



An Examination of the Own-Race Preference in Infancy

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An Examination of the Own-Race Preference in Infancy

Abstract

The goal of this dissertation was to better characterize the nature of infants' visual preference for own-race faces, and to test two theories regarding its origin.

Chapters I and II assessed whether the race bias in infancy could be attributed to an enhanced ability to discriminate familiar faces. Based on this account, infants' race preference should be more pronounced for female pairs of faces, and should only arise whenever different individuals are presented across trials. In Chapter I, White 3-month-old infants saw multiple male and female pairs differing in race. Looking times revealed a significant own-race preference only when male faces were presented. In Chapter II, participants viewed different photographs of the same two Black and White faces across 8 trials. Findings still revealed a robust own-race visual bias uniquely in male pairs. Collectively, these findings provide evidence against the notion that differences in face discriminability are responsible for babies' racial preference.

Moving to the question of origin, Chapter III tested the hypothesis that the male-specific own-race preference is rooted in an evolutionary threat response. Participants were presented with male and female pairs of own- and other-race faces displaying averted eye gaze, a cue meant to reduce threat. Findings were inconclusive as a looking time bias specifically toward White males yet again emerged.

Finally, Chapter IV examined the idea that infants' early visual preferences are shaped by experience. Three-month-olds were shown a video of an own- and other-race

male addressing them in an infant-directed manner. Immediately following the video presentation participants' visual preference for the two men depicted in the film was measured. Though the own-race preference persisted, looking times toward the Black male were significantly higher in comparison to a group of infants who received no exposure.

These results are novel in revealing an own-race bias that is dependent on target gender, suggesting that gender is a stronger cue than race in guiding infants' responses. Furthermore, though exposure did not attenuate overall preference, the findings point to the potential benefit of using such manipulations for changing bias in future research.

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I lovingly dedicate this dissertation to my grandpa
Bernard Ross
On the occasion of his 95th birthday

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Introduction

Humans routinely divide the social world into groups and evaluate others based on their group membership. Race has been identified as a powerful category on which judgments are based (along with gender and age; see Fiske, 1998), and though adults nowadays try to regulate explicit prejudice (Devine, Plant, Amodio, Harmon-Jones, & Vance, 2002; Dovidio & Gaertner, 1991), race is nonetheless automatically and rapidly encoded (e.g. Devine, 1989; Greenwald, McGhee, & Schwartz, 1998, Ito & Urland, 2003). In-lab experiments have shown that race influences a myriad of factors such as interpretation of other's behavior (e.g. Duncan, 1976), face memory (MacLin & Malpass, 2001), and whom we trust (Stanley, Sokol-Hessner, Banaji, & Phelps, 2011) and help (Saucier, Miller, & Doucet, 2005). Real world effects of race are visible in patterns of urban settlement (Reardon et al., 2009), hiring decisions (Bertrand & Mullainathan, 2004), and even courtroom sentencing (Eberhardt, Davies, Purdie-Vaughns, & Johnson, 2006).

When does racial prejudice first arise and how does it reach its robust adult state? Social psychology often ignores such questions despite the potential contribution of a developmental approach to theorizing in the field (see Dunham & Degner, 2010 for a discussion). As will be reviewed shortly, by now we know that race-based selectivity is already observed in childhood and infancy. The goal of this dissertation is to characterize the nature of infants' earliest racial biases, and to explore potential mechanisms that could have given rise to them, by assessing whether and how they can be changed.

Early Attention to Race

The developmental origins of racial prejudice have been the focus of much research (see Quintana, 1998 for a review of child and adolescent studies). Recent findings employing mostly indirect methodologies (i.e. ones that do not explicitly mention race) continue to reveal strong biases in children's friendship choices, memory, and implicit attitudes. For instance, when presented with photographs of Asian, Black, and White children matched for subject gender, Asian participants selected own-race targets as playmates already by the age of 3. Interestingly, subjects who were asked to self-identify by race prior to making their friendship choices, showed significantly more own-race choices due to the increased salience of race (Kowalski & Lo, 2001; see also Kinzler & Spelke, 2011 and Newman, Liss, & Sherman, 1983 for findings with older children, and Aboud, Mendelson, & Purdy, 2003 on peer relations in school). Four-year-olds have been shown to display enhanced recall of stories depicting cultural racial stereotypes (Bigler & Liben, 1993; Corenblum, 2003), and White children remembered an ambiguous race face significantly more often if they were told it has a White compared to a Black "sibling" (Shutts & Kinzler, 2007). Furthermore, 3-year-olds were more likely to categorize an ambiguous race angry face as Black, however this tendency was dependent on children's ability to categorize unambiguous faces by race (Dunham & Banaji, 2008). Finally, by the age of 6 children from high status groups display implicit racial attitudes akin in magnitude to those found in adults (as measured by a child version of the IAT; Baron & Banaji, 2006; Dunham, Baron, & Banaji, 2006; Rutland, Cameron, Milne, & McGeorge, 2005b). Biased explicit attitudes show a decline with age due to effects of self-presentation (Rutland et al., 2005b).

Since the youngest age group tested above (3-year-olds) already shows race dependent responding, the experiments do not specify when awareness to race first arises. Motivated by the question of whether racial bias could be present pre-linguistically and with minimal experience with culture-specific stereotypes, research has turned to examining infants. Young infants' limited response repertoire requires reliance on patterns of visual fixation as the dependent measure. Thus, participants were presented with gender-matched pairs of own- and other-race faces, and their looking times at each of the photographs were measured. This undertaking revealed a preference for own-race faces from 3 months of age, a phenomenon documented cross-culturally and across a variety of racial comparisons (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly et al., 2005, 2007a). Newborns do not show the own-race visual bias (Kelly et al., 2005) and neither do babies of Ethiopian descent who live in Israel, a predominantly Caucasian environment (Bar-Haim et al., 2006) pointing to the rapid emergence of the preference and to its dependence on the racial make up of the infant's surroundings.

These findings raise a number of unresolved questions, some of which the present dissertation aims to advance. First, given that numerous factors could potentially modulate babies' attention toward and away from the entities they encounter—novelty (Fantz, 1964), arousal (Field, 1977), wariness (Waters, Matas, & Sroufe, 1975), as well as a variety of social variables (Farroni, Csibra, Simion, & Johnson, 2002; Hamlin, Wynn, & Bloom, 2007), we are faced with the challenge of identifying what factor drives infants' visual race preference. Second, even though race does not occur in isolation from other social group markers (e.g. gender, language), the interactive effect of these cues on infants' preferences has so far received quite limited attention. Third, what mechanism

could have produced preferential looking toward own-race faces? Does this tendency derive from our evolutionary history? Or are infants' preferences shaped by experience with own-race individuals? Finally, can the own-race preference be attenuated, and if so, under what circumstances and how long lasting is such a change?

These questions are, of course, not mutually exclusive. Understanding the interaction between race and other social categories in guiding preference could allude to its underlying nature. Understanding the nature of the preference might help uncover the mechanism that yielded it, and how it might be changed.

Perceptual or Social Preferences?

The debate over the nature of infants' visual preferences typically revolves around two contrasting alternatives (e.g. Kinzler & Spelke, 2011). The first, postulates that babies' responses reflect a desire for social interaction. The second view attributes infants' visual biases to differences in perceptual processing of the presented stimuli.

Infants' reactions to speakers of different languages serve as a useful reference point for illustrating a social preference in the above sense, due to substantial evidence for selectivity on various interactive measures across development. At 6 months of age, as in the case of race, language-based preferences are manifested in greater visual fixation toward someone who previously spoke the infant's native language (Kinzler, Dupoux, & Spelke, 2007). By 10 months, infants prefer to take a toy offered by a native language speaker compared to a foreign language speaking individual (Kinzler et al., 2007), 12-month-olds use language to guide their food selections (Shutts, Kinzler, McKee, & Spelke, 2009), and 2.5-year-olds will more often give a toy to an own-language speaker (Kinzler, Dupoux, & Spelke, 2012). Finally, English-speaking

preschoolers preferentially imitate a native English speaker over a foreign accented speaker of English when learning the function of a novel object (Kinzler, Corriveau, & Harris, 2011).

In contrast to language, there is no empirical support for selective responding based on race until later in childhood. Specifically, when presented with two females, one African one Caucasian, offering identical toys 10-month-olds were equally likely to select a toy from both women (Kinzler & Spelke, 2011). In addition, under a variety of pro-social games involving live interactions with racial in-group and out-group experimenters, 18-month-olds did not preferentially engage with own-race members (Schug, 2009). Likewise, no race-based selectivity was evident when employing the toy-giving paradigm at 2.5 years of age (Kinzler & Spelke, 2011), and lastly, unlike gender and age, race did not guide 3-year-olds in inferring their own preferences for unfamiliar objects (Shutts, Banaji, & Spelke, 2010). According to Kinzler and Spelke (2011) the late emergence of social responding based on race casts doubt on a strong social interpretation of young infants' looking patterns, which might instead result from differences in face processing efficiency.

If increased looking at own-race individuals is not driven by a deep social preference, what specific perceptual process could have produced these results? One candidate possibility relates to differences in discriminating own- and other-race faces (the Other-Race Effect (ORE); Meissner & Brigham, 2001), a phenomenon documented also in infancy (Hayden, Bhatt, Joseph, & Tanaka, 2007; Kelly et al., 2007b, 2009; Sangrigoli & de Schonen, 2004b). The source of the ORE is still a matter of much discussion. Perceptual expertise accounts argue that other-race face processing is less

efficient due to limited exposure (e.g. Tanaka, Kiefer, & Bukach, 2004), while social cognitive models attribute the lack of other-race face individuation to social categorization processes (e.g. Hugenberg, Young, Bernstein, & Sacco, 2010). Either way, since infants' visual responses are known to be guided by the magnitude of change they perceive from one stimulus to the next, such that a larger change results in longer visual fixation (e.g. Fantz, 1964; Welch, 1974), if babies are attuned to the changing identity in own-race faces but do not distinguish other-race individuals the overall pattern of looking would favor own-race faces without them necessarily having any real social meaning. One aim of the current dissertation is to test whether differences in face discriminability could indeed account for the race bias in infancy.

Hierarchically Organized Social Categories?

As hinted by the above-described disparities in reactions to race and language, exposing the interplay between different social categories could provide a clearer picture of the organization of infants' social category representations and its effect on subsequent behavior. Indeed, the literature indicates that babies attend to a variety of cues that have social meaning for adults (gender: Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002; age: McCall & Kennedy, 1980; attractiveness: Langlois, Ritter, Roggman, & Vaughn, 1991; see Ziv & Banaji, 2012 for a review), so how do they decide on what basis to respond to a new person who belongs to multiple groupings? One could imagine a system by which all social categories have equal weight. Thus, an own-race person speaking the infant's native language would be preferred to an own-race foreign language speaking individual or an other-race native language speaker, however since the latter two individuals both share a single group membership with the infant (either race or language) there might not

be a preference between them. Studies have revealed that rather than relying on a continuous scale of affiliation, infants and young children privilege certain categories over others (see Kinzler, Shutts, & Correll, 2010 for a discussion). As in the example above, when conflicting race and accent information was provided such that an own-race child spoke with a foreign accent while an other-race child spoke with a native accent, 5-year-old children based their friendship choices on accent rather than on race (Kinzler, Shutts, DeJesus, & Spelke, 2009; see also Kinzler et al., 2007 for friendship selections based on language alone). In another study, preschoolers were presented with 4 photographs of male and female child and adult models eating food, and were asked which snack they themselves would prefer to eat. The rank ordering of participants' selections indicated that same-gender child models were preferred to child models of the opposite gender, yet when comparing photos of adults gender did not seem to influence children's choices. Using the same measure but crossing race and age, yet again revealed no selectivity based on race (Frazier, Gelman, Kaciroti, Russell, & Lumeng, 2012).

Though no study has assessed infants' responses when two social categories are directly pitted against one another, Quinn and colleagues proposed a theoretical account for the interaction of race and gender based on previous preference findings (Quinn et al., 2008). In particular, 3-month-olds brought up by a female caretaker look longer at female compared to male faces (Quinn et al., 2002), however when other-race faces are presented no gender preference emerges (Quinn et al., 2008). Additionally, the magnitude of the own-race preference (Bar-Haim et al., 2006; Kelly et al., 2005, 2007a) is not significantly different for male and female pairs of faces. Collectively, these findings

point to a hierarchical structure in which race is superordinate to gender in guiding infants' visual preferences (Quinn et al., 2008).

Possible Underlying Mechanisms for Race-Based Selectivity

The early emergence of racial bias raises one of the oldest philosophical questions regarding the origin of human behavior. Is attention to social groups, and race specifically, shaped by evolution or does it arise with even minimal life experience? Monitoring patterns of cooperation and competition, and the cues that predict these patterns, has great fitness value. It has been suggested that humans have therefore evolved a cognitive mechanism designed to detect coalitional alliances. Racial bias is presumed to be a byproduct of that mechanism, since it is unlikely that race was specifically selected as a cue to group boundaries due to the vast distances between racial groups in ancient times (Cosmides, Tooby, & Kurzban, 2003; Kurzban, Tooby, & Cosmides, 2001). Following this analysis, Kinzler and Spelke (2011) argue that infants' disparate responses to race and language may reflect the privileged role language, and particularly accent, have historically played as adaptive group markers due to variations over shorter geographical distances.

Further elaborating on the specific challenges that could have produced the psychology of intergroup bias, Navarrete and colleagues put forth the outgroup male target hypothesis (Navarrete, McDonald, Molina, & Sidanius, 2010). They claim that at times of intergroup conflict the immense fitness gains associated with acquiring multiple mates motivated men to pursue aggressive tactics. The different risks this strategy imposed on males (e.g. death) and females (sexual coercion) led to the development of separate adaptive responses for men (approach) and women (avoidance) in dealing with

this kind of threat. It is consequently predicted that over time out-group males should have become the main targets of negativity.

In line with Navarrete et al.'s hypothesis, research on adults' racial bias has pointed to a strong association between out-group males and threat (e.g. Hugenberg & Bodenhausen, 2004; Mendes, Blascovich, Lickel, & Hunter, 2002; Olsson, Ebert, Banaji, & Phelps, 2005; Trawalter, Todd, Baird, & Richeson, 2008), which is not observed for female targets (e.g. Navarrete, Olsson, Ho, Mendes, Thomsen, & Sidanius, 2009). Applying this approach to early race preferences, more pronounced looking time differences favoring in-group members would be predicted when male targets are presented, if out-group males are indeed inherently more threatening. To date, no study has shown that infants' racial preferences are modulated by face gender (see Bar-Haim et al., 2006; Kelly et al., 2005, 2007a).

A second possibility that should be considered is that infants' visual preferences might be shaped by their experiences with members of different social groups. Ample social psychological literature has revealed that even in adulthood increased intergroup contact attenuates bias (Bornstein, 1989; Pettigrew & Tropp, 2006). Manipulations ranging from assignment of an other-race roommate during freshman year of college (Shook & Fazio, 2008; Sidanius, Levin, van Laar, & Sears, 2008) to brief subliminal presentation of other-race faces (Zebrowitz, White, & Wieneke, 2008) have consistently produced gains in positivity toward the out-group. Remarkably similar findings have been reported in childhood as well (e.g. Ball & Cantor, 1974; Feddes, Noack, & Rutland, 2009). In infancy, evidence for contact effects on race preference comes from a group of Israeli babies of Ethiopian origin who have extensive exposure to White individuals and

do not visually prefer own-race faces (Bar-Haim et al., 2006). Also suggestive are a number of studies showing that infants can regain face discrimination abilities of unfamiliar faces (such as other-race or monkey faces) after relatively brief familiarization periods (Anzures et al., 2012; Fair, Flom, Jones, & Martin, in press; Sangrigoli & de Schonen, 2004b). The majority of infants' face-to-face interactions during the first year of their lives are with own-race individuals (92% according to Rennels & Davis, 2008). In addition, babies show visual preferences for social communicative cues such as eye contact (Farroni et al., 2002) and infant-directed speech (Schachner & Hannon, 2011), and they expect their interaction partners to be responsive and contingent (Nadel, Carchon, Kervella, Marcelli, & Réserbat-Plantey, 1999; Tronick, Als, Adamson, Wise, & Brazelton, 1978). Therefore, if the mechanism responsible for intergroup bias tracks infants' exposure and produces greater liking for people with whom they have previously interacted, own-race individuals should clearly be favored.

The Present Research

The aim of the present dissertation is to rigorously examine the visual own-race bias in infancy. Is the preference early in life perceptual in nature? Does it interact with other social categories, specifically gender? And can the mechanism that produced these effects be identified? Chapter I investigated whether disparities in the ability to discriminate faces of different races explain infants' looking patterns. As outlined above, this account would predict longer looking durations at own-race faces due to the detection of a new individual on each trial, along with a steady decline in interest when observing other-race faces due to their perceived similarity. The combination of these trends should elicit an own-race preference that gradually increases in magnitude

throughout the experiment. In addition, since infants are more proficient at individuating female faces compared to male faces (Quinn et al., 2002), a more pronounced bias was expected to emerge for female pairs of faces. White 3-month-olds were shown pairs of male and female own-and other-race faces across 8 trials. Looking times revealed a reliable own-race preference only when male faces (not female faces) were presented. In addition, a trial-by-trial analysis of the male pair data showed that the magnitude of the preference remained consistent across experimental trials. These findings provide initial evidence against the proposal that the race bias in infancy results from differences in face discriminability.

Chapter II put the above perceptual account to another test. If babies' looking durations at own-race faces indeed reflect a response to newly recognized individuals from one trial to the next, then presentation of the same two people across the experiment should eliminate the bias. Participants saw a single male or female pair of individuals differing in race, across 8 trials. Following this manipulation, infants again looked significantly longer at the White face only when observing the male pair, and no difference in the magnitude of the preference was observed across trials. These findings further weakening an account based on enhanced detection of novel White faces from trial to trial.

Since in Chapters I and II an own-race preference was exclusively observed in male pairs of faces, a pattern which is in line with the predictions of the outgroup male target hypothesis, the possibility that a threat response might have produced these effects was considered next. Chapter III presented infants with pairs of own- and other-race male and female faces displaying averted gaze, a cue shown to reduce bias in adults (Trawalter

et al., 2008), and to which infants are sensitive from birth (Farroni et al., 2002). Under the current design an attenuated own-race bias should be observed, if the threat hypothesis is valid and if indeed infants perceive averted gaze faces as less threatening. Counter to this prediction, White 3-month-old infants' looking times showed a significant own-race preference for male pairs but not female pairs, replicating findings of previous chapters, and leaving unresolved the question of whether threat mediates racial bias in infancy.

Finally, based on the idea that infants' preferences might be shaped by early experience, Chapter IV examined the effect of an exposure manipulation on race bias. Participants were presented with a video of a brief friendly interaction with an own- and an other-race male, after which their preference toward still photographs of those same two men was assessed. Overall, findings still showed a significant own-race preference at test, however looking durations at the Black face were significantly higher in comparison to a group of infants who saw the same presentations without prior video exposure. Though infants' racial bias was not entirely eliminated in Chapter IV, the findings encourage exploring more extensive exposure manipulations in the future.

Chapter I

The studies presented in this dissertation are aimed at advancing our understanding of the source of infants' preferential looking toward own-race faces (Bar-Haim et al., 2006; Kelly et al., 2005, 2007a). For decades, looking time measures have provided a tool for assessing different aspects of early human development (See Aslin, 2007 for a review) and, as will be illustrated shortly, have exposed a myriad of factors that could potentially modulate infants' attention toward and away from the entities they encounter. This opening chapter will examine one such factor by assessing whether differences in perceptual processing of own- and other-race faces could explain infants' visual race bias.

Interpretation of Looking Times in Infancy

One of the earliest discoveries concerning looking patterns in infancy pointed to differences in responses to repetition versus novelty. In a seminal demonstration (Fantz, 1964), infants from 2 months of age were presented with pairs of stimuli across 10 trials, one of which remained constant and the other changed from trial to trial. Over consecutive exposures looking durations at the novel patterns remained consistently high whereas responses to the constant pattern significantly declined. Researchers have since capitalized on infants' novelty preference and response decrement following repetition in order to probe cognitive capacities, such as discrimination abilities (e.g. Fagan, 1970). After habituation to a single female face for example, 5-month-olds look longer at a novel woman when paired with the familiar face indicating they were able to tell the two apart (Bornstein & Arterberry, 2003). Categorization can be assessed in a similar manner (see review by Mareschal & Quinn, 2001). Infants are typically familiarized with various

stimuli that share a common characteristic. The test phase consists of pairs of novel stimuli, one belonging to the familiarized category alongside a member of a novel category. Categorization is inferred if babies look longer toward the novel category exemplar indicating that they have identified the commonalities between the familiarized stimuli, and generalized those features to a new member of that category. Using this method it has been shown that infants between 3 and 5 months of age can categorize geometric forms (Bomba & Siqueland, 1983; Quinn, Slater, Brown, & Hayes, 2001), furniture (Behl-Chadha, 1996), and facial expressions (Bornstein & Arterberry, 2003). Finally, looking times can also point to early expectations about the world. For instance, after habituation to a sequence in which a train rolls from one side of a stage behind a screen and a box emerges from the other side, infants look longer when the train does not make contact with the box once the screen is removed, suggesting they were surprised by this event (Muentener & Carey, 2010). As an aside, it should be noted that familiarity preferences do sometimes arise in the context of all these paradigms, either due to an a priori preference for one stimulus over another (see Civan, Teller, & Palmer 2005 for an illustration of this effect), or insufficient stimulus encoding during habituation (Roder, Bushnell, & Sasseville, 2000; Rose, Gottfried, Melloy-Carminar, & Bridger, 1982).

In addition to these novelty responses, visual orienting serves arousal regulation functions in infancy (Brazelton, Koslowski, & Main, 1974; Stern, 1974). For example, distress induced by presentation of an over stimulating computer display was temporarily alleviated if babies' attention was directed toward various toys (Harman, Rothbart, & Posner, 1997), and following familiarization with a distressing novel toy 6-month-olds significantly reduced their negative affect by focusing on a different object in the

environment or attending to their mother (Crockenberg & Leerkes, 2004). Similarly, infants aroused by elevated maternal activity (as in a peek-a-boo game), produced longer and more frequent gaze aversions (Field, 1977; Stifter & Moyer, 1991).

Infants also commonly use visual avoidance in order to cope with stranger anxiety (e.g. Feinman, 1980). It has been shown that shifts in gaze away from an approaching stranger are temporally related to physiological changes as they occur immediately prior to peaks in heart rate acceleration. Upon heart rate recovery babies resume observation of the unfamiliar individual (Waters et al., 1975). A cross-sectional examination of infants' interactions with strangers showed that 6 month-olds responded primarily by averting their gaze and did so significantly more often than 12- and 18-month-olds. Additionally, infants characterized as wary by their mothers exhibited more frequent and longer durations of gaze aversions (Mangelsdorf, Shapiro, & Marzolf, 1995). Moreover, after observing their mother anxiously conversing with an unfamiliar male, 12- to 14-month-olds display greater fearfulness and more frequent looking toward the mother when approached by the same individual (in comparison to a condition in which the mother-stranger interaction was non-anxious), illustrating babies' capacity to detect subtle and indirect emotional signals (de Rosnay, Cooper, Tsigaras, & Murray, 2006).

Looking times have also uncovered sensitivity to a variety of direct social cues much earlier in development. Newborns visually prefer direct gaze compared to averted gaze (Farroni et al., 2002; Farroni, Menon, & Johnson, 2006) and the sound of infant-directed speech over adult-directed vocalizations (Cooper & Aslin, 1990). In addition, babies' heart rate increases and they subsequently look away if their mother suddenly stops interacting in an expected social manner (Field, 1981; Toda & Fogel, 1993; Tronick

et al., 1978; see Mesman, van IJzendoorn, & Bakermans-Kranenburg, 2009 for a meta-analysis of the Still Face paradigm). By 5 months infants look longer at a person who during familiarization spoke to them in infant-directed speech compared to a stranger, however this preference flips to longer looking toward the stranger if the familiarized individual speaks in adult-directed speech (Schachner & Hannon, 2011; see Brand & Shallcross, 2008 for related findings on infant-directed action). Furthermore, 6-month-olds are more likely to follow an adults' gaze toward one of two objects when first greeted with communicative cues such as eye contact and infant-directed speech (Senju & Csibra, 2008), and older infants will use their own gaze for communication by alternating their looks between a caregiver and an interesting object (Bakeman & Adamson, 1984).

Finally, infants' spontaneous visual preferences may signify their desire for specific social partners. Three-month-olds look longer and 6-month-olds reach significantly more often toward a character that previously engaged in helpful behavior compared to an antisocial character (Hamlin, Wynn, & Bloom, 2007, 2010). Favoring of familiar social group members has been best exemplified in the case of language, as 6-month-olds look longer at someone who previously spoke their native language compared to a foreign language or foreign accented speaker (Kinzler et al., 2007), and from 10 months of age infants preferentially engage with native language speakers on a variety of measures such as toy choice (Kinzler et al., 2007), food selection (Shutts et al., 2009) and patterns of toy giving (Kinzler et al., 2012). The congruence in responding across age using different dependent measures in both these cases strengthen claims that the initial visual biases are social in nature.

The above review gives a flavor of the vast hypothesis space in need of consideration when accounting for race-based looking preferences in infancy. Could they be driven by infants' ability to detect stimulus novelty across trials? Perhaps looking times are the result of differences in elicited arousal or wariness? Could infants be signaling with whom they would rather interact and whom they would prefer to avoid? Over the course of the dissertation I will go back to these questions and present experiments motivated by them. As a first step, the current chapter asks whether infants' pattern of visual fixation could be attributed to differences in discrimination of own- and other-race faces.

A Perceptual Account of Infants' Own-Race Preference

It is important to state from the outset in what sense the explanation that will unfold below is "perceptual". For the present purposes, it is suggested that the entire phenomenon of greater looking toward faces of one's own race could be explained by infants' processing of certain properties of the stimuli or the relationship between them (e.g. their similarity). Though faces clearly denote social group membership in adulthood, under this account infants' visual preference is not necessarily driven by identification of social affiliation or indicative of infants' predilection for future social engagement with the depicted individuals (or other individuals from that group).

