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Infant Perceptions of Mixed-Race Faces: An Exploration of the Hypodescent Rule in 8.5 Month-Old Infants

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Abstract

Studies have shown that adults often categorize mixed-race individuals of White and non-White descent as members of the non-White racial group, an effect said to be reminiscent of the "hypodescent" or "one-drop rule." This effect has not yet been thoroughly studied in infants, although 9-month-old infants have been shown to be able to categorize mono-racial faces into different racial groups. In the present study, the perception of mixed-race White and Asian/Asian American faces was studied in sixteen 8.5-month-old infants. The infants were randomly assigned to two stimulus groups. The stimuli were the photographed faces of female college students who had self-identified as White, Asian/Asian American, or a 50-50 mix of those two races. Half the infants were habituated to White faces and half were habituated to Asian/Asian American faces, after which all infants were shown a mixed-race face. The results revealed that only infants in the White stimulus group recovered looking to the mixed-race face. This effect suggests that 8.5-month-old infants might see the mixed-race face as part of a different racial group than the White faces, and may see the mixed-race face as part of the same racial group as the Asian faces. Implications of this study on a larger scale are discussed. Further research including a larger sample size and participants of Asian/Asian American descent is recommended.

Infant Perception of Mixed-Race Faces: An exploration of the hypodescent rule in 8.5-month-old infants

The increasing number of interracial dating relationships and marriages, and offspring of these relationships, has made the study of how mixed-race individuals are perceived increasingly important and relevant. The distinctions between putative races like White, Black, Asian, and Latino are being blurred with the ever-growing frequency of people who self-identify as multiracial in the United States (Chen & Hamilton, 2011). Even with the newly available "check all that apply" option for race in the U.S. census (Brunsma, 2006), evidence suggests that multiracial people still encounter "monoracial categorizations" (Shih & Sanchez, 2005) even if they categorize themselves as multiracial. Mixed-race celebrities such as Halle Berry and Tiger Woods are examples of this phenomenon in today's society (Chen & Hamilton, 2011). Although Halle Berry comes from a White mother and Black father, she is credited as a talented "Black" actress. Much like Berry, Woods is recognized as one of today's most gifted Black golfers, even though his heritage is very much mixed (Chen & Hamilton, 2011). Additionally, a prominent figure in American culture, President Barack Obama, is acknowledged as our first Black president, despite his mixed Black and White descent (Peery & Bodenhausen, 2008).

Many scholars consider race to be socially constructed as there are no biological differences between racial groups (Shih, Bonam, Sanchez & Peck, 2007; Smedley & Smedley, 2005; Goodman, 2000). The consensus among many scholars is that racial distinctions are not scientifically meaningful, nor can they be reliably measured (Smedley & Smedley, 2005). Although racial categories have no connection to one's genetic makeup (Goodman, 2000), individuals continue to classify themselves and others into racial groups; thus, the perception of race as a social construction is still very real and relevant. Race plays an important role in society, economically,

politically, and socially, and while the view of race as a fixed category may perpetuate racism and stereotypes, the awareness of race as a social construction should do just the opposite (Shih et al., 2007). That being said, studies regarding the perception of race will likely have results that will vary with different historical time periods, due to the ever-changing characteristics of individuals who self-identify as belonging to a certain racial group (Smedley & Smedley, 2005), but these different perceptions, though changing, are important to study. For the purpose of the current study, we consider a person's race to be only what they consider their own race to be. When we refer to individuals in the study as White, mixed-race, or Asian/Asian American, this is their self-identified race (with the exception of the infants, whose racial identifications were determined by the self-identifications of their two parents).

Much research has been done on the positive and negative implications of being a mixed-race individual, but less research (although rapidly expanding) has been done on the perception and categorization of these individuals, that is, whether they are regarded as belonging to the racial group of the parent who identifies as belonging to society's dominant racial group or if they are regarded as belonging to the racial group of the parent who identifies as belonging to a minority racial group (Ho, Sidanius, Levin, & Banaji 2011; Shih et al., 2007). Most of the current literature examining these implications of being a mixed-race individual looks at how adults perceive the faces of mixed-race individuals; less of the current body of research examines how infants perceive faces with different racial backgrounds. The study of how people, and especially infants, perceive and categorize mixed-race individuals, is important and relevant to today's world, and can reveal how social rules and basic perceptual processes may affect and ultimately limit social perception.

Below, we will examine the existing literature concerning the perception of mixed-race individuals using both strictly visual stimuli (photographs of faces) and ancestral information. First,

we will look at the existing literature involving adult participants, and then we will examine the currently available literature involving infant participants. Finally, we will discuss the current study that assesses how infants perceive the faces of individuals self-identified as half-White and half-Asian.

Adults

The hypodescent rule. Chen and Hamilton (2011) argue that Americans are adept at making monoracial categorizations. The categorical distinction between races is well practiced—many people tend to be experts at placing individuals into monoracial categories based on their appearance (Chen & Hamilton, 2011). Recognizing a mixed-race identity, however, is less practiced and takes more consideration. In the past in the United States, mixed-race individuals have often been designated as one race for legal reasons based on the "hypodescent," or "one drop" rule, stating that if an individual has any bit of non-White ancestry, he/she should be labeled as the minority/non-White side (Ho et al., 2011). The "hypodescent rule" was historically the notion that one drop of 'Black blood' in an individual's ancestry was sufficient for classifying a person as Black. The hypodescent rule has its roots deep in racist history, yet even today, biracial children of one White parent and one non-White parent are often perceived and associated with their non-White half rather than their White half (Peery & Bodenhausen, 2008). Normally, the hypodescent rule was not based on physical appearance, but on family ancestry. Today, however, it has been shown that children commonly use the hypodescent rule when it comes to judging physical appearance, and many adults use it as well when judging the perceived racial membership of an individual (Chen & Hamilton, 2011). For example, research has shown that in a speed response task in which adult participants were able to look at a family tree and categorize a photo of the grandchild as White, mixed, or minority (Black or Asian), the hypodescent rule held true when the

grandchild was half-White and half-minority (Ho et al., 2011). To clarify, adult participants of many racial groups including White, African American, and Asian American, categorized half-White/Asian or half-White/Black targets as belonging to the minority group even when they were shown that the target's ancestry indicated a mixed heritage (Ho et al., 2011). Moreover, regardless of their own race, participants often classified the target as the minority race even if it was evident that the subject was only ¼ minority, exemplifying the hypodescent rule's effect even further (Ho et al., 2011).

Peery and Bodenhausen (2008) tested the hypothesis that when a subject is half-Black and half-White, adult participants would be more likely to view the non-White parent's features as more salient in the target's face, likely leading them to categorize the target as monoracially Black. In their research, they examined whether this effect held true. In this study, White, Hispanic, and Asian adults were exposed to various Black and White adult stimulus faces as well as to "ambiguous" stimulus faces that were digitally morphed from Black and White faces (50% Black, 50% White); the participants in this study were given some information about the stimulus subject's biological background before the test started (i.e., pictures of the subjects' parents or an explicit statement revealing the subjects' parents' racial groups). Once the participants read information about 16 out of 28 subjects, and memorized this information (as shown by a quick memorization test before the experiment started), they were told to rapidly judge the racial background of each of the 28 faces (Peery & Bodenhausen, 2008). As a result, even when primed with explicit information regarding the subject's mixed-race (Black *and* White) background, the participants still categorized most morphed/ambiguous faces as only Black (Peery & Bodenhausen, 2008). In conclusion, it is generally the non-White part of a mixed-race individual that is more defining and memorable to non-Black adult participants even when evidence of a mixed-race ancestry is presented. This result

may suggest that the rule of hypodescent may prevail when classifying an individual's race that is not one's own.

