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DETERMINANTS OF ACCURACY IN CROSS-RACIAL IDENTIFICATION

by

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A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Abstract

DETERMINANTS OF ACCURACY IN CROSS-RACIAL IDENTIFICATION

by

Justin Lee Anderson

Adviser: Professor Bernard Seidenberg

The existence of an own-race face recognition bias has been reliably demonstrated by innumerable experiments. Subsequently, a cross-race effect or deficit for other-race faces must exist. The robustness of these findings is impressive, yet the explanation of the phenomenon remains elusive. This study replicates the own-race bias/cross-race effect, using a yes/no recognition task and Signal Detection analysis (d'), for White, Black, Hispanic and Asian observers and targets. Based on research across domains, e.g., information processing, learning, memory and cognitive processing, a theory utilizing the common denominator of developmental contact is posited. In order to assess such a dimension, observers from the four aforementioned races with multiracial parentage were tested on own- and other-race targets with the same procedures as above. These observers, regardless of self-declared race, demonstrated a multi-own-race bias corresponding to parentage. Predictors of own- and other-race accuracy were investigated in the hopes of establishing some arbitrary measure of eyewitness accuracy. A mock crime and lineup were presented to all observers. Again, for this more generalizable task, an own-race/parentage bias was found. In determining cognitive processing as a function of contact, automatic and rapid decision-making significantly predicted accuracy.

Conversely, effortful/process of elimination strategies were less accurate and were accompanied by longer reaction times. Other-race contact from grade school onward was self-reported and was found to not significantly differ across populations. This, combined with own-race expertise/decision-making ability, and the fundamental quality of exposure across the aforementioned domains, support developmental contact as the raison d'être behind the own-race bias/cross-race effect. A model based upon implicit learning through developmental exposure of covariation amongst relational characteristics of own-race faces is proposed.

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INTRODUCTION

You're walking down the street when suddenly someone starts screaming "That's the one—quick, call the detectives..." and the next thing you know you're in the hands of the justice system being identified and convicted as a miscreant because someone misidentified you. Kafka-esque? Yes. Yet some five thousand of the two million people convicted of crime each year in the United States find themselves in such a predicament (Huff, Rattner, and Sagarin, 1996 pp. 62)—and this applies only to the eight index crimes on which statistics are kept[1]. Chillingly the power of eyewitness identification, although fallible, is tantamount to that of a deathbed statement. Determining veracity in cases involving eyewitness identification is of vital importance to the defendant, the victim/witness, the justice system, and society as a whole.

Goldstein, Chance, and Schneller (1989) found 78,000 trials during 1987 were decided primarily on the basis of eyewitness identification and resulted in an astounding 82% conviction rate. Eyewitness misidentification results in more wrongful convictions than all other causes combined (Wells, Small, Penrod, Malpass, Fulero, and Brimcombe, 1998). A large and disturbing factor in these wrongful convictions is the dynamic of cross-racial identification. This paper examines the research on race in eyewitness identification as it has been performed over the past three decades, and builds upon it. The resulting infrastructure facilitates isolation of predictor variables that can serve as

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[1] Murder and nonnegligent manslaughter, forcible rape, aggravated assault, robbery, burglary, larceny-theft, motor vehicle theft, and arson.

indicators of recognition accuracy, thereby reducing the incidence of wrongful convictions in the criminal justice system.

Denoting race in a scientific paper is difficult because of the lack of precise definition, the sometimes pejorative connotations, and individual sensitivities. Racial designations, however, are widely accepted by lay groups and give us a handle for discussion. This paper, therefore, designates groups as White, Black, Hispanic, Asian, etcetera, to more readily characterize physical appearance, an obvious necessity in discussing face recognition.

Own-race bias

When manipulated for race of witness and race of target, research on unfamiliar face recognition reveals a robust and consistent cross-racial identification effect comprised of own-race bias with its corollary, the other-race effect. This differential recognition ability under laboratory and field conditions has been well documented (for reviews, see Brigham, 1986; Brigham and Malpass, 1985; Chance and Goldstein, 1996; Lindsay and Wells, 1983; Malpass, 1981, 1982; Shepherd, 1981). A meta-analysis of 128 facial identification experiments by Shapiro and Penrod (1986) allowed 17 separate tests of the cross-racial effect for Whites, Blacks, and Asians on face recognition and found own-race correct identifications were significantly better, with fewer false alarms, than other-race. Bothwell, Brigham, and Malpass (1989) meta-analyzed 14 studies, using combinations of Black and White participants and targets, and found strong own-race bias to be equivalent in magnitude for Blacks and Whites. In a meta-analysis allowing 22 separate tests, Anthony, Cooper, and Mullen (1992) found the own-race bias to be slightly

stronger for Whites than Blacks. Ayuk (1990), using Black and White participants and faces, found both groups to be significantly more accurate with own- than other-race stimuli, with the other-race effect being stronger for Whites. Another study on other-race face perception found White participants performed notably better on White targets compared to Black, but no such difference was found for Blacks, who performed equally well on both Black and White targets (Lindsay, Jack, and Christian, 1991). Chiroro and Valentine (1995) reported participants recognized own-race faces more accurately than other-race.

While race has been manipulated using Black and White participants and/or targets predominantly, other races show the same own-race bias in recognition. Platz and Hosch (1988) demonstrated the own-race bias in Mexican-Americans, Blacks, and Whites. The other-race effect has been produced for Asian faces identified by White participants (Chance, Turner, and Goldstein, 1982; Elliot, Wills, Goldstein, 1973) even though these two classes of faces were found to be reliably discernable (Goldstein and Chance, 1978). Using Asian (Chinese and Japanese) and White participants and targets, Luce (1974a, 1974b) found Whites to be proficient at both own- and other-race identification while Asians manifested an own-race bias. Two other studies found correct identifications of Japanese targets by Black and White participants was significantly smaller than for Black and White targets (Chance, Goldstein, and McBride, 1975; Elliot et al., 1973). In a recognition memory test, Valentine and Endo (1992) found a significant interaction between race of ace and race of participant (White or Japanese). Ng and Lindsay (1994) replicated the cross-race effect for d' and false alarms in two studies using

both Asian and White faces and participants. In a comparable experiment with pan-Asian and White participants viewing Japanese and White faces a significant own-race bias was found (O'Toole, Deffenbacher, Valentin, and Abdi, 1994).

Although demonstrating an own-race bias, the data across studies were variable both for the interaction between race of participant x race of target and main effects. These asymmetries may be symptomatic of several factors. They may be due to study artifacts masking the other-race effect, e.g., intrinsic differences in the difficulty of the stimulus faces (distinctiveness betters recognizability); varying stimulus, interstimulus, and retention intervals; or differential degree of attention allotment. Or there may be true differences among and within the races for both perception and recognition. Or any combination of these artifacts and factors may pertain.

Recognition tasks are not the only test of the own-race bias. Lineup construction requiring the selection of look-alike foils indicates bias through the larger selection of foils by other- as compared to own- race participants (Brigham and Ready, 1985). This finding has strong forensic relevance in that it suggests that the race of the constructor of a lineup be the same as its members (putting a positive spin on own-race bias). Using White participants, Chance and Goldstein (1987) observed longer response latencies for both hits and false alarms for Japanese targets as compared to own-race faces. White participants were also slower and less confident when identifying Black rather than own-race faces (Frauenhoffer, 1987).