This idea can be exemplified by considering the set up of previous race preference studies (e.g. Bar-Haim et al., 2006). Very much like Fantz's (1964) original experiment, multiple different pairs of own- and other-race faces were presented in succession. As noted earlier, within this paradigm detection of change from one trial to the next maintains high looking durations, while repetition results in a decline in interest. It has

been suggested that rather than depending on a single stimulus property (e.g. complexity; Caron & Caron, 1969), the degree of looking recovery is dependent on the relative dissimilarity between two stimuli. For example, 4-month-olds habituated to uniformly colored simple geometric shapes showed the longest visual response at test to a novel stimulus that differed from the original in both color and form compared to a novel stimulus that changed only on a single dimension (Cohen, Gelber, & Lazar, 1971). Similar findings were obtained when manipulating the orientation and arrangement of complex patterns (Cornell, 1975), and a linear increase in fixation to novel stimuli was revealed when comparing 1, 2, or 3 dimensions of transformation (in this case color, shape, and the arrangement of elements; Welch, 1974). Further testing established that the relationship between novelty responses and stimulus discrepancy follows an inverted U pattern (e.g. McCall, Kennedy, & Appelbaum, 1977; see also Kagan, 2008). That is, increased attention to a new stimulus will occur so long as its level of disparity from the previous item is not too extreme or unnoticeable/nonexistent.

Returning to racial preferences, across development face processing is characterized by better proficiency in discriminating own-race faces compared to other-race faces, a phenomenon named the Other-Race Effect (ORE) (childhood: Pezdek, Blandon-Gitlin, & Moore, 2003; Sangrigoli & de Schonen, 2004a; infancy: Hayden et al., 2007; Kelly et al., 2007b, 2009; Sangrigoli & de Schonen, 2004b; for a review see Meissner & Brigham, 2001). Given that infants' visual attention is guided by the magnitude of change they perceive from one stimulus to the next, this disparity in face discriminability could influence their performance on a race preference test. In particular, if infants consistently differentiate own-race faces then every time a new pair is shown

the own-race face will be perceived as a novel individual, while the novelty of the other-race face might be more ambiguous. Put differently, infants may be displaying a novelty preference for own-race faces from trial to trial because they perceive the face of a different person on each trial, along with a habituation response to the other-race faces, resulting in greater looking durations at own-race faces overall.

Background on the Other Race Effect

There is much debate in the literature about the underlying source of the ORE. Perceptual expertise accounts attribute the effect to greater efficiency processing faces of one's own race, which is ascribed to more experience in own-race face individuation. Indeed, findings have consistently shown a relationship between other-race face recognition accuracies and the amount of cross-race contact (e.g. Chiroro & Vanlentine, 1995; Elliott, Wills, & Goldstein, 1973; Stahl, Wiese, & Schweinberger, 2008; cf. Ng & Lindsay, 1994), and recent training studies have supported the idea that opportunities for face individuation are crucial for improved recognition (McGugin, Tanaka, Lebrecht, Tarr, & Gauthier, 2011; see Tanaka & Pierce, 2009 for ERP evidence). Furthermore, it has been suggested that exposure specifically improves holistic face processing strategies, which may be at the root of the ORE (Hancock & Rhodes, 2008; Michel, Caldara, & Rossion, 2006; Rhodes et al., 2009; Tanaka et al., 2004).

Effects of experience in infancy are usually exemplified in the tuning of an initially broad perceptual system toward better processing of the stimuli most frequently encountered in the infants' environment (Scott, Pascalis, & Nelson, 2007). Accordingly, Kelly et al. (2007b, 2009) attributed the gradual decline in other-race face recognition that they observed between 3 to 9 months of age to the absence of other-race faces in the

environmental input. In a more direct test of this hypothesis, Sangrigoli and de Schonen (2004b) have shown that while 3-month-old Caucasian infants are better at recognizing faces of their own race in comparison to Asian faces (see also Hayden et al., 2007), brief familiarization to 3 photographs of Asian faces (for only 120 seconds) cancels the own-race recognition advantage. Similarly, routinely presenting 6-month-old infants with images of individually labeled monkey faces maintains their ability to discriminate novel monkey faces at 9 months of age, an ability that would have otherwise been lost (Pascalis, de Haan, & Nelson, 2002; Pascalis et al., 2005). In accord with the findings of adult training studies, 9-month-olds' face recognition abilities were not preserved if the same monkey faces were presented for the same length of time all labeled at the category level ("monkey"), arguing that face experience that encourages individuation is necessary (Scott & Monesson, 2009, 2010). Recently, exposure to other-race (Chinese) faces for 3 months was shown to maintain White infants' ability to discriminate Chinese faces as 9 months of age (Heron-Delaney et al., 2011).

In contrast to the expertise account, social cognitive models (e.g. Hugenberg et al., 2010; Levin, 1996, 2000; Sporer, 2001) argue that the depth of face encoding is dependent on social categorization processes. They claim that while in-group faces are individuated, greater attention to category-specifying information in out-group faces overrides individuation and consequently compromises recognition accuracies. Thus, the way in which one carves up the social environment in a given context will determine whether targets will be coded at the individual or category level.

Spontaneous effects of social categorization on face processing have been demonstrated even when race is held constant. For example, by manipulating perceived

college affiliation of White faces more holistic processing of in-group university targets (Hugenberg & Corneille, 2009) and inferior recognition of out-group university members by White participants has been observed (Bernstein, Young, & Hugenberg, 2007). Following-up on these results, it was shown that when Black faces were included in the university in-group, White subjects were able to recognize them as accurately as same-race members (Hehman, Mania, & Gaertner, 2010). Similarly, categorization of ambiguous race faces as either in- or out-group members (induced by a face aftereffect or even by a race stereotypical hair style) determined whether faces were processed holistically or not and whether they are subsequently recognized (MacLin & Malpass, 2001; Michel, Corneille, & Rossion, 2010). Together these findings challenge perceptual expertise accounts since none of the experimental manipulations involved altering subjects' visual experience.

Experiments with adults have also shown that during a visual search task an other-race face is detected more rapidly among a group of own-race distractors in comparison to the reverse configuration of a single own-race face among multiple other-race distractors (Levin, 2000). Levin argued that these results provide evidence that race is a positive visual feature unique to other-race faces. Additionally, this "pop-out" asymmetry was reduced in participants who show no deficit in other-race face recognition (Levin, 2000). Interestingly, 9-month-olds visually prefer a display containing one Asian face among multiple Caucasian distractors (Hayden, Bhatt, Zieber, & Kangas, 2009). Following Levin (2000), these results have been taken as evidence for infants' attention to category specifying information in out-group faces (Hayden et al., 2009), but have not been linked further to the ORE in infancy. One study attempted to

track infants' race categorization alongside their ORE and found that Caucasian infants were able to categorize Asian and Caucasian faces into discrete groups at 9 months of age (when their own-race recognition advantage is well in place) but attempts at assessing categorization earlier in development were unsuccessful since looking times were overwhelmingly driven by infants' spontaneous preference for Caucasian faces (Anzures, Quinn, Pascalis, Slater, & Lee, 2010), leaving the relationship between the two processes unclear.

In sum, though both bottom-up perceptual processing and top-down social categorization factors likely contribute jointly to the ORE in adulthood (Young & Hugenberg, 2012), their interplay in infancy remains an open question that the current experiments will be unable to address. Nevertheless, both outlined accounts agree that out-group faces will not be individuated, and therefore raise the possibility that the ORE influences infants' race-modulated looking preferences, if those preferences are indeed driven by responses to stimulus novelty.

Interactions of Face Gender and Race

The analysis thus far neglected to take into account the gender of the faces presented, however a number of studies have documented superior processing of female faces compared to male faces in early infancy. For example, when familiarized with a series of 8 White female faces, 3- to 4-month-olds will subsequently prefer a novel White female when paired with a face presented during familiarization, but the same procedure with male faces does not elicit a novelty response at test, reflecting poorer individuation of male faces (Quinn et al., 2002). Furthermore, while infants have been shown to extract prototypes from a group of female faces by 3 months of age (de Haan, Johnson, Maurer,

& Perrett, 2001), there is currently no consistent evidence for infants' ability to average across multiple male exemplars (see Ramsey, Langlois, & Marti, 2005 for a review). This gender-based disparity in infant's face processing and categorization has been attributed to their greater experience with female faces early in life (Ramsey et al., 2005; Ramsey-Rennels & Langlois, 2006). Data collected on infants' daily interactions during a 1-week period across different ages has confirmed the imbalance in input in favor of females (Rennels & Davis, 2008).

Three-month-old infants brought up by a female caretaker look longer at female compared to male faces (Quinn et al., 2002), but only when observing own-race faces (Quinn et al., 2008). A perceptual view, like the one outlined for race preferences earlier in this introduction, could account for both findings by appealing to the female face processing advantage. If infants are better able to detect differences among females their novelty response to the female faces over six 10-second preference trials (as in Quinn et al., 2002) should be more pronounced than their response to the male faces. In addition, given that infants have trouble discriminating other-race faces, it is not surprising that a female preference did not emerge for other-race pairs as gender information might not have been extracted (this suggestion is in parallel to findings showing impairments in adults' judgments of other-race face gender; O'Toole, Peterson, & Deffenbacher, 1996).

Combining the race and gender literatures leads to the prediction that when presented with gender-matched pairs differing in race infants should show the strongest overall own-race preference in female pairs, even more so than male pairs, since babies are expected to be most proficient at processing White female faces, followed by White male faces, and recognition of out-group male and female faces should be equally poor.

Interestingly, no previous study has reported significant differences between male and female pairs of faces in the magnitude of the own-race preference (Bar-Haim et al., 2006; Kelly et al., 2005, 2007a). According to Quinn and colleagues (2008), these findings collectively imply a hierarchical structure in which race is superordinate to gender in directing preferential looking.

The current experiments will reexamine the interplay between race and gender in guiding 3-month-olds' visual preferences, and assess whether the own-race preference could be explained in relation to the outlined perceptual framework focusing on detection of novelty across trials. Two key predictions arise from the reviewed evidence. First, infants should exhibit a stronger own-race preference for female pairs compared to male pairs of faces. Second, since looking times toward other-race faces are expected to decline across trials while looking durations at own-race faces are expected to remain high, the own-race preference should emerge gradually throughout the experiment. The following studies put these predictions to test and lay the groundwork for further exploring the race bias in infancy in the upcoming chapters.

Experiment 1

Method

Participants. Sixteen White, full term, 3-month-old infants (8 males) were recruited for participation in the study (mean age = 3 months 15 days, range = 3 months 0 days to 4 months 1 day). Parents were given a questionnaire and asked to indicate their own race, their infant's race, and the race and gender of the 5 people their infant spends most time with in a typical week. These listings showed that all babies had a White female primary caregiver. Fourteen of the 16 infants were exclusively exposed to White

individuals, and two additional participants had regular contact with a non-white female who was not African-American.

Stimuli. A total of 104 colored photographs of male and female Caucasian and African-American faces were selected from the Nimstim stimulus set (Tottenham et al., 2009), The Center for Vital Longevity Face Database (Minear & Park, 2004), and from photographs collected in our lab. Faces were placed on a grey background and any jewelry was digitally removed using the Adobe Photoshop CS2 software. All faces were frontally oriented and exhibited a neutral facial expression. Twelve undergraduate students judged the attractiveness and friendliness of each of the photographs on a 1-7 scale (e.g. 1 = very unattractive, 7 = very attractive). Faces were matched based on these ratings, yielding 16 unique pairs each consisting of one White face and one Black face of the same gender (8 male, 8 female pairs, see figure 1.1). These pairs remained constant throughout the experiment. The 16 pairs were divided into two separate sets of 8 pairs each (4 male, 4 female pairs per set; Average attractiveness set A=3.16, set B=3.2). Presentations were then created for each set separately making sure that every pair appeared once in every possible ordinal position and was shown an equal number of times with the Black face on the left and on the right. Thus 16 unique presentations were produced in total. Within each presentation 4 pairs appeared with the Black face on the left and the remaining 4 with the Black face on the right. Photographs measured 9x10.5 cm, and were placed against a light grey background 6 cm apart.

A subset of 8 presentations (4 from each set) was selected for use in the study. Two participants viewed each presentation. A research assistant who was unrelated to any stage of coding or data analysis assigned participants to presentations.

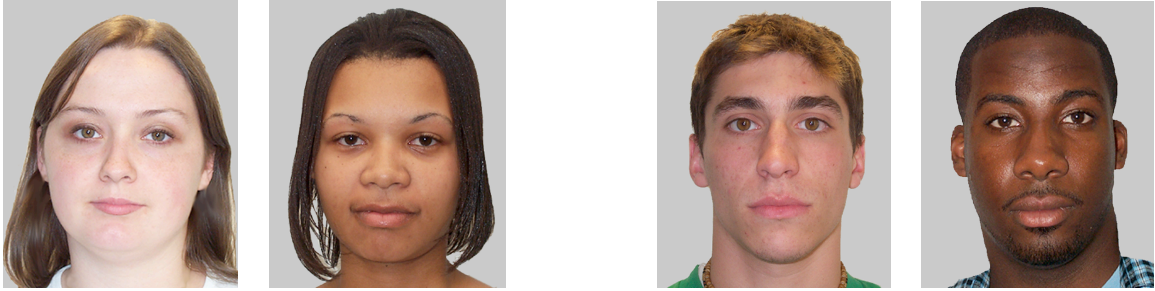


Figure 1.1 Examples of face stimuli presented in Experiment 1.

Procedure. Infants were tested in the presence of a caregiver at their homes. The set-up consisted of two laptop computers separated by a portable two-way mirror. One computer (15.4-inch screen) was used for stimulus presentation, and the other for live coding of infants' looking direction by an experimenter who was facing the infant on the other side of the mirror and was unaware of the lateral position of the faces presented on each trial. Infants were seated on a parent's lap at a distance of approximately 30cm from the display. Parents were instructed not to look at the computer screen throughout the testing session. At the beginning of each trial black-and-white geometric figures were presented along with a noise in order to attract infants' attention to the center of the screen. Once this was achieved, a pair of faces was presented and remained visible for 10 seconds after the first look was recorded. This procedure was repeated for all 8 trials. Overall duration of fixation (in seconds) on the left/right face as well as looks away from the screen per trial were recorded by the coder using a designated program. The coder's reliability was measured in a pilot study conducted in the lab. During the first phase of that study 3-month-old infants were shown six 10-second trials of own- and other-race pairings. Videos of 6 subjects were randomly selected for frame-by-frame analysis, which was compared to the live coding. Inter-coder reliability computed by Pearson's correlation showed high agreement ($r=.98$).

Results

An initial analysis showed no effect of subject gender ($F(1,12)=.637, p=.44$) or the specific stimulus set presented ($F(1,12)=.29, p=.60$), and no interactions involving these two variables (all $ps > .19$), hence they were removed from the main analysis. Average looking times (in seconds) were subjected to a repeated measures analysis of variance (ANOVA) with Race (Black/White) and Gender of Pair (male/female) as within-subject variables. The analysis yielded a significant Race x Gender of Pair interaction ($F(1,15) = 7.713, p=.014$), as well as a main effect of Race ($F(1,15)=4.610, p=.049$). The main effect of Gender of Pair was not significant ($F(1,15)=3.165, p=.095$). Follow-up analyses revealed a strong White preference for the male pairs ($t(15)=-3.008, p=.009$), but not for the female pairs ($t(15)=.031, p=.976$). On average, infants looked 3.89 seconds ($SD=1.67$) at the White male faces, compared to only 2.35 seconds ($SD=1.22$) at the Black male faces. Looking times toward the female Black and White faces were virtually identical (2.89s ($SD=1.61$) and 2.88s ($SD=1.30$) respectively). See figure 1.2.

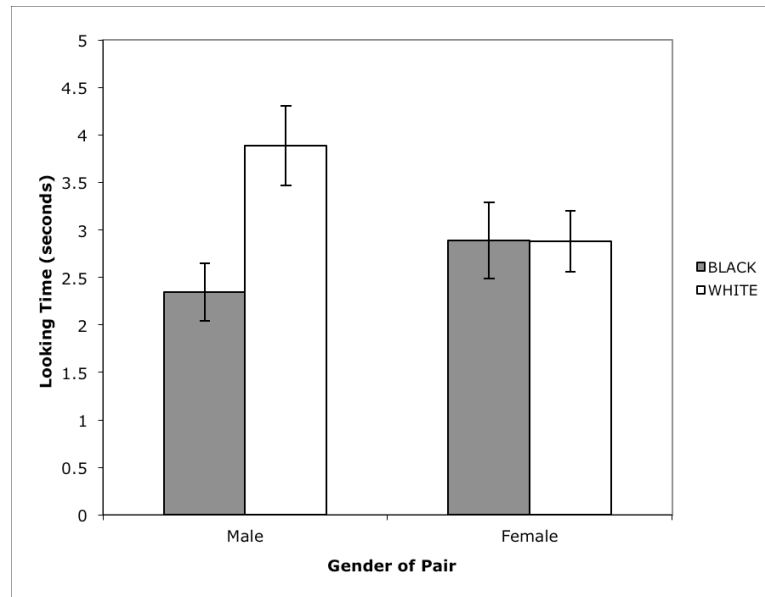


Figure 1.2 Mean looking times to the Black and White faces in Experiment 1 as a function of pair gender.

If infants are differentially discriminating own- and other-race faces, one would expect looking times toward the Black faces to gradually decline across trials, while looking times toward the White faces should increase or remain consistently high. In order to test whether these trends occurred in the current study a trial-by-trial analysis was performed on the male pairs only. A repeated measures ANOVA with Trial (4) and Race (Black/White) as within-subject factors showed the predicted main effect of Race ($F(1,15)=9.583, p=.007$), no effect of Trial ($F(3,45)=2.140, p=.108$) and no Trial x Race interaction ($F(3,45)=.970, p=.415$). Furthermore, the Trial x Race linear contrast was not significant ($F(1,15)=1.930, p=.185$), see figure 1.3. The graph certainly depicts a pattern that aligns with a habituation account, but even when performing the trial analysis on mean looking times separately by race, no Trial effect emerges for the White male faces ($F(3,45)=.662, p=.580$) or the Black faces ($F(3,45)=1.601, p=.202$). The linear trend in looking times at the Black faces is marginal ($F(1,15)=4.342, p=.055$). Given these

findings it seems possible that the current experiment lacked sufficient statistical power to reveal a difference across trials in the overall analysis.

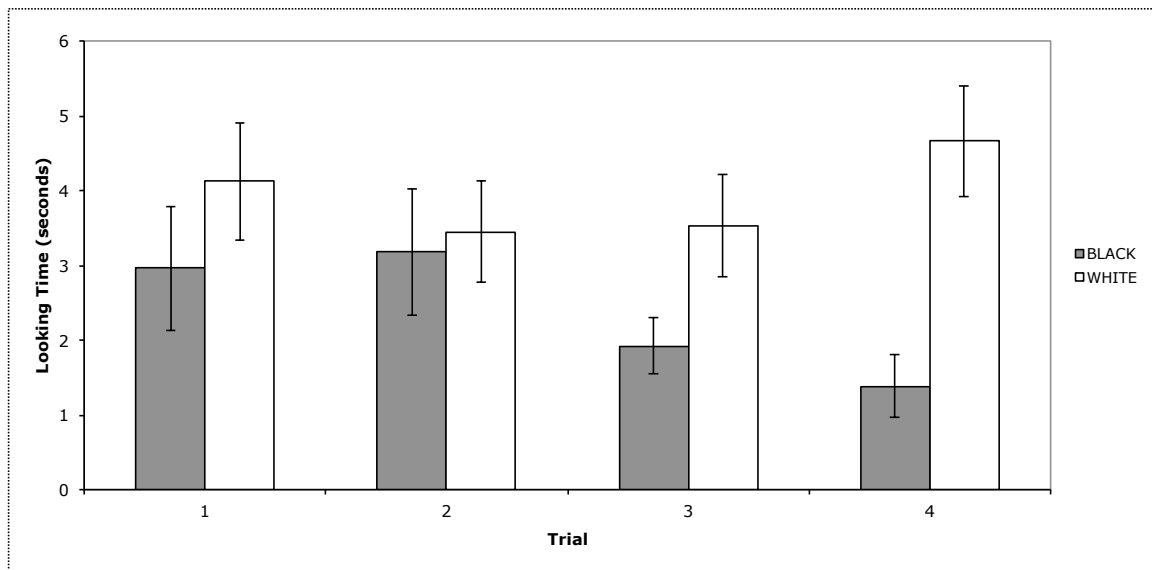


Figure 1.3 Mean trial-by-trial looking times to the Black and White male faces in Experiment 1.

Discussion

In the current study, infants' preference for faces of their own race was dependent on face gender. Only when male pairs were presented did participants look significantly longer at the White face, while no such preference was evident for the female pairs. According to parental reports all participants were raised by White females and had limited contact with other-race individuals, thus the obtained results are surprising under a perceptual interpretation of the bias. In particular, White female faces should have been most distinguishable from one another and thus should have generated the strongest novelty response from trial to trial. Consequently a strong own-race visual preference should have been observed also for female pairs.

Regarding the male pairs, analysis of looking times trial-by-trial proved somewhat inconclusive. On the one hand the lack of a trial by race interaction means that

babies' patterns of looking toward Black and White faces do not significantly differ across trials, suggesting that the overall White preference is not the result of gradual habituation to other-race faces. On the other hand, figure 1.3 does reveal a non-significant increase in the magnitude of the own-race preference over trials, as would have been predicted by a perceptual account, a trend that is weakly supported when examining the separate linear trends by race.

In light of previous studies using similar methods not reporting differences between male and female pairs in the magnitude of the own-race bias, as well as the questionable evidence for a trial effect in the male pairs of the current experiment, I next sought to verify both these findings with a new set of faces.

Experiment 2

The aim of the current study was to provide a direct replication of Bar-Haim et al. (2006)—in terms of both face stimuli and method, in order to observe whether the race by gender of pair interaction of Experiment 1 is upheld, and to reexamine the pattern of looking toward pairs of faces from trial to trial.

Method

Participants. Sixteen White, full term, 3-month-old infants (8 males; mean age = 3 months 16 days, range = 3 months 4 days to 3 months 27 days) participated in the study. Information concerning participants' race and the 5 people they spend most time with was yet again gathered. Parents' responses indicated that all infants had a White female primary caregiver. Twelve infants were exclusively exposed to White individuals, and four additional infants had some contact with non-White individuals, none of whom were Black.

Stimuli. The exact same presentations generated by Bar-Haim et al. (2006) were used in the current study. These presentations consisted of eight pairs of White (Israeli) and African (Ethiopian) faces (4 male, 4 female), ordered randomly with the only restriction being that within each presentation the Black faces appear an equal number of times on the left and on the right. Each participant was assigned a unique presentation. Face photographs measured 8x9.5 cm, and were placed against a light grey background 6.2 cm apart.

Procedure. The procedure was identical to that of Experiment 1.

Results

A preliminary analysis showed no effect of subject gender ($F(1,14)=1.150$, $p=.30$) and no interactions involving this variable (all $ps >.65$), hence it was not included in subsequent analyses. A repeated-measures ANOVA was carried out on average looking times (in seconds) with Race (Black/White) and Gender of Pair (male/female) as within-subject variables. The main effect of Race ($F(1,15)=7.237$, $p=.017$) and the main effect of Gender of Pair ($F(1,15)=7.692$, $p=.014$) were both significant, however the overall Race x Gender of Pair interaction was not ($F(1,15)=.597$, $p=.452$). Infants looked longer at female pairs (3.28s, $SD=1.21$) compared to male pairs (2.56s, $SD=1.08$) collapsed over race, and they looked longer at White faces (3.38s, $SD=1.31$) compared to African faces (2.46s, $SD=1.15$) collapsed across pair gender. Bearing in mind the interaction reported in Experiment 1 and the resulting a-priori prediction of differences based on Gender of Pair, separate paired-samples t-tests were conducted in order to find out whether the significant race effect was driven primarily by the male pairs. These analyses indeed revealed a highly significant own-race preference for male faces ($t(15)=-3.160$, $p=.006$)

yet no such preference for female faces ($t(15)=-1.294$, $p=.215$). On average, babies looked at the White male faces for 3.14 seconds ($SD=1.59$) and toward the Black male faces for 1.98 seconds ($SD=.93$). Looking times at the Black and White female faces were 2.94 ($SD=1.82$) and 3.63 ($SD=1.38$) seconds respectively. See figure 1.4.

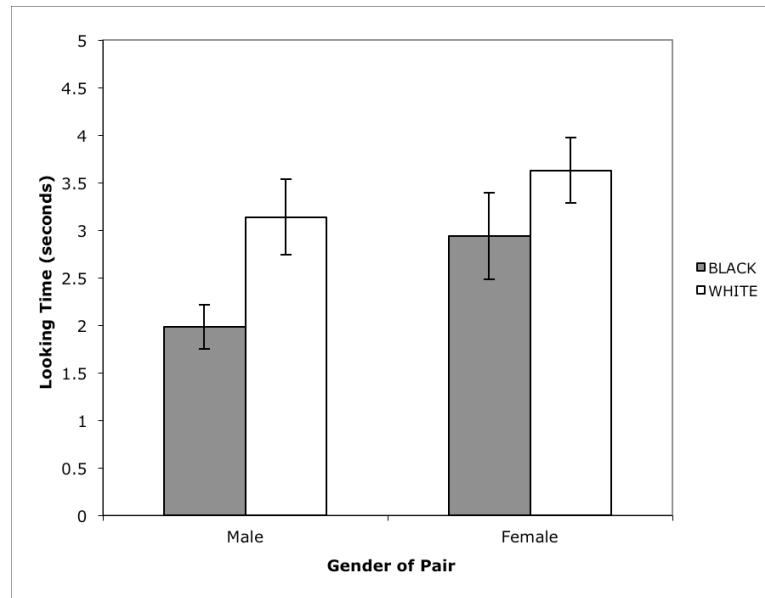


Figure 1.4 Mean looking times to the Black and White faces in Experiment 2 as a function of pair gender.

In order to ensure that the discrepant findings for male and female pairs did not arise due to significantly greater looking at female faces overall, looking times per trial were converted to percentages and averaged. Paired-samples analyses on average percent looking confirmed the significant own-race preference for male pairs ($t(15)=-2.718$, $p=.016$), and the absence of a race effect in the female pairs ($t(15)=-1.365$, $p=.193$).