In-group/out-group bias: the overexclusion effect. Additional research suggests that the distinction between an in-group and an out-group may have a dramatic influence on social perception and categorization (Castano, Yzerbyt, Bourguignon, & Seron, 2002). Castano et al.'s (2002) research showed that people have a difficult time classifying people of ambiguous ethnic backgrounds as part of their "in-group" because of their desire to maintain a positive social reputation and the concomitant fear of letting the 'wrong' people into their well-bounded group. Consequently, when faced with a decision to categorize an individual as an in-group member (a northern Italian) or an out-group member (a southern Italian) based on his/her appearance, participants who highly identified with their northern Italian descent were more likely to exclude ambiguous faces (computer-generated morphed northern and southern Italian faces) from their in-group in order to prevent the possibility of letting in a "bad" member (Castano et al., 2002, p. 319). This finding exemplifies the "in-group overexclusion effect," in which people who are strongly affiliated with an in-group are more likely to have stronger criteria for acceptance into this in-group; consequently, these strongly affiliated people are more likely than less affiliated people to exclude most others (Castano et al., 2002). Ultimately, participants who rated themselves as highly attached to their in-group were more likely to categorize ambiguous faces as out-group participants and were more concerned about erroneously including an ambiguous face or southern Italian member in the in-group than they were about falsely excluding an ambiguous face, an effect revealed by their delayed response when deciding to include members in comparison to their quick response when rejecting members (Castano et al., 2002). Although the in-group/out-group bias is certainly an interesting and potentially important effect in adults, it is difficult to determine how strongly an

infant feels attached to his/her in-group; thus, this effect was not taken into account in the present study.

The other race effect and recognition. Adult humans rely heavily on the recognition of faces to interact with other human beings; they can also remember faces for long durations (Hayden, Bhatt, Joseph, & Tanaka, 2007). However, adults are better at remembering certain faces than others. The "other race effect," or "ORE," refers to the idea that "humans are better at recognizing faces from their own race than faces from another race" (Hayden et al., 2007, p. 96). Additionally, adults are better at discriminating among faces of their own race than among faces of another race and therefore exhibit an own-race advantage (Walker & Tanaka, 2003). In a study by Walker and Tanaka (2003), the ORE was studied using a continuum of digitally morphed White and East-Asian faces as stimuli. Morphed faces were created by combining different percentages of the faces of White and East-Asian individuals. The percentage contributions of the two races to each face varied by increments of ten. White and East-Asian participants were shown an Asian or White face (without morph), then shown either an identical face or a different morphed face and asked to judge whether it was physically identical to or different from the first face. This procedure was repeated for a total of 200 trials in the experiment. As a result, it was found that the ORE held true—Asian participants were more accurate in detecting differences between Asian faces and morphed faces than between White faces and morphed faces, and White participants were more accurate in detecting differences between White faces and morphed faces than between Asian faces and morphed faces (Walker & Tanaka, 2003). Thus, Asian participants were more likely to erroneously think the original White face and a novel morphed face were identical, and White participants were more likely to mistakenly think the original Asian face and a novel morphed face were identical.

One explanation for the ORE could be that people tend to associate with others of their own race, thus they have more experience with that race. This heightened familiarization could allow easier recognition (Hayden et al., 2007). If familiarization is the critical factor, then it is important to study when this level of experience is reached. To understand more about how much experience is necessary to become familiar with one's own race, Hayden et al. (2007) explored the existence of the ORE in 3.5-month-old White infants.

Infants

The other race effect. Hayden et al. (2007) sought to explore the existence of the ORE in 3.5-month-old White infants to argue that recognition of and familiarization with one's own race develops early in life. They used morphed faces as stimuli taken from Walker and Tanaka's (2003) research. Whereas the Walker and Tanaka (2003) study used ten morphed faces with differing percentages of Asian and White face contributions, the faces used in Hayden et al.'s (2007) study were only the ones morphed to reflect a 100% White face, a 70% White/30% Asian face, a 70% Asian/30% White face, and a 100% Asian face (Walker & Tanaka, 2003). Specifically, Hayden et al. (2007) sought to examine whether White infants could discriminate between the 100% White face and the 70% White/30% Asian face, and between the 100% Asian face and the 70% Asian/30% White face. They hypothesized that in order to show the ORE, White infants would be able to see a difference between the White face and the 70% White/30% Asian face, but would fail to see a difference between the Asian face and the 70% Asian/30% White face. Infants were habituated to either the 100% White face or the 100% Asian face, and tested with the corresponding mixed faces, during which the infants' looking times were recorded. It was expected that when habituated to the White face, the infants' looking times would increase when shown a morphed 70% White/ 30% Asian face. However, when habituated to the Asian face, the infants' looking

times would not increase when shown a morphed 70% Asian/30% White face, because they would not see this face as part of a novel category (i.e., they would see the "mixed" face as Asian). As anticipated, the 3.5-month-old White infants exhibited the ORE, shown by their ability to see a difference between the White face and the morphed 70% White/30% Asian face and their lack of ability to see a difference between the Asian face and the morphed 70% Asian/30% White face. This finding suggests that no more than 3.5 months of experience is needed to discriminate faces of one's own race more accurately than faces of another race (Hayden et al., 2007). In a similar study by Sangrigoli and de Schonen (2004), 3-month-old Caucasian infants were able to differentiate between two Caucasian faces but not two Asian faces, providing further evidence for this effect.

Other investigations of the ORE in infants have nonetheless suggested that amplified experience with own-race versus other-race faces may be the origin of the ORE (Rennels & Davis, 2008). Rennels and Davis (2008) found that infants mainly interact with their primary caregiver, which is often someone of the same race. These infants exhibit the ORE by the age of 3.5 months. Children in mixed-race environments, however, have been found to show little or no indication of the ORE, suggesting that it could be simply the primary caregivers surrounding the infant during the first year that influence this effect (de Heering, de Liedekerke, Deboni & Rossion, 2010).

A limitation in Hayden et al.'s study is that they only used Caucasian infants to test the existence of the ORE. Because in the first year of their lives infants spend most of their time with same-race individuals, and because the development of the ORE is clearly affected by that experience (Rennels & Davis, 2008), the Hayden et al. study could have been expanded with the use of Asian infants, because the stimuli included both White and Asian faces. Additionally, this study, as well as past studies (Walker & Tanaka, 2003), used only computer-generated morphed faces that may not accurately reflect the faces or races we actually encounter. The present study

does not examine the ORE, per se, but these findings and limitations have been taken into account to design the current study on infant perception of mixed faces; although we were unable to test any Asian babies to address the first of the above criticisms, the present study involved presenting infants with photographs of real—not morphed—faces.