HYPOTHESES IN EXPLANATION OF OWN-RACE BIAS

All of the above studies convincingly document an own-race bias or other-race effect in face recognition, the explanation for which has not been as convincingly demonstrated. This is exhibited by the numerous hypotheses culled from the literature. Ellis, Deregowski, and Shepherd, (1975) and Shepherd and Deregowski (1981) proposed a differential cue utilization hypothesis which evolved into the race-specific perceptual skills hypothesis. Brigham and Malpass (1985) enumerated four explanations: (a) inherent lack of variability in faces of other race, making them more difficult to recognize; (b) racially prejudiced attitudes that impair other-race face recognition (differential attitudes hypothesis); (c) differential depth-of-processing; and (d) level of contact/experience with other races (differential experience hypothesis). The other-race effect might be attributable to perceived similarity, commonly known as the "they all look alike" hypothesis, wherein other-race faces are perceived to be more homogeneous. It has also been proposed that other-race face perception is less useful, and so less used and less accurate (Malpass, 1990). When considered individually, however, none of these hypotheses adequately accounts for own-race bias.

Inherent difficulty hypothesis

The inherent difficulty hypothesis postulates that discrimination difficulty is the product of a lack of physiognomical variation in other races. Malpass and Kravitz (1969) generated this hypothesis when they found own-race recognition bias only for White participants along with a trend for Black participants to identify more accurately White targets as compared to Black. A main effect for race of face has been found in a number

of studies, but not always for White faces. White faces have been better recognized than Black (Cross, Cross, and Daly, 1971, Shepherd, Deregowski, and Ellis, 1974; Lindsay, Jack, and Christian, 1991), but Black and Asian faces have been better recognized than White (Brigham and Barkowitz, 1978; Brigham and Williamson, 1979; Buckhout and Regan, 1988; Ellis and Deregowski, 1981; Luce, 1974a, 1974b), and yet other studies have not found differential face recognition ability for Black, White, or Asian participants (Ayuk, 1990; Bothwell, Brigham, and Malpass, 1989; Chance, Goldstein and McBride, 1975; Chiroro and Valentine, 1995; Feinman and Entwistle, 1976; O'Toole, Deffenbacher, Valentin, and Abdi, 1994; Valentine and Endo, 1992). Goldstein and Chance (1976, 1978) compared facial features and found that Whites made the same physical distinctions for Japanese as for White faces. Studying individuated impressions of other-race groups, Zebrowitz, Montepare, and Lee (1993) found that Whites, Blacks, and Koreans made comparable distinctions regarding perceived traits and appearance. Shepherd and Deregowski (1981) reported Blacks and Whites were able to detect feature distinctiveness equally well amongst own- and other-race faces, but that they did not use the same features. An objective anthropometric investigation and analysis of Black, White, and Japanese facial characteristics was performed by Goldstein (1979a, 1979b) and revealed heterogeneity across the races. This finding of heterogeneity and parallel distinctiveness, along with reliable main effects for race of stimuli, yields no empirical support for the inherent difficulty hypothesis or intra-race homogeneity. Even if one race *were* more homogenous, its members could not manifest an own-race bias.

Perceived similarity hypothesis

The refutation of the inherent difficulty hypothesis invalidates the oft-repeated statement, "They're all alike." It does not, however, refute the even more common protest, "They all look alike," which is a matter of perception and the foundation of the perceived similarity hypothesis in which other-race faces are perceived as more homogeneous and therefore less discriminable.

Two experiments on similarity judgments of White participants for White and Japanese faces found no race-related differences in decision time, correctness, match-to-sample search time, or similarity ratings (Goldstein and Chance 1976, 1978). Goldstein (1979a) also found that Japanese faces were perceived as more alike by White observers. Malpass, Erskine, and Vaughn (1988) found longer response latencies with more checking to match-to-sample for White participants and Black faces than for White. Ng and Lindsay (1994) reported a race of face x race of participant interaction between White/Asian participants, in which own-race faces were rated as more heterogeneous. Perceived homogeneity increased false alarms for other-race recognition, which is consistent with a finding that high similarity between lineup foils did not impair correct recognition accuracy (Lindsay and Wells, 1980). While not a solid predictor of recognition ability, perceived similarity is indicative of poor discrimination amongst other-race members.

Relative heterogeneity hypothesis

Perceived similarity or the "they all look alike" hypothesis has led to the cross-racial effect being compared to the social cognitive relative heterogeneity effect (Jones,

Wood, and Quattrone, 1981; Mullen and Hu, 1989) wherein out-group (other-race) members are perceived to be more homogenous and therefore less identifiable individually (Anthony, Cooper, and Mullen, 1992; Brigham, 1991). Perception is the foundation upon which all the viable explanations for differential recognition of own- and other-race faces are built. All deal with influences on perception across races, and all are grossly confounded with one another along one, perhaps causal, variable—contact.

Attitudinal influence hypothesis

Contact with other races shapes attitude and attitude affects contact. Both contact and attitude can be positively and/or negatively valenced and generate or constrain one another. Attitudinal influences, while difficult to separate from contact, have been hypothesized as responsible for either the presence or absence of an own-race bias in cross-racial face memory. Whites with positive attitudes toward Blacks recognized Black faces better than White (Seeleman, 1940). This study, however, suffered from a methodological flaw in that response bias was uncontrolled: Positive-attitude Whites might have felt constrained to designate more Black faces as familiar. One could also interpret this study as demonstrating the other-race effect—impaired differentiation of other-race faces may have led to the reporting of greater familiarity. In refutation of Seeleman's finding, a study controlling response bias by Dowdle and Settler (in Yarmey, 1979) found that negative attitudes toward Blacks did not correlate with recognition accuracy. Testing the impact of inter-racial attitude of Whites on Black face recognition (Lavarkas, Buri, and Mayzner, 1976) again found no relationship between the own-race bias and attitude. And Brigham and Barkowitz (1978), in a definitive experiment,

assessed both White and Black participants' racial attitudes and found no relationship between them and other-race face recognition, while finding an own-race bias for both groups. Several studies using Black, White, and Mexican participants and targets investigated the effects of contact on own-race bias and measured indices of inter-racial attitude. While these studies found a relationship between contact and own-race bias across the groups, they also found attitude to be unrelated to recognition accuracy (Carroo, 1986, 1987; Platz and Hosch, 1988). Thus, there is no empirical support for a direct relationship between inter-racial attitude and recognition of other races. The possibility exists, however, that racial attitude cannot be teased out of attitude-congruent behavior such as familiarity or contact—or lack of it. Demand characteristics for a participant to present as non-racist can significantly distort self-reporting. Brigham and Malpass (1985) suggested that prejudiced individuals cease processing a face once it is categorized as belonging to a disliked group. Thus racial attitude is hypothesized as causal to a differential depth-of-processing between own- and other-race faces as well as in/out- group membership. Differential depth-of-processing is not a direct product of attitude, as evidenced by the above studies, but of attitude-congruent behavior.

Depth-of-processing hypothesis

Depth-of-processing as a rationale for differential face recognition was derived by Bower and Karlin (1974) from the levels-of-processing research on verbal learning (Craik and Lockhart, 1972). Shallower processing focuses on superficial, isolated physical characteristics (e.g., race, gender, nose size), resulting in impoverished recognition of own- and other-race faces. Subjective inferences about personality attributes/ impression

formation (e.g., honesty, intelligence) induces deeper processing, resulting in more elaborative memory with subsequently increased recognition. Alternatively, better memory through personality assessment is likely to stem from broader feature scanning or global searching for distinctive features, which is quantitative or elaborative searching rather than qualitatively deeper processing (Courtois and Mueller, 1979; Winograd, 1976, 1978, 1981).