As in Experiment 1, a trial-by-trial analysis was conducted only on the male pairs in order to test whether the current pattern of findings results from differences in infants' ability to tell own- and other-race faces apart. A repeated measures ANOVA on raw looking times (in seconds) with Trial (4) and Race (Black/White) as within-subject factors yielded a main effect of Race ($F(1,15)=11.358$, $p=.004$), but no effect of Trial

($F(3,45)=2.140$, $p=.108$) and no Trial x Race interaction ($F(3,45)=.415$, $p=.743$). The Trial x Race linear contrast was not significant either ($F(1,15)=.182$, $p=.675$), see figure 1.5. Separate examination of the means across trials by race shows no Trial effects (Black faces: $F(3,45)=.393$, $p=.758$; White faces: $F(3,45)=.890$, $p=.453$), and no linear trends (Black faces: $F(1,15)=.245$, $p=.628$; White faces: $F(1,15)=1.041$, $p=.324$).

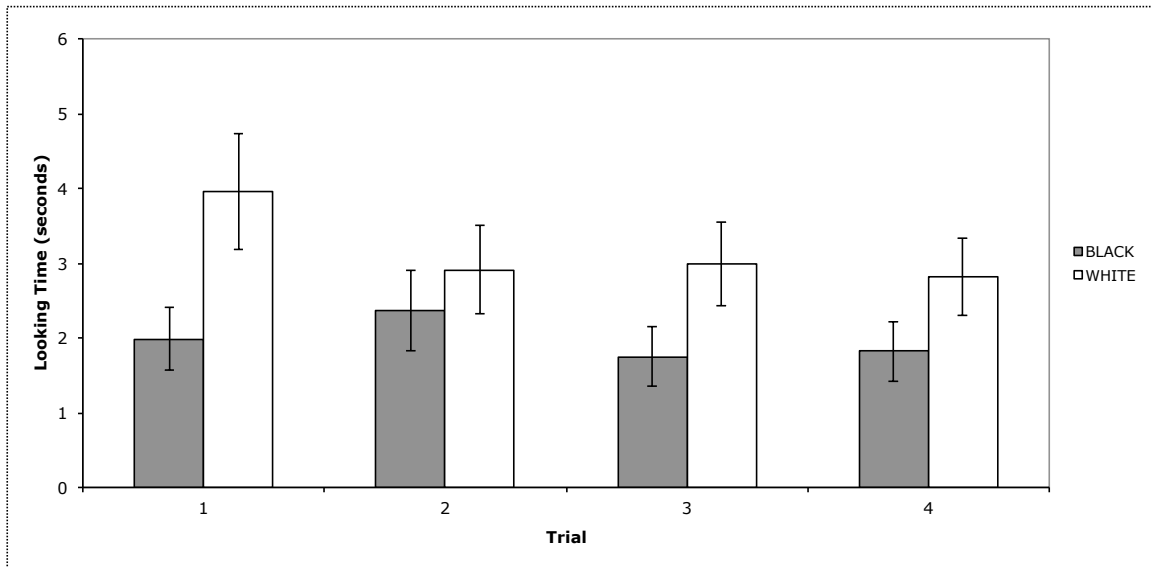


Figure 1.5 Mean trial-by-trial looking times to the Black and White male faces in Experiment 2.

Finally, in order to address the possibility that a trial effect was not detected in each experiment separately due to lack of statistical power, the male-pair data of Experiments 1 and 2 were pooled and analyzed trial-by-trial ($n=32$). An initial analysis showed no between subjects effect of Experiment ($F(1,30)=2.560$, $p=.12$), and no interactions involving this factor (all $ps>.53$). Average looking times (in seconds) were subjected to a repeated measures ANOVA with Trial (4) and Race (Black/White) as within-subject variables. The analysis showed a significant effect of Race ($F(1,31)=20.314$, $p<.001$), a significant effect of Trial ($F(3,93)=4.140$, $p=.008$), and again no Trial x Race interaction ($F(3,93)=.840$, $p=.475$). The linear contrast of Trial was

significant ($F(1,31)=7.982, p=.008$), yet the Trial x Race linear contrast was not ($F(1,31)=.514, p=.479$).

Discussion

As in all previously reported data on infants' racial preferences (Bar-Haim et al., 2006; Kelly et al., 2005; 2007a), the current study did not yield a significant race by pair gender interaction. Had this study been conducted on its own, the nonsignificant interaction would have precluded any further examination of the race effect. However, follow-up analyses did support the notion that the significant effect of race is carried by the male pairs, which raises the possibility that similar reactions to male faces fueled the findings of previous studies as well.

The current findings provide a second instance in which a preference for White faces is observed only for male pairs, not female pairs, in a different set of face stimuli than Experiment 1. As discussed earlier, the results for the female pairs are contrary to the predictions of an account explaining infants' preferences in terms of reactions to the magnitude of change from one trial to the next, since White female faces should have been most effectively individuated and should have produced the highest looking durations. Moreover, with regards to the male pairs, the data again show no differences across trials in the size of the own-race preference even when doubling the sample, thus undermining the possibility that the preference is in essence a habituation response to non-discriminable other-race faces. In other words, if infants were not differentiating the Black faces and were merely sustaining their interest at the White faces on each trial because they detect the appearance of a new individual, one would expect the difference

in visual fixation at each of two the stimuli to increase over the experiment. The similar looking time differences across trials cast doubt on this interpretation.

General Discussion

The experiments reported here have uncovered two novel characteristics of infants' own-race bias. First, they show that this visual preference is dependent on target gender, appearing uniquely in male pairs of faces. Previous preference studies in the literature have shown that White infants look longer at White female faces compared to male faces (Quinn et al., 2002), yet do not prefer other-race females to other-race males (Quinn et al., 2008). Though the question of whether these biases are perceptually or socially driven is again applicable, based on the combination of these effects one would theoretically expect a significant own-race preference when female pairs of faces are presented. Second, the current findings show that the own-race preference does not incrementally increase in magnitude across experimental trials, even when combining the data from both experiments. This pattern provides preliminary evidence against the thesis that better discrimination of own-race faces accounts for infant's looking times. If this is indeed a correct interpretation of the observed trends, then presentation of novel stimuli from trial to trial should not be a necessary condition for the emergence of the own-race preference. This proposal will be expanded, and directly tested in Chapter II by presenting infants with the same two individuals across trials.

More broadly, the interaction between race and gender supports the idea that from very early on in development all social categories do not exert the same influence in guiding preference (Kinzler et al., 2010). The experiments reported here challenge the hierarchical structure proposed by Quinn et al. (2008), and in fact suggest the opposite

arrangement whereby gender is a more potent cue than race in guiding infants' early preferences. Quinn's formulation was partially based on the lack of an interaction between race and gender in previous studies (Bar-Haim et al., 2006; Kelly et al., 2005, 2007a), however future reexamination of those data is encouraged, especially in light of Experiment 2 of this chapter, which revealed an overall nonsignificant interaction yet a strong race preference for male pairs and not female pairs when analyzed individually.

The present chapter highlights the need for a theoretical explanation that could account for the observed race by gender interaction, as it is unclear what mechanism might produce differences only for male faces. One possibility arises when considering the findings from a categorization perspective. As mentioned earlier, a typical categorization study involves familiarization with multiple exemplars from a single category in the laboratory prior to test. However, it has been shown that experience prior to the lab visit may affect infants' basic-level category representations. For instance, only 4-month-olds who both had pets at home and whose looking behavior was characterized by a high degree of gaze switching during familiarization were able to separately group cats and dogs, and to encode the individual exemplars within each category (Kovack-Lesh, Horst, & Oakes, 2008). In addition, the extent of processing during familiarization determines looking durations at test such that incomplete encoding leads infants to prefer familiar stimuli (Roder et al., 2000; Rose et al., 1982). Thus, infants' differential experience with male and female faces and the resulting asymmetry in their processing of gender categories (Quinn et al., 2002; Ramsey et al., 2005) could influence looking behavior in the paired preference task. In particular, a well-defined White female category would encourage longer looking at the novel out-of-category Black female

faces. If this tendency competes with an a-priori White female preference, the result would be an overall null effect. With regards to the male pairs, longer looking toward the familiar White face would also be predicted from this perspective, as the White male category is weaker or not yet fully formed.

A somewhat related speculation is that a strong White female category could allow infants to better detect the commonalities among own- and other-race females, and to more easily generalize their positive experiences to the female category as a whole. It has been suggested that infants' category boundaries are influenced by the ease with which they can actively compare different items (Oakes, Horst, Kovack-Lesh, & Perone, 2009). Accordingly, 4-month-olds' dog category excluded cats only if different exemplars of dogs were presented in pairs during familiarization (hence facilitating detection of similarities and differences; Oakes & Ribar, 2005), and infants of the same age formed a more exclusive category if during familiarization they were presented with pairs consisting of both category contrasts (a female lion paired with a cat) and same-category items (Eimas, Quinn, & Cowan, 1994). Interestingly, Boroditsky (2007) has shown that adult participants asked to compare two items (by listing their similarities *or* differences) subsequently rate them as more similar to one another than two items that were not previously compared. This effect was evident if participants had some basis for comparison (e.g. all items were animals), but did not emerge for items from distant categories (e.g. comparing a telephone to a pretzel). Thus, it is possible that in infancy presentation of an exemplar from an established category next to a novel item (that shares some of the defining characteristics of that category) aids the comparison process and accentuates meaningful similarities.

Both the above interpretations could be assessed in future research by testing infants brought up by a male primary caregiver who have a preference for male faces and presumably a well-defined male category, therefore no difference in looking times should arise for the male pairs.

The final chapters of this dissertation will investigate two alternative explanations for infants' male-specific own-race preference, beyond gender differences in categorization. Findings with adults have shown that other-race male (but not female) targets elicit a threat response under a variety of conditions. Based on this evidence Chapter III will employ a threat reduction manipulation in order to explore whether the same mechanism could be at play in infancy. Cross-race exposure also reduces intergroup bias in adulthood. If infants' visual preference is indicative of their positivity toward members of groups with whom they have previously interacted, then exposure to a friendly other-race individual might attenuate the own-race preference. Chapter IV aims at testing this prediction.

Chapter II

Chapter I provided the first piece of evidence against the interpretation that the own-race preference results from a novelty response to White individuals across trials. No preference was observed for White female faces, which are more discriminable than White males, and other-race faces. In addition, a trial-by-trial analysis of the male pairs suggested that the pattern of results was not due to a habituation response to Black faces. If detection of individual novelty is a prerequisite for the own-race preference to emerge, then presenting the same two people over consecutive trials should result in the elimination of the preference. The current experiments set out to test this prediction.

Infants' ability to detect individual identity has been exemplified from a very early age. Newborns only a few hours old prefer their mother's face over a stranger's face (Field, Cohen, Garcia, & Greenberg, 1984; Walton, Bower, & Bower, 1992; See Barrera & Maurer, 1981 for equivalent findings with 3-month-olds), a tendency which is strengthened with increased observation of the mother's face prior to test, and shown even after a 15-minute delay between seeing the mother and testing (Bushnell, 2001). This early face identification however is easily disrupted by masking the external contour of the head (Pascalis, de Schonen, Morton, Deruelle, & Fabre-Grenet, 1995), or when the mother is presented in profile view (Sai & Bushnell, 1988). Older infants' ability to recognize their mother is more stable, and is based on attention to the internal facial features (Bartrip, Morton, & de Schonen, 2001).

Preference for the mother's face in these experiments indicates that babies were able to identify that face as the same one they have previously experienced. High familiarity with the mother may raise concern that these effects do not generalize to other

faces, however studies have demonstrated infants' recognition of *new* individuals under various presentation conditions as well. For example, when newborns were habituated to a neutral female face in full frontal view or $\frac{3}{4}$ view (45° rotation), and subsequently presented with a novel female face and the familiar face in the pose not presented during habituation (either frontal or $\frac{3}{4}$ view), longer looking at the novel face was observed. Since the hairline of the stimuli was masked, success on this task must have relied on processing of the faces' internal features. Newborns showed no evidence of face recognition when required to generalize from a frontal orientation to profile (90° rotation) or from profile view to $\frac{3}{4}$ view and vice versa, presumably since a face profile does not contain adequate perceptual information (Turati, Bulf, & Simion, 2008).

In older infants, identification across variations in facial expression intensity has been observed at 5 months of age (Bornstein & Arterberry, 2003). Furthermore, 4-month-olds habituated to a single upright male or female face in multiple viewpoints (and 2 facial expressions) were able to identify the familiar face in a never before presented orientation and expression combination at test (Turati, Sangrigoli, Ruel, & de Schonen, 2004, exp. 2; cf. Cohen & Strauss, 1979). Using a very similar design, ERP evidence at 3 months of age showed that after a 2-minute retention interval the novel face elicited a large positive slow wave, while the familiar face elicited a return to baseline (Pascalis, de Haan, Nelson, & de Schonen, 1998, exp. 3). According to the authors this pattern suggests that the memory representation of the novel stimulus required updating while the familiar stimulus was fully encoded. Fagan (1976, exp. 3) has shown that infants 7 months of age are able to generalize male face identity from a frontal view to $\frac{3}{4}$ and profile views (cf. Cohen & Strauss, 1979), and observing photographs of baby faces, 7-

month-olds generalize identity from a full face view to $\frac{3}{4}$ but not to a face profile. Recognition following the profile transformation was observed at 12 months (Rose, Jankowski, & Feldman, 2002).

These findings suggest that infants are able to detect the identity of a single person across photographs differing in pose and facial expression. It should be noted that White faces always served as stimuli in these studies, questioning whether this ability exists for out-group faces. Two studies on the development of the ORE indicate that it might be (Kelly et al., 2007b, 2009). Infants were habituated to a single own- or other-race face in one of two orientations—either frontal or $\frac{3}{4}$ view, and tested with a pair of faces of the same race, one familiar and the other novel, in an orientation not presented during habituation. Both Chinese and White infants recognized own- and other-race faces at 3 months of age, an ability that deteriorated with age. However, in two other studies testing the same effect using the same method without varying face orientation from habituation to test (therefore making the task easier), 3-month-olds showed no evidence of other-race face recognition (Hayden et al., 2007; Sangrigoli & de Schonen, 2004b), which might have been due to the masking of the faces' hairline. Altogether the findings show that out-group identity recognition is quite fragile at this age.

The current experiments relied on the aforementioned evidence that infants identify a single own-race individual even when pose or facial expression are varied, and habituate to such a presentation (e.g. Bornstein & Arterberry, 2003; Turati et al., 2004), in order to assess the source of the own-race preference. If the White preference in Chapter I reflects attention to individuals with better discrimination of different individuals (and hence a stronger novelty response) when they are White, then when

presented with the same person across trials a significant reduction in looking time is expected. If babies are similarly able to recognize a single Black individual across variations in photographs, then looking times toward the Black male should also decline during the experiment, and the overall own-race preference should disappear. It is plausible that a reversal of the effect, that is longer looking toward the other-race face, might be observed if participants are uncertain about the novelty of the Black face, and treat the faces as different people.

In addition to the change from multiple individuals to presentation of the same person from trial to trial, the two experiments reported shortly differ from Chapter I in that smiling faces were presented across trials. The use of smiling faces resulted from both practical and theoretical considerations. On the practical side, the videos from which these photographs were extracted (see method section for further explanation) depicted individuals positively interacting with the infants, and therefore still frames of neutral faces were impossible to obtain. On the theoretical side, studies have shown that young infants are able to discriminate a variety of facial expressions (e.g. Bornstein & Arterberry, 2003; Field, Woodson, Greenberg, & Cohen, 1982; Haviland & Lelwica, 1987; Young-Browne, Rosenfeld, & Horowitz, 1977), and visually prefer happy faces prior to 6 months of age (Farroni, Menon, Rigato, & Johnson, 2007b; LaBarbera, Izard, Vietze, & Parisi, 1976; cf. Montague & Walker-Andrews, 2001). Furthermore, recent evidence suggests that face identification is facilitated when presented with a smile. Three-month-olds familiarized with a smiling female were able to distinguish her face from an unfamiliar face on the first test trial while infants familiarized with a female assuming a neutral expression recognized her only on the second test pair (Turati,

Montirosso, Brenna, Ferrara, & Borgatti, 2011). Similarly, 7-month-old infants habituated to a neutral face in either a frontal or $\frac{3}{4}$ view were not able to identify the face upon presentation in a new pose, however, when faces displayed a positive or negative emotion during habituation and test, infants of the same age succeeded in recognizing the habituated face even when in a different pose (Gross & Schwarzer, 2010).

To summarize, if the own-race preference results from a tendency to attend to newly recognized individuals then it should only arise when multiple *different* pairs of faces are presented across trials. A lack of change in individual identity should produce no novelty response. The experiments in the current chapter were designed to test this prediction by presenting infants with a single pair of individual people from trial to trial, appearing in a changing succession of photographs. If indeed dishabituation to novel White faces accounts for the own-race preference, then eliminating novelty should at minimum result in equal looking toward the Black and White faces.

Experiment 1

Method

Participants. Thirty-two White, full term, 3-month-old infants took part in the study (16 males; mean age = 3 months 18 days, range = 3 months 1 day to 4 months 0 days), and were evenly divided between a male and female pair conditions (8 boys and 8 girls in each). Three additional infants (2 females) were tested but excluded from the final sample due to fussing (n=2) or equipment failure (n=1). Parental reports on the exposure questionnaire indicated that one baby was brought up by a White male primary caregiver, and all other participants (n=31) were brought up by White females. Twenty-seven

participants were exclusively exposed to White individuals. Of the remaining 5 babies, 2 had regular contact with a Black female.

Stimuli. The female pair consisted of the two actresses from Kinzler and Spelke's (2011) experiment 1. Eight still frames of each actress' face were selected from the raw footage filmed for that experiment, and closely matched in terms of facial expression and posture, yielding 8 unique pairs that remained constant throughout the experiment. The 8 male pairs were created in the same manner from videos of two men that were filmed in the lab. In both cases faces were frontally oriented and smiling, appearing against a black background. The photographs measured 8.8x11.2 cm, and were placed 6.1 cm apart on a light grey background (see figure 2.1).

Presentations were created for each condition separately making sure that every pair appeared once in every possible ordinal position and equally often with the Black face on the left and on the right, thus producing 16 presentations in total (8 presentations per condition). Within presentations Black faces appeared on the left for half of the trials and on the right for the remaining half. Two participants (one boy, one girl) were randomly assigned to each presentation.

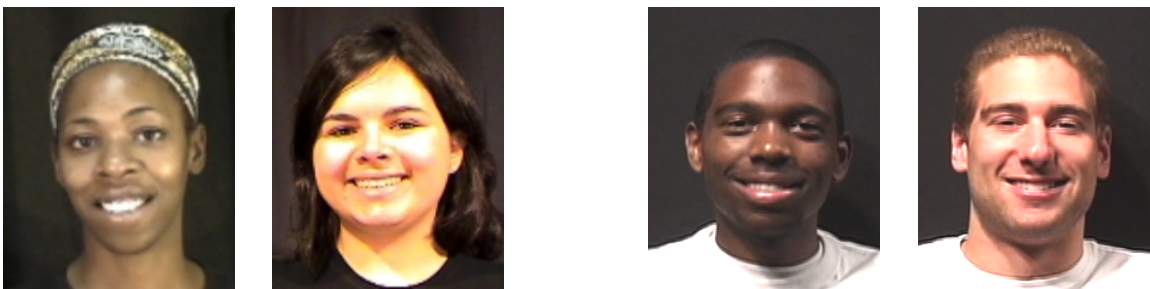


Figure 2.1 Sample photographs of the male and female pair presented in Experiment 1

Procedure. The procedure was identical to the one described in Chapter I.

Results

An ANOVA with Subject Gender and Condition (male/female pair) as between-subject variables, and Race (Black/White) as a within-subject variable was performed on average looking times and revealed a significant Condition x Subject Gender x Race interaction ($F(1,28)=4.766, p=.038$). The Subject Gender x Race interaction was also significant ($F(1,28)=9.930, p=.004$), as were the main effect of Race ($F(1,28)=15.019, p=.001$) and Subject Gender ($F(1,28)=7.010, p=.013$). No other main effects or interactions approached significance (all $ps>.21$).

Further analyses separated by condition showed a highly significant effect of Race in the male pair condition ($F(1,14)=21.450, p<.001$), that did not interact with Subject Gender ($F(1,14)=.761, p=.398$). Participants spent on average 3.98s (SD=1.45) looking at the White male, and 2.59s (SD=1.01) looking at the Black male. The between subjects effect of Subject Gender was not significant ($F(1,14)=4.119, p=.062$). In the female pair condition however there was a significant Race x Subject Gender interaction ($F(1,14)=10.276, p=.006$), and no effect of Race ($F(1,14)=2.465, p=.139$). Boys significantly preferred looking at the White female over the Black female face ($t(7)=-3.368, p=.012$; White female=4.56s (SD=1.33), Black female=2.41s (SD=.68)), while girls did not show a race preference ($t(7)=1.160, p=.284$; White female=2.48s (SD=.97), Black female=3.21s (SD=1.51)). The between subjects effect of Subject Gender was not significant ($F(1,14)=2.912, p=.11$).

Interestingly, an ANOVA collapsing across Subject Gender with Race as a within subjects variable, and Condition as a between subjects variable elicits the now familiar pattern of data found in Chapter I—no Condition x Race interaction ($F(1,30)=1.121,$

$p=.298$), a strong own-race preference when analyzing the male pair condition ($t(15)=-4.669$, $p<.001$), and no race preference toward the female pair ($t(15)=-1.234$, $p=.236$), see figure 2.2.

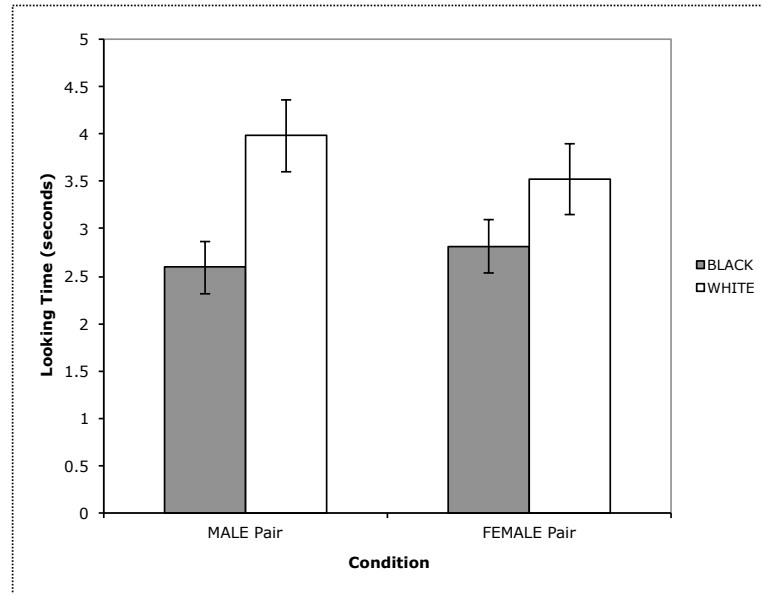


Figure 2.2 Mean looking times to the Black and White faces in Experiment 1 as a function of condition (male pair vs. female pair).

Unlike the experiments reported in Chapter I, the present analysis revealed effects of subject gender on race preference. In addition, in the current experiment two participants (1 boy, 1 girl), both tested in the female pair condition, were regularly exposed to Black women. In order to assess whether exposure might have had an effect on the results, the data were reanalyzed excluding these participants. The overall ANOVA still yielded a significant Condition x Subject Gender x Race interaction ($F(1,26)=4.907$, $p=.036$), and a separate analysis of the female pair condition again showed the Race x Subject Gender interaction ($F(1,12)=8.984$, $p=.011$), with boys preferring the White face ($t(6)=-3.004$, $p=.024$; White female=4.56s (SD=1.44), Black female=2.36s (SD=.72)), and girls showing no preference ($t(6)=1.214$, $p=.27$; White female=2.4s (SD=1.02), Black female=3.27s (SD=1.62)). The between subjects effect of

Subject Gender was not significant ($F(1,12)=2.100, p=.173$). In sum, removal of these two participants had no influence on the obtained pattern of results.

Finally, a trial-by-trial analysis was performed on looking times toward the male pair ($n=16$). An ANOVA with Trial (8) and Race (Black/White) as within-subject variables revealed a significant effect of Trial ($F(7,105)=3.485, p=.002$), the significant Race effect ($F(1,15)=21.797, p<.001$), as well as a significant Trial x Race interaction ($F(7,105)=2.100, p=.05$). Looking times across the experiment steadily declined as indicated by a significant linear contrast of Trial ($F(1,15)=8.543, p=.01$). The Trial x Race linear contrast was not significant ($F(1,15)=1.570, p=.229$), see figure 2.3.

For exploratory purposes, the trial analysis was performed separately on the Black and White male faces and revealed a significant Trial effect ($F(7,105)=2.741, p=.012$) and a significant linear trend for looking times toward the White face ($F(1,15)=4.533, p=.05$). Analysis of looks toward the Black face yielded a non-significant effect of Trial ($F(7,105)=1.805, p=.094$).

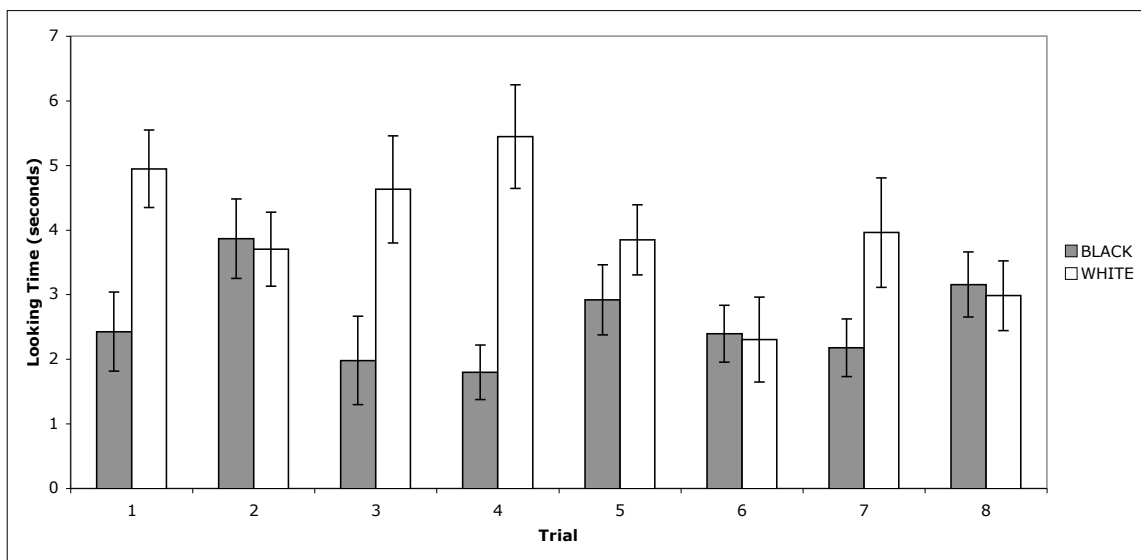


Figure 2.3 Mean trial-by-trial looking times to the Black and White male pair of Experiment 1.

