likely due to more positive evaluations of own-race individuals rather than negative evaluations of other-race individuals (reviewed in Cameron, Alvarez, Ruble, & Fuligni, 2001; Griffiths & Nesdale, 2006; see Kowalski, 2003, for a similar effect in 3- to 5-year-olds).

Racial majority versus minority group membership has also been shown to mediate the development of racial preferences for social partners and racial stereotypes. In general, children between 4 and 13 years of age who belong to racial minority groups tend to show no overt racial biases in their preferences for friends or playmates (Davey & Mullin, 1980), nor do they show implicit racial biases in their racial categorization of ambiguous race faces displaying positive and negative emotions (Dunham et al., 2013). However, in instances when an own-race bias in social partners is observed among children from racial minority groups (Cantor, 1972; Davey & Mullin, 1980), the bias emerges at a later age (e.g., 9 to 10 years of age) relative to children from the racial majority group. In addition, when children from racial minority groups are asked to rate images of children from different racial backgrounds on a variety of dimensions (e.g., friendliness, cleanliness, etc. with 5 = “very friendly”/“clean” and 1 = “very unfriendly”/“dirty”), they give equally positive ratings for own-race children and other-race children from the racial majority group (Griffiths & Nesdale, 2006). They still give positive ratings for individuals from an other-race minority group, but less positive ratings compared to their own race group and the majority group (Griffiths & Nesdale, 2006).

Overall, it appears that exposure to own- and other-race individuals during childhood tends to be associated with a lack of a racial bias in preferences for social partners, as well as positive attribute ratings, towards individuals from the familiar race groups. Indeed, more contact with other-race individuals has been found to be related to less prejudiced attitudes in both children and adults (Binder et al., 2009; Pettigrew & Tropp, 2006, 2008; see also Meissner & Brigham, 2001, for a review). In addition, mere visual exposure to photographs of other-race faces increases adults’ ratings of likeability for novel faces from the same other-race group (Zebrowitz, White, & Wieneke, 2008). Although there is no direct association between the ORE and *self-reports* of racial attitudes (see Meissner & Brigham, 2001, for a review), experience in individuating between other-race faces appears to have a positive influence on children’s and adults’ evaluations of other-race individuals. For example, training 8- to 12-year-olds to individuate between other-race faces is associated with lower racial biases in attributing positive and negative traits to own- and other-race individuals (Katz & Zalk, 1978). Likewise, training adults to individuate between other-race faces has been associated with a reduction in implicit racial biases (Lebrecht, Pierce, Tarr, & Tanaka, 2009).

## CONCLUSIONS AND FUTURE DIRECTIONS

Differential experience with own- and other-race faces cultivates an early visual preference and recognition advantage for the familiar race group. With age and continued asymmetry in own- and other-race face experience, own-race face recognition biases persist and race-based preferences for social partners and stereotypes emerge during early childhood. Early own-race biases are more likely perceptually driven, whereas later biases more likely derive from perceptual as well as social-conceptual influences (e.g., relating to a particular social group)—hence, the temporal delay in the emergence of social preferences and stereotypes. Examining the transition from a perceptually driven face recognition bias to a bias influenced by a mixture of perceptual and social-conceptual factors warrants further studies during the early childhood years when social category formation and categorization of the self in relation to social categories develop. This transitional phase would additionally be important to investigate in relation to the role of early interracial contact in ameliorating the emergence of race-based social preferences and stereotypes. Given an initial reliance on perceptual cues in categorizing familiar and unfamiliar groups of individuals, perhaps early exposure to other-race individuals would not only minimize the own-race recognition bias, but might also minimize the later use of race in social categorization, which would, in turn, minimize race-based social preferences and stereotypes. It is further the case that despite the early development of own-race biases, later experiences with a novel race group can enhance other-race face recognition and improve evaluations of other-race individuals. Future studies should identify and examine mediating factors that can potentially maximize the positive effects of intergroup experience on minimizing the development of own-race biases.

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