A plethora of studies have explored differential depth-of-processing on face perception (for review, see Sporer, 1991). Meta-analysis revealed a small but reliable increase in recognition due to deeper processing (Shapiro and Penrod, 1986). Included in this meta-analysis were several studies that manipulated cross-racial identification factors. Chance and Goldstein (1981) theorized that shallow processing/superficial orienting on encoding of other-race faces stems from minimal exposure and is responsible for the other-race effect. They investigated depth-of-processing by rating participants' first impressions, using separate groups of White participants for White, Black, and Japanese targets. White target faces elicited deeper judgments. A replication of this study (unpublished; in Chance and Goldstein, 1996, p. 165) included a recognition test that had not been performed previously due to time-to-test delay and subject mortality, in which White participants demonstrated own-race bias in deeper processing and recognition. No correlation was found between individuated depth-of-processing responses and face memory. In another study, Chance and Goldstein (1982) manipulating depth-of-processing instructions wherein White participants rated either facial features (shallow) or intelligence/friendliness (deep) of White or Japanese targets, found unambiguously

unexpected results as compared to a look-to-remember control group: Deeper processing led to small recognition gain for White targets and no effect for Japanese; shallow processing resulted in significantly poorer recognition of Whites and still worse recognition of Japanese targets. Within a fully cross-racial paradigm, Devine and Malpass (1985) tested the hypothesis that shallow processing is responsible for the other-race effect by using instructional manipulation to control depth-of-processing. They found an own-race bias for all groups; otherwise their findings duplicated those of Chance and Goldstein (1982): The deeper processing group evaluating friendliness of other-race faces performed the same as the look-to-remember control group; shallow processing, as compared to control or deep, led to impaired other-race recognition. A critical assessment of encoding strategies independent of race, in three experiments manipulating depth of processing, amount of elaboration, and self-generation judgmental categories found all induced whole-face scanning strategies equivalent to no-instruction controls (Sporer, 1991). These experiments also demonstrated the deleterious effects of shallow processing on face recognition, which, through manipulation checks, were ascertained to be due to lesser task involvement.

Deeper or more holistic processing was not superior to the natural encoding strategies of control participants and when manipulated for race did not moderate participants' own-race bias. Shallow processing, on the other hand, diminished the own-race bias and significantly impaired other-race recognition. These findings, taken together, suggest that differential cross-racial identification ability resulting in an own-race bias is more the influence of shallow, opposed to deeper, processing on natural

encoding strategies. Sporer (1991) determined that the social psychology of psychological experimentation was intrinsic to the adverse effect of shallow processing by determining it to be the product of task simplicity and resultant boredom. Other social factors such as personal histories and experiences, while not as constrained as boredom within experimental conditions, are also integral to perception and recognition of the most socially relevant stimuli—faces.

A meta-analysis of 15 studies manipulating Black and White participants and targets was designed to integrate cross-racial identification with the effects of depth of processing (Anthony, Cooper, and Mullen, 1992). In addition to own-race bias, a significant interaction between elaborative processing and race was found: cross-racial identification effect increased for Whites and decreased for Blacks. Any interaction of this nature, suggestive as it is of race specific encoding processes, would account for own-race bias by virtue of learned within-race perceptual expertise.

Differential cue hypothesis

Own-race bias has been hypothesized as a function of race-related differential cue utilization for encoding of faces (Ellis et al., 1975). Within-group familiarity is developed by contact, facilitating attentional foci on specific cues or features that have been demonstrated to support discriminabilty; if these within-group cues are used to discriminate between-groups (across race), failure in recognition could result from inappropriate cuing or feature analysis. Ellis, Deregowski, and Shepherd (1975) found a difference in both frequency and feature descriptors between Black and White male participants and photo targets. Blacks more frequently mentioned hair position, eye size

and amount of white, eyebrows, chins, ears, and face outline, while Whites referred to hair color, eye color, and hair length and texture. Black and White participants used the same descriptors, albeit different ones for each target race: hair color in Whites, hair texture and shape of nose and lips for Blacks. Shepherd and Deregowski (1981) elicited similar results in an experiment using Black and White participants and targets to judge similarity amongst women's faces: The features used by both races of participants to judge Black targets were different from those for White targets. Thus, one race differentiates amongst others in similar ways, though the features used to distinguish across race are different from those used within race.

Perceptual expertise hypothesis

Race-specific perceptual expertise on encoding and recognition of faces, a derivative of the cue utilization hypothesis, premises the use of both feature characteristics and complex configural (holistic) patterns, e.g., relative positional or proportional relationships between features (for reviews, see Bartlett and Searcy, 1993; Rhodes, Brake, and Atkinson, 1993; Tanaka, 1993). Determination of configural versus featural encoding in recognition is enabled through the inversion of stimuli (for review, see Valentine, 1988; Tanaka and Farah, 1991), which disrupts configural relationships (Sergent 1984a) without disturbing independent feature analysis (Bruyer and Coget, 1987; Rhodes, Brake, and Atkinson, 1993). Numerous studies examining the effect of inversion and feature filtering/displacement on configural and featural encoding have demonstrated that configural processing underlies recognition expertise for faces (Carey and Diamond, 1977; Carey, Diamond and Woods, 1980; Haig, 1973; Harmon, 1973; Rhodes 1985,

1986, 1988; Rhodes, Brennan, and Carey, 1987; Rock, 1973, 1974, 1988; Schooler and Engstler-Schooler, 1990; Sergent 1984b; Wells and Hryciw, 1984; Yin, 1969). In apposition, Czigler (1985) demonstrated that relational information interferes with, and increases, response latencies for isolated feature processing.

Race-specific perceptual expertise has been investigated using primarily match-to-sample and inversion paradigms. Goldstein and Chance (1978, Experiment 4) had White participants perform a series of sample-present match-to-sample trials involving both White and Japanese faces and found search time and accuracy similar for both target races. This finding, weakened by a missing Japanese comparison group, argues against perceptual skills as an explanation for the other-race effect. Chinese and White participants' perceptual expertise and bias were examined (Rhodes, Ronke, and Tan, 1990), using complex visuospatial stimuli and target faces of both races. Perceptual bias was found only for the faces, while Whites exhibited an own-race bias/expertise and Chinese participants were equally adept at both races. A delayed match-to-sample test of perceptual expertise using tachistoscopic (120ms) presentation of Black and White photos found an own-race bias for Whites, while Blacks were equally proficient on Black and White faces (Lindsay, Jack, and Christian, 1991). This study also found a significant correlation between self-reported amounts of other-race contact and recognition: Black participants indicated the highest amount of interaction with Whites and did not demonstrate an own-race bias, while White participants indicated much less interaction with Blacks and manifested an own-race bias.

Configural processing hypothesis

Diamond and Carey (1986) proposed that face recognition is commensurate with the encoding of configural as well as featural information, but that expertise stemmed from the use of configural relationships. This being the case, any stimuli differentiated on the basis of configural relationships of features should demonstrate a large inversion effect. They found the predicted effect for expert perceivers whose recognition of familiar stimuli (dogs) was as impaired by inversion as was the recognition of human faces. Novice perceivers were also adversely affected by stimuli inversion but not to the extent that experts were, since unfamiliarity does not facilitate configural encoding in the first place. Bruyer (1992) replicated these results, using experts and novices who analyzed inverted samples of handwriting and experts were more affected by inversion. These studies compellingly support configural encoding in perceptual expertise.