Discussion

In the current experiment, participants visually preferred the own-race face when repeatedly presented with the same pair of male faces. Though the female pair condition elicited an uninterpretable effect of subject gender, examining the subject group as a whole resulted in no race preference. Along with Chapter I, this is the third time a race bias emerged exclusively when male faces were presented.

The trial analysis of the male condition did reveal a linear decrease in looking toward the White male face as would have been predicted if novelty detection across trials was driving the race effect. Nevertheless, this decline was not strong enough to override an overall White preference. Thus, it is possible that a response to novel White individuals contributed to the maintenance of the own-race preference in previous studies, yet it is not capable of fully explaining those findings, as a complete elimination of this novelty did not result in an elimination of the preference. Of note is that while infants saw 4 trials of male faces interspersed among female pairs in Chapter I, they were currently presented with the male pair 8 times. This difference could have produced the weaker responding during the latter half of the experiment. Indeed, the first 4 trials show no evidence of a decline in interest in the White male face, which is surprising given that the faces were smiling and should have enhanced infants' ability to recognize that the same individual is being presented (Gross & Schwarzer, 2010; Turati et al., 2011).

A potential limitation of the current experiment lays in contrast differences between the two male faces (refer to figure 2.1). Specifically, the Black male may have been less perceptually salient to infants than the White male face against the dark background, and therefore less preferred (see Farroni et al., 2005 and Rose, Katz, Birke,

& Rossman, 1977 for examples of contrast effects on face preference). In order to ensure that this difference was not responsible for the obtained White male preference, the next experiment aimed at replicating the findings with a new pair of stimuli.

Experiment 2

Experiment 2 addresses the concern that the race effect observed in the previous study arose due to unequal contrast in the male pair of faces. I chose not to replicate the female pair findings for a number of reasons. First, similar contrast concerns were not raised with regards to the female pair used in Experiment 1, but more important, it has now been established across three studies that female faces do not elicit a reliable own-race preference, and hence any perceptual differences between the stimuli are not playing a substantial role in generating a looking bias.

Method

Participants. Sixteen, full term, White 3-month-old infants were recruited for participation in the current study (8 males; mean age = 3 months 18 days, range = 3 months 5 days to 3 months 28 days). As before, parents were asked to indicate their own race, and the racial identity of the 5 people their infant spends most time with during a typical week. Parents' responses showed that one participant had a bi-racial (Asian/Caucasian) mother, and all other participants were brought up by a White female caregiver. Four participants had exposure to non-White individuals, but only one had regular contact with African-American female daycare providers.

Stimuli. Stimuli consisted of eight unique pairs of the same two Black and White males. Pairs were created by capturing still frames from videos created in the lab for another study in which the actors were performing against a grey background. These

photos centered on the actors' faces and were matched as closely as possible in pose and facial expression. Photos measured 8.8x11.2 cm and were placed against a light grey background 6.2 cm apart (see figure 2.4). Eight presentations were created such that each pair appeared once in every ordinal position, and equally often with the Black face on either side of the screen. Within each presentation 4 pairs were shown with the Black face on the right and the other 4 with the Black face on the left. Two participants (one male, one female) were randomly assigned to each presentation.

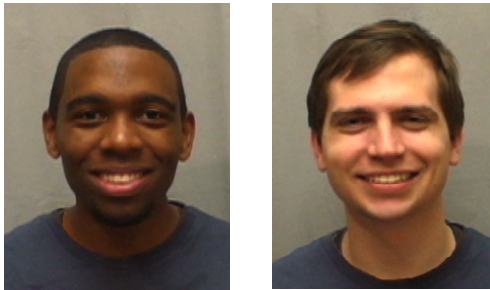


Figure 2.4 Sample photographs of the male pair presented in Experiment 2

Procedure. The procedure was identical to that of Experiment 1.

Results

An initial analysis with Race (Black/White) as a within subjects variable and Subject Gender produced a marginal effect of Subject Gender ($F(1,14)=4.399$, $p=.055$) indicating that boys looked longer than girls (3.69s (SD=1.13) vs. 2.59s (SD=.94) respectively), yet this effect did not interact with Race ($F(1,14)=1.487$, $p=.243$). A paired-samples t-test on average looking times (in seconds) showed a significant difference in looking toward the Black and White faces ($t(15)=-3.330$, $p=.005$; White face=3.90s (SD=1.75), Black face=2.38s (SD=1.13)). See figure 2.5.

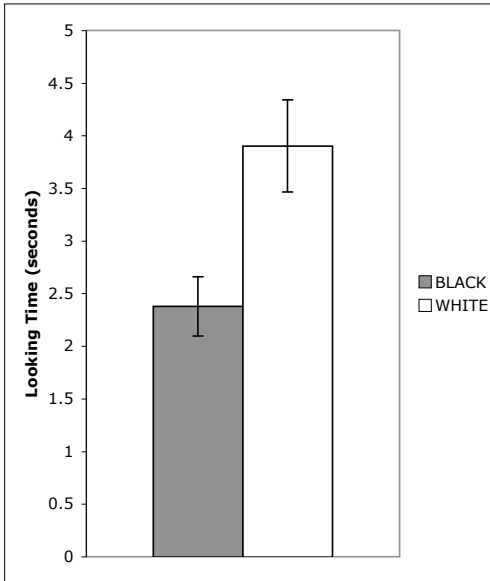


Figure 2.5 Mean looking times to the Black and White male pair of Experiment 2.

In order to assess trial-by-trial looking trends, as in Experiment 1 an ANOVA was performed with Trial (8) and Race (Black/White) as repeated measures. The analysis showed a significant effect of Trial ($F(7,105)=2.877, p=.009$), a significant Race effect ($F(1,15)=11.212, p=.004$), but no Trial x Race interaction ($F(7, 105)=1.145, p=.341$). The linear contrast of Trial was significant ($F(1,15)=13.368, p=.002$), but the Trial x Race contrast was not ($F(1,15)<.001, p=.989$), see figure 2.6.

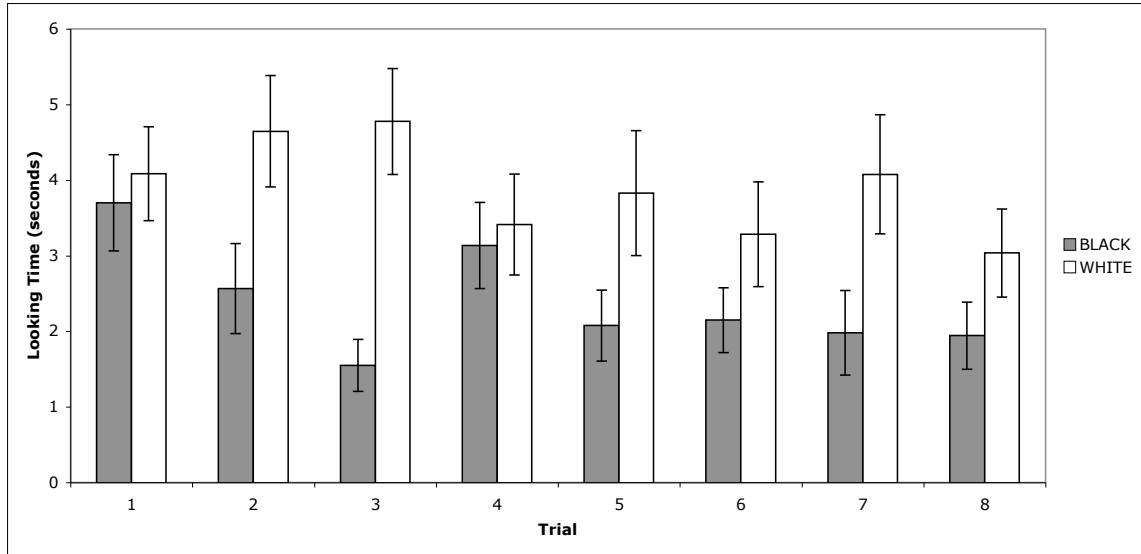


Figure 2.6 Mean trial-by-trial looking times to the Black and White male pair of Experiment 2.

Separating the trial-by-trial data by race shows a significant Trial effect for looking times at the Black face ($F(7,105)=2.358, p=.028$), and a significant linear trend ($F(1,15)=4.739, p=.046$). No Trial effect was found for the White face ($F(7,105)=1.119, p=.357$).

Since slightly different looking patterns emerged across trials in Experiment 2 and the male pair condition of Experiment 1, the findings of both groups were pooled and analyzed jointly ($n=32$). No between subjects effect of study ($F(1,30)=.127, p=.724$) and no interactions involving this variable were evident in the preliminary analysis (all $p>.07$). A Trial (8) by Race (Black/White) repeated measures ANOVA yielded a significant effect of Trial ($F(7,217)=5.601, p<.001$), a significant effect of Race ($F(1,31)=29.732, p<.001$), and no Trial x Race interaction ($F(7,217)=1.413, p=.201$). The linear Trial contrast was significant ($F(1,31)=22.177, p<.001$), but the Trial x Race linear contrast was not ($F(1,31)=.831, p=.369$). Separate analyses by race revealed a significant Trial effect ($F(7,217)=2.611, p=.013$) and significant linear contrast ($F(1,31)=6.571,$

$p=.015$) for the White face, and no Trial effect when analyzing looking times toward the Black face ($F(7,217)=1.856, p=.078$).

Finally, average looking times toward the male pairs across all experiments reported thus far (Chapters I and II; $n=64$) were directly compared in a Race (Black/White) x Study (4) ANOVA. Results showed a highly significant effect of Race ($F(1,60)=45.323, p<.001$), no Study x Race interaction ($F(3,60)=.183, p=.907$), and no between subjects effect of Study ($F(3,60)=1.359, p=.264$).

Discussion

The present experiment replicates the findings of the male pair in Experiment 1 and strengthens the claim that the own-race preference goes beyond a response to new individuals across trials, as a strong White preference was still observed when the same two males were repeatedly presented. In addition, a trial by race interaction did not emerge in the current study or when pooling the male pair data from both experiments, meaning that the preference does not significantly change across trials. Even though the pooled data show a linear decrease in looking toward the White face (when analyzed separately) this trend does not seem to dramatically influence the race bias.

Moreover, comparing the results of all 4 experiments reported thus far in this dissertation yields a robust own-race preference in the male pairs, which is unaffected by the different stimulus sets or the types of manipulations used.

General Discussion

In the current chapter the identity of the faces infants observed remained constant across trials yet an own-race preference emerged for male pairs of faces. The preference did not significantly change in magnitude throughout the experiment, and was not

observed when a female pair was shown. Together, these findings suggest that infants' racial bias cannot solely be attributed to a novelty response due to better recognition of White individuals.

The above conclusion is based on the notion that infants are in fact paying attention to the unchanging individual identity depicted in the photographs. However, other factors such as pose and facial expression did vary slightly from one slide to the next, and these subtle differences could have conceivably impacted the results. For instance, if infants more effectively extract posture information when the individual presented is from their own race, then the magnitude of change over consecutive trials might seem larger for the White face compared to the Black face. To the best of my knowledge, no study has systematically explored infants' ability to detect changes in pose across races. Likewise, though it is known that infants prefer smiling faces (LaBarbera et al., 1976), only one study on infants' responses to different facial expressions explicitly reported using other-race female faces as stimuli and found that newborns prefer happy over fearful faces (but not fearful vs. neutral faces; Farroni et al., 2007b). Recent electrophysiological data from 9-month-olds has also shown that the P400 component responds differently to congruent and incongruent pairings of an emotional sound (e.g. laughter) and female facial expression (happy or sad) in own- but not other-race faces. The neural response to this congruency was independent of race at 5 months of age (Vogel, Monesson, & Scott, 2012). Besides these two sets of findings, very little is known about the efficiency with which other-race facial expressions are processed and discriminated in infancy, particularly when presented by male exemplars. Adult findings have pointed to an in-group advantage in recognition of emotional expressions (see

Elfenbein & Ambady, 2002 for a meta-analysis), highlighting the possibility that infants' looking responses in the present experiments were driven by better detection of (and subsequent preference for) smiles assumed by the White man. Though the above concerns are valid when considering the findings of the male pairs, the lack of preference for White females either means that the smiling faces were equally perceived or that any difference in extracting positive emotion was not substantial enough to produce a race bias.

Given that the novelty explanation is unable to account for the full set of findings, and based on evidence that adults' inter-group interactions might be mediated by a threat response that yields selective bias against out-group males, in Chapter III I will propose and put to test the hypothesis that a similar threat mechanism may be responsible for the gender difference observed in infants' pattern of looking toward own- and other-race faces in the studies presented thus far.

Chapter IV will examine the additional possibility that infants' pattern of visual fixation is influenced by their previously experienced social interactions, and alludes to their desire for social engagement. In this regard, a recent paper (Kinzler & Spelke, 2011) has shown that tasks that elicit selective responding based on the language an individual speaks do not generate race-based social choices at 10 months and 2.5 years of age (i.e. participants interact equally with the Black and White female), arguing against the idea that early looking time preferences for own-race faces are social in nature. However, the female face stimuli of Experiment 1 were pictures of the same actresses used in that paper, and given that here I show that these individuals (and in fact female faces more generally) do not produce an own-race visual preference at 3 months of age, the above

conclusion might be premature. Repetition of Kinzler & Spelke's (2011) experiments with male actors differing in race might provide a better understanding of older infants' selectivity in engaging with in- and out-group members, and its relation to earlier looking durations. The experiment undertaken in Chapter IV will gauge the social interpretation of infants' race-dependent looking times in a different manner, by assessing the influence of positive out-group exposure.

Chapter III

The current chapter puts forth a threat-based interpretation for infants' preferential looking patterns toward own-race males, inspired by the outgroup male target hypothesis (Navarrete et al., 2010). Applying evolutionary psychological theory to race bias, Navarrete et al. (2010) suggest that the strong intrasexual competition among males (compared to females) due to the high fitness gains associated with acquiring multiple mates, has incentivized aggressive behavior at times of intergroup conflict. Since this strategy imposes great risks for males (e.g. death) as well as for females (e.g. sexual coercion), men and women have developed separate adaptive responses (approach vs. avoidance) for dealing with out-group male threat. The crucial prediction of this hypothesis is that both genders will express greater bias against out-group male targets.

The results of previous chapters of this dissertation in which infants' own-race preference was exclusively expressed in male pairs of faces align with Navarrete et al.'s account. As will be reviewed shortly, ample adult studies also point to a link between race and threat, which is specific to males. The present experiment is a first attempt at testing an equivalent link in infancy.

Race and Threat in Adults

Behavioral, physiological and neural indices of threat have been observed in tasks involving other-race targets. For example, subjects will more frequently misidentify a tool as a handgun after being primed with Black faces compared to White faces (Payne, 2001; see also Eberhardt, Goff, Purdie, & Davies, 2004), and will perceive the same ambiguous shove as violent if produced by a Black individual and innocuous if produced by a White individual (Duncan, 1976). Using a dot-probe task it has been shown that

White participants are faster to attend to Black male targets compared to White males (Donders, Correll, & Wittenbrink, 2008), an effect which is modulated by presentation of faces with an averted gaze (a cue meant to reduce threat; Trawalter et al., 2008), or when faces display a happy facial expression (Richeson & Trawalter, 2008). Furthermore, in what has been termed the “Shooter Bias” participants in videogame simulations are faster and more accurate at deciding to “shoot” an armed Black male target (compared to an armed White male), and more quickly and accurately decide *not* to shoot an unarmed White male compared to an unarmed Black male (Correll, Park, Judd, & Wittenbrink, 2002; Correll, Urland, & Ito, 2006). It has recently been demonstrated that this bias uniquely arises when male targets are presented, as responses toward armed and unarmed Black and White females do not differ from each other and are equivalent to the response patterns toward White males (Plant, Goplen, & Kunstman, 2011). Interestingly, increasing the threat level of the videogame by placing male characters against dangerous background scenes produces identical response latencies and accuracies for shooting Black and White targets (Correll, Wittenbrink, Park, Judd, & Goyle, 2011).

Face processing and categorization are similarly influenced by perceived threat. Hugenberg and Bodenhausen (2004) demonstrated that European-American adults high in implicit race bias more frequently categorize racially ambiguous angry male faces as Black. Categorization of ambiguous race happy faces was not predicted by racial prejudice (see also Miller, Maner, & Becker, 2010 for race categorization based on target cues of masculinity, movement toward the perceiver, and following a fearful mood induction). Similarly, a facial expression categorization task has shown that angry unambiguous Black male faces are categorized faster than happy Black male faces, while

the reverse pattern of response latencies emerges for categorization of happy and angry unambiguous White male faces (Hugenberg, 2005).

With regards to the ORE, manipulating threat through facial expression has yielded inconsistent results. In one study the ORE was reversed when faces displayed an angry expression, such that White subjects were better at identifying previously presented Black faces compared to White faces, a finding attributed to the functional importance of attending to potential harm imposed by out-groups (Ackerman et al., 2006), yet another study found enhanced memory for angry White faces (compared to angry Black faces) and happy Black faces (compared to happy White faces), which was explained by enhanced memorability of stimuli that are incongruent with culturally held stereotypes (Corneille, Hugenberg, & Potter, 2007). Both these studies used only male face stimuli. Of importance to the current experiment however, manipulation of eye gaze direction results in elimination of the ORE via reduction in own-race face memory to levels equivalent to that of other-race faces (Adams, Pauker, & Weisbuch, 2010).

At the physiological level, conditioned fear toward other-race male faces resists extinction (as measured by participants' skin conductance; Olsson et al., 2005), whereas fear conditioning to other-race female faces does not (Navarrete et al., 2009), reinforcing the notion that male out-group members are more readily associated with threat. Factors shown to moderate these extinction resistance responses include verbal instruction (Mallan, Sax, & Lipp, 2009), and close interracial contact (Olsson et al., 2005; Navarrete et al., 2009). Moreover, in-laboratory interracial interactions have been shown to produce a pattern of cardiovascular reactivity and hormonal changes indicative of threat and stress (Mendes et al., 2002; Mendes, Gray, Mendoza-Denton, Major, & Epel, 2007). Once

again, greater previous contact with Black individuals moderated subjects' threat responses (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001), and race bias as assessed by the IAT was linked to stress reactivity patterns (Mendes et al., 2007).

Measuring event related brain potentials reveals a larger P200 amplitude for Black male target faces compared to White males, Black females and White females (Ito & Urland, 2003). As pointed out by Correll et al. (2006) this early attentional component has been shown to be more generally responsive to threatening stimuli. In a related study, the magnitude of the ERP difference between Black and White faces correlated with participants' IAT scores (He, Johnson, Dovidio, & McCarthy, 2009). Studies focusing on the amygdala, a brain structure implicated in evaluation of emotion, show that differences in activation for Black compared to White male faces are predicted by subjects' pro-white implicit biases. These effects are eliminated when faces of well-regarded Black and White individuals are presented (Phelps et al., 2000). Greater amygdala activation to Black faces is particularly pronounced when face presentation duration is short (30ms; Cunningham et al., 2004), and is modulated when faces display averted gaze or closed eyes (Richeson, Todd, Trawalter, & Baird, 2008). Longer face presentations (525ms and above) reveal greater frontal lobe functioning in response to Black faces versus White faces, presumably due to enhanced demands for cognitive control (Cunningham et al., 2004; Richeson et al., 2003).

In sum, these findings provide considerable evidence in support for the outgroup male target hypothesis by showing consistent threat reactions to male faces, and the absence of such reactions when female faces are presented (e.g. Ito & Urland, 2003; Navarrete et al., 2009; Plant et al., 2011). Given that target gender differences were

observed in Chapters I and II, the findings motivate exploring whether threat responses could be at the root of infants' visual preference bias as well.

Threat in Childhood and Infancy

Studies on threat detection in childhood have recently used a procedure in which a matrix of 9 pictures are simultaneously presented on a touch screen, and the participant is instructed to pick the “odd one out”. Findings show that 3-year-olds are faster to detect a snake among threat-irrelevant stimuli (such as flowers), than the reverse configuration of a single flower among snakes (LoBue & DeLoache, 2008). Using the same method, five-year-olds detect angry and fearful facial expressions more quickly than happy and sad faces (LoBue, 2009; see Waters & Lipp, 2008 for similar findings with 8-11-year-olds).

With respect to race, like adults (Hugenberg & Bodenhausen, 2004), 3-year-olds are more likely to categorize an ambiguous race angry face as Black, but this depends on children's ability to categorize unambiguous faces by race (Dunham & Banaji, 2008). Furthermore, an adaptation of Duncan's (1976) task has shown that 6th grade boys will perceive the same behavior as more mean or threatening if a Black actor performed it. This finding was observed in both Black and White participants (Sagar & Schofield, 1980).

Sensitivity to threat-relevant stimuli has also been tested in infancy. Eight- and 16-month-olds were presented with pairs consisting of a snake and a non-snake animal while simultaneously hearing audio recordings of the same sentence in either a happy or a frightened tone of voice. Longer looking times were observed toward the snake while listening to the frightened voice in comparison to the happy voice, thus indicating an association between snakes and fear (DeLoache & LoBue, 2009). Moreover, 8- to 14-

month-olds orient more quickly toward a picture of a snake when presented simultaneously alongside a picture of a flower, and orient faster to an angry face when paired with a happy face (LoBue & DeLoache, 2010). Heightened attention to fearful faces (compared to happy faces) has been well documented at 7 months of age in measures of looking time, heart rate, and ERPs (Leppänen, Moulson, Vogel-Farley, & Nelson, 2007; Nelson & de Haan, 1996; Nelson & Dolgin, 1985; Peltola, Leppänen, & Hietanen, 2011; Peltola, Leppänen, Palokangas, & Hietanen, 2008), but is not observed earlier in development (Peltola, Leppänen, Mäki, & Hietanen, 2009).

Finally, 9-month-old infants have been shown to preferentially attend to a display containing a single other-race face among seven own-race faces, in comparison to the reverse configuration (Hayden et al., 2009). While conceptually similar to findings with older children discussed at the start of this section (LoBue, 2009; LoBue & DeLoache, 2008), further research is necessary to determine whether this pop-out effect is related to a threat reaction. It should be noted that recently the same method has shown increased attention to threat-related stimuli: 9-month-olds look longer at a pattern containing a single fearful face among 7 neutral faces compared to a display containing one neutral face among fearful face distractors (Hayden, Bhatt, Zieber, & Kangas, 2010).

The literature indicates a propensity to orient *toward* threatening stimuli from around 7 months of age (and into adulthood), yet the race bias for males demonstrated in previous chapters of this dissertation is expressed via heightened attention to own-race faces, which are hypothesized to be *less* threatening. As formerly noted, younger infants direct their gaze away rather than toward over-stimulating displays or “still-faced” individuals (Crockenberg & Leerkes, 2004; Field, 1981; Mesman et al., 2009), and

babies' wariness of strangers is expressed by avoidance of eye contact (Mangelsdorf et al., 1995; Waters et al., 1975). Additionally, early in development infants exhibit a positivity bias in emotional processing (which by 12 months of age changes to a negativity bias; Vaish, Grossmann, & Woodward, 2008). For example, happy facial expressions are visually preferred and are better recognized compared to angry and fearful faces (Ferroni et al., 2007b; LaBarbera et al., 1976; cf. Montague & Walker-Andrews, 2001). Thus, if other-race males are perceived as threatening at 3 months of age, when presented with pairs of faces differing in race, the tendency to privilege positive emotional information along with the threat avoidance reaction manifested in eye gaze aversion should yield a visual preference toward own-race faces, as observed in Chapters I and II.

In order to test whether a threat mechanism underlies infants' race bias in the current experiment faces were presented with averted gaze. From birth infants can detect gaze direction as evidenced by their visual preference for faces displaying direct over averted gaze, and their tendency to allocate attention in accord with observed shifts in eye gaze (Ferroni et al., 2002, 2006; Ferroni, Massaccesi, Pividori, & Johnson, 2004; Hood, Willen, & Driver, 1998). Enhanced neural processing (expressed in greater negativity of the "infant N170" ERP component) of neutral faces displaying direct compared to averted gaze has also been reported (Ferroni et al., 2002; Ferroni, Johnson, & Csibra, 2004). A number of studies have examined the effect of gaze direction on responses to threat-relevant facial expressions. For example, at 6 months of age fearful faces gazing at a simultaneously presented object elicited a larger Nc amplitude compared to neutral faces, yet no difference was found when faces looked away from the objects (Hoehl &

Striano, 2010). Furthermore, at 7 months of age angry averted gaze faces produced a smaller Nc compared to angry faces displaying direct gaze (Hoehl & Striano, 2008). Whether these gaze related electrophysiological changes affect babies' looking durations is yet to be determined, however analogous findings from infant rhesus monkeys have revealed longer visual fixation at averted gaze monkey face stimuli, which are less threatening compared to direct gaze faces (Mendelson, Haith, & Goldman-Rakic, 1982). Therefore, it was hypothesized that if indeed the own-race visual preference in infancy results from a threat response to out-group males, and if averted gaze reduces threat at 3 months of age, then presenting pairs of Black and White faces displaying averted eye gaze should enhance infants' attention toward the Black males and consequently diminish the overall race bias.

Though not the primary goal of Chapter II, presentation of smiling face stimuli already provides one test of the threat hypothesis. As reviewed above, under some conditions smiling faces reduce adults' spontaneous allocation of attention to out-group males (e.g. Richeson & Trawalter, 2008), and generally do not produce the same patterns of biased responding observed toward angry faces (e.g. Hugenberg & Bodenhausen, 2004). In addition to a preference for smiling faces in early infancy (Farroni et al., 2007b; LaBarbera et al., 1976), recognition abilities are accelerated when faces display a smile rather than a neutral expression (Turati et al., 2011). Despite all this evidence, a White male preference still emerged in Chapter II when faces exhibited a smile, challenging the threat argument.