The other race effect and perceptual narrowing. Results from a study by Kelly et al. (2007) indicate that the other race effect may emerge in more of a gradual process, beginning in 3-month-old infants but being fully present in 9-month-old infants (i.e., the perceptual narrowing hypothesis: "the decrease in processing abilities for other race faces"; Kelly et al., 2009, p. 106). It has been suggested that "perceptual narrowing" in infants may be the origin of the ORE seen in adults (Vogel, Monesson, & Scott, 2012). Contrary to Hayden et al.'s findings (2007), though with a very similar procedure, Kelly et al. (2007) concluded that the ORE was not present in 3-month-old Caucasian infants, but was fully present in 9-month-old Caucasian infants. In this study, the 3-, 6-, and 9-month-old infants were habituated to one face, which was of White, Chinese, Middle-Eastern, or African descent. This study used an infant-controlled method of habituation; the face would appear on the computer screen and the infants' looking times were recorded, and when the infants looked away for over 2 seconds, the image disappeared. The experimenter then presented the same image. This procedure was repeated until the infants were habituated to this face, which was defined as when the infants' looking times decreased to below 50% of the average looking during the first two trials. Once habituated, the infants were shown two images: one was a novel face of the same race, and the other was identical to the habituation trial face. The infants' looking times were recorded for each screen he/she fixated. Recognition of the habituation trial face was inferred by a preference for the novel face; if infants did not prefer to look at the novel face, it was inferred that they failed to recognize the habituation trial face. Results showed that 3-month-old

infants demonstrated novelty preferences in all four face conditions, while 6-month-old infants only demonstrated novelty preferences in the Chinese and Caucasian conditions, and 9-month-old infants only demonstrated a novelty preference in the Caucasian condition. These results are indicative of the diminishing ability with age to recognize differences between faces that are not of one's own race—evidence of the perceptual narrowing hypothesis.

A follow-up study by Kelly et al. (2009) was designed to explore whether the ORE results could be extended to another racial group-- Chinese. In this study, 3-, 6-, and 9-month-old Chinese infants were habituated to one African, White, or Chinese face, and the procedure used in the Kelly et al. (2007) study was replicated. The findings were consistent with the perceptual narrowing hypothesis that 3-month-old Chinese infants recognized (i.e., discriminated faces from *within* racial groups) all race faces equally well (African, Caucasian, and Chinese), whereas 6-month-old Chinese infants only recognized Caucasian and Chinese faces, and 9-month-old Chinese infants further narrowed their recognition to only Chinese faces (Kelly et al., 2009). These findings offer significant evidence that the ORE may universally develop in infants, at least among White American and Chinese infants. However, it is important to point out that although infants may be able to discriminate between faces of members of their own race, it is not until later in life (namely, 5 years old) that children express explicit social preferences for own-race play partners (Kinzler & Spelke, 2011).

The implications of Kelly et al.'s 2007 and 2009 studies call into question whether or not Hayden et al. (2007) were merely studying the ability to discriminate between unmorphed faces and mixed morphed faces. Because Kelly et al. studied recognition of faces within races and Hayden et al. studied discrimination between faces of mixed and non-mixed race, it might be fair to assume the authors were in fact studying different phenomena.

Own-race preferences. Much of the above literature indicates that infants are able to discriminate between faces of different races and are able to discriminate faces within their own race better than faces within other races. Closely related to these phenomena is the idea that at only 3 months of age, infants show a strong preference for looking at faces of their own race (Balas, Westerlund, Hung, & Nelson, 2011). In a study by Bar-Haim, Ziv, Lamy, and Hodes (2006), 3-month-old infants showed a preference for looking at faces of their own race, but this preference was shown to be influenced by the exposure the infants had to their own race compared to other races. In this study, participants were African infants living in an African environment, African infants living in a Caucasian environment, and Caucasian infants living in a Caucasian environment. Infants sat on their caretakers' laps, and a computer monitor in front of them showed side-by-side images of African and Caucasian faces. The researcher kept track of the infants' eye movements, and recorded how long the infants looked at each image. Results of the study showed that the African infants from an African environment preferred to look at African faces, the Caucasian infants from a Caucasian environment preferred to look at Caucasian faces, and the African infants from a Caucasian environment showed no preferences for either Caucasian or African faces at all (Bar-Haim et al., 2006). This means that 3-month-old infants tend to show a preference for faces with which they are most familiar, but when they are regularly exposed to more than one race, they do not seem to show a preference toward any particular race.

At 6 months, infants' preference for their own race is strong, as evidenced in a study done by Anzures, Quinn, Pascalis, Slater, and Lee (2010). In this study, 6-month-old White infants whose parents reported they had little to no experience with Asian individuals were familiarized with either White female faces or Asian female faces shown on a computer screen, and then were shown a test face from a novel racial group (i.e., a group they had not previously seen). The infants'

looking times were recorded to determine if they saw the test face as novel (indicated by an increase in looking times). Results showed no significant increase in looking at Asian faces after being familiarized with White faces, but a significant increase in looking at White faces after being familiarized with Asian faces. This increase in looking at White faces regardless of the race with which they were familiarized suggests that White 6-month-olds simply prefer to look at their own race, consistent with the findings from the Bar-Haim et al. (2006) study. Nine-month-olds did not show this preference. Specifically, after being habituated to White faces, 9-month-olds looked longer at the novel race faces (Asian), and, after being habituated to Asian faces, they looked longer at the novel race faces (White) (Anzures et al., 2010). These findings suggest that beyond having a preference for their own race faces, 6-month-old infants may have an ability to categorize faces by race, but their asymmetry in categorization may be driven by their preference for their own race, with which they have had most experience (Anzures et al., 2010). Thus, it is possible that a developmental change occurs between 6 and 9 months that overcomes 6-month-olds' perceptual preferences and allows 9-month-olds to demonstrate more separated categories of race.

Anzures et al. (2010) argue that 9-month-old White infants are indeed able to form discrete categories of Caucasian and Asian faces, as evidenced by their increase in looking at novel faces in both experimental groups. Moreover, the study by Anzures et al. (2010) suggests that the ability to show preference for one's own race face exemplifies the ability to differentiate between races. Thus, even at 3 months of age, infants are able to distinguish their own-race faces from other-race faces. However, it is not until 9-months that infants can truly categorize faces by race without these categories being confused by preference for their own race (Anzures et al., 2010).

The Anzures et al. (2010) study was done as a paired-comparison task, in which infants were able to choose between looking at the White or Asian face in each trial. The paired-

comparison task allowed the infants to exhibit own-race preference, but this type of study does not permit evaluation of the infants' responses to different-race faces, because the infants are given a choice between looking at faces of their own race or the other race. It could be useful to look at infants' responses to other-race faces when they do not have the option to look at their own race face, too.