Own-race bias in recognition presupposes own-race configural (perceptual) expertise and thus should be more severely impaired by inversion than other-race recognition. However, Valentine and Bruce (1986) did not demonstrate the expected larger inversion effect on own-race face recognition, instead finding that their all-White participants were less able to identify inverted other-race (Black) faces. Unfortunately, this experiment was confounded by differential stimuli exposure time across race (2s for White and 5s for Black) in an attempt to compensate for lack of other-race familiarity. This compensatory methodology may have introduced attentional differences leading to increased familiarity which was more disrupted by inversion. Buckhout and Regan (1988) presented participants with inverted and upright Black and White stimuli and found an

own-race bias for upright faces and impaired recognition in all participants for inverted Black faces—thus not obtaining a complete own-race inversion effect. This may have been due to the fact that faces were inverted on both presentation and testing, thus encouraging featural encoding (Endo, 1986; Phillips and Rawles, 1979) which has been shown to be unreliable for recognition (for reviews, see Brigham and Malpass, 1985; Shepherd, 1981; Yarmey, 1986). The results of the Valentine and Bruce (1986) study might also be attributable to reliance on featural encoding.

Rhodes, Tan, Brake, and Taylor (1989), in further investigating configural encoding as the dominant component of recognition expertise (Diamond and Carey, 1986), proposed that while such processing is for all faces it is best for those with which participants have expertise and inferior for races with whom there is less familiarity. They found Chinese and White participants' reaction time and recognition ability were significantly more disrupted by inversion within race as opposed to across race. This interaction between race of face and inversion, in conjunction with the findings of Diamond and Carey (1986) and the premise that configural properties are critical to expertise in discrimination (Rhodes and McLean, 1989), support the hypothesis that faces are configurally encoded, with own-race face recognition bias reflective of within-race expertise. The findings of Rhodes et al. (1989) do not preclude the possibility of across-race featural encoding. Ayuk (1990) found a significant interaction between White own-race bias for untransformed-pose White faces and Black own-race bias for transformed-pose Black faces as well as a significant interaction between White accuracy on

untransformed faces and Black accuracy on transformed faces and posits that differences in Black vs. White processing strategies produces the variance in other-race accuracy.

Traditionally, the relationship between face recognition and verbal descriptors has been weak to nonexistent (Sporer 1989, 1992a, 1996; Tulving, 1985). Neither good and bad face describers (Goldstein, Johnson, and Chance, 1979), nor the number of descriptors generated (Goldstein and Chance, 1971), show any differences in recognition ability. When asked to both describe and recognize faces, participants performed no better than when asked just to recognize them (Chance and Goldstein, 1976; Sporer, 1989).

The forensically relevant task of translating visually encoded faces into the verbal domain is problematic (Deffenbacher, Leu, and Brown, 1981). Verbal description demands feature based adjectival delineation, a constrained lexicon at best. Sporer (1996) suggests this inadequacy may be responsible for participants' tendency to use psychological rather than physical attributes despite explicit prompting to the contrary (Grass and Sporer, 1991; Sporer, 1992a). This phenomenon may actually be more reflective of participants searching for a more appropriate way to verbalize visually/configurally encoded information. Disruption of configural processing may occur because of the inherent difficulty in reporting the dynamics of recognition (Diamond and Carey, 1986; Rhodes et al., 1989; Sporer, 1996) and engender the more easily articulated feature descriptors that are inadequate for expert recognition (Wells and Hryciw, 1984; Wells and Turtle, 1987).

Recently, a spate of research has shown that verbalizing face descriptors interferes with expertise in recognition (Dodson, Johnson, and Schooler, in press; Schooler, 1989;

Schooler and Engstler-Schooler, 1990; Schooler, Ryan, and Reder, in press; Shepherd and Ellis, 1996; Sporer, 1989, 1992a), particularly for holistic rather than featural processors (Ryan and Schooler, 1995). Investigating perceptual expertise, Fallshore and Schooler (1995) nicely integrate the effects of race, inversion, and verbalization on recognition of own- (expert) and other-race (novice) faces. They found that descriptive verbalization impaired own-race recognition of White participants but did not have that effect on other-race (Black) recognition. A second experiment suggested that other-race recognition is highly dependent upon featural (verbalizable) factors. Their third experiment replicated the interaction between race-of-face and verbalization for an upright recognition array and eliminated it with inversion. This three-way interaction shows that recognition expertise is disrupted by inversion, thus leaving no venue for verbalization's deleterious effects and demonstrating that verbalization confounds configural processing in the same fashion as does inversion and lack of other-race expertise.

Contact/Experiential hypothesis

The research on perceptual expertise suggests that differential face recognition is dependent upon the perceiver's experience and the degree to which individual features or their configuration are processed and drawn upon. Experience develops expertise along a continuum from featural/novel to configural/expert. Novelty or interference impacts perceptual expertise and causes a downshift along the continuum to feature-based recognition. Own-race perceptual bias is the product of experience/expertise obtained through contact, other-race recognition is more novel and thus expert methodology for processing fails and defaults to featural analysis.

The perceptual hypotheses enumerated are implicitly and explicitly dependent on contact. Dominant within-race contact or experience is hypothesized as being responsible for the own-race bias and its converse, the other-race effect, which is assumed to be due to lesser contact or experience across race. Laboratory and field studies have assessed the influence of contact both correlationally and empirically, using a variety of self-report and inferential techniques. In an early study, Malpass and Kravitz (1969) found no relationship between self-reported other-race contact and recognition.

Two extensive studies used school and neighborhood integration demographics to infer cross-racial contact and experience. Cross, Cross, and Daly (1971), found White children from non-integrated areas manifested a larger own-race effect than those from integrated areas; only a minimal difference was found amongst Black children. It should be noted that the entire study set was presented simultaneously, thereby losing control of attentional factors. Feinman and Entwistle (1976) corrected for this and found that children in integrated schools had a smaller own-race bias than those in segregated schools. Inferring contact from "functional race (group) membership," Galper (1973) tested White and Black participants enrolled in a Black studies course and compared their performance with a control group of psychology students. All control participants manifested the own-race bias, whereas in the experimental condition no own-race bias materialized. Galper (1973), like Cross et al. (1971), presented the study set in its entirety, possibly introducing selective attention and differential demand characteristics across the groups.

Ascribing inherent interracial contact differences to geographical disparities, Luce (1974b) tested cross-racial recognition using Black, White, and Asian college students enrolled in either southwestern or metropolitan campuses. At test, all groups saw four matrices of 20 interracial pictures, each matrix presented for one minute. Each group had an own-race bias, irrespective of the inferred degree of contact. In addition to the exceeding difficulty of this task, methodologically this experiment suffers from the same lack of attentional controls as did Cross et al. (1971), and Galper (1973). Shepherd, Deregowski, and Ellis (1974), using global geographic demarcations to infer degree of interracial contact, studied Black and White face recognition amongst Black Rhodesian (now Zimbabwean) males/females and White Scottish males/females. Own-race bias was not as strong for Rhodesian participants as it was for Scottish. One caveat is that the Rhodesian participants were attached to the military and likely had more cross-racial interaction with the relatively large White population there. Manipulating location, in an attempt to eliminate any attitudinal influence on contact assessment, Chance, Goldstein, and McBride (1975) hypothesized that the usage of White and Black university students in Missouri would yield the typical own-race bias for Black and White faces respectively, while Japanese face recognition would be severely impaired. As predicted, they found each group to be most accurate on own-race members and least accurate for Japanese faces. The inference that attitudes were never developed by virtue of lack of exposure is spurious; this does not refute, however, the influence of exposure on recognition ability.

Lavrakas, Buri, and Mayzner (1976) found that White participants who reported experience with Blacks to be more accurate at Black face recognition than participants

without such experience. Brigham and Barkowitz (1978), however, found no relationship between self-reported degree of interracial contact and recognition. Within the last 20 years almost all studies have shown a positive relationship between experience with and recognition of other races. Several field studies yielding high ecological validity, investigated the relationship between interracial experience and recognition, using convenience store clerks in situ. Brigham, Maass, Snyder, and Spaulding (1982) tested recognition memory (two-hour delay) among 64 White and 9 Black clerks for one Black and one White customer each of whom had behaved distinctively and asked for directions when paying. White clerks' self-reported experience with Blacks significantly correlated with accurate target recognition from a photographic array. Hosch and Platz (1984) replicated this study in a different geographic area with the same results. Meta-analysis of these two studies reveals a strong cross-race effect for Whites; however, a paucity of Black participants made similar comparisons uninformative (Bothwell, Brigham, and Malpass, 1985).