Smiling faces may not however be the optimal test for the role of threat in infants' own-race bias. As previously discussed, it is yet unclear whether infants process and

differentiate own- and other-race facial expressions with the same efficiency (cf. Vogel et al., 2012), and whether the aforementioned preference for smiling faces (Farroni et al., 2007b; LaBarbera et al., 1976) is equivalent in magnitude across racial categories. Considering that an own-race face recognition advantage is present early in development (Kelly et al., 2007b, 2009; Hayden et al., 2007; Sangrigoli & de Schonen, 2004b), processing of facial expression might similarly be influenced by face race. It is noteworthy that in intermodal matching studies 3-month-olds show gains in perception of facial emotion when presented by their mothers (Kahana-Kalman & Walker-Andrews, 2001; Montague & Walker-Andrews, 2002) suggesting a role for face familiarity (see also Elfenbein & Ambady, 2002 for a meta-analysis examining cultural influences on emotion recognition in adults).

Manipulation of gaze direction allows for a test of the threat hypothesis, while dealing with some of the factors that could have produced an advantage for the White faces in Chapter II. For example, averted gaze faces are disliked in infancy and should not necessarily lead to a preference toward own-race faces (unlike the preferred smiling faces). Furthermore, much like adult findings showing that the ORE is eliminated when faces present an averted gaze due to a reduction in own-race face memory (Adams et al., 2010), 4-month-olds habituated to an averted gaze face will not subsequently exhibit a novelty response in a paired-preference task indicating a disruption in face identification (Farroni, Massaccesi, Menon, & Johnson, 2007a; see also Hood, Macrae, Cole-Davies, & Dias, 2003 for similar effects of gaze on 6-7-year old children's face memory). Thus, any processing advantage that may have resulted from the presentation of smiling White faces (Turati et al., 2011) should not arise when faces look away. The following experiment

therefore tested the hypothesis that infants' own-race preference reflects a threat response by examining looking times toward averted gaze Black and White faces.

Method

Participants

Sixteen White, full-term, 3-month-olds participated in the current study (8 males). The mean age of participants was 3 months and 17 days (range = 3 months 4 days to 3 months 28 days). One additional infant was tested but excluded from the final analysis due to significant interference by a sibling who was present in the home at the time of testing.

Parents' responses on the race and gender exposure questionnaire indicated that all babies had a White female caretaker. Three infants had regular exposure to non-White individuals, among them only one had contact with an African-American female.

Stimuli

The same sixteen face pairings and presentation orders generated for Experiment 1 of Chapter I were used in the current experiment, thus there were 16 unique presentations (8 presentations per pair set consisting of 4 male and 4 female pairs). The eye gaze direction of each face was digitally manipulated using the Adobe Photoshop CS2 software such that the individuals in every pair of faces seemed as though they were directing their gaze away from each other. Faces were still frontally oriented and displayed a neutral facial expression (see figure 3.1). As in Chapter I the photographs measured 9x10.5 cm, and were placed 6 cm apart against a light grey background. Each participant was randomly assigned to a different presentation, while making sure that the same number of boys and girls view each set of pairs.

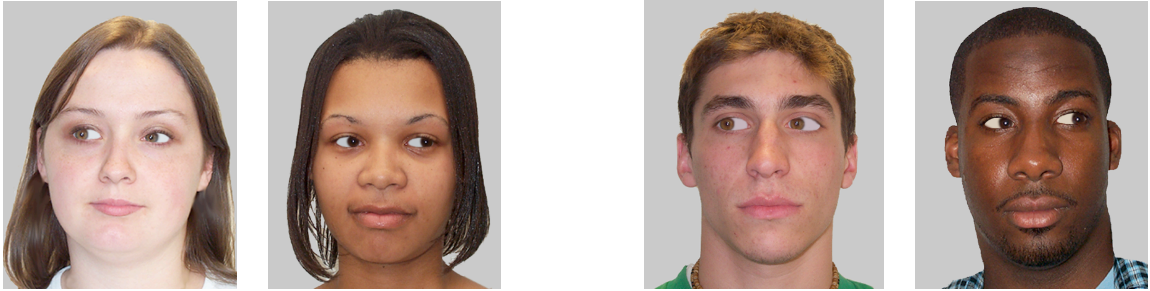


Figure 3.1 Examples of averted-gaze face stimuli

Procedure

The current study followed the same procedure carried out in Chapters I and II.

Results

An initial analysis showed no main effect of Pair Set ($F(1,12)=.125, p=.73$) or Subject Gender ($F(1,12)=.465, p=.508$) and no interactions between these variables and any within-subject factors (all $ps>.15$), so they were excluded from subsequent analyses. Average looking times (in seconds) were subjected to a repeated-measures ANOVA with Race (Black/White) and Gender of Pair (male/female) as within-subject variables. No significant main effects or interactions were found (all $ps>.13$). As in previous studies however, follow-up analyses by pair gender revealed a White preference for the male pairs ($t(15)=-2.687, p=.017$), but not for the female pairs ($t(15)=.312, p=.76$). On average, infants looked 4.02 seconds ($SD=1.71$) at the White male faces, compared to 2.82 seconds ($SD=1.19$) at the Black male faces. Looking times toward the female Black and White faces were again highly similar (3.60s ($SD=2.02$) and 3.38s ($SD=1.61$) respectively). See figure 3.2.

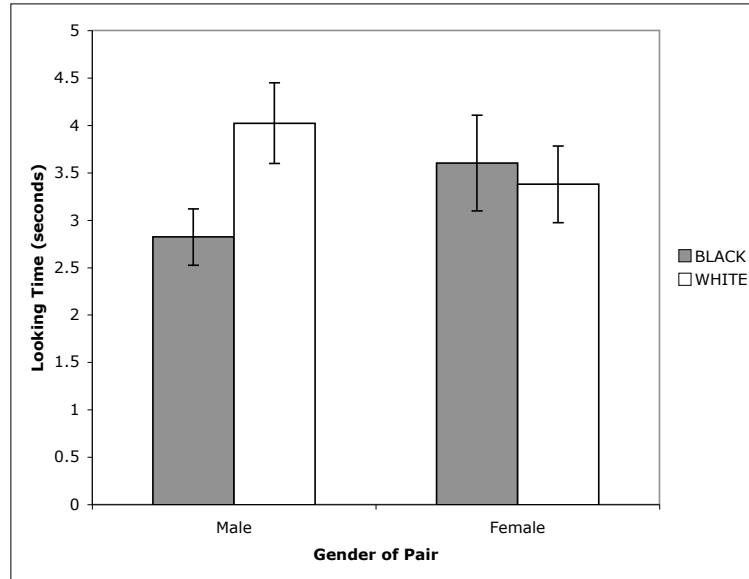


Figure 3.2 Mean looking times to the Black and White averted-gaze faces as a function of pair gender.

The effect of eye gaze was additionally assessed in relation to Experiment 1 of Chapter I, which used the exact same face pairs as the current study only displaying a direct gaze. An ANOVA with Gaze Direction (Averted/Direct) as a between-subjects factor, and Race (Black/White) and Gender of Pair (male/female) as within subject variables yielded a significant effect of Race ($F(1,30)=5.431, p=.027$) and a significant Race x Gender of Pair interaction ($F(1,30)=7.994, p=.008$) that did not interact with Gaze Direction ($F(1,30)=.015, p=.905$). No other main effect or interactions approached significance (all $p>.17$). Since no differences emerged based on gaze direction, the data across the two experiments were combined ($n=32$) and a trial-by-trial analysis of the male pairs was performed. A repeated measures ANOVA on raw looking times (in seconds) with Trial (4) and Race (Black/White) as within-subject factors yielded a significant effect of Trial ($F(3,93)=4.124, p=.009$), a significant effect of Race ($F(1,31)=17.284, p<.001$), and no Trial x Race interaction ($F(3,93)=9.970, p=.547$). The linear contrast of

Trial was significant ($F(1,31)=9.038$, $p=.005$), yet this trend did not interact with Race ($F(1,31)=.411$, $p=.526$).

Discussion

In manipulating gaze direction, the current experiment intended to test whether infants' own-race preference results from a threat response toward out-group males. Specifically, it was predicted that averted gaze faces would lessen the threat imposed by Black male faces, which would in turn result in a reduced own-race bias. This prediction was not confirmed by the data as a significant visual preference toward White faces was yet again observed for male pairs and not female pairs, replicating the findings obtained when the same faces were shown with a direct gaze (Experiment 1 of Chapter I). Furthermore, the absence of a trial by race interaction even upon combining the findings of the male pairs across the two experiments strengthens the claim that the White male preference does not gradually emerge across trials as would have been predicted if the preference resulted from differences in infants' ability to detect the novelty of own- and other-race individuals.

At least two possible explanations arise for the observed outcome of the current experiment. First, perhaps the averted gaze manipulation did not serve as a sufficient threat reduction cue for infants. Although ERP studies have indicated that attention to angry and fearful faces is modulated by gaze direction (Hoehl & Striano, 2008, 2010), these findings are difficult to compare to the current data due to myriad methodological differences (e.g. own-race face stimuli presented individually and for a very short duration). A related possibility is that babies are not as sensitive to gaze direction in out-group males. If so, the longer looking durations at own-race faces in earlier chapters

could have resulted from infants' clear perception that those faces are looking back at them. Even if gaze direction were a successful threat reduction cue in infancy, a failure to reliably discern Black males' direction of regard would tamper with any attempt to influence the own-race bias using averted gaze faces. Since there was no difference in overall looking times between Experiment 1 of Chapter I and the current experiment (i.e. no main effect of Study), it is impossible to tell from the data whether participants detected the change in gaze direction. Rather than assessing the effect of threat reduction on the own-race male preference, future research could evaluate whether increased threat levels (e.g. via an angry face manipulation) elicit racial preference for female faces.

A second explanation for the current findings is that infants' preferences do not result from a reaction to threatening out-group males, which may arise only later in development. In combination with Chapter II the current experiment provides a second instance in which attempting to attenuate threat did not influence the own-race preference. It has been proposed that the shift in attention allocation toward fearful faces at 7 months of age (displayed in a larger negativity of the Nc component) may result from maturation of brain systems implicated in processing of threat (Peltola et al., 2009). Thus, a clearer picture of the role of threat in racial preference might emerge by comparing Nc modulation to own- and other-race faces both at 3 months of age and later in infancy. An additional avenue for future research could include measurement of differences in startle eye blink or heart rate in response to faces of different races and genders, as these measures have been effective at identifying threat responses to facial expressions in infancy (Balaban, 1995; Peltola et al., 2011).

A number of authors have attributed the association between Black men and threat observed in adulthood to the acquisition of culture specific stereotypes (see Correll et al., 2002; Trawalter et al., 2008). Under this account one would expect a more protracted emergence of threat responses toward out-group males, perhaps fully visible only late in childhood. Utilizing previously described methodologies (e.g. DeLoache & LoBue, 2009; LoBue, 2009; LoBue & DeLoache, 2008) with racial stimuli across a wide range of ages could help uncover whether there is an increase in the race-threat association across development, as would be predicted by a cultural account.

Going back to the first point however, averted gaze faces are a somewhat unnatural stimulus since infants rarely encounter frontally oriented individuals looking sideways during face-to-face interactions. Unresponsive smiling faces are equally uncommon at 3 months of age. It has been proposed that dynamic bimodal presentations better enable young infants to extract emotional information from face stimuli (Flom & Bahrick, 2007; see Walker-Andrews, 1997 for a review), and previous studies examining the influence of exposure on face preference (Bar-Haim et al., 2006; Quinn et al., 2002) have always included highly social contact. The next chapter will therefore assess the effect of a positive social interaction with an own- and other-race male on infants' visual race bias.

Chapter IV

The present chapter aims at testing the possibility that babies' visual predilections are driven by a desire to engage with members of groups they have interacted with in the past. Under this account the greater preference for own-race faces arises due to infants' more substantial history of contact with similar own-race individuals. It follows that increasing contact with out-group members should attenuate bias, and indeed as the review below will illustrate, extensive research points to the positive effects of exposure on adults' and children's intergroup attitudes. The forthcoming experiment will assess whether a brief, friendly, social interaction with an own- and other-race male prior to the paired-preference test could similarly reduce the race bias in infancy.

Exposure Effects on Intergroup Bias in Adults

The notion that direct, positive, cross-group contact reduces prejudice, especially in the context of race relations, has been firmly established in the social psychological literature (e.g. Allport, 1954; Dovidio, Gaertner, & Kawakami, 2003; see Pettigrew & Tropp, 2006 for a meta-analysis). Allport (1954) had originally proposed certain "optimum" conditions for prejudice reduction, namely, that contact between groups involve equal status, common goals, intergroup cooperation, and should be supported by authority or custom. Research has shown that cross-group friendships (which encompass most of Allport's conditions; Pettigrew, 1997) indeed improve intergroup attitudes (Levin, van Laar, & Sidanius, 2003; Pettigrew, 1997; see meta analysis by Davies, Tropp, Aron, Pettigrew, & Wright, 2011), however, as highlighted by Dovidio, Eller, and Hewstone (2011), indirect contact situations such as knowledge of a close friendship between an in-group and out-group member (termed "extended contact"; Gómez, Tropp,

& Frenández, 2011; Turner, Hewstone, Voci, & Vonofakou, 2008; Wright, Aron, McLaughlin-Volpe, & Ropp, 1997), observing a positive intergroup interaction (“vicarious contact”; Mallett & Wilson, 2010; Mazziotta, Mummendey, & Wright, 2011), or merely mentally simulating such an interaction (“imagined contact”; Crisp & Turner 2009; Turner, Crisp, & Lambert, 2007a; Turner & West, 2012) lessen bias as well, suggesting that Allport’s conditions are not crucial. Pettigrew and Tropp’s (2006) meta-analysis, which was limited to studies involving face-to-face interaction, reached the same conclusion.

While most of the abovementioned studies utilized explicit self-report measures of prejudice, the available evidence points to similar influences of contact on implicit attitudes. For example, White college freshmen randomly assigned to room with a fellow African American student demonstrated increases in positive attitudes toward Blacks (as assessed by an evaluative priming procedure; Shook & Fazio, 2008), and White individuals with a close Black or Latino friend showed less pro-White bias on the IAT (Aberson, Shoemaker, & Tomolillo, 2004). Additionally, a significant reduction in anti-Black IAT scores was observed in students enrolled in a 14-week “prejudice and conflict” seminar, which was taught by an African American professor and included interactions with African American classmates. Control students (some of whom were enrolled in a lecture course with the same professor) did not show any decline in bias (Rudman, Ashmore, & Gary, 2001). Short-term encounters in laboratory settings also impact implicit bias. European American subjects who completed the IAT in the presence of a Black experimenter exhibited lower implicit racial bias than subjects assigned to the White experimenter condition (Lowery, Hardin, & Sinclair, 2001), and Non-Muslim

participants who spent only 2-minutes imagining a pleasant interaction with a Muslim individual showed less anti-Muslim bias on the IAT than participants in the control group instructed merely to think about Muslims (Turner & Crisp, 2010; study 2).

Entirely eliminating the interactive aspect of the manipulation still produces positive effects. Dasgupta and Greenwald (2001) demonstrated that presentation of admired Black (e.g. Martin Luther King) and disliked White males (e.g. Charles Manson) prior to the IAT, produces lower implicit racial bias compared to exposure to positive White and negative Black exemplars. This difference is still observed 24 hours after initial exposure. Similarly, watching a 2-minute positive video of a Black family diminished White participants' biased responses on the IAT, whereas no difference was observed in participants who viewed a negative, gang-related scene involving Black individuals (Wittenbrink, Judd, & Park, 2001; study 1).

Finally, in a highly influential paper, Zajonc (1968) introduced the phenomenon whereby an evaluation of a stimulus becomes more positive merely by repeated exposure (see meta-analysis by Bornstein, 1989). Zajonc's initial demonstration showed a correlation between exposure frequency and the rated positivity of Chinese-like ideograms or nonsense word meanings, but similar effects have been reported with faces of different races. In one study, White subjects were asked to rate the favorability of photographs of Black and White faces. Half the participants were then exposed to the photos 10 additional times, while a control group engaged in an unrelated task. Post-test favorability ratings significantly increased for faces of both races following exposure and no change was observed in the control group (Hamm, Baum, & Nikels, 1975). These results have since been extended in several ways (Zebrowitz et al., 2008). First, it showed

that the mere exposure effect generalized to novel exemplars of the exposed race (in this case Asian faces; exp. 1). Second, the generalization effect was also reported for subliminally presented Black faces (17ms; exp. 2). Interestingly, neither of these findings emerged for in-group (White) faces, which is in fact consistent with a meta-analysis showing larger exposure effect sizes for out-group compared to in-group stimuli (Bornstein, 1993).

The effect of repetition on attitude change is influenced by the setting in which faces are presented. Regardless of race, stimuli presented in a positive context, e.g. a doctor or a scientist, show stronger mere exposure effects than neutral stimuli, while negative contexts (e.g. individuals depicted as criminals) seem to elicit the smallest gains in positivity. It should be noted that repetition does not result in the enhancement of negative evaluations of stimuli presented in unfavorable settings (Perlman & Oskamp, 1971; Zajonc, Markus, & Wilson 1974).

Mere exposure effects complement the aforementioned intergroup contact findings and could be considered the smallest unit of studied exposure. Taken together, the literature indicates that in adulthood both passive viewing and intensive social interaction produce gains in positivity toward the out-group. Could similar effects be observed earlier in life? If so, what aspects of contact are most crucial for prejudice reduction (e.g. its length, its interactive nature)? What are the processes by which change is achieved and what can they teach us about the source of intergroup bias? The limited scope of a single experiment does not permit addressing all these issues, so the present chapter will focus on the fundamental question of whether increasing exposure to out-group members in infancy influences the visual race bias. I first turn to the evidence on

exposure effects in childhood, which might provide additional insight into the developmental course of the contact effect.

Exposure Effects on Intergroup Bias in Childhood

Historically, much empirical work on the effect of contact on children's intergroup relations in the U.S. was generated following the implementation of school desegregation (see Schofield, 1995 for a review). Recent examinations of the impact of racial diversity reveal less bias in heterogeneous schools, though the amount and depth of intergroup contact was not directly assessed in these studies (e.g. Jackson, Barth, Powell, & Lochman, 2006; McGlothlin & Killen, 2010; Rutland, Cameron, Bennett, & Ferrell, 2005a). Tropp and Prenovost (2008) separately analyzed direct contact studies with child and adolescent samples that were reported in the meta-analysis by Pettigrew and Tropp (2006). They showed that much like the findings of the larger sample, structured contact in accord with Allport's key conditions produces stronger prejudice reduction effects, but is not essential for the emergence of these outcomes. Indeed, positive outcomes of cross-group friendships have been consistently observed earlier in life. For example, children and adolescents in the U.S who reported higher levels of interracial interaction rated race-based exclusion as more wrongful compared to low-contact participants (Crystal, Killen, & Ruck, 2008). Likewise, in a sample of White elementary school English children, explicit and implicit attitudes toward South Asians were related to cross-group friendships outside of school (Turner, Hewstone, & Voci, 2007b; study 1). Looking at outcomes over a longer period of time, the number of direct friendships German 3rd and 4th graders had with Turkish peers at the beginning of the school year reliably predicted positive out-group evaluations at the end of the year, after accounting for their initial

evaluations. This effect was partially mediated by children's perceptions of the social norms surrounding cross-group friendships (Feddes et al., 2009).

Bias has also been shown to decline in children experiencing indirect contact. In a series of studies, Cameron and colleagues (e.g. Cameron, Rutland, & Brown, 2007; Cameron, Rutland, Brown, & Douch, 2006) performed 6-week school interventions in which 6-11-year-olds read stories portraying a close friendship between an in-group and out-group member. More positive out-group attitudes were observed following this manipulation, compared to control conditions (see also Liebkind & McAlister, 1999 for findings with middle schoolers). Additionally, like extended contact findings with adults, the number of self-reported in-group friends and family members who have cross-group friendships was associated with more positive explicit out-group attitudes among English middle school students (Turner et al., 2007b; studies 2 and 3). Imagined contact produced similar trends. For example, Italian 5th graders were asked during three 30-minute sessions to mentally simulate a pleasant interaction with an immigrant child, to provide a written description of this imagined contact, and to discuss it with a researcher. Results revealed less implicit in-group bias, as measured by the Child-IAT, in the experimental condition compared to a control group who did not take part in the imagination sessions. More positive explicit behavioral intentions toward the out-group were also observed after engaging in imagined contact, an effect that was mediated by participants' reported likelihood of self-disclosure to an immigrant child (Vezzali, Capozza, Giovannini, & Stathi, 2012; see also Cameron, Rutland, Turner, Holman-Nicolas, & Powell, 2011 for effects of imagined contact on children's attitudes toward disabled individuals).

Finally, evidence for the mere exposure effect in childhood is quite scant (Bornstein, 1989), though two studies have examined race preferences in this context. In one instance, White 9-11-year-olds were familiarized with photographs of 3 White and 3 Black boys over ten 10-second trials. At test, faces of novel children were intermixed with the familiar stimuli and results showed significantly greater liking of the previously observed Black boys compared to novel Black and familiar White faces (whose ratings decreased following exposure; Cantor, 1972). A follow-up study testing other exposure rates showed a linear increase in favorability of Black stimuli and a decline in ratings of White stimuli with increased repetition. In addition, photographs of Black children seen 10 or 20 times during the familiarization phase received significantly higher ratings than photographs of White children shown for the same durations. No differences between Black and White stimuli were observed when exposure frequency was lower (e.g. 0, 1 or 5 times during familiarization; Ball & Cantor, 1974). Thus, in childhood, as in adulthood (Bornstein, 1993; Zebrowitz et al., 2008), brief repeated exposure yields more positive effects for out-group compared to in-group faces, which could be related to the already high exposure frequency to faces of one's own racial group prior to testing.

In sum, the preceding studies employed methodologies akin to the ones used with adult participants, and showed remarkable developmental continuity in the effect of cross-race contact on bias reduction. These findings encourage exploration of the contact conditions that might produce similar effects even earlier in development, as such an undertaking could help determine how intergroup bias initially arises.

Effects of Exposure on Face Preference in Infancy

As noted in Chapter I, various exposure manipulations produce changes in infants' face *perception* (e.g. Pascalis et al., 2005; Scott & Monesson, 2009). Of particular relevance to the current experiment are findings showing that processing abilities can be altered even after perceptual narrowing has occurred. Accordingly, it has been demonstrated that after only 40 seconds of familiarization with a single monkey face 12-month-olds regain their ability to discriminate unfamiliar monkeys (Fair et al., in press). In addition, though infants are better able to tell own-race faces apart, 120 seconds of familiarization to still images of Asian faces enabled White 3-month-olds to discriminate Asian and Caucasian faces equally (Sangrigoli & de Schonen, 2004b). At 8-10 months of age, three weeks of daily viewing of a video depicting interactive Asian females improved discrimination of male and female Asian faces (Anzures et al., 2012), and Korean adults adopted by Caucasian families in childhood discriminated White faces more accurately than Asian faces (Sangrigoli, Pallier, Argenti, Ventureyra, & de Schonen, 2005; see also Kuefner, Macchi Cassia, Picozzi, & Bricolo, 2008 and Macchi Cassia, Picozzi, Kuefner, & Casati, 2009 for similar exposure effects with other-age faces).

Given these results, and the reviewed effects of contact on bias reduction later in life, the possibility that exposure could also change babies' face *preference*, should be considered. So far, 3 studies have provided some support for this idea. First, the aforementioned Ethiopian sample of 3-month-olds raised in a predominantly White environment (Bar-Haim et al., 2006) did not show an own-race looking time preference. Likewise, gender preferences in infancy are modulated by contact such that infants

preferentially attend to photographs that match the gender of their primary caregiver (Quinn et al., 2002). Lastly, evidence from non-human primates shows that following a deprivation period infant monkeys will display a preference toward the first type of face (human or monkey) they are exposed to immediately after the deprivation period. This preference is maintained even after a whole year of equal exposure to humans and monkeys (Sugita, 2008). While these examples are suggestive, they focus on the formation of an initial preference (Quinn et al., 2002), or on the prolongation of a face-sensitive period such that plasticity is maintained, and preference formation is delayed until the relevant face stimuli are selected (Bar-Haim et al., 2006; Sugita, 2008), yet they do not illustrate change in a preexisting preference.

Babies' exposure in the above studies was marked by a relatively lengthy, highly social interaction (Bar-Haim et al., 2006; Quinn et al., 2002). As mentioned before, infants' are exquisitely attuned to others' communicative cues. They prefer to look at photographs of people who previously spoke to them with direct eye gaze (Guellai & Streri, 2011) or infant directed speech (Schachner & Hannon, 2011) after only a very brief familiarization period, and they avert their gaze away from unusual interactions such as unresponsive or non-contingent partners (Nadel, Carchon, Kervella, Marcelli, & Réserbat-Plantey, 1999; Tronick et al., 1978). It is therefore conceivable that babies' race bias arises because early in life the vast majority of their face-to-face interactions are with own-race individuals (Rennels & Davis, 2008), and that change of preference could occur by enhancing social encounters with out-group members.

Unlike the outgroup male target hypothesis, the idea that increased looking durations toward familiar group members results from previous social contact does not

inherently predict the pair gender differences observed in earlier chapters. In fact, a preference for White females might even be expected due to the substantially greater time infants spend interacting with women compared to men at 3 months of age (Rennels & Davis, 2008). On the other hand, the abundance of female exposure (and the resulting strong female category) could perhaps aid generalization of positivity to females of all races (see discussion in Chapter I). The current study will be unable to provide a direct explanation for the pair gender differences, since focusing on the question of whether contact could change race bias in infancy necessitates using stimuli that reliably elicit bias, namely, male targets. Therefore, 3-month-olds' visual preference will be assessed following exposure to two men differing in race.

Method

Participants

Sixteen White, full term, 3-month-old infants (8 males) were recruited for participation in the current experiment (mean age = 3 months 12 days, range = 3 months 1 day to 3 months 29 days). Four additional infants (3 males) were tested but eliminated from the final sample due to parental interference (n=1), looking away during more than half of the familiarization clips (n=2), or fussing during test trials (n=1). Parents were given a questionnaire and asked to indicate their own race, their infant's race, and the race and gender of the 5 people their infant spends most time with in a typical week. Parents' listings showed that all babies had a White female primary caregiver, and none had any regular contact with African-American individuals. Language exposure data were also collected, and showed that all babies were predominantly exposed to English.