Preference for female faces. Studies suggest that infants by the age of 3 months are able to categorize male and female faces (Ramsey, Langlois, & Marti, 2005). Even further, Ramsey et al. (2005) argue that infants are better at processing and categorizing female faces than male faces. Asymmetry in discrimination of different female faces from one another and of different male faces from one another has been found when looking at newborns; infants as young as 2 days old can discriminate between their mother's face and a female stranger's face. However, this effect does not hold true with fathers' faces even by 4 months of age (Ramsey et al., 2005). Additionally, it has been found that infants are better at processing female faces than they are at processing male faces (Ramsey-Rennels & Langlois, 2006). Furthermore, older infants (9-10 months old) have been found to be more accurate when categorizing female faces than when categorizing male faces (Ramsey-Rennels & Langlois, 2006).

Moreover, it has been found that race and gender interact to produce preferences for faces; these factors do not exert their influences independently (Quinn et al., 2008). A study by Quinn, Yahr, Kuhn, Slater, and Pascalis (2002) found that 3-month-olds have a preference for female faces over male faces, and sought to introduce the variable of race in a following study in 2008. In this study (Quinn et al., 2008), 3-month-old Caucasian infants were presented with photos of Asian or Caucasian males and females paired together, and their looking preferences were recorded. Three-month-old Caucasian infants demonstrated a preference for female Caucasian faces over male

Caucasian faces, but failed to demonstrate that same preference when the faces were Asian. This study shows that Caucasian 3-month-old infants prefer to look at females of their own race over males of their own race and, in general, over other-race faces; thus, race and gender interact to form this preference.

Categorization. Categorization is a fundamental activity for all human beings—being able to group objects, individuals, and events into different units is key to both cognitive and social development. Infants have been shown to be able to use categorization in the lab after only minimal exposure to stimuli (Ramsey, Langlois & Marti, 2005). Many studies (e.g., Eimas, 1994; Mandler, 1992; Quinn & Eimas, 1987; Younger & Gottlieb, 1988) have shown the infantile ability to categorize inanimate objects into distinct groups, but of more importance to the present study is the infantile ability to categorize faces into distinct groups. It has been shown that infants are, in fact, able to extend categorization to faces, both human and animal (Quinn & Eimas, 1996). In a study by Quinn and Eimas (1996), 3- to 4-month-old infants were able to categorize cat and dog faces into distinct groups using the habituation and forced choice method. Specifically, infants were either habituated to cat faces or dog faces (shown on a computer screen) and were then simultaneously shown a novel cat face and novel dog face in the test trial. Infants who were habituated to cat faces looked at the novel dog face for longer, and infants who were habituated to dog faces looked at the novel cat face for longer, even though both the dog and cat faces in the test trials were completely novel. These phenomena indicated that the infants saw these novel faces as different from both the faces they were habituated to and the other novel face; thus, the infants were able to both discriminate between the novel face and the habituation faces, and categorize these animals into two distinct groups (Quinn & Eimas, 1996).

As the Anzures et al. (2010) study suggested, 9-month-old infants seem to have the ability to categorize racial groups. In other words, 9-month-old infants show increased interest in novel faces of a different race, regardless of the race faces to which they were habituated. In the present study, we sought to explore this categorization ability. Thus, the present study used infants who were 8.5 months, plus or minus four weeks, an age group that has been shown to be able to categorize faces into groups (both in animal groups and racial groups), to explore how they categorize mixed-race individuals.

The Present Study

Very few current studies have focused on perception of mixed-race individuals, and even fewer have focused on infant perceptions. Furthermore, most of the existing studies regarding infants' perception of race, to our knowledge, have habituated the infants to only one photo; because race is seen as a category, a more appropriate habituation sequence might include multiple photos of individuals who all identify as part of the same racial group. With these limitations of the current literature in mind, the purpose of the study reported here was to explore infants' perception of mixed-race individuals while examining relatively unstudied factors, like the use of real mixed-race faces and a habituation sequence that included multiple photos, to determine the effect of these variables on perception of biracial faces. The introduction of real "mixed-race" faces (who identify as 50/50 White and Asian), rather than morphed photos representing the faces of "people" who are 70% Asian/White or 70% White/Asian (Hayden et al., 2007), allowed us to examine whether infants can differentiate between real life mixed-race and Asian/Asian American individuals or between real life mixed-race and Caucasian (a term that will be used synonymously with "White" for the purposes of this study) individuals. The use of a sequence of habituation trials using photos of multiple individuals who identified as part of the same racial group, rather than just one photo,

allowed us to explore whether infants are able to categorize real individuals with obvious physical differences into racial categories. We chose the racial groups of Asian/Asian American and White mainly because past research (Hayden et al., 2007; Kelly et al., 2007; Kelly et al., 2009; Anzures et al., 2010) has focused on these specific groups, but also because individuals who identify as Asian/Asian American or White tend to have more similar skin tones than those who identify as African American, another racial group that has been studied in past research (Bar-Haim et al., 2006). If the study were to be done with African American individuals as stimuli (or another racial group with a typically darker skin tone), it could be argued that any effect seen was due to the contrast in skin color (Bar-Haim et al., 2006). It is important to point out that because racial groups are socially constructed and made up by rapidly-changing social rather than biological factors, this study only examined how infants perceive individuals who have self-identified as being a member of a particular racial group.

Informed by the existing literature on infants' abilities to categorize faces by race, we studied the behaviors of 8.5-month-olds (plus or minus four weeks), as this seems to be the age by which spontaneous preference for own-race faces does not affect categorization, and the age at which categorization of racial groups has been shown to occur (Anzures et al., 2010). In addition, because previous research has indicated that infants prefer looking at female faces over looking at male faces, we maintained the gender of the faces constant and used only female faces as stimuli.

In the current study, infants were presented with photos of female college student faces on a computer monitor. Infants were habituated to either a random sequence of photos of self-identified White females or a random sequence of photos of self-identified Asian/Asian American females. We recorded the infants' looking times at each photo to explore their reactions to each face and racial group. When the infants looked away from any given photo for more than two seconds, the

photo would disappear and the next photo would appear. Once the infants were deemed habituated (i.e., when their average looking times at the photos decreased to below 50% of their initial average looking times at the first three photos), or they had seen all available White or Asian/Asian American faces (12 maximum), they were presented with a photo of a mixed-race female face, and then a photo of an individual of the racial group to which they had not been habituated.

Based on existing literature on the hypodescent rule in adults and existing studies regarding the perceptual narrowing effect and infants' abilities to categorize faces by race, we formed the following hypothesis. Because the hypodescent rule holds that mixed-race individuals are perceived as looking more like their non-White parent (Chen & Hamilton, 2011), our hypothesis was that the mixed-race face would be seen as (or treated as) Asian. Thus, when habituated to White faces, the infants would be able to discriminate between the White faces and the mixed-race face, but when habituated to Asian faces, the infants would not be able to discriminate between the Asian faces and the mixed-race face. This hypothesis also took the perceptual narrowing hypothesis into account, which states that 9-month-old infants are better at discriminating between faces of their own race than between faces of another race (Anzures et al., 2010). Because we were unable to recruit Asian participants and we studied infants from a variety of racial backgrounds, we could only hypothesize that the infants might be worse at discriminating between the mixed-race face and the Asian faces (because none of the infants were Asian themselves) than they would be at discriminating between the mixed-race face and the White faces (because most of the infants were, in fact, at least partially White themselves). Due to a lack of previous studies exploring the perceptions of non-White infants, we could not form a specific hypothesis regarding the other-race infants we studied but instead wanted to explore whether these infants had reactions similar to those of the White infants.