In a review of the extant literature Brigham and Malpass (1985) speculated that, based on the well-established impact of experience on learning and remembering, frequent positive interracial contact should mitigate the own-race recognition bias. Investigating within-race differential recognition ability for White faces, Carroo (1986) compared 10 American Black and 10 Nigerian Black students, finding superior performance amongst the former and a significant correlation between interracial relationships and correct recognition. Furthermore, accuracy among Nigerian Blacks reflected the amount of time spent, regardless of relationship, within a predominantly

White environment. These results suggest that either quality or quantity of experience is beneficial to other-race recognition, but two problems are readily apparent in this study: the small sample and lack of comparison with Black faces. Carroo (1987), pursuing the influence of differential experience, related information from Black college students on their history with Whites to their recognition of briefly viewed Black and White student photos. Friendship, not mere exposure, elicited better performance with smaller within-subject differences between own- and other-race recognition. On the face of it, this seems to contradict Carroo's earlier finding that mere exposure results in improved other-race recognition (Carroo, 1986), yet the likelihood is that these interracial friendships generate secondary exposure to a host of other-race members, thus affording quantitative as well as qualitative experience.

Self-reported other-race experience and recognition was investigated in a field study by Platz and Hosch (1988) using virtually identical procedures as those of Brigham et al. (1982) and Hosch and Platz (1984), with the addition of Mexican participants and targets. In addition to all three groups showing an own-race bias, White clerks reporting more experience with Blacks correctly identified a Black confederate more often, and Black clerks who had reported greater experience with Mexicans identified a Mexican confederate more often. Self-reported degree of other-race interaction has been positively correlated with correct identification of White faces by Black participants who did not demonstrate the own-race bias and indicated the highest possible degree of interaction, while White participants who reported minimal interaction with Blacks had a pronounced own-race bias (Lindsay, Jack, and Christian, 1991). Sporer (1992b, Experiments 15, 16,

and 17) observed that White German participants, whose contact with Blacks was presumed to be minimal as compared to White American, manifested a much more robust cross-race effect.

Ng and Lindsay (1994) conducted two standard recognition paradigm experiments wherein the effect of White and Asian interracial contact was evaluated. Results of the first experiment revealed that the cross-race effect, in the form of a race x race interaction, was obtained for both false alarms and d'. Self-reported interactive contact was significantly greater within-race, but was unrelated to recognition. If only the means are considered, these results support the contact hypothesis. Experiment Two, was a geographic manipulation of contact, assumed that minority groups should better recognize majority group members due to sheer exposure. Whites in both North America and Singapore were compared to Asians in the same locales on both race faces in order to avoid confounding race and minority group. Regardless of location, Asian participants exhibited a significant own-race bias for hits, while both races demonstrated the effect for false alarms and d'. Contact, thought to have been geographically manipulated for both races, was revealed through self-report to be significantly different only for Asian participants (Singapore versus North America), thus limiting the contact hypothesis test to Asians only. This manipulation check reveals the illusory effect of geography on contact, in that a ghetto effect for race appears to occur.

Chiroro and Valentine (1995), in another cross-cultural geographic manipulation designed to test the contact hypothesis, compared Black Africans with either high or little/no contact with Whites to White Britons with the same diverse degree of contact.

Findings replicated the cross-race effect for both Blacks and Whites and found contact to be a significant factor in recognition; high contact, particularly in Black participants, significantly reduced the effect size. The study had difficulty matching the low-contact groups, as Black participants lived in a remote village and had virtually no other-race contact, whereas White participants' other-race exposure was influenced by the media. This could account for the racial schism found in the mitigation of the cross-race effect.

Differential theory of contact

As established in the literature, contact and recognition is biased toward own race; axiomatically, own-race bias produces impaired other-race recognition. More importantly, it would seem that the goal of finding a single hypothesis to explain cross-race effect has been met unwittingly: All of the hypotheses advanced in explanation of the effect have contact as a lowest common denominator, making each an individualized investigation into the various processes by which contact influences own- and other-race perception and recognition. Thus differential contact within and between races is progenitor and nurturer of all the hypotheses delineated above. This symbiotic relationship prevents any one of these hypotheses from being an adequate explanation for the other-race effect; they are subsumed by contact, which at the same time engenders them. Consequentially, a "differential contact" theory of the interchangeably labeled cross-race effect, own-race bias, and other-race effect is posited. It is a theory that needs further explication in the hope of finding determinants and indicators of accuracy in cross-racial eyewitness identifications.

INDICATORS OF ACCURACY

Empirical research into eyewitness identification has not produced any viable means—psychological or physiological—of confirming accuracy. Confidence, the most intuitively appealing indicator of accuracy, has been revealed in innumerable studies to be nothing of the sort (for review, see Narby, Cutler, and Penrod, 1996). Pretest witness confidence in his/her ability to make a correct identification has no relationship to correctness (Cutler and Penrod, 1989; Cutler, Penrod, and Martens, 1987; Cutler, Penrod, O'Rourke, and Martens, 1986; Sporer, 1992a; Franzen and Sporer, 1994). Meta-analysis of nine studies (Cutler and Penrod, 1989) also supported these findings although it found a small but significant relationship between posttest confidence and accuracy. Bothwell, Deffenbacher, and Brigham (1986) in a meta-analysis of 40 independent tests of postjudgment confidence found a .25 correlation with accuracy.

Awareness of witness prowess in recognition, i.e., in a police officer, might also seem to be an indicator of accuracy in identification. Unfortunately, Woodhead, Baddeley, and Simmonds (1979) found no relationship between such awareness and accuracy.

Yet another intuitive indicator of correct identification is the adroitness, or lack of it, with which witnesses recall information. As with confidence and awareness vis-a-vis accuracy, however, quantity or quality of anatomical descriptions show little or no relationship with correct identification (Goldstein, et al., 1979; Tulving, 1985; for reviews, see Sporer, 1989, 1996). In fact, research has revealed that recall can effectively interfere with recognition because of the differential demand characteristics of each.

Expertise in face recognition is commensurate with the use of configural information, the proportional relationship of facial features and overall face shape (Bruyer, 1992; Diamond and Carey, 1986; Rhodes, 1988; Rhodes and McLean, 1989; Rhodes, et al., 1989; Sergent, 1984). Details of configural depiction are not easily explicated (Fallshore and Schooler, 1995; Ryan and Schooler, 1995). Effortful recall forces the communication of visually/configurally represented information, thereby decomposing it by engendering the use of easily explicated feature descriptors that are inadequate (unsuited) for expert recognition (Dodson, et al., in press; Ellis, 1984, 1986; Narby, Cutler, and Ingebrigtson, 1990; Narby, Polsky, and Cutler, 1989; Schooler, 1989; Schooler and Engstler-Schooler, 1990; Schooler, et al., in press; Shepherd and Ellis, 1996; Sporer, 1989, 1992a; Wells and Hryciw, 1984; Wells and Turtle, 1987). This dichotomy precludes the use of recall as an indicator of identification accuracy but at the same time affords insight into the underlying processes of recognition.