Stimuli

Prior to the paired preference task infants were shown a video of 2 men, one African-American and one Caucasian, talking in a friendly infant-directed manner. Actors appeared in alternation saying one sentence at a time. The same 5 sentences were spoken by both actors, and these were presented in a single mixed order. Each sentence was presented as a separate clip (12 seconds long), which began with the actor fading in and directing a smile at the infant, then the sentence was uttered, the actor resumed smiling and the clip faded out, moving on to the next actor until all 10 clips were shown. The entire video lasted 2 minutes. Clips were ordered such that one video began with the Black man speaking first, and on a second video the White man spoke first. The actors' face was centrally positioned on screen against a grey background and measured approximately 9x11.5 cm.

To ensure the actors' emotion was well matched, 3 examples of each sentence were originally filmed. Six females (3 African-American) judged these segments on how infant-friendly the actor seemed using a 1-7 scale. Based on these ratings clips were selected for inclusion in the final videos (average infant-friendliness ratings for the five selected sentences was 5.82 out of 7 for both actors).

The paired preference test consisted of presenting 8 pairs of still images of the two actors who appeared in the above-described video. These were the exact same face stimuli, face pairings, and eight presentations that were created for Experiment 2 of Chapter II of this dissertation. Each presentation was paired once with the video beginning with the Black actor and once with the video beginning with the White actor, producing 16 unique combinations. Two infants (one male, one female) viewed each of

the 8 presentations, and an equal number of boys and girls viewed the video with the Black actor first.

Procedure

The procedure was identical to the studies carried out in previous chapters with the only exception that prior to the paired-preference test infants were presented with the exposure video (on the same laptop computer). The video began as soon as infants directed their attention to the screen, and the coder monitored whether at any point the participant looked away from the presentation. In order to be included in the study babies had to fully view at least 3 of the 5 clips per actor. As noted above 2 infants from the original sample did not meet this criterion, and were excluded from the final analysis.

The paired-preference test commenced immediately after the video presentation, and followed the exact same procedure as previously reported studies.

Results

An initial analysis revealed no effect of subject gender ($F(1,12)=.393$, $p=.54$) or video order ($F(1,12)=.053$, $p=.82$) and no significant interactions involving these variables and Race (all $ps>.38$). A paired-samples t-test on average looking times was therefore performed, yielding a significant Race effect ($t(15)=-2.349$, $p=.033$). Infants looked longer at the White male face (3.97 seconds, $SD=1.29$) compared to the Black male face (3.25 seconds, $SD=1.09$).

Comparison of these findings to Experiment 2 of Chapter II provides a more direct test for the effectiveness of the exposure manipulation since the two studies were methodologically identical apart from the inclusion of an exposure phase in the present

version. For clarity, the experiment from Chapter II will be termed the “Baseline” condition, and the present study the “Exposure” condition.

Preliminary tests showed no effect of subject gender ($F(1,28)=3.659, p=.066$), and no interactions involving this variable (all $p>.13$), hence it was excluded from further analyses. An ANOVA with Study (Baseline/Exposure) as a between subjects variable, and Race (Black/White) as a within-subjects factor revealed a strong effect of race ($F(1,30)=16.598, p<.001$) that did not interact with Study ($F(1,30)=2.079, p=.16$). The between subjects effect of Study was not significant ($F(1,30)=1.483, p=.233$), see figure 4.1.

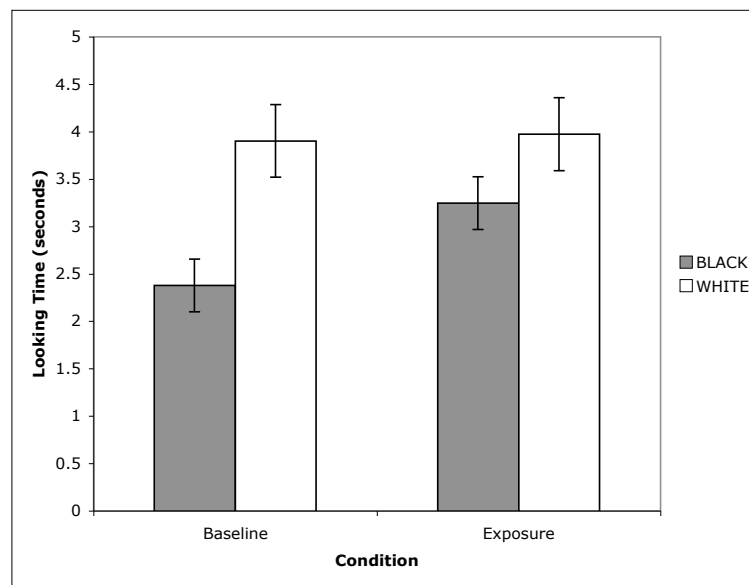


Figure 4.1 Mean looking times to the Black and White male pair as a function of condition (Baseline vs. Exposure).

The above graph brings to light a notable difference in looking toward the Black male face after exposure relative to baseline. Interestingly, despite the reported null interaction between the magnitude of the own-race preference and study type, an independent samples t-test confirmed that looking times at the Black face significantly increased from 2.38 seconds ($SD=1.13$) in the Baseline condition to 3.24 seconds

(SD=1.09) in the present study ($t(30)=-2.211, p=.035$). Looking times toward the White face were very similar in both conditions ($t(30)=-.130, p=.90$; Baseline: 3.90 seconds (SD=1.75), Exposure: 3.97 seconds (SD=1.29)). As a means of further exploring the change in looking toward the Black face across conditions, a trial-by-trial analysis was performed. An ANOVA with Study (Baseline/Exposure) as a between subjects variable, and Trial (8) as within-subjects factor showed a significant effect of Trial ($F(7,210)=4.052, p<.001$), and no Trial x Study interaction ($F(7,210)=.320, p=.944$). See figure 4.2.

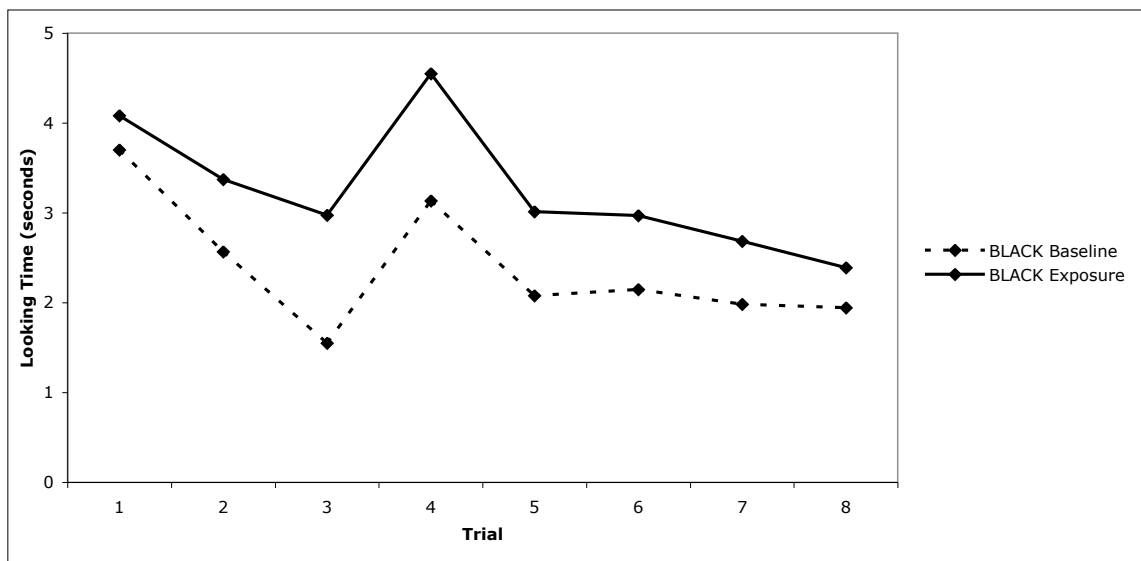


Figure 4.2 Mean trial-by-trial looking times to the Black male face as a function of condition (Baseline vs. Exposure).

Given that babies looked significantly longer at the White faces compared to the Black faces at Baseline, and considering that exposure led to increased looking only toward the Black faces, perhaps looking times at the White males following exposure reflect a ceiling effect. If so, the data for White faces should be more negatively skewed in the Exposure condition than at Baseline. The skewness of the White face Baseline data was .502 and after exposure -.190. Though the trend points to increased negativity, both

these values are within the accepted range of a normal distribution. Furthermore, the Shapiro-Wilk test of Normality was not significant in both cases (both $p > .24$). A similar shift in skewness was observed for the Black faces (Baseline = .203, Exposure = -.175), as well as non-significant Shapiro-Wilk tests (both $p > .38$). Overall, the evidence does not support the idea that the rise in looking toward the Black face is due to a ceiling effect on White faces, though it should be mentioned that a larger sample would have allowed for a stronger evaluation of these trends.

Discussion

Motivated by evidence that contact reduces intergroup bias in adulthood, and directs preference formation in infancy, the present experiment sought to examine whether infants' visual own-race preference would be affected by a positive exposure manipulation. Findings showed that participants' preference remained unchanged even though they encountered two equally friendly own- and other-race individuals. They looked significantly longer at the White male face at test, a pattern no different from a baseline group. Nevertheless, a significant increase in looking toward the Black male face was observed across conditions. This change did not come at the "expense" of looking durations toward the White face, which were equivalent in both groups.

The persistent own-race preference is particularly puzzling in light of several features of the present experiment that were designed to make infants' task of reducing their baseline bias easier. First, exposure immediately preceded the preference test, thus reducing any memory demands. Second, faces at test were identical to those presented during familiarization, eliminating infants' need to generalize their reduced bias (if achieved) to novel individuals. Third, the interaction was positive, dynamic, and directed

at the infant, providing optimal conditions for extracting relevant information (see Flom & Bahrick, 2007) and mimicking what would be a natural social exchange. Finally, infants heard both men speak their native language. While preferences for native language speakers have been reported with slightly older infants (Kinzler et al., 2007), it is not unreasonable to assume that language could have served as an additional cue to group membership for infants in the present study.

Perhaps then, biased responding occurs already during the exposure stage, giving an advantage to the own-race individual at test. In order to assess this possibility a recently conducted follow-up study examined overt social reactions toward these videos in a new group of sixteen 3-month-olds. Instead of seeing the men in alternation, all 5 clips of each actor were presented consecutively. In addition to the male pair used in the current experiment all participants were shown a Black and a White female, and clip presentation was blocked by gender. A coder rated infants' happiness, distress, engagement, and boredom when viewing the videos on a 1-5 scale, and counted the number of smiles participants produced. No significant differences emerged based on race or gender on any of the variables. These findings could either be due to low sensitivity of the coding measure, or could reflect a real lack of selectivity based on social category membership. If the latter interpretation is accurate, it once again raises questions regarding the relationship between looking time findings and more interactive responses in infancy.

It is important to add that while both men were unfamiliar to the infants, participants came into the experiment with ample exposure to interactive and friendly own-race males. This imbalance compared to their exposure to Black men might be

difficult to override with a 2-minute clip, even if both men elicit equivalent positive responses. The literature reviewed in the introduction of this chapter showed that reduction of negative attitudes has been achieved across a wide range of exposure durations in childhood and adulthood, yet similar effects on infants' preference have so far involved multiple interpersonal exchanges over a long period of time. Relative to such exposure, the current manipulation maintained the social nature of the interaction, but reduced its length substantially. Furthermore, since a video presentation was used, it lacked some of the contingent responding inherent to face-to-face interaction. Given that changes were observed in looking times toward the Black face even under these more limited conditions, it is possible that longer exposure to the current interaction, perhaps over multiple sessions, could eventually equate own- and other-race looking times. Future research could additionally test whether a live interaction is more advantageous, compared to video, as has been shown in early language learning situations (Kuhl, Tsao, & Liu, 2003). As a follow-up to previous studies of extended or vicarious contact, it would also be interesting to examine whether observation of a third-party interracial interaction (either friendly or unfriendly) could drive infants' out-group preferences in different directions.

Beyond possible limitations of the length of the current exposure and its specific features, recent findings suggest that inclusion of a positive White male may have dampened the manipulation's overall effect. A follow-up study to Dasgupta and Greenwald (2001) illustrated that juxtaposing negative and positive exemplars is crucial for decreasing the Pro-White IAT effect, as presentation of both admired Black and admired White individuals did not yield the same bias reduction (Joy-Gaba & Nosek,

2010). It has also been shown that subliminal repeated exposure to own-race faces increases negative out-group attitudes, compared to no exposure (Smith, Dijksterhuis, & Chaiken, 2008; though see Zebrowitz et al., 2008 for conflicting findings). Perhaps then, presenting participants with only one race during familiarization, or a positive interaction with a Black male alongside an unfriendly or angry White male prior to test would have led to stronger outcomes. The downside of both these manipulations however is their minimal resemblance to infants' real world encounters.

The present experiment was a first attempt at changing an existing preference in infancy using controlled exposure, yet it was not designed to determine *how* contact lessens bias. This issue is still the focus of much debate in the literature. For example, one explanation for the mere exposure effect has asserted that repetition improves stimulus processing efficiency and speed, named "processing fluency", which leads to increased positive affect (Reber, Winkielman, & Schwarz, 1998). Others have proposed that repetition enhances liking by gradually reducing a novel stimulus' association with potential negativity or harm (Bornstein, 1989, 1993; Zajonc, 2001), and a meta-analytic examination of contact studies has similarly identified intergroup anxiety as one key mediator of the link between contact and prejudice (in addition to empathy, Pettigrew & Tropp, 2008). In order to delve deeper into the mechanism question, other measures beyond looking times would need to be employed. Adult studies have already begun assuming this task. For instance, recent evidence has shown attenuation of neural activation in lateral orbitofrontal cortex (LOFC) to previously presented other-race faces relative to novel faces from that racial category, which in turn produced lower activation compared to faces from an unexposed race. Since the LOFC is known to respond to

negative stimuli, these findings have been taken as evidence for the role of familiarity in reducing apprehension (Zebrowitz & Zhang, 2012). Likewise, physiological measures provide compelling support for the mediating role of decreased anxiety in positive contact outcomes. In one study, individuals high in implicit bias demonstrated a significant reduction in cortisol reactivity across 3 structured friendship meetings with an out-group partner, and more self-initiated cross-group interactions after the conclusion of the study compared to participants assigned to a same-group partner (Page-Gould, Mendoza-Denton, & Tropp, 2008; See also the introduction of Chapter III of this dissertation). In support of the perceptual fluency account, facial EMG techniques have revealed that manipulating ease of processing (by extending presentation duration or repeated exposure) elicits greater activation of the zygomaticus (cheek) muscle, which is indicative of increased positive affect (Winkielman & Cacioppo, 2001; Harmon-Jones & Allen, 2001). Investigating the effect of contact on infants' responses using equivalent methodologies could be a fruitful avenue for future research, and could advance our understanding of the origin of infants' race bias.

As a final note it is worth looking again at the current findings in relation to the perceptual explanation developed in Chapter I. The data show a strong own-race bias even though the same two individuals were presented throughout the experiment, as in Chapter II. Furthermore, when comparing looking durations at the Black faces across conditions (Figure 4.2), rather than a more pronounced habituation curve following exposure (due to better recognition), there is an overall elevation in looking times. Thus, the idea that infants' own-race preference is driven by an enhanced ability to tell own-race faces apart again receives no support.

Conclusion

Given the wide range of evidence for racial bias in adulthood, the present dissertation aimed to better characterize the nature of the earliest form of race-based selectivity, manifested in infants' visual preferences, and to put to test two theories regarding its origin.

Chapter I tested a specific perceptual account of the underlying nature of infants' own-race preference. Given that babies' visual attention is affected by the magnitude of change they perceive from one stimulus to the next (Fantz, 1964), it was suggested that the race bias could arise from an own-race advantage in face recognition. Such an advantage would produce maintained interest in own-race faces due to the detection of their changing identity from trial to trial, in combination with a habituation response to indistinguishable other-race faces. Two main predictions arise from this account: first, since infants are most proficient at distinguishing own-race females, a stronger preference should arise when female pairs are shown. Second, the steady decline in looking toward other-race faces should produce a preference that increases in magnitude as the experiment progresses. White 3-month-olds were presented with pairs of male and female faces differing in race. Infants looked longer at the White faces only when male pairs were shown. Furthermore, the male-pair data revealed that infants' preference remains constant across trials rather than gradually arising over the course of the experiment.

Further testing the above interpretation, Chapter II presented White infants with a single own- and other-race pair across 8 trials. Faces changed slightly in pose and displayed a positive facial expression. If novelty detection is indeed the driving force behind infants' race preference, then presenting the same two individuals throughout the

experiment should lead to a decline in looking at both faces, and no overall bias. Results still showed a strong White preference, once again arising solely toward male faces. Thus, Chapters I and II provide evidence against the idea that infants' visual race preference is driven by differences in the ability to discriminate own- and other-race faces.

Why would the own-race bias be specifically directed at males? Under one hypothesis (Navarrete et al., 2010), greater negativity toward out-group males is rooted in a threat response that developed due to males' role as perpetrators of aggressive intergroup conflict throughout human evolution. If so, reducing the threat level in out-group faces should modulate infants' bias. Chapter II, provides an initial challenge to this account as smiling face stimuli, which are known to reduce threat and attenuate bias in experiments with adults (Richeson & Trawalter, 2008), did not change infants' responses. Chapter III set out to test the effectiveness of an additional threat reduction manipulation—averted gaze faces. Participants' looking times toward pairs of male and female own- and other-race faces displaying averted eye gaze revealed yet again a robust own-race preference only toward male pairs of faces. On the one hand, the data could mean that the threat hypothesis is false. On the other hand, the averted gaze cue may have been too subtle and achieved inadequate levels of threat reduction. Thus, based on these results it is impossible to conclusively determine whether racial bias originates in a threat response.

Finally, Chapter IV focused on a family of theories of the origin of racial prejudice that attribute an important role to exposure (Allport, 1954; Zajonc, 1968), and sought to apply them to infants' racial preferences. Participants were presented with a

short video of one Black and one White male addressing them in a friendly manner. Pairs of photographs of these same two individuals were presented immediately following exposure and looking times were measured. Babies still preferred the own-race face at test, but interestingly, attention to the Black face reliably increased in comparison to a no-exposure baseline group. Therefore, Chapter IV suggests that exposure plays some role in shaping (and changing) bias.

This research is novel in showing that the own-race visual preference at 3 months of age is gender dependent. Across six experiments, White infants persistently preferred White males over Black males, an effect which survived multiple manipulations and stimulus sets. When female faces were presented, no preference was observed. These findings suggest that gender is prioritized over race in guiding infants' early visual responses. Therefore, they add to a growing body of literature pointing to a hierarchical structure in social categories' influence on behavior early in life (e.g. Kinzler et al., 2009), and reveal the complex interplay between categories when those are combined.

How is this hierarchical structure determined? From an evolutionary perspective it has been proposed that preferential attention to accent over race in children's friendship choices (Kinzler et al., 2009), as well as the selective social responding to native language speakers but not own-race individuals in infancy (Kinzler & Spelke, 2011) may reflect the functional significance of language in detection of group boundaries. Infants are also familiarized with their native language in utero, before they encounter race (Kinzler & Spelke, 2011). The strength of gender relative to race can be explained along the same lines. Though gender would not have been a good cue for distinguishing group membership, our minds probably evolved to encode gender nonetheless due to its

important function within groups (Kurzban et al., 2001). Early in life exposure to women is typically higher than exposure to men (Rennels & Davis, 2008), and indeed 3-month-olds exhibit a visual preference for females (assuming they are primarily cared for by their mother; Quinn et al., 2002). Despite the similarities between language and gender, it is noteworthy that when two females are simultaneously presented racial differences do not affect infants' looking times (as shown in the present dissertation), while differences in spoken language continue to guide visual preference (Kinzler et al., 2007). This pattern suggests that language is prioritized over gender.

In order to gain a better understanding of the relationship between different social categories across development other interactions should be tested further. Eventually an elaborate organization might emerge allowing better prediction of behavior and targeted change based on the given circumstances. For example, though accent trumps race when faces are matched for gender (Kinzler et al., 2009), it is possible that gender would trump accent in childhood due to a strong preference for same-gender peers (e.g. Martin & Fabes, 2001).

Based on the findings of the present dissertation, it might be tempting to interpret infants' visual preference as social in nature. First, the perceptual processing explanation described in Chapter I was unable to account for the trends observed in the data. Second, the threat hypothesis received no support (at least when using smiling and averted-gaze face stimuli). Third, the results align with adult findings showing no biased responses toward other-race women under a variety of tasks (e.g. Ito & Urland, 2003; Plant et al., 2011). And finally, the manipulation that ultimately yielded some gains in visual

attention toward a Black male individual (relative to baseline) engaged participants in a social manner.

Although methods that previously elicited social responding based on language failed to do so when race was the relevant social category (Kinzler & Spelke, 2011), a reexamination of this account might be necessary. Generally, it is yet unclear whether these methods (i.e. toy-choice and toy-giving) are sensitive enough to pick up on social responses in domains that have been proven less robust than language. Furthermore, the fact that 10-month-olds do not exhibit social responding based on race does not entirely eliminate this possibility for the 3-month-olds. In a related manner, no data are currently available on older infants' looking time preferences based on race, thus directly linking responses on the two measures has not been possible.

More crucial to the current findings however, experiments on infants' social responding based on race were all conducted with female targets, yet female pairs in the present experiments do not elicit an own-race preference at 3 months of age. In fact, in Experiment 1 of Chapter II infants viewed still images of the same two women presented in the toy-choice experiment, and did not display a looking bias. Replicating Kinzler and Spelke's (2011) experiments with male social partners would allow for a more adequate assessment of their claims regarding the strength of race relative to language in eliciting social responses across development, as well as their speculation that the visual preference in infancy is solely perceptual in nature.

In addition, it would be interesting to correlate the magnitude of infants' looking time preferences for own-race individuals and native language speakers with their responding on explicit social measures later in childhood, such as language- and race-

based friendship choices. If only responses to language are truly social in infancy one might expect a significant correlation for language but not race. Furthermore, if infants' race biases were perceptually driven perhaps a correlation with later measures of face processing capabilities might emerge.

Comparing responses on different measures across ages provides one way of dealing with the interpretive constraints imposed by looking time data. As highlighted throughout the dissertation, converging results across measures within a single age group would also be highly informative. For example, trying to identify a mechanism such as threat might be aided by measuring heart rate, ERPs, or startle eyeblink, which elicit specific patterns indicative of threat.

A number of features of the population tested and their potential influence on the results and the theoretical questions of interest are worth mentioning. Since all participants were White and had a female primary caretaker testing infants from other cultures or those who experience other exposure conditions would be of essence for solidifying the observed trends. Own-race preferences have previously been documented in Asian and African infants (Bar-Haim et al., 2006; Kelly et al., 2007a) yet no interaction between race and gender was reported. In light of the current findings, it would be essential to perform separate analyses for male and female pairs of faces in order to assess the prediction that looking times toward own-race males drive the overall effect. Of even greater importance is testing participants brought up by a male primary caretaker. It has been shown that by 3 months of age babies raised by their fathers prefer male faces over female faces (Quinn et al., 2002) suggesting a role for exposure in preference formation. If the lack of a race preference toward female pairs in the present

dissertation results from ample exposure to females, the race by gender interaction might reverse with extensive exposure to males such that an own-race preference would arise for female pairs not male pairs. It is unclear how an evolutionary explanation would deal with such an outcome. On the one hand, the threat hypothesis (Navarrete et al., 2010) does not deny that exposure could attenuate race bias as evidenced by findings with adults showing no physiological threat responses in subjects who have had close relationships with other-race partners (Olsson et al., 2005; Navarrete et al., 2009). Therefore, the lack of a race preference in male faces due to exposure would not be entirely inconsistent with this account. In contrast, explaining a visual bias against out-group females would be much more difficult given that there should be no evolutionary basis for a threat response to begin with.

The findings of this dissertation unfortunately do not converge on an explanation for infants' own-race visual preference. It is impossible to rule out perceptual processing altogether since only one version of such an account was tested. It might be proposed for example that rather than relying on a response to novelty from trial to trial, infants' preference arises from differences in the processing effort they must exert in order to extract meaningful information from the face stimuli. Indeed, considerable differences between male and female faces have been reported in this regard (when testing infants brought up by a female primary caregiver with own-race faces). Babies are able to extract an abstract prototype from a series of female faces at a younger age than they can do so for males. Furthermore, studies involving male face stimuli typically produce longer looking durations overall than studies using female faces, a difference that is more pronounced with greater task complexity (Ramsey et al., 2005). The relative efficiency

and ease of processing of female faces might make any differences based on race inconsequential, while for male faces adding race might substantially increase processing demands, thus producing a preference for own-race faces. Increasing the processing difficulty of female face pairs differing in race, perhaps by degrading their quality, could provide a test for this account, as an own-race bias would be expected to emerge.

The most promising result reported here is the increase in looking duration toward the Black male faces in Chapter IV, as they point to the potential of stronger exposure manipulations. Though it is yet unclear what particular aspect of exposure is aiding bias reduction, I would like to end with a couple of follow-up ideas not yet fully discussed. First, given that language is a robust social group marker, with clear consequences for infant selectivity, it is possible that exposure to an other-race native language speaker paired with a foreign language speaking own-race individual would produce a change in preference. Such a finding would then encourage assessing the interplay between direct social communicative cues and language. Faced with an other-race adult-directed native language speaker along with an own-race infant-directed foreign language speaker, who would infants prefer? The role of positive social interaction in eliciting an in-group preference could further be evaluated by testing babies with weaker social experiences (such as infants born to depressed mothers or institutionalized infants) who might show different trends.

Finally, it would be important to assess whether bias reduction, once achieved, is maintained over time. Would infants display later race-based social responding, for example when tested on the toy choice measure? Hopefully, these questions will be addressed in future research.