Method

Participants

The Claremont Infant Study Center recruits participants by sending out informational letters and business reply mail postcards to all of the parents of newborns within driving distance of the Claremont Colleges. The state of California sends the Infant Study Center information about the birth of these newborns every two months. Parents/caregivers who are interested in volunteering their infants send the postcard back. For this study, we called caregivers of 8.5-month-old infants (plus or minus four weeks) who expressed interest, and we read them a script about the research topic and what participating in the study would entail. Additionally, we posted a flyer in various lower grade schools, coffee shops, and churches to recruit participants. Those who saw the flyer and expressed interest called the Infant Study Center and were then informed about the study. If the caregivers were still interested after hearing about the study, they came to the Infant Study Center. They were asked to make sure their infants were well fed and well rested before joining us at the lab.

The participants in our study were 16 healthy, full term infants from a diverse set of socioeconomic backgrounds. Infants were an average of 8.79 months old with a range of 7.55 to 9.84 months. Eight of these infants had both parents identify as White, three infants had both parents identify as Hispanic, one infant had both parents identify as Black, and four infants were of mixed decent. There were 11 male infants and five female infants. Descriptive statistics of the infant participants can be found in Table 1.

Stimuli

The stimulus photos were face-shots of 28 college-aged female volunteers. Student email accounts on the college list-serv were used to recruit 20 volunteers using convenience sampling.

Each volunteer filled out a quick survey on how she identified (White/Caucasian, Multiracial, or Asian/Asian American). Volunteers were also asked how their parents identified. Photos of those who identified as White were used in the study only if both parents also self-identified as White. Photos of those who identified as Asian/Asian American were used in the study only if both parents also self-identified as Asian/Asian American. Photos of those who identified as Multiracial (a term that will be used synonymously with "mixed-race" for the purposes of this study) were used in the study only if one of the person's parents self-identified as White and one of the person's parents self-identified as Asian/Asian American. Those who identified as Asian/Asian American also indicated their country of origin. Although the country of origin could be an important factor to examine in subsequent studies, for this study, we did not analyze this variable. The photos of these individuals were taken from the same distance, during the same time of day for similar lighting, and against a white wall. All individuals had a neutral facial expression and hair was digitally cropped from each photo to make sure hair color would not be a potentially confounding variable. The ears of the individuals were also cropped with the hair. Individuals wore little to no makeup and no facial jewelry. The individuals' eyebrows were left in to make sure they still looked 'human;' we expected that the infants would focus on the individual's facial structure as a whole rather than the color of the eyebrows.

After collecting photos of 20 White female faces, eight Multiracial faces, and 20 Asian/Asian American faces, we administered an online survey to ask participants (a convenience sample of 20 college-aged female and male individuals of various racial backgrounds) to help identify the stimuli to use in the study. We told participants that all individuals had self-identified as White, Asian/Asian American, or Multiracial with one parent that self-identified as White and one parent that self-identified as Asian/Asian American. We then asked participants to "choose ten

individuals you think are most easily identifiable as White," out of the pool of 20 individuals who self-identified as White, then to "choose ten individuals you think are most easily identifiable as Asian/Asian American," out of the pool of 20 individuals who self-identified as Asian/Asian American, and finally to "choose four individuals who you think are most identifiable as Multiracial with one parent that identifies as White and one parent that identifies as Asian/Asian American" out of the pool of eight individuals who self-identified as Multiracial. From this survey, we were able to identify the 12 White faces, 12 Asian/Asian American faces, and four mixed-race faces that were most easily identifiable to adults as their respective racial categories. The chosen stimulus photos can be found in the Appendix.

Design

A computer program randomly assigned infants to either the Asian/Asian American habituation condition or to the White habituation condition; the computer program balanced the groups by the infants' sex. The infants' ages did not differ between groups $t(14) = 0.263$, $p = .79$.

Procedure

Once they arrived at the Claremont Infant Study Center, the caregivers filled out a consent form and a basic informational form about their pregnancy and the infant's birth. A research assistant was present to babysit siblings, if need be. Caregivers were able to ask any questions before being asked to sign the consent form. Once they agreed to participate in the study, we directed them to the testing room with their infant.

Each infant was positioned on the caregiver's lap facing a computer monitor. Everything around the infant was dark, so the infant was not distracted by anything and attended primarily to the monitor. The infant was seated approximately 1 meter from the computer monitor screen that was embedded in a black wall. This black wall contained one small hole from which the infants'

eye movements could be unobtrusively observed from the opposite side of the wall; this also allowed the researcher to remain blind to what the infant was seeing. Below the eye-hole, a video camera recorded the infants' behavior through another hole in the wall, in case a recording was needed for reference. We briefed the caregiver and asked him/her to keep the infant generally facing the computer monitor and to remain silent during the study. Additionally, we directed the caregiver to close his/her eyes during the study so as to not influence the infants' behavior. The caregiver was able to see the stimuli before or after the study, if requested.

Once the infant was situated, the researcher, now looking at the infant's eyes through the hole in the wall, pressed a button on a joystick to initiate an "attention getter" on the monitor, which was a beeping noise accompanied by a bright green screen. Once the infant looked at the monitor, the researcher pressed the toggle on the joystick to display an exemplar of either a White or Asian/Asian American face that was randomly selected by the computer program from the pool of 12 photos that made up the stimulus set. Half of the infants, balanced by gender, saw a random sequence of White faces first and the other half saw a random sequence of Asian/Asian American faces first. By operating the joystick, the researcher indicated if the infant was looking at the photo or not, which allowed the computer program to record how long (in milliseconds) the infant looked at this photo and at each subsequently seen photo. When the infant looked away from the photo, the researcher let go of the joystick; if the infant looked away for two consecutive seconds, the photo would disappear. If this never happened and instead the infant looked continuously at the photo, the photo would automatically disappear after 60 seconds, indicating that the infant looked at the photo for the maximum amount of time. When the photo disappeared, the researcher pressed a button to initiate the attention-getter again, and another face from the habituation sequence appeared as soon as the infant looked back at the monitor.

An infant-controlled habituation method was used (shown to be effective in many past infant studies; Colombo & Mitchell, 2009; Ferland & Mendelson, 1989). In this procedure, an infant's looking times affected how many photos he/she saw. Infants were deemed to have met our habituation criterion when their average looking times in a three-block-trial decreased to below 50% of their average looking times at the first three photos (Colombo & Mitchell, 2009). If an infant did not meet this criterion, the infant saw all 12 available habituation photos before he/she moved on to the test trial.

Once the infant was deemed habituated to either the White or Asian/Asian American faces, or had seen all 12 habituation photos, he/she was shown a test photo that was randomly selected from the mixed-race faces stimulus set. The amount of time the infant looked at the mixed-race face was recorded. Then, in a final trial, the infant saw a face from the stimulus set that was *not* seen during the habituation trials. The other-race face displayed in the final trial was used as a control, to make sure the infants were capable of looking-time recovery after being habituated (i.e., to make sure the infants were not asleep or completely inattentive), but was also used to explore whether infants could differentiate between racial groups as past research suggests. We then debriefed the caretakers and answered any questions.