Most individuals are expert at familiar face recognition (Bahrick, Bahrick, and Wittlinger, 1975; Ellis, 1981), yet there is a concomitant inability to express what it is about the face or the memory process that led to the identification. Hay, Young and Ellis (1986) presented study participants with celebrity faces and subsequently embedded them amongst foils in a recognition task. When asked how they identified target faces, participants often responded that the faces "just popped out," and that they weren't distracted by the foils. This reflects the use of automatic, and thus rapid, cognitive decision-making processes that transpire without awareness or deliberation. Further

research strengthened the relationship between rapid, automatic cognitive processes and accurate face recognition.

Schooler and Engstler-Schooler (1990) found that verbal description (recall) impaired face recognition, but if these same participants were forced to make recognition judgments quickly (5 seconds), they were as accurate as participants in a recognition-only task. Failure to identify a target automatically leads to deliberative cognitive processes (Johnson, Hashtroudi, and Lindsay, 1993). Comparing accurate with inaccurate identifications, Sporer (1993) found accuracy directly related to rapidity. A literature review (Sporer, 1994) revealed a slight, but reliable, correlation between reaction time and eyewitness accuracy. In four studies, Dunning and Stern (1994) found that automatic recognition, as assessed by participants' inability to detail any explicit decision-making strategy, yielded significantly more accurate target identifications from lineups compared to inaccurate witnesses who reported deliberative process-of-elimination strategies. The accurate identifications were made more rapidly than inaccurate, replicating Sporer (1993). Accurate witnesses also reported no effect of the foils, whereas inaccurate responses were analogous with the foils having had a confusing or deleterious effect upon decision-making, replicating the findings of Hay, Young and Ellis (1986).

Information Processing

These results are reflective of the literature on information-processing systems and memory. A distinction is drawn between two types of memory processes: automatic and attentional or effortful. In perception, automatic processes occur at an early age, attentional processes relatively late and after substantial sensory processing (McClelland

and Rumelhart, 1982; Posner and Klein, 1971). Automatic processes, characterized by a lack of awareness, are rapid and deal with the familiar, while attentional processes are slower as they grapple with what is novel and unpracticed (Ericsson and Simon, 1980; Mandler, 1975; Marcel, 1980; Posner, 1978). Recognition of familiar words, objects, and faces is skilled and therefore automatic, with rapidity, efficiency, and a diminution of performance awareness all indicators of mastery. Describing performance is an attentional task. Skilled recognizers are unlikely to provide the rationale for their performance ability, and their very efforts to describe the processes involved will interfere with that ability. Mastery of performance is a function of exposure and practice resulting in hierarchically formulated task-specific procedures (Anderson, 1982; Chase and Ericsson, 1981; McClelland and Rumelhart, 1982). Difficulty in description stems from this information-processing hierarchy in that once a featurally-based lower tier is assimilated, higher control levels are automatically activated to access the information. Kahneman and Treisman (1984) distinguish between automatic perception of the properties of an object and the attentional control of perception between objects. Awareness, or attention, are present only at these higher control levels. Before practice, attention is directed toward component features and their relationship; with practice, attention is turned to a single entity (Keele, 1981). This is the foundation of upon which Anderson (1982) posits the existence of two different types of knowledge: declaritive and procedural. The early stages of learning (lower level, feature-based, nonproficiency) are declarative; later stages occur as the result of extensive practice that establishes procedural regulation of declarative knowledge. This development brings a comparable rapidity in processing and

awareness of only the higher order functioning. Familiar language as well as face perception and recognition are based on this higher order fusion of specific componentry. Marcel (1983b) proposed that perceptual recognition occurs at the "most functionally useful" level, which becomes higher as we learn more related stimuli. It has also been proposed that other-race face perception is less useful, and so less used and less accurate (Malpass, 1990). These implications of awareness, or lack thereof, and attention on information processing is as indicative for recognition as it is for perception.

If recognition occurs automatically, it would be accomplished without awareness of the underlying decision-making processes and would be evidenced by the inability to verbalize them. Conversely, if recognition is accomplished through attentional or effortful processes, these should be describable. Fundamental to a hierarchical representation of processing are the factorally variable associative pathways interconnecting features and higher-order functioning. Within pattern recognition models, automatic perceptual recognition of a word, with its familiar meaning, is extremely fast, whereas associative meanings of that word are processed much more slowly. The difference in speed has been attributed to practice effects—automatic perceptual recognition utilizes habitual pathways established via the frequency of the task, whereas associative search by definition is unpracticed, effortful, and thus time- consuming. Klatzky (1984, p.72) indicates that recognition testing, like recall, may employ either automatic or associative strategies depending on the similarity or cuing between study and test phases. These discrete strategies have been propounded as the rationale for variations in recognition memory performance (Atkinson and Joula, 1973; Baddeley, 1982; Mandler, 1980). Posner and

Snyder (1975) and Shiffrin and Schneider,(1977); Schneider and Shiffrin, (1977) explicated similar theories to account for variant recognition memory performance through automatic and attentional processes, which they termed "controlled processing". Shiffrin and Schneider (1977) compellingly demonstrate the role of massive practice in the development of automatic processing. Subjects who were throughly practiced on target items responded directly and rapidly on both single and multiple targets lists. Lack of practice (training) resulted in a search process which yielded more errors and longer response times. These results nicely demonstrate the significant positive correlation between the progression of performance from controlled to automatic through practice.

In summary, controlled-conscious-attentional-effortful processing becomes automatic through substantial training or practice. Differing degrees of practice make for different degrees of automaticity with resultant variations in performance expertise. Feature-detection and configural processing expertise develop from effortful/attentional to effortless automaticity, through learning that is either explicit (i.e., visual pattern recognition of letters of the alphabet) or implicit (language acquisition) via the critical dimension of practice/training. This practice, however, must be in overwhelming quantity and with consistency of stimuli. Once practice has established a high degree of automaticity, it is very difficult to undo it. This is illustrated by the aforementioned inability to decompose expertise into its fundamental components.

Differential contact

Individuals vary in their ability to recognize familiar and unfamiliar faces correctly (Sporer, 1993). A face recognition study designed to evaluate individual ability,

(Woodhead, Baddeley, and Simmonds, 1979) found accuracy among participants ranged from 17% to 100%. Grouped by good versus bad recognition on the first recognition test, good "recognizers" performed significantly better at a second face recognition test (4% vs. 15% errors), and on a picture recognition test (1% vs. 5% errors), while word recognition was equivalent for both groups. These findings suggest that individual differences exist in visual memory, but not in word recognition. However, this dichotomy may be more reflective of variations in exposure and/or practice leading to between-subject differences in automaticity/expertise and commensurate accuracy for face recognition. The more practiced task of word recognition would not be expected to manifest significant intersubject differences.

If degree of contact or exposure were reflected in face recognition performance, training to enhance performance, both within- and between-races, should be possible. Yet within-race training has not resulted in any gain in performance (Penry, 1971; Woodhead et al., 1979; Baddeley and Woodhead, 1983; Sporer, 1993). Malpass (1981) investigated whether own- and/or other-race recognition could be improved, finding that own-race performance remained constant while short-term other-race recognition improved. Other-race performance using White observers and Japanese faces improved with training on a paired associates task (Elliot, Wills, and Goldstein, 1973), and this gain persisted over a period of five months (Goldstein and Chance, 1985). Simply using a large number of recognition trials, (Malpass, Lavigueur, and Weldon, 1973) found that Black and White participants lost the own-race bias that they had initially demonstrated. Lavrakas, Buri,

and Mayzner (1976) found White participants' performance on Black face recognition improved but only for a one-week period.