References

- Aberson, C.L., Shoemaker, C., & Tomolillo, C. (2004). Implicit bias and contact: The role of interethnic friendships. *The Journal of Social Psychology, 144*(3), 335-347.
- About, F.E., Mendelson, M.J., & Purdy, K.T. (2003). Cross-race peer relations and friendship quality. *International Journal of Behavioral Development, 27*, 165-173.
- Ackerman, J.M., Shapiro, J.R., Neuberg, S.L., Kenrick, D.T., Becker, D.V., Griskevicius, V., Maner, J.K., & Schaller, M. (2006). They all look the same to me (unless they're angry): From out-group homogeneity to out-group heterogeneity. *Psychological Science, 17*, 836-840.
- Adams, R.B., Pauker, K., & Weisbuch, M. (2010). Looking the other way: The role of gaze direction in the cross-race memory effect. *Journal of Experimental Social Psychology, 46*, 478-481.
- Allport, G.W. (1954). *The nature of prejudice*. Reading, MA: Addison Wesley.
- Anzures, G., Quinn, P.C., Pascalis, O., Slater, A.M., & Lee, K. (2010). Categorization, categorical perception, and asymmetry in infants' representation of face race. *Developmental Science, 13*(4), 553-564.
- Anzures, G., Wheeler, A., Quinn, P.C., Pascalis, O., Slater, A.M., Heron-Delaney, M., Tanaka, J.W., & Lee, K. (2012). Brief daily exposure to Asian females reverses perceptual narrowing for Asian faces in Caucasian infants. *Journal of Experimental Child Psychology, 112*, 484-495.
- Aslin, R.N. (2007). What's in a look? *Developmental Science, 10*(1), 48-53.
- Bakeman, R., & Adamson, L.B. (1984). Coordinating attention to people and objects in mother-infant and peer-infant interaction. *Child Development, 55*, 1278-1289.
- Balaban, M.T. (1995). Affective influences on startle in five-month-old infants: Reactions to facial expressions of emotion. *Child Development, 66*, 28-36.
- Ball, P.M., & Cantor, G.N. (1974). White boys' ratings of pictures of Whites and Blacks as related to amount of familiarization. *Perceptual and Motor Skills, 39*, 883-890.
- Bar-Haim, Y., Ziv, T., Lamy, D. & Hodes, R.M. (2006). Nature and nurture in own-race face processing. *Psychological Science, 17*, 159-163.

- Baron, A.S., & Banaji M.R. (2006). The development of implicit attitudes: Evidence of race evaluations from ages 6 and 10 and adulthood. *Psychological Science, 17*(1), 53-58.
- Barrera, M.E., & Maurer, D. (1981). Recognition of mother's photographed face by the three-month-old infant. *Child Development, 52*, 714-716.
- Bartrip, J., Morton, J., & de Schonen, S. (2001). Responses to mother's face in 3-week to 5-month-old infants. *British Journal of Developmental Psychology, 19*, 219-232.
- Behl-Chadha, G. (1996). Basic-level and superordinate-like categorical representations in early infancy. *Cognition, 60*, 105-141.
- Bernstein, M.J., Young, S.G., & Hugenberg, K. (2007). The cross-category effect: Mere social categorization is sufficient to elicit an own-group bias in face recognition. *Psychological Science, 18*(8), 706-712.
- Bertrand, M., & Mullainathan, S. (2004). Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *The American Economic Review, 94*, 991-1013.
- Bigler, R., & Liben, L.S. (1993). A cognitive-developmental approach to racial stereotyping and reconstructive memory in Euro-American children. *Child Development, 64*, 1507-1518.
- Blascovich, J., Mendes, W.B., Hunter, S.B., Lickel, B., & Kowai-Bell, N. (2001). Perceiver threat in social interactions with stigmatized others. *Journal of Personality and Social Psychology, 80*, 253-267.
- Bomba, P.C., & Siqueland, E.R. (1983). The nature and structure of infant form categories. *Journal of Experimental Child Psychology, 35*, 294-328.
- Bornstein, R.F. (1989). Exposure and affect: Overview and meta-analysis of research, 1968-1987. *Psychological Bulletin, 106*(2), 265-289.
- Bornstein, R.F. (1993). Mere exposure effects with outgroup stimuli. In D.M. Mackie & D.L. Hamilton (Eds.), *Affect, Cognition, and Stereotyping: Interactive Processes in Group Perception* (pp. 195-211). San Diego, CA: Academic Press.
- Bornstein, M.H., & Arterberry, M.E. (2003). Recognition, discrimination and categorization of smiling by 5-month-old infants. *Developmental Science, 6*(5), 585-599.
- Boroditsky, L. (2007). Comparison and the development of knowledge. *Cognition, 102*, 118-128.

- Brand, R.J., & Shallcross, W.L. (2008). Infants prefer motionese to adult-directed action. *Developmental Science, 11*(6), 853-861.
- Brazelton, T.B., Koslowski, B., & Main, M. (1974). The origins of reciprocity: The early mother-infant interaction. In M. Lewis & L.A. Rosenblum (Eds.), *The Effect of the Infant on Its Caregiver* (pp. 49-76). New York, NY: John Wiley & Sons.
- Bushnell, I.W.R. (2001). Mother's face recognition in newborn infants: Learning and memory. *Infant and Child Development, 10*, 67-74.
- Cameron, L., Rutland, A., & Brown, R. (2007). Promoting children's positive intergroup attitudes towards stigmatized groups: Extended contact and multiple classification skills training. *International Journal of Behavioral Development, 31*(5), 454-466.
- Cameron, L., Rutland, A., Brown, R., & Douch, R. (2006). Changing children's intergroup attitudes toward refugees: Testing different models of extended contact. *Child Development, 77*(5), 1208-1219.
- Cameron, L., Rutland, A., Turner, R., Holman-Nicolas, R., & Powell, C. (2011). 'Changing attitudes with a little imagination': Imagined contact effects on young children's intergroup bias. *Anales de Psicología, 27*(3), 708-717.
- Cantor, G.N. (1972). Effects of familiarization on children's ratings of pictures of Whites and Blacks. *Child Development, 43*, 1219-1229.
- Caron, R.F., & Caron, A.J. (1969). Degree of stimulus complexity and habituation of visual fixation in infants. *Psychonomic Science, 14*(2), 78-79.
- Chiroro, P., & Valentine, T. (1995). An investigation of the contact hypothesis of the own-race bias in face recognition. *The Quarterly Journal of Experimental Psychology, 48A*, 879-894.
- Civan, A., Teller, D.Y., & Palmer, J. (2005). Relations among spontaneous preferences, familiarized preferences, and novelty effects: Measurements with forced-choice techniques. *Infancy, 7*(2), 111-142.
- Cohen, L.B., Gelber, E.R., & Lazar, M.A. (1971). Infant habituation and generalization to differing degrees of stimulus novelty. *Journal of Experimental Child Psychology, 11*(3), 379-389.
- Cohen, L.B., & Strauss, M.S. (1979). Concept acquisition in the human infant. *Child Development, 50*, 419-424.
- Cooper, R.P., & Aslin, R.N. (1990). Preference for infant-directed speech in the first month after birth. *Child Development, 61*, 1584-1595.

- Corenblum, B. (2003). What children remember about ingroup and outgroup peers: Effects of stereotypes on children's processing of information about group members. *Journal of Experimental Child Psychology*, *86*, 32-66.
- Corneille, O., Hugenberg, K., & Potter, T. (2007). Applying the attractor field model to social cognition: Perceptual discrimination is facilitated, but memory is impaired for faces displaying evaluatively congruent expressions. *Journal of Personality and Social Psychology*, *93*, 335-352.
- Cornell, E.H. (1975). Infants' visual attention to pattern arrangement and orientation. *Child Development*, *46*, 229-232.
- Correll, J., Park, B., Judd, C.M., & Wittenbrink, B. (2002). The police officer's dilemma: Using ethnicity to disambiguate potentially threatening individuals. *Journal of Personality and Social Psychology*, *83*, 1314-1329.
- Correll, J., Urland, G.R., & Ito, T.A. (2006). Event-related potentials and the decision to shoot: The role of threat perception and cognitive control. *Journal of Experimental Social Psychology*, *42*, 120-128.
- Correll, J., Wittenbrink, B., Park, B., Judd, C.M., & Goyle, A. (2011). Dangerous enough: Moderating racial bias with contextual threat cues. *Journal of Experimental Social Psychology*, *47*, 184-189.
- Cosmides, L., Tooby, J., & Kurzban, R. (2003). Perceptions of race. *Trends in Cognitive Sciences*, *7*, 173-179.
- Crisp, R.J., & Turner, R.N. (2009). Can imagined interactions produce positive perceptions? Reducing prejudice through simulated social contact. *American Psychologist*, *64*(4), 231-240.
- Crockenberg, S.C., & Leerkes, E.M. (2004). Infant and maternal behaviors regulate infant reactivity to novelty at 6 months. *Developmental Psychology*, *40*(6), 1123-1132.
- Crystal, D.S., Killen, M., & Ruck, M. (2008). It is who you know that counts: Intergroup contact and judgments about race-based exclusion. *British Journal of Developmental Psychology*, *26*, 51-70.
- Cunningham, W.A., Johnson, M.K., Raye, C.L., Gatenby, J.C., Gore, J.C., & Banaji, M.R. (2004). Separable neural components in the processing of black and white faces. *Psychological Science*, *15*, 806-813.
- Dasgupta, N., & Greenwald, A.G. (2001). On the malleability of automatic attitudes: Combating automatic prejudice with images of admired and disliked individuals. *Journal of Personality and Social Psychology*, *81*(5), 800-814.

- Davies, K., Tropp, L.R., Aron, A., Pettigrew, T.F., & Wright, S.C. (2011). Cross-group friendships and intergroup attitudes: A meta-analytic review. *Personality and Social Psychology Review, 15*(4), 332-351.
- de Haan, M., Johnson, M.H., Maurer, D., & Perrett, D.I. (2001). Recognition of individual faces and average prototypes by 1- and 3-month-old infants. *Child Development, 16*(2), 659-678.
- de Rosnay, M., Cooper, P.J., Tsigaras, N., & Murray, L. (2006). Transmission of social anxiety from mother to infant: An experimental study using a social referencing paradigm. *Behaviour Research and Therapy, 44*, 1165-1175.
- DeLoache, J.S., & LoBue, V. (2009). The narrow fellow in the grass: Human infants associate snakes and fear. *Developmental Science, 12*, 210-207.
- Devine, P.G. (1989). Stereotypes and prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology, 56*, 5-18.
- Devine, P.G., Plant, E.A., Amodio, D.M., Harmon-Jones, E., & Vance, S.L. (2002). The regulation of explicit and implicit race bias: The role of motivations to respond without prejudice. *Journal of Personality and Social Psychology, 82*, 835-848.
- Donders, N.C., Correll, J., & Wittenbrink, B. (2008). Danger stereotypes predict racially biased attentional allocation. *Journal of Experimental Social Psychology, 44*, 1328-1333.
- Dovidio, J.F., Eller, A., & Hewstone, M. (2011). Improving intergroup relations through direct, extended and other forms of indirect contact. *Group Processes & Intergroup Relations, 14*(2), 147-160.
- Dovidio, J.F., & Gaertner, S.L. (1991). Changes in the expression and assessment of racial prejudice. In H.J. Knopke, R.J. Norrell, & R.W. Rogers (Eds.), *Opening Doors: Perspectives on Race Relations in Contemporary America* (pp. 119-148). Tuscaloosa, AL: University of Alabama Press.
- Dovidio, J.F., Gaertner, S.L., & Kawakami, K. (2003). Intergroup contact: The past, present and the future. *Group Processes & Intergroup Relations, 6*(1), 5-21.
- Duncan, B.L. (1976). Differential social perception and attribution of intergroup violence: Testing the lower limit of stereotyping of Blacks. *Journal of Personality and Social Psychology, 34*, 590-598.
- Dunham Y., & Banaji, M.R. (2008). *Invariance of intergroup attitudes across the lifespan*. Unpublished manuscript. Harvard University

- Dunham, Y., Baron, A.S., & Banaji, M.R. (2006). From American city to Japanese village: A cross-cultural investigation of implicit race attitudes. *Child Development, 77*, 1268-1281.
- Dunham, Y. & Degner, J. (2010). Origins of intergroup bias: Developmental and social cognitive research on intergroup attitudes (introduction to the special issue). *European Journal of Social Psychology, 40*, 563-568.
- Eberhardt, J.L., Davies, P.G., Purdie-Vaughns, V.J., & Johnson, S.L. (2006). Looking deathworthy: Perceived stereotypicality of Black defendants predicts capital-sentencing outcomes. *Psychological Science, 17*, 383-386.
- Eberhardt, J.L., Goff, P.A., Purdie, V.J., & Davies, P.G. (2004). Seeing black: Race, crime, and visual processing. *Journal of Personality and Social Psychology, 87*, 876-893.
- Eimas, P.D., Quinn, P.C., & Cowan, P. (1994). Development of exclusivity in perceptually based categories of young infants. *Journal of Experimental Child Psychology, 58*, 418-431.
- Elfenbein, H.A., & Ambady, N. (2002). On the universality and cultural specificity of emotion recognition: A meta-analysis. *Psychological Bulletin, 128*(2), 203-235.
- Elliott, E.S., Wills, E.J., & Goldstein, A. (1973). The effects of discrimination training on the recognition of White and Oriental faces. *Bulletin of the Psychonomic Society, 2*, 71-73.
- Fagan, J.F. (1970). Memory in the infant. *Journal of Experimental Child Psychology, 9*, 217-226.
- Fagan, J.F. (1976). Infants' recognition of invariant features of faces. *Child Development, 47*, 627-638.
- Fair, J., Flom, R., Jones, J., & Martin, J. (in press). Perceptual learning: 12-month-olds' discrimination of monkey faces. *Child Development*. DOI: 10.1111/j.1467-8624.2012.01814.x
- Fantz, R.L. (1964). Visual experience in infants: Decreased attention to familiar patterns relative to novel ones. *Science, 146*, 668-670.
- Farroni, T., Csibra, G., Simion, F., & Johnson, M.H. (2002). Eye contact detection in humans from birth. *Proceedings of the National Academy of Sciences, 99*(14), 9602-9605.
- Farroni, T., Johnson, M.H., & Csibra, G. (2004). Mechanisms of eye gaze perception during infancy. *Journal of Cognitive Neuroscience, 16*, 1320-1326.

- Farroni, T., Johnson, M.H., Menon, E., Zulian, L., Faraguna, D., & Csibra, G. (2005). Newborns' preference for face-relevant stimuli: Effects of contrast polarity. *Proceedings of the National Academy of Sciences*, *102*(47), 17245-17250.
- Farroni, T., Massaccesi, S., Menon, E., & Johnson, M.H. (2007a). Direct gaze modulates face recognition in young infants. *Cognition*, *102*, 396-404.
- Farroni, T., Massaccesi, S., Pividori, D., & Johnson, M.H. (2004). Gaze following in newborns. *Infancy*, *5*, 39-60.
- Farroni, T., Menon, E., & Johnson, M.H. (2006). Factors influencing newborns' preference for faces with eye contact. *Journal of Experimental Child Psychology*, *95*, 298-308.
- Farroni, T., Menon, E., Rigato, S., & Johnson, M.H. (2007b). The perception of facial expressions in newborns. *European Journal of Developmental Psychology*, *4*, 2-13.
- Feddes, A.R., Noack, P., & Rutland, A. (2009). Direct and extended friendship effects on minority and majority children's interethnic attitudes: A longitudinal study. *Child Development*, *80*(2), 377-390.
- Feinman, S. (1980). Infant response to race, size, proximity, and movement of strangers. *Infant Behavior and Development*, *3*, 187-204.
- Field, T.M. (1977). Effects of early separation, interactive deficits, and experimental manipulations on infant-mother face-to-face interaction. *Child Development*, *48*, 763-771.
- Field, T.M. (1981). Infant gaze aversion and heart rate during face-to-face interactions. *Infant Behavior and Development*, *4*, 307-315.
- Field, T.M., Cohen, D., Garcia, R., & Greenberg, R. (1984). Mother-stranger face discrimination by the newborn. *Infant Behavior and Development*, *7*, 19-25.
- Field, T.M., Woodson, R., Greenberg, R., & Cohen, D. (1982). Discrimination and imitation of facial expressions by neonates. *Science*, *218*, 179-181.
- Fiske, S.T. (1998). Stereotyping, prejudice, and discrimination. In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *The Handbook of Social Psychology: Volume II* (pp. 357-411). New York, NY: McGraw-Hill.
- Flom, R. & Bahrick, L.E. (2007). The development of infant discrimination of affect in multimodal and unimodal stimulation: The role of intersensory redundancy. *Developmental Psychology*, *43*, 238-252.

- Frazier, B.N., Gelman, S.A., Kaciroti, N., Russell, J.W., & Lumeng, J.C. (2012). I'll have what she's having: the impact of model characteristics on children's food choices. *Developmental Science, 15*(1), 87-98.
- Gómez, A., Tropp, L.R., & Frenández, S. (2011). When extended contact opens the door to future contact: Testing the effects of extended contact on attitudes and intergroup expectancies in majority and minority groups. *Group Processes & Intergroup Relations, 14*(2), 161-173.
- Greenwald, A.G., McGhee, D.E., & Schwartz, J.L.K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*, 1464-1480.
- Gross, C., & Schwarzer, G. (2010). Face recognition across varying poses in 7- and 9-month-old infants: The role of facial expression. *International Journal of Behavioral Development, 34*(5), 417-426.
- Guellai, B., & Streri, A. (2011). Cues for early social skills: Direct gaze modulates newborns' recognition of talking faces. *PLoS ONE, 6*(4), e18610.
- Hamlin, J.K., Wynn, K., & Bloom, P. (2007). Social evaluation by preverbal infants. *Nature, 450*, 557-560.
- Hamlin, J.K., Wynn, K., & Bloom, P. (2010). Three-month-olds show a negativity bias in their social evaluations. *Developmental Science, 13*(6), 923-929.
- Hamm, N.H., Baum, M.R., & Nikels, K.W. (1975). Effects of race and exposure on judgments of interpersonal favorability. *Journal of Experimental Social Psychology, 11*, 14-24.
- Hancock, K.J., & Rhodes, G. (2008). Contact, configural coding and the other-race effect in face recognition. *British Journal of Psychology, 99*, 45-56.
- Harman, C., Rothbart, M.K., & Posner, M.I. (1997). Distress and attention interactions in early infancy. *Motivation and Emotion, 21*(1), 27-43.
- Harmon-Jones, E., & Allen, J.J.B. (2001). The role of affect in the mere exposure effect: Evidence from psychophysiological and individual differences approaches. *Personality and Social Psychology Bulletin, 27*(7), 889-898.
- Haviland, J.M., & Lelwica, M. (1987). The induced affect response: 10-week-old infants' responses to three emotion expressions. *Developmental Psychology, 23*, 97-104.
- Hayden, A., Bhatt, R.S., Joseph, J.E., & Tanaka, J.W. (2007). The other-race effect in infancy: Evidence using a morphing technique. *Infancy, 12*, 95-104.

- Hayden, A., Bhatt, R.S., Zieber, N., & Kangas, A. (2009). Race-based perceptual asymmetries underlying face processing in infancy. *Psychonomic Bulletin & Review*, *16*(2), 270-275.
- Hayden, A., Bhatt, R.S., Zieber, N., & Kangas, A. (2010). *Emotion is a Fundamental Feature in Faces for Infants: Evidence of Salience and Perceptual Asymmetry at 9 Months*. Poster presented at the International Conference on Infant Studies, Baltimore, MD.
- He, Y., Johnson, M.K., Dovidio, J.F., & McCarthy, G. (2009). The relation between race-related implicit associations and scalp-recorded neural activity evoked by faces from different races. *Social Neuroscience*, *4*, 426-442.
- Helman, E., Mania, E.W., & Gaertner, S.L. (2010). Where the division lies: Common ingroup identity moderates the cross-race facial-recognition effect. *Journal of Experimental Social Psychology*, *46*, 445-448.
- Heron-Delaney, M., Anzures, G., Herbert, J.S., Quinn, P.C., Slater, A.M., Tanaka, J.W., Lee, K., & Pascalis, O. (2011). Perceptual training prevents the emergence of the other race effect during infancy. *PLoS ONE*, *6*(5), e19858.
- Hoehl, S., & Striano, T. (2008). Neural processing of eye gaze and threat-related emotional facial expressions in infancy. *Child Development*, *79*, 1752-1760.
- Hoehl, S., & Striano, T. (2010). The development of emotional face and eye gaze processing. *Developmental Science*, *13*(6), 813-825.
- Hood, B.M., Macrae, C.N., Cole-Davies, V., and Dias, M. (2003). Eye remember you: The effects of gaze direction on face recognition in children and adults. *Developmental Science*, *6*, 67-71.
- Hood, B.M., Willen, J.D., & Driver, J. (1998). Adult's eyes trigger shifts of visual attention in human infants. *Psychological Science*, *9*, 131-134.
- Hugenberg, K. (2005). Social categorization and the perception of facial affect: Target race moderates the response latency advantage for happy faces. *Emotion*, *5*, 267-276.
- Hugenberg, K., & Bodenhausen, G.V. (2004). Ambiguity in social categorization: The role of prejudice and facial affect in race categorization. *Psychological Science*, *15*, 342-345.
- Hugenberg, K., & Corneille, O. (2009). Holistic processing is tuned for in-group faces. *Cognitive Science*, *33*, 1173-1181.

- Hugenberg, K., Young, S.G., Bernstein, M.J., & Sacco, D.F. (2010). The categorization-individuation model: An integrative account of the other-race recognition deficit. *Psychological Review*, *117*(4), 1168-1187.
- Ito, T.A., & Urland, G.R. (2003). Race and gender on the brain: Electro cortical measures of attention to the race and gender of multiple categorizable individuals. *Journal of Personality and Social Psychology*, *85*, 616-626.
- Jackson, M.F., Barth, J.M., Powell, N., & Lochman, J.E. (2006). Classroom contextual effects of race on children's peer nominations. *Child Development*, *77*(5), 1325-1337.
- Joy-Gaba, J.A., & Nosek, B.A. (2010). The surprisingly limited malleability of implicit racial evaluations. *Social Psychology*, *41*(3), 137-146.
- Kagan, J. (2008). In defense of qualitative changes in development. *Child Development*, *79*(6), 1606-1624.
- Kahana-Kalman, R., & Walker-Andrews, A.S. (2001). The role of person familiarity in young infants' perception of emotional expressions. *Child Development*, *72*, 352-369.
- Kelly, D.J., Liu, S., Ge, L., Quinn, P.C., Slater, A.M., Lee K., Liu, Q., & Pascalis, O. (2007a). Cross-race preferences for same-race faces extend beyond the African versus Caucasian contrast in 3-month-old infants. *Infancy*, *11*, 87-95.
- Kelly, D.J., Liu, S., Lee, K., Quinn, P.C., Pascalis, O., Slater, A.M., & Ge, L. (2009). Development of the other-race effect during infancy: Evidence toward universality? *Journal of Experimental Child Psychology*, *104*, 105-114.
- Kelly, D.J., Quinn, P.C., Slater, A.M., Lee, K., Ge, L., & Pascalis, O. (2007b). The other-race effect develops during infancy. *Psychological Science*, *18*, 1084-1089.
- Kelly, D.J., Quinn, P.C., Slater, A.M., Lee, K., Gibson, A., Smith, M., Ge, L., & Pascalis, O. (2005). Three-month-olds, but not newborns, prefer own-race faces. *Developmental Science*, *8*, F31-F36.
- Kinzler, K.D., Corriveau, K.H., & Harris, P.L. (2011). Children's selective trust in native-accented speakers. *Developmental Science*, *14*, 106-111.
- Kinzler, K.D., Dupoux E., & Spelke, E.S. (2007). The native language of social cognition. *Proceedings of the National Academy of Sciences*, *104*, 12577-12580.
- Kinzler, K.D., Dupoux, E., & Spelke, E.S. (2012). 'Native' objects and collaborators: Infants' object choices and acts of giving reflect favor for native over foreign speakers. *Journal of Cognition & Developments*, *13*(1), 67-81.

- Kinzler, K.D., Shutts, K., & Correll, J. (2010). Priorities in Social Categories. *European Journal of Social Psychology, 40*, 581-592.
- Kinzler, K.D., Shutts, K., DeJesus, J., & Spelke, E.S. (2009). Accent trumps race in guiding children's social preferences. *Social Cognition, 27*, 623-634.
- Kinzler, K.D., & Spelke, E.S. (2011). Do infants show social preferences for people differing in race? *Cognition, 119*, 1-9.
- Kovack-Lesh, K.A., Horst, J.S., & Oakes, L.M. (2008). The cat is out of the bag: The joint influence of previous experience and looking behavior on infant categorization. *Infancy, 13*(4), 285-307.
- Kowalski, K., & Lo, Y.-F. (2001). The influence of perceptual features, ethnic labels, and sociocultural information on the development of ethnic/racial bias in young children. *Journal of Cross-Cultural Psychology, 32*, 444-455.
- Kuefner, D., Macchi Cassia, V., Picozzi, M., & Bricolo, E. (2008). Do all kids look alike? Evidence for an other-age effect in adults. *Journal of Experimental Psychology: Human Perception and Performance, 34*(4), 811-817.
- Kuhl, P.K., Tsao, F.-M., & Liu, H.-M. (2003). Foreign-language experience in infancy: Effects of short-term exposure and social interaction on phonetic learning. *Proceedings of the National Academy of Sciences, 100*(5), 9096-9101.
- Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences, 98*, 15387-15392.
- LaBarbera, J.D., Izard, C.E., Vietze, P., & Parisi, S.A. (1976). Four- and six-month-old infants' visual responses to joy, anger, and neutral expressions. *Child Development, 47*, 535-538.
- Langlois, J.H., Ritter, J.M., Roggman, L.A., & Vaughn, L.S. (1991). Facial diversity and infant preferences for attractive faces. *Developmental Psychology, 27*(1), 79-84.
- Leppänen, J.M., Moulson, M.C., Vogel-Farley, V.K., & Nelson, C.A. (2007). An ERP study of emotional face processing in the adult and infant brain. *Child Development, 78*, 232-245.
- Levin, D.T. (1996). Classifying faces by race: The structure of face categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*(6), 1364-1382.
- Levin, D.T. (2000). Race as a visual feature: Using visual search and perceptual discrimination tasks to understand face categories and the cross-race recognition deficit. *Journal of Experimental Psychology: General, 129*, 559-574.