Results

First, to examine whether the infants' looking times decreased during the habituation trials, a paired-samples *t*-test was run. As discussed earlier, the infants were able to control how many habituation photos they saw based on their interest. Some infants saw all 12 habituation photos, indicating that they may not have actually habituated to these faces; some infants saw as few as five habituation photos before moving on to the test trial. Infants saw an average of 9.81 photos before moving on to the test trial. Through this *t*-test, it was determined that infants looked significantly

longer at the first three habituation faces (M = 19.12, SD = 11.46) than the last three habituation faces (M = 9.42, SD = 5.33), $t(15) = 4.57$, $p = .00$, $d = 1.08$. From this analysis, it can be determined that most infants habituated during the habituation trials; however, there were four infants who did not meet our habituation criterion. These four infants were excluded from some of the subsequent analyses; even when these infants were excluded, the infants' ages did not differ by age, $t(10) = 0.177$, $p = .86$.

A paired-samples t-test was conducted to see if, after being habituated to either White or Asian faces, infants looked longer at the mixed-race face. The t-test compared the average durations of looking at the last three faces seen during the habituation trials to the average durations of looking at the mixed-race face. The results indicated that the mean looking time (in seconds) at the mixed-race photo (M = 7.81, SD = 5.2) did not differ from the mean looking time at the last three habituation photos (M= 9.40, SD = 5.3), $t(15) = 0.87$, $p = 0.39$, $d = 0.29$, 95% CI [-2.22 to 5.27]. This lack of recovery of attention to the mixed-race face may be further explained by the following test that looked at whether the infants' stimulus group had an effect on how long they looked at the mixed-race face.

In order to calculate whether the infants' stimulus groups had an effect on their looking times at the mixed-race face, a 2 (stimulus group: Asian vs. White habituation photos) x 2 (trial block: the last three habituation trials vs. the mixed-race face trial) mixed factorial ANOVA was conducted. The stimulus group was the between-subjects variable, and the trial block was the within-subjects variable. For this analysis, infants who did not habituate during the habituation trials were excluded (n = 4). Analyzing the data provided by the remaining 12 infants, we found no significant main effect of trial block, $F(1, 10) = 1.27$, $p = .286$, partial $\eta^2 = .113$, or habituation group, $F(1, 10) = 2.59$, $p = .14$, partial $\eta^2 = .206$, but there was a significant interaction between

trial block and group, $F(1, 10) = 6.86$, $p = .026$, partial $\eta^2 = .407$. In comparison to the looking times at the last three habituation photos, those who were habituated to White faces looked at the mixed-race face for longer ($M = 14.01$, $SD = 6.40$) than did those who were habituated to Asian faces ($M = 5.98$, $SD = 3.15$). All means, standard deviations, and confidence intervals for this analysis can be found in Table 2, and the interaction can be seen in Figure 1.

As a follow-up to this ANOVA, three post-hoc *t*-tests were run to determine what was responsible for the discovered interaction. First, a paired-samples *t*-test was run on the data provided by the four habituated infants from the White habituation condition, to examine the difference between their looking times at the last three habituation photos and their looking times at the mixed-race face. Results indicated that although, on average, these infants looked almost twice as long at the mixed-race face ($M = 14.01$, $SD = 6.40$) than at the last three habituation photos ($M = 7.90$, $SD = 2.56$), this effect was not significant $t(3) = -2.09$, $p = .13$, $d = 1.25$, 95% CI [-15.43, 3.21]. Second, a parallel paired-samples *t*-test was run on the data provided by the infants from the Asian habituation condition. Results indicated that there was no difference between looking times at the last three habituation photos ($M = 8.42$, $SD = 5.60$) and the mixed-race photo ($M = 5.98$, $SD = 3.15$), $t(7) = 1.35$, $p = .22$, $d = 0.54$, 95% CI [-1.81, 6.68]. Lastly, an independent samples *t*-test was run to determine whether there was a significant difference in how long the infants in the two habituation groups looked at the mixed-race photo. Infants in the White condition looked significantly longer at the mixed-race photo ($M = 14.01$, $SD = 6.40$) than did infants in the Asian condition ($M = 5.98$, $SD = 3.15$), $t(10) = 2.98$, $p = .01$, $d = 1.59$, 95% CI [8.02, 2.69]. This effect can be seen in Figure 1.

Finally, to see whether the infants recovered to the other-race face and whether the infants' stimulus group had an effect on their looking times at the other-race face, a 2 (stimulus group:

Asian vs. White habituation photos) x 2 (trial block: the last three habituation photos vs. the other-race face) mixed factorial ANOVA was conducted. The stimulus group was the between-subjects variable, and the trial block was the within-subjects variable. For this analysis, the four infants who did not habituate were excluded. There was no significant main effect of trial block, $F(1, 10) = 0.78$, $p = .397$, partial $\eta^2 = .073$, nor was there a significant main effect for habituation group, $F(1, 10) = 0.02$, $p = .89$, partial $\eta^2 = .002$ and there was no significant interaction between trial block and group, $F(1, 10) = 0.00$, $p = .99$, partial $\eta^2 = .00$. All means, standard deviations, and confidence intervals can be found in Table 2.

Discussion

The purpose of this study was to explore infants' perception of mixed-race individuals while examining relatively unstudied factors, like the use of real mixed-race faces and a habituation sequence that included multiple photos. We used real mixed-race faces in our study rather than morphed photos meant to represent people of mixed decent, allowing us to examine whether infants can differentiate between real life mixed-race individuals and Asian/Asian American or White individuals. Furthermore, we used photos of multiple individuals during our habituation trials rather than just one photo, which allowed us to examine whether infants are able to categorize real individuals with physical differences into racial categories.

We hypothesized that the mixed-race face would be seen (or treated) as Asian, consistent with the hypodescent rule studied in adults (Chen & Hamilton, 2011). We thought that when habituated to White faces, the infants would be able to discriminate between the White faces and the mixed-race face, but when habituated to Asian faces, the infants would not be able to discriminate between the Asian faces and the mixed-race face. As we expected, the infants' habituation group affected their looking times at the mixed-race face; infants in the White

habituation group looked significantly longer at the mixed-race face than did the infants in the Asian habituation group. Although infants in the White habituation condition did not look significantly longer at the mixed-race face than at the previous three habituation photos, we did find that their looking times almost doubled between these trials, and the effect size was quite large (d = 1.25). We would expect that with a larger sample size, this effect would become significant and would support the hypothesis that infants can discriminate between real-life mixed-race Asian/White faces and White faces.

Interestingly, the infants who were habituated to Asian faces did not show recovery to the mixed-race face. Although null results are difficult to interpret, this result is consistent with the possibility that (non-Asian) infants were unable to differentiate between the Asian faces and the mixed-race face, which shows possible evidence for the hypodescent rule (Peery & Bodenhausen, 2008) in infancy. Just as adults often perceive mixed-race individuals as looking more like their non-White parent (Chen & Hamilton, 2011), infants might view the non-White features in mixed-race faces as more salient. Our findings are consistent with our hypothesis that non-Asian infants would be unable to differentiate between the mixed-race face and the Asian faces, suggesting that they viewed the mixed-race face as part of the same racial group as the Asian faces.