Differential contact, exposure, or practice are variables that impact the development of human complex performance in general. Not only is this demonstrated by the own-race effect, but most studies on skill development in learning and memory also demonstrate that practice improves performance along a continuum from novice to expert. Expert performance with its automaticity, accuracy, and rapidity differs quantitatively and qualitatively from the controlled, conscious, or effortful performance of the not-so-expert. Exposure/familiarity implicitly develops own-race perception and recognition expertise, exemplifying automaticity (as in literacy) but at the same time relegating other-race perception and recognition to effortful, controlled, or conscious processing with lesser discriminabilty.

HYPOTHESES

This paper has reviewed the theories advanced, and subsequently dismissed as inadequate, in explanation of own-race recognition bias. Building upon and redefining the role of contact/exposure by capitalizing on research in human perception, learning, and memory, this study forges ahead in an effort to account for the elusive nature of this bias or cross-race effect. Establishment of a viable theory of contact should inherently yield distinctive decision-making parameters reflective of eyewitness accuracy—among the most sought after and elusive practical implementations of research in forensic psychology.

The discarded theory of contact in explanation of the cross-race effect was quantitatively based; it posited that mere exposure would result in better other-race recognition. The present research proffers a workable theory of contact which is both qualitative and quantitative in nature. Indeed, it *is* mere exposure that promotes own-race recognition expertise with its inherent other-race effect. The critical quantitative dimension of exposure occurs during the qualitatively based development of recognition skills. This theory raises, and this dissertation appraises, the following hypotheses:

1) There exists an own-race bias resulting in better recognition of own- compared to other-race faces. Experiment one, using a yes/no recognition task, seeks to demonstrate and thus replicate this effect for Black, White, Asian, and Hispanic participants who were raised in uniracial homes.

2) The underpinnings of the own-race bias can be demonstrated to be a function of infant and early childhood contact. Experiment two, using the same paradigm and stimuli

as Experiment one but using participants raised in interracial homes, seeks to demonstrate the own-race bias for faces corresponding to the races of participants' primary caregivers.

3) Within- and between-group comparison of results from Experiments one and two should reveal that other-race recognition ability is a function of early developmental background and exposure.

4) The own-race bias is the product of automatic processing (developed implicitly during infancy/early childhood) whose use is demonstrable through the assessment of reaction time, self-reported cognitive decision-making methodology, and accuracy. Experiment three, using the participants from Experiments one and two, presents a video of a mock crime (Black, White, Hispanic, or Asian perpetrator) and subsequently tests recognition with a simultaneous photo lineup. This allows uni- vs. inter-racial comparison of both own- and other-race recognition accuracy as well analysis of the underlying decision-making processes (automatic vs. process-of-elimination). Accurate identification is hypothesized to be automatic and rapid for own-race parental componentry (hereinafter, the terms "parent" and "parentage" will be understood to mean not only biological parents, but caretakers, guardians, foster parents, etc.).

5) A general other-race recognition task and familial background questionnaire (Experiment one/two) can be of value as a ancillary support for determining the veracity of cross-racial eyewitness identification (Experiment three).

EXPERIMENT 1

The purpose of this experiment is to replicate the own-race bias with a yes/no recognition task using White, Black, Hispanic, and Asian stimuli and observers.

Method

Participants. Thirty observers from each of the aforementioned races (N=120), with uniracial parentage (determined by questionnaire as to familial constellation and background—Appendix A), were recruited from the undergraduate psychology subject pool and received two hours' research credit for their participation. All observers were required to have lived in a uniracial home for the first three years of life. Each observer was randomly assigned to, and individually tested on, a randomly ordered stimulus presentation of 24 slides.

Stimuli. These consisted of a pool of 48 color slides (drawn from a pool of 300) depicting the face and upper torso of young adult males (aged 18-24), equally distributed by race. All slides had been screened by eight own-race judges (two per race) to eliminate bias from any atypically memorable slides. No outstanding characteristics, i.e., facial hair, scars, glasses, or distinctive clothing (all subjects wore a blue windbreaker), were present. The level of, and center point between, the eyes are constant across photos. Facial images were held relatively constant due to fixed camera-to-subject distance.

Design and Procedure. The study or acquisition phase presented 24 randomly ordered (each presentation) faces, each with equal representation of race: 6 White, 6 Black, 6 Hispanic, and 6 Asian. Each slide was displayed for seven seconds with an inter-stimulus interval of three seconds. The test or recognition stage presented the 24 target

(old) faces randomly intermeshed with 24 foil (new) faces, each for seven seconds with an inter-stimulus interval of three seconds. The set of new faces followed the same distribution of race. In this stage, faces were grouped by race with order of group and appearance counterbalanced across observers.

Participants were run individually with the experimenter present. Upon entering the room (8x10, no windows) participants were seated at the table approximately two feet directly in front of a slide projector (Singer Caramate Model 4235 with built-in 12" screen). Participants were informed that they would be viewing a series of color slides depicting faces in order to assess recognition ability for the purpose of evaluating eyewitness accuracy. To heighten participant attention to the task, they were presented with a letter from the New York State Supreme Court trial administration division introducing the study, its purpose, and thanking them for their participation (Appendix B). Participants were then shown the acquisition series of slides. Upon completion of the study phase, observers answered a twenty-minute (held constant) questionnaire on their understanding of how memory works (Appendix C). The recognition phase required observers to identify photos as previously seen (old) or not (new) by circling the appropriate indicator on a 6-point Likert scale from "1" *absolutely certain face was old*, to "6" *absolutely certain face was new*. For analysis, ratings of less than or equal to three were considered "old" and greater than or equal to four were considered "new." Upon completion of this task, participants were offered refreshments and took a ten minute break before proceeding to Experiment three.

Results

As predicted, recognition for own-race was significantly better than for other-race (see Figure 1). The data were subjected to signal detection analysis yielding the recognition performance measure d'(z Hit rate - z False Alarm) for each subject. Criteria