- Levin, S., van Laar, C., & Sidanius, J. (2003). The effects of ingroup and outgroup friendships on ethnic attitudes in college: A longitudinal study. *Group Processes & Intergroup Relations*, 6(1), 76-92.
- Liebkind, K., & McAlister, A. (1999). Extended contact through peer modelling to promote tolerance in Finland. *European Journal of Social Psychology*, 29, 765-780.
- LoBue, V. (2009). More than just another face in the crowd: Superior detection of threatening facial expressions in children and adults. *Developmental Science*, 12, 305-313.
- LoBue, V., & DeLoache, J.S. (2008). Detecting the snake in the grass: Attention to fear-relevant stimuli by adults and young children. *Psychological Science*, 19, 284-289.
- LoBue, V., & DeLoache, J.S. (2010). Superior detection of threat-relevant stimuli in infancy. *Developmental Science*, 13, 221-228.
- Lowery, B.S., Hardin, C.D., & Sinclair, S. (2001). Social influence effects on automatic racial prejudice. *Journal of Personality and Social Psychology*, 81(5), 842-855.
- Macchi Cassia, V., Picozzi, M., Kuefner, D., & Casati, M. (2009). Why mix-ups don't happen in the nursery: Evidence for an experience-based interpretation of the other-age effect. *The Quarterly Journal of Experimental Psychology*, 62(6), 1099-1107.
- MacLin, O.H., & Malpass, R.S. (2001). Racial categorization of faces: The ambiguous race face effect. *Psychology, Public Policy, and Law*, 7(1), 98-118.
- Mallan, K.M., Sax, J., & Lipp, O.V. (2009). Verbal instruction abolishes fear conditioned to racial out-group faces. *Journal of Experimental Social Psychology*, 45, 1303-1307.
- Mallett, R.K., & Wilson, T.D. (2010). Increasing positive intergroup contact. *Journal of Experimental Social Psychology*, 46, 382-387.
- Mangelsdorf, S.C., Shapiro, J.R., & Marzolf, D. (1995). Developmental and temperamental differences in emotion regulation in infancy. *Child Development*, 66, 1817-1828.
- Mareschal, D., & Quinn, P.C. (2001). Categorization in infancy. *Trends in Cognitive Sciences*, 5(10), 443-450.
- Martin, C.L., & Fabes, R.A. (2001). The stability and consequences of young children's same-sex peer interactions. *Developmental Psychology*, 37(3), 431-446.

- Mazziotta, A., Mummendey, A., & Wright, S.C. (2011). Vicarious intergroup contact effects: Applying social-cognitive theory to intergroup contact research. *Group Processes & Intergroup Relations*, *14*(2), 255-274.
- McCall, R.B., & Kennedy, C.B. (1980). Attention of 4-month infants to discrepancy and babyishness. *Journal of Experimental Child Psychology*, *29*, 189-201.
- McCall, R.B., Kennedy, C.B., & Appelbaum, M.I. (1977). Magnitude of discrepancy and the distribution of attention in infants. *Child Development*, *48*, 772-785.
- McGlothlin, H., & Killen, M. (2010). How social experience is related to children's intergroup attitudes. *European Journal of Social Psychology*, *40*, 625-634.
- McGugin, R.W., Tanaka, J.W., Lebrecht, S., Tarr, M.J., & Gauthier, I. (2011). Race-specific perceptual discrimination improvement following short individuation training with faces. *Cognitive Science*, *35*, 330-347.
- Meissner, C.A., & Brigham, J.C. (2001). Thirty years of investigating the own-race bias in memory for faces: A meta-analytic review. *Psychology, Public Policy, and Law*, *7*, 3-35.
- Mendelson, M.J., Haith, M.M., & Goldman-Rakic, P.S. (1982). Face scanning and responsiveness to social cues in infant Rhesus monkeys. *Developmental Psychology*, *18*(2), 222-228.
- Mendes, W.B., Blascovich, J., Lickel, B., & Hunter, S. (2002). Challenge and threat during social interactions with White and Black men. *Personality and Social Psychology Bulletin*, *28*, 939-952.
- Mendes, W.B., Gray, H.M., Mendoza-Denton, R., Major, B., & Epel, E.S. (2007). Why egalitarianism might be good for your health: Physiological thriving during stressful intergroup encounters. *Psychological Science*, *18*, 991-998.
- Mesman, J., van IJzendoorn, M.H., & Bakermans-Kranenburg, M.J. (2009). The many faces of the Still-Face Paradigm: A review and meta-analysis. *Developmental Review*, *29*, 120-162.
- Michel, C., Caldara, R., & Rossion, B. (2006). Same-race faces are perceived more holistically than other-race faces. *Visual Cognition*, *14*(1), 55-73.
- Michel, C., Corneille, O., & Rossion, B. (2010). Holistic face encoding is modulated by perceived face race: Evidence from perceptual adaptation. *Visual Cognition*, *18*(3), 434-455.

- Miller, S.L., Maner, J.K., & Becker, D.V. (2010). Self-protective biases in group categorization: Threat cues shape the psychological boundary between “us” and “them”. *Journal of Personality and Social Psychology, 99*, 62-77.
- Minear, M. & Park, D.C. (2004). A Lifespan Database of Adult Facial Stimuli. *Behavior Research Methods, Instruments, and Computers, 36*, 630-633.
- Montague, D.P.F., & Walker-Andrews, A.S. (2001). Peekaboo: A new look at infants’ perception of emotion expressions. *Developmental Psychology, 37*, 826-838.
- Montague, D.P.F., & Walker-Andrews, A.S. (2002). Mothers, fathers, and infants: The role of person familiarity and parental involvement in infants’ perception of emotion expressions. *Child Development, 73*, 1339-1352.
- Muentener, P., & Carey, S. (2010). Infants’ causal representations of state change events. *Cognitive Psychology, 61*, 63-86.
- Nadel, J., Carchon, I., Kervella, C., Marcelli, D., & Réserbat-Plantey, D. (1999). Expectancies for social contingency in 2-month-olds. *Developmental Science, 2*(2), 164-173.
- Navarrete, C.D., McDonald, M.M., Molina, L.E., & Sidanius, J. (2010). Prejudice at the nexus of race and gender: An outgroup male target hypothesis. *Journal of Personality and Social Psychology, 98*, 933-945.
- Navarrete, C.D., Olsson, A., Ho, A.K., Mendes, W.B., Thomsen, L., & Sidanius, J. (2009). Fear extinction to an out-group face: The role of target gender. *Psychological Science, 20*, 155-158.
- Nelson, C.A., & de Haan, M. (1996). Neural correlates of infants’ visual responsiveness to facial expressions of emotion. *Developmental Psychobiology, 29*, 577-595.
- Nelson, C.A., & Dolgin, K.G. (1985). The generalized discrimination of facial expressions by seven-month-old infants. *Child Development, 56*, 58-61.
- Newman, M.A., Liss, M.B., & Sherman, F. (1983). Ethnic awareness in children: Not a unitary Concept. *The Journal of Genetic Psychology, 143*, 103-112.
- Ng, W.-J., & Lindsay, R.C.L. (1994). Cross-race facial recognition: Failure of the contact hypothesis. *Journal of Cross-Cultural Psychology, 25*(2), 217-232.
- O’Toole, A., Peterson, J., & Deffenbacher, K.A. (1996). An ‘Other-Race Effect’ for Categorizing Faces by Sex. *Perception, 25*, 669-676.

- Oakes, L.M., Horst, J.S., Kovack-Lesh, K.A., & Perone, S. (2009). How infants learn categories. In A. Woodward & A. Needham (Eds.), *Learning and the Infant Mind* (pp. 144-171). New York, NY: Oxford University Press.
- Oakes, L.M., & Ribar, R.J. (2005). A comparison of infants' categorization in paired and successive presentation familiarization tasks. *Infancy*, 7(1), 85-98.
- Olsson, A., Ebert, J.P., Banaji, M.R., & Phelps, E.A. (2005). The role of social groups in the persistence of learned fear. *Science*, 309, 785-787.
- Page-Gould, E., Mendoza-Denton, R., & Tropp, L.R. (2008). With a little help from my cross-group friend: Reducing anxiety in intergroup contexts through cross-group friendship. *Journal of Personality and Social Psychology*, 95(5), 1080-1094.
- Pascalis, O., de Haan, M., & Nelson, C.A. (2002). Is face processing species-specific during the first year of life? *Science*, 296, 1321-1323.
- Pascalis, O., de Haan, M., Nelson, C.A., & de Schonen, S. (1998). Long-term recognition memory for faces assessed by visual paired comparison in 3- and 6-month-old infants. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24(1), 249-260.
- Pascalis, O., de Schonen, S., Morton, J., Deruelle, C., & Fabre-Grenet, M. (1995). Mother's face recognition by neonates: A replication and an extension. *Infant Behavior and Development*, 18, 79-85.
- Pascalis, O., Scott, L.S., Kelly, D.J., Shannon, R.W., Nicholson, E., Coleman, M., & Nelson, C.A. (2005). Plasticity of face processing in infancy. *Proceedings of the National Academy of Sciences*, 102(14), 5297-5300.
- Payne, B.K. (2001). Prejudice and perception: The role of automatic and controlled processes in misperceiving a weapon. *Journal of Personality and Social Psychology*, 81, 181-192.
- Peltola, M.J., Leppänen, J.M., & Hietanen, J.K. (2011). Enhanced cardiac and attentional responding to fearful faces in 7-month-old infants. *Psychophysiology*, 48, 1291-1298.
- Peltola, M.J., Leppänen, J.M., Mäki, S., & Hietanen, J.K. (2009). Emergence of enhanced attention to fearful faces between 5 and 7 months of age. *Social Cognitive and Affective Neuroscience*, 4, 134-142.
- Peltola, M.J., Leppänen, J.M., Palokangas, T., & Hietanen, J.K. (2008). Fearful faces modulate looking duration and attention disengagement in 7-month-old infants. *Developmental Science*, 11, 60-68.

- Perlman, D., & Oskamp, S. (1971). The effects of picture content and exposure frequency on evaluations of Negroes and Whites. *Journal of Experimental Social Psychology, 7*, 503-514.
- Pettigrew, T.F. (1997). Generalized intergroup contact effects on prejudice. *Personality and Social Psychology Bulletin, 23*(2), 173-185.
- Pettigrew, T.F., & Tropp, L.R. (2006). A meta-analytic test of intergroup contact theory. *Journal of Personality and Social Psychology, 90*(5), 751-783.
- Pettigrew, T.F., & Tropp, L.R. (2008). How does intergroup contact reduce prejudice? Meta-analytic tests of three mediators. *European Journal of Social Psychology, 38*, 922-934.
- Pezdek, K., Blandon-Gitlin, I., & Moore, C. (2003). Children's face recognition memory: More evidence for the cross-race effect. *Journal of Applied Psychology, 88*(4), 760-763.
- Phelps, E.A., O'Connor, K.J., Cunningham, W.A., Funayama, E.S., Gatenby, J.C., Gore, J.C., & Banaji, M.R. (2000). Performance on indirect measures of race evaluation predicts amygdala activation. *Journal of Cognitive Neuroscience, 12*, 729-738.
- Plant, E.A., Goplen, J., & Kunstman, J.W. (2011). Selective responses to threat: The roles of race and gender in decisions to shoot. *Personality and Social Psychology Bulletin, 37*, 1274-1281.
- Quinn, P.C., Slater, A.M., Brown, E., & Hayes, R.A. (2001). Developmental change in form categorization in early infancy. *British Journal of Developmental Psychology, 19*, 207-218.
- Quinn, P.C., Uttley, L., Lee, K., Gibson, A., Smith, M., Slater, A.M., & Pascalis, O. (2008). Infant Preference for Female Faces Occurs for Same- But Not Other-Race Faces. *Journal of Neuropsychology, 2*, 15-26.
- Quinn, P.C., Yahr, J., Kuhn, A., Slater, A.M., & Pascalis O. (2002). Representation of the Gender of Human Faces by Infants: A Preference for Female. *Perception, 31*, 1109-1121.
- Quintana, S.M. (1998). Children's developmental understanding of ethnicity and race. *Applied and Preventive Psychology, 7*, 27-45.
- Ramsey, J. L., Langlois, J. H., & Marti, C. N. (2005). Infant categorization of faces: Ladies first. *Developmental Review, 25*, 212-246.
- Ramsey-Rennels, J.L., & Langlois, J.H. (2006). Infants' differential processing of female and male faces. *Current Directions in Psychological Science, 15*(2), 59-62.

- Reardon, S.F., Farrell, C.R., Matthews, S.A., O'Sullivan, D., Bischoff, K., & Firebaugh, G. (2009). Race and space in the 1990s: Changes in the geographic scale of racial residential segregation, 1990-2000. *Social Science Research, 38*, 55-70.
- Reber, R., Winkielman, P., & Schwarz, N. (1998). Effects of perceptual fluency on affective judgments. *Psychological Science, 9*(1), 45-48.
- Rennels, J.L., & Davis, R.E. (2008). Facial Experience During the First Year. *Infant Behavior & Development, 31*, 665-678.
- Rhodes, G., Ewing, L., Hayward, W.G., Maurer, D., Mondloch, C.J., & Tanaka, J.W. (2009). Contact and other-race effects in configural and component processing of faces. *British Journal of Psychology, 100*, 717-728.
- Richeson, J.A., Baird, A.A., Gordon, H.L., Heartherton, T.F., Wyland, C.L., Trawalter, S., & Shelton, J.N. (2003). An fMRI investigation of the impact of interracial contact on executive function. *Nature Neuroscience, 6*, 1323-1328.
- Richeson, J.A., Todd, A.R., Trawalter, S. & Baird, A.A. (2008). Eye-gaze direction modulates race-related amygdala activity. *Group Processes & Intergroup Relations, 11*, 233-246.
- Richeson, J.A., & Trawalter, S. (2008). The threat of appearing prejudiced and race-based attentional biases. *Psychological Science, 19*, 98-102.
- Roder, B.J., Bushnell, E.W., & Sasseville, A.M. (2000). Infants' preferences for familiarity and novelty during the course of visual processing. *Infancy, 1*(4), 491-507.
- Rose, S.A., Gottfried, A.W., Melloy-Carminar, P., & Bridger, W.H. (1982). Familiarity and novelty preferences in infant recognition memory: Implications for information processing. *Developmental Psychology, 18*(5), 704-713.
- Rose, S.A., Jankowski, J.J., & Feldman, J.F. (2002). Speed of processing and face recognition at 7 and 12 months. *Infancy, 3*(4), 435-455.
- Rose, S., Katz, P.A., Birke, M., & Rossman, E. (1977). Visual following in newborns: Role of figure-ground contrast and configurational detail. *Perceptual and Motor Skills, 45*, 515-522.
- Rudman, L.A., Ashmore, R.D., & Gary, M.L. (2001). "Unlearning" automatic biases: The malleability of implicit prejudice and stereotypes. *Journal of Personality and Social Psychology, 81*(5), 856-868.

- Rutland, A., Cameron, L., Bennett, L., & Ferrell, J. (2005a). Interracial contact and racial constancy: A multi-site study of racial intergroup bias in 3-5 year old Anglo-British children. *Applied Developmental Psychology, 26*, 699-713.
- Rutland, A., Cameron, L., Milne, A., & McGeorge, P. (2005b). Social norms and self-presentation: Children's implicit and explicit intergroup attitudes. *Child Development, 76*, 451-466.
- Sagar, H.A., & Schofield, J.W. (1980). Racial and behavioral cues in Black and White children's perceptions of ambiguously aggressive acts. *Journal of Personality and Social Psychology, 39*, 590-598.
- Sai, F., & Bushnell, I.W.R. (1988). The perception of faces in different poses by 1-month-olds. *British Journal of Developmental Psychology, 6*, 35-41.
- Sangrigoli, S., & de Schonen, S. (2004a). Effect of visual experience on face processing: A developmental study of inversion and non-native effects. *Developmental Science, 7*(1), 74-87.
- Sangrigoli, S., & de Schonen, S. (2004b). Recognition of own-race and other-race faces by three-month-old infants. *Journal of Child Psychology and Psychiatry, 45*, 1219-1227.
- Sangrigoli, S., Pallier, C., Argenti, A.-M., Ventureyra, V.A.G., & de Schonen, S. (2005). Reversibility of the Other-Race Effect in Face Recognition During Childhood. *Psychological Science, 16*, 440-444.
- Saucier, D.A., Miller, C.T., & Doucet, N. (2005). Differences in helping whites and blacks: A meta analysis. *Personality and Social Psychology Review, 9*(1), 2-16.
- Schachner, A., & Hannon, E.E. (2011). Infant-directed speech drives social preferences in 5-month-old infants. *Developmental Psychology, 47*(1), 19-25.
- Schofield, J.W. (1995). Review of research on school desegregation's impact on elementary and secondary school students. In J.A Banks & C.A.M. Banks (Eds.), *Handbook of research on multicultural education* (pp. 597-616). New York, NY: Macmillan.
- Schug, M.G. (2009). The ontogeny of group bias and prosocial behavior. *Dissertation Abstracts International: Humanities and Social Sciences, 69*, 2768.
- Scott, L.S., & Monesson, A. (2009). The origin of biases in face perception. *Psychological Science, 20*(6), 676-680.
- Scott, L.S., & Monesson, A. (2010). Experience-dependent neural specialization during infancy. *Neuropsychologia, 48*, 1857-1861.

- Scott, L.S., Pascalis, O., & Nelson, C.A. (2007). A domain-general theory of the development of perceptual discrimination. *Current Directions in Psychological Science*, 16(4), 197-201.
- Senju, A., & Csibra, G. (2008). Gaze following in human infants depends on communicative signals. *Current Biology*, 18, 668-671.
- Shook, N.J., & Fazio, R.H. (2008). Interracial roommate relationships: An experimental field test of the contact hypothesis. *Psychological Science*, 19(7), 717-723.
- Shutts, K., Banaji, M.R., & Spelke, E.S. (2010). Social categories guide young children's preferences for novel objects. *Developmental Science*, 13, 599-610.
- Shutts, K., & Kinzler, K.D. (2007). An ambiguous-race illusion in children's face memory. *Psychological Science*, 18, 763-767.
- Shutts, K., Kinzler, K.D. McKee, C.B., & Spelke E.S. (2009). Social information guides infants' selection of foods. *Journal of Cognition and Development*, 10, 1-17.
- Sidanius, J., Levin, S., van Laar, C., & Sears, D.O. (2008). *The diversity challenge: Social identity and intergroup relations on the college campus*. New York, NY: Russell Sage Foundation.
- Smith, P.K., Dijksterhuis, A., & Chaiken, S. (2008). Subliminal exposure to faces and racial attitudes: Exposure to Whites makes Whites like Blacks less. *Journal of Experimental Social Psychology*, 44, 50-64.
- Sporer, S.L. (2001). Recognizing faces of other ethnic groups: An integration of theories. *Psychology, Public Policy, and Law*, 7(1), 36-97.
- Stahl, J., Wiese, H., & Schweinberger, S.R. (2008). Expertise and own-race bias in face processing: An event-related potential study. *Neuroreport*, 19(5), 583-587.
- Stanley, D.A., Sokol-Hessner, P., Banaji, M.R. & Phelps, E.A. (2011). Implicit race attitudes predict trustworthiness judgments and economic trust decisions. *Proceedings of the National Academy of Sciences*, 108(19), 7711-7715.
- Stern, D.N. (1974). Mother and infant at play: The dyadic interaction involving facial, vocal, and gaze behaviors. In M. Lewis & L.A. Rosenblum (Eds.), *The effect of the infant on its caregiver* (pp. 187-213). New York, NY: John Wiley & Sons.
- Stifter, C.A., & Moyer, D. (1991). The regulation of positive affect: Gaze aversion activity during mother-infant interaction. *Infant Behavior and Development*, 14, 111-123.

- Sugita, Y. (2008). Face perception in monkeys reared with no exposure to faces. *Proceedings of the National Academy of Sciences, 105*(1), 394-398.
- Tanaka, J.W., Kiefer, M., & Bukach, C.M. (2004). A holistic account of the own-race effect in face recognition: Evidence from a cross-cultural study. *Cognition, 93*, B1-B9.
- Tanaka, J.W., & Pierce, L.J. (2009). The neural plasticity of other-race face recognition. *Cognitive, Affective, & Behavioral Neuroscience, 9*(1), 122-131.
- Toda, S., & Fogel, A. (1993). Infant response to the still-face situation at 3 and 6 months. *Developmental Psychology, 29*(3), 532-538.
- Tottenham, N., Tanaka, J.W., Leon, A.C., McCarry, T., Nurse, M., Hare, T.A., Marcus, D.J., Westerlund A., Casey B.J., & Nelson, C. (2009). The NimStim set of Facial Expressions: Judgments from untrained research participants. *Psychiatry Research, 168*, 242-249.
- Trawalter, S., Todd, R.A., Baird, A.A., & Richeson, J.A. (2008). Attending to threat: Race-based patterns of selective attention. *Journal of Experimental Social Psychology, 44*, 1322-1327.
- Tronick, E., Als, H., Adamson, L., Wise, S., & Brazelton, T.B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child Psychiatry, 17*(1), 1-13.
- Tropp, L.R., & Prenovost, M.A. (2008). The role of intergroup contact in predicting children's interethnic attitudes: Evidence from meta-analytic and field studies. In S.R. Levy (Ed.), *Intergroup attitudes and relations in childhood through adulthood* (pp. 236-248). New York, NY: Oxford University Press.
- Turati, C., Bulf, H., & Simion, F. (2008). Newborns' face recognition over changes in viewpoint. *Cognition, 106*, 1300-1321.
- Turati, C., Montiroso, R., Brenna, V., Ferrara, V., & Borgatti, R. (2011). A smile enhances 3-month-olds' recognition of an individual face. *Infancy, 16*, 306-317.
- Turati, C., Sangrigoli, S., Ruel, J., & de Schonen, S. (2004). Evidence of the face inversion effect in 4-month-old infants. *Infancy, 6*(2), 275-297.
- Turner, R.N., & Crisp, R.J. (2010). Imagining intergroup contact reduces implicit prejudice. *British Journal of Social Psychology, 49*, 129-142.
- Turner, R.N., Crisp, R.J., & Lambert, E. (2007a). Imagining intergroup contact can improve intergroup attitudes. *Group Processes & Intergroup Relations, 10*(4), 427-441.

- Turner, R.N., Hewstone, M., & Voci, A. (2007b). Reducing explicit and implicit outgroup prejudice via direct and extended contact: The mediating role of self-disclosure and intergroup anxiety. *Journal of Personality and Social Psychology*, *93*(3), 369-388.
- Turner, R.N., Hewstone, M., Voci, A., & Vonofakou, C. (2008). A test of the extended intergroup contact hypothesis: The mediating role of intergroup anxiety, perceived ingroup and outgroup norms, and inclusion of the outgroup in the self. *Journal of Personality and Social Psychology*, *95*(4), 843-860.
- Turner, R.N., & West, K. (2012). Behavioural consequences of imagining intergroup contact with stigmatized outgroups. *Group Processes & Intergroup Relations*, *15*(2), 193-202.
- Vaish, A., Grossmann, T., & Woodward, A. (2008). Not all emotions are created equal: The negativity bias in social-emotional development. *Psychological Bulletin*, *134*(3), 383-403.
- Vezzali, L., Capozza, D., Giovannini, D., & Stathi, S. (2012). Improving implicit and explicit intergroup attitudes using imagined contact: An experimental intervention with elementary school children. *Group Processes & Intergroup Relations* *15*(2). 203-212.
- Vogel, M., Monesson, A., & Scott, L.S. (2012). Building biases in infancy: The influence of race on face and voice emotion matching. *Developmental Science*, *15*(3), 359-372.
- Walker-Andrews, A.S. (1997). Infants' perception of expressive behaviors: Differentiation of multimodal information. *Psychological Bulletin*, *121*, 437-456.
- Walton, G.E., Bower, N.J.A., & Bower, T.G.R. (1992). Recognition of familiar faces by newborns. *Infant Behavior and Development*, *15*, 265-269.
- Waters, A.M., & Lipp, O.V. (2008). Visual search for emotional faces in children. *Cognition and Emotion*, *22*, 1306-1326.
- Waters, E., Matas, L., & Sroufe, L.A. (1975). Infants' reactions to an approaching stranger: Description, validation, and functional significance of wariness. *Child Development*, *46*, 348-356.
- Welch, M.J. (1974). Infants' visual attention to varying degrees of novelty. *Child Development*, *45*, 344-350.
- Winkielman, P., & Cacioppo, J.T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation elicits positive affect. *Journal of Personality and Social Psychology*, *81*(6), 989-1000.

- Wittenbrink, B., Judd, C.M., & Park, B. (2001). Spontaneous prejudice in context: Variability in automatically activated attitudes. *Journal of Personality and Social Psychology, 81*(5), 815-827.
- Wright, S.C., Aron, A., McLaughlin-Volpe, T., & Ropp, S.A. (1997). The extended contact effect: Knowledge of cross-group friendships and prejudice. *Journal of Personality and Social Psychology, 73*(1), 73-90.
- Young, S.G., & Hugenberg, K. (2012). Individuation motivation and face experience can operate jointly to produce the own-race bias. *Social Psychological and Personality Science, 3*(1), 80-87.
- Young-Browne, G., Rosenfeld, H.M., & Horowitz, F.D. (1977). Infant discrimination of facial expressions. *Child Development, 48*, 555-562.
- Zajonc, R.B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9*(2), 1-27.
- Zajonc, R.B. (2001). Mere exposure: A gateway to the subliminal. *Current Directions in Psychological Science, 10*(6), 224-228.
- Zajonc, R.B., Markus, H., & Wilson, W.R. (1974). Exposure effects and associative learning. *Journal of Experimental Social Psychology, 10*, 248-263.
- Zebrowitz, L.A., White, B., & Wieneke, K. (2008). Mere exposure and racial prejudice: Exposure to other-race faces increases liking for strangers of that race. *Social Cognition, 26*(3), 259-275.
- Zebrowitz, L.A., & Zhang, Y. (2012). Neural evidence for reduced apprehensiveness of familiarized stimuli in a mere exposure paradigm. *Social Neuroscience, 7*(4), 347-358.
- Ziv, T., & Banaji, M.R. (2012). Representations of social groups in the early years of life. In S.T. Fiske & C.N. Macrae (Eds.), *The SAGE handbook of social cognition* (pp. 372-389). Thousand Oaks, CA: Sage.