Two tests were run to see if all infants, regardless of the stimulus group to which they were assigned, recovered looking to the mixed-race face and to the other-race face. Neither test was significant, but the especially low looking-times at the mixed-race face, we believe, are due to the fact that most infants in the Asian habituation condition did not see this image as novel. Our results did indicate that infants tended to look nominally longer at the other-race face than at the last three habituation photos, and with a larger sample size, we suspect that this recovery would become significant, as infants' abilities to categorize faces of distinct races has been shown in past research

(Anzures et al., 2010; Kelly et al., 2007; Kelly et al., 2009). The fact that neither group recovered to the other-race face, even when we know that infants at this age should be able to tell the difference, means that we should not be discouraged by the finding that infants in the White habituation group did not recover to the mixed-race face. Instead, this likely means that our sample size was simply too small to generate a significant effect.

Most infants (all but four) habituated to their assigned habituation photos, getting bored of the images fairly quickly. The discovery of this ability to habituate to a series of photos of different real-life faces rather than to just one morphed or computer-generated face is an important contribution of this study. Much of the previous research examining infant perception of race has used only one morphed or computer-generated face during habituation trials (Chen & Hamilton, 2011; Hayden et al., 2007; Sangrigoli & de Schonen, 2004, Walker & Tanaka, 2003), so the finding that infants can habituate to a series of different real-life faces of the same ethnic origin may suggest that infants are able to group multiple real-life faces with the same ethnic origin into a single category.

A major limitation of this study was that while we intended to work with only Asian and White infants in our study (because we used Asian- and White-face stimuli), we were unable to recruit any Asian infants and were unable to recruit a sufficiently large population of White infants. As a result, we had to open the study up to all ethnic backgrounds and had to analyze our data without considering any potential influence of the infants' race. Because we were unable to recruit any Asian infants, we were, unfortunately, unable to study how Asian infants would react to the photos, though one might expect that Asian infants would have an easier time differentiating between the mixed-race photo and the Asian photos because they would be better at making distinctions between faces of their own race (Anzures et al., 2010). Future research should take

infants' race into account and should specifically look into whether Asian infants are able to discriminate between Asian and mixed-race faces.

An additional limitation of this study was that, due to time constraints, we were unable to recruit enough 9-month-old infants, so we expanded our age range to include 7.5- and 8-month-old infants. Because it is not until 9 months of age that infants seem to lose their preference for their own race and become able to categorize individuals into racial groups (Anzures, et al., 2010), the addition of younger infants into our sample may have affected our results. Unfortunately, though, the small sample size prevented us from being able to statistically examine whether or not our results were affected by the infants' ages. Future studies should use a more specific age group to prevent the infants' ages from potentially being a confounding variable.

Even though we expanded our age range and opened our study to infants of all racial backgrounds, we still wound up with a very small sample size. This small sample size, we believe, prevented us from being able to show a significant recovery of the White habituation group to the mixed-race face. When we analyzed the difference between this group's looking times at the last three habituation photos and the mixed-race face, there was a large effect size even though this effect was not significant. With a larger sample size, we would expect this difference to become significant. Additionally, we believe that the small sample size prevented us from being able to show that infants recovered to the other-race face, as this is a well-examined phenomenon. Future studies should recruit a larger sample to find significant effects in the expected directions.

The present study has added to the current body of literature on infant perception of race in a few ways. Our study showed that infants are able to habituate to a series of different real-life faces, rather than a single morphed face, a relatively unstudied factor; this might mean that infants are able to categorize real people into racial categories, overlooking their individual differences. In

addition, our study found that the hypodescent rule, an effect mainly studied in adults, is also used by infants. The results of a larger-scale version of this study may have important implications for today's society; because the adult perception of mixed-race individuals is so relevant in today's world, infants' perception of these individuals is important, and may provide insight into when and how our abilities to racially categorize other people emerge.

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Table 1

Descriptive Statistics of Sample by Habituation Condition

Condition	*n*	*Avg. age (in months)*	*SD*
Asian faces	8	8.75	0.65
White faces	8	8.83	0.51
White faces (excluding non-habituators)	4	8.82	0.36
Total (including non-habituators)	16	8.79	0.57

Table 2

Means and Standard Deviations of Looking Times (in Seconds) at the Last Three Habituation Faces, the Mixed-Race Face, and the Other-Race Face by Habituation Condition

Habituation		Last Three Photos		Mixed-Race Face		Other-Race Face	
Condition	*n*	*M* (*SD*)	95% CI	*M* (*SD*)	95% CI	*M* (*SD*)	95% CI
Asian faces	8	8.42 (*5.60*)	[4.57, 12.27]	5.98 (*3.15*)	[1.27, 10.25]	11.89(*14.05*)	[2.36, 21.43]
White faces	4	7.90 (*2.56*)	[2.45, 13.34]	14.01 (*6.40*)	[9.12, 18.89]	11.30(*5.30*)	[-2.18, 24.79]

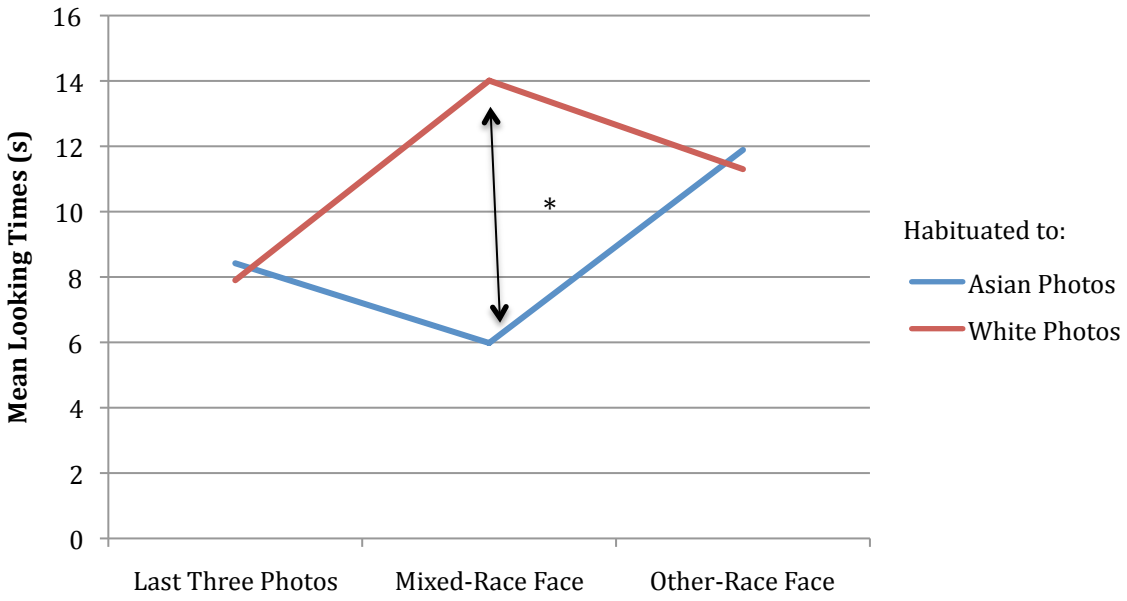
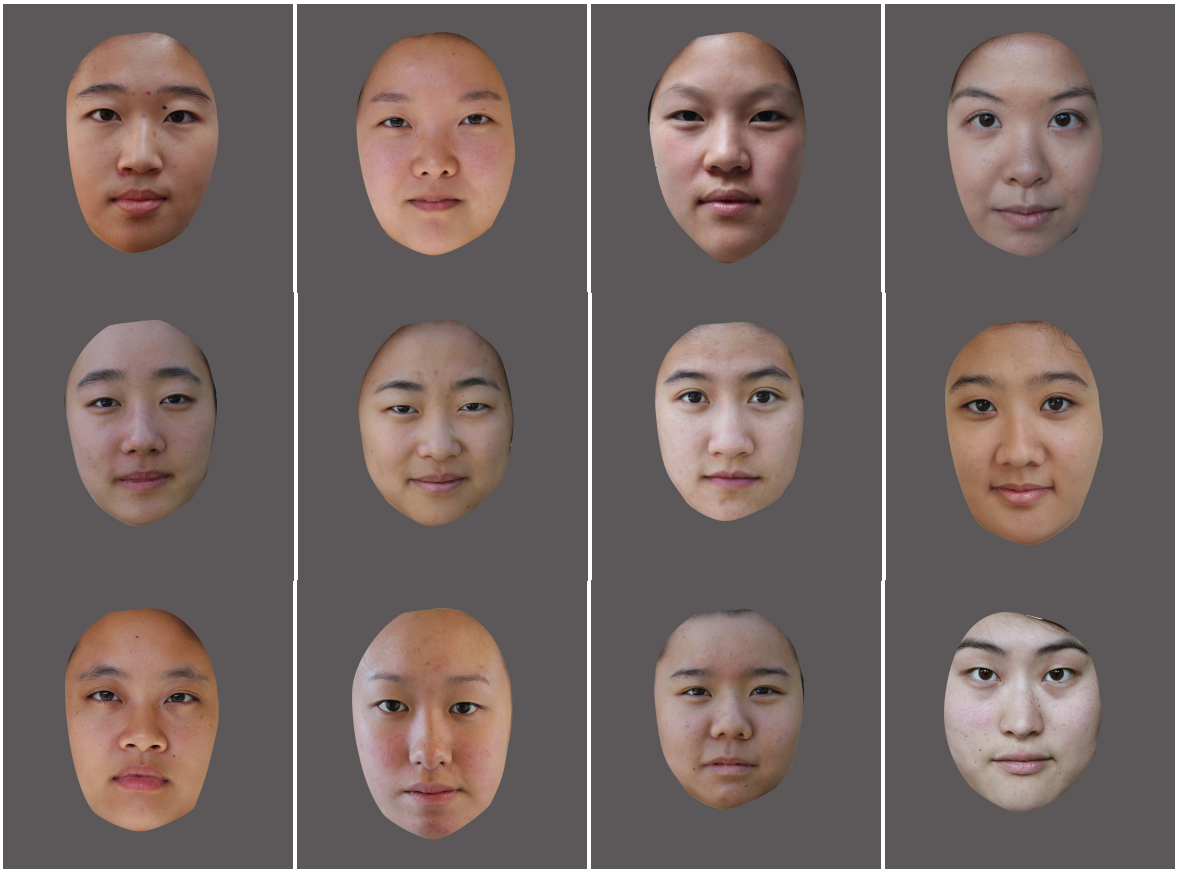


Figure 1. Mean looking times at the last three habituation photos, the mixed-race face, and the other-race face by habituation group.

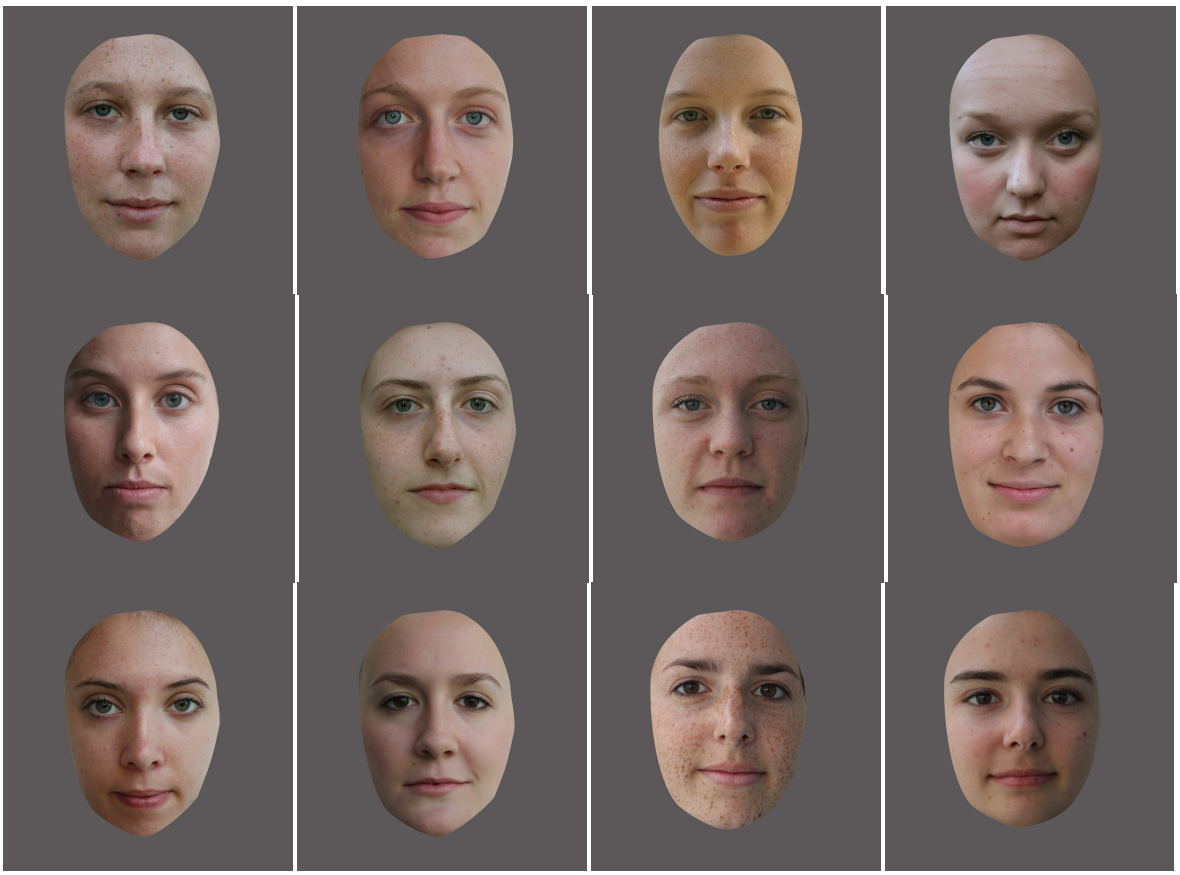
Appendix

Stimulus Photos

Asian/Asian American Stimulus Photos



Caucasian/White Stimulus Photos



Mixed-Race Stimulus Photos