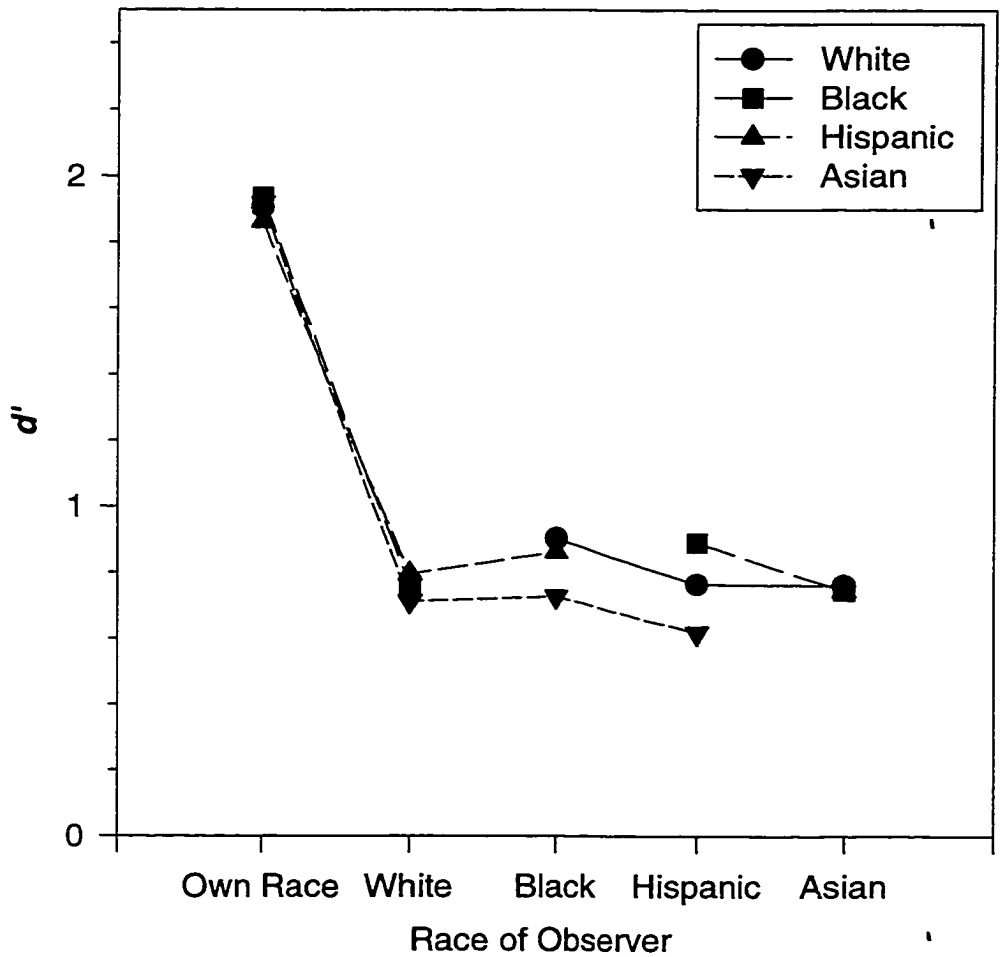

Figure 1. Own-race bias in recognition for uniracial observers.

did not significantly differ between same race groups or within other race groups[2]. No effect for presentation order of group or individual was apparent. There was a minimal $r(120) = .281$, but non-significant relationship between confidence and d'.

A General Linear Model repeated-measures analysis of d' scores (within-subjects factor—4 levels of Target) by race of observer (between-subjects variable—4 levels) revealed, as predicted, a significant interaction $F(9, 348) = 46.161$, $MSE = 12.94$, $p < .0005$. Allowing for the possibility of violation of test assumptions a Huynh-Feldt degrees of freedom adjustment was performed ($\varepsilon = 1.000$). There were no main effects for either race of target $F(3, 348) = .777$, $MSE = .218$, $p > .05$, or race of observer $F(3, 116) = .418$, $MSE = .138$, $p > .05$.

Scheffé post-hoc analysis of homogeneous subsets indicated significant differences on recognition performance for each race of observer on own-race targets (see Table 1).

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[2] C, a measure of the displacement in z-score units of the criterion, computed as $-0.5(z_H + z_{FA})$. Smaller values imply looser criteria (Snodgrass and Corwin, 1988).

Table 1.

Scheffé Post-Hoc Analyses for Homogeneous Subsets From Uniracial Parentage

Parent Race	Subset	
	1	2
	d' Means for White Targets	
Asian/Asian	0.76	
Hispanic/Hispanic	0.76	
Black/Black	0.90	
White/White		1.88
	d' Means for Black Targets	
Asian/Asian	0.74	
White/White	0.76	
Hispanic/Hispanic	0.89	
Black/Black		1.96

(table continues)

Table 1 (continued)

Parent Race	Subset 1	Subset 2
	d' Means for Hispanic Targets	
Asian/Asian	0.74	
White/White	0.79	
Black/Black	0.86	
Hispanic/Hispanic		1.86
	d' Means for Asian Targets	
Hispanic/Hispanic	0.62	
White/White	0.71	
Black/Black	0.73	
Asian/Asian		1.90

Note. Harmonic mean sample size = 30. Scheffé $\alpha = .05$.

EXPERIMENT 2

The purpose of Experiment two is to determine whether the cross-race effect existed for members of multiracial parentage or homes. If other-race recognition ability is a function of developmental background and exposure, it is hypothesized that children with multiracial exposure would demonstrate own-race biases for the races of their primary caregivers.

Method

Participants. One hundred and seven observers (30 Black [B], 30 White [W], 25 Hispanic [H], and 22 Asian [A]) from interracial homes as determined by questionnaire (Appendix A) on familial constellation and background. Observers were required to have lived in a multiracial home for the first three years of life. Race of observer by "Father/Mother" was as follows:

Black (N=30)—8 W/B, 7 B/H, 2 B/A, 9 B/W, 4 H/B;

White (N=30)—5 W/B, 10 W/H, 4 W/A, 2 B/W, 7 H/W, 2 A/W;

Hispanic (N=25)—8 W/H, 4 B/H, 1 H/A, 5 H/W, 6 H/B, 1 A/H;

Asian (N=22)—9 W/A, 1 B/A, 4 H/A, 6 A/W, 1 A/B, 1 A/H.

Observes were recruited from the undergraduate psychology subject pool at Brooklyn College and from Kingsborough Community College. The former received two hours' research credit and the latter extra credit for their participation.

As in Experiment one, each observer was randomly assigned to, and individually tested on, a randomly ordered stimulus presentation of the same 24 slides.

Stimuli, Design, Procedure. Same as Experiment One.

Results

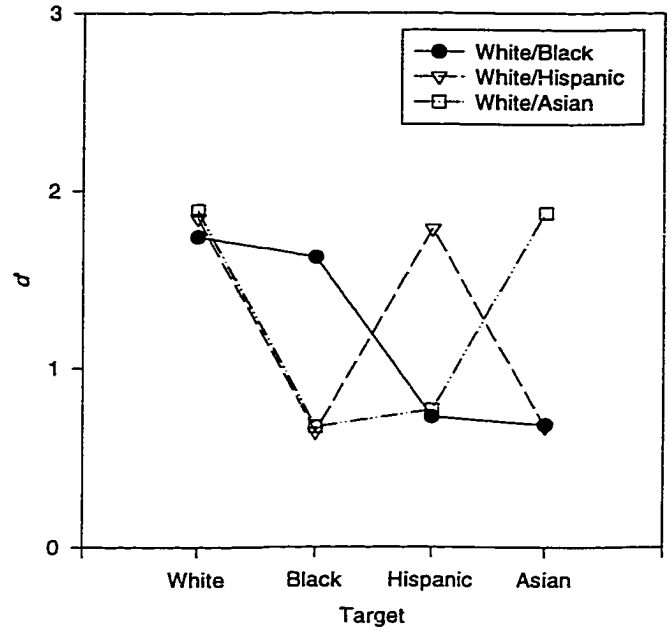
As hypothesized, multiracial developmental background affords own-race performance ability for both parental races (see Figure 2, p. 44-45). Data, as in Experiment 1, were subjected to signal detection analysis yielding a d' score for each subject. Criteria (see above footnote 2, p. 38) did not significantly differ between same race multiracial groups or within other race groups. No effect for presentation order of group or individual was apparent. No relationship between confidence and d' was apparent. Since there were no order differences for parents (Father/Mother), $F(11, 95) = .608$, $MSE = .134$, $p > .05$, results were collapsed for parentage order: W/B + B/W = W/B; W/H + H/W = W/H; W/A + A/W = W/A; B/H + H/B = B/H; B/A + A/B = B/A; H/A + A/H = H/A.

Means (d') for collapsed parentage by race of target are presented within the Scheffé analysis. A General Linear Model repeated-measures analysis of d' scores (within-subjects factor—4 levels of Target) by race of observer (between subjects variable—4 levels) and collapsed race of parents (between subjects variable—6 levels) was performed. Allowing for the possibility of violation of test assumptions a Huynh-Feldt degrees of freedom adjustment was performed ($\varepsilon = 1.000$). No significant three-way within-subjects interaction (race of subject x race of target x collapsed race of parent) was observed. Additionally, no two-way within-subjects interaction (race of subject x race of target), no two-way between-subjects interaction (race of subject x collapsed race of parents), and no main effects were apparent. However, as predicted, the two-way interaction between race of target and collapsed race of parents was significant $F(15, 285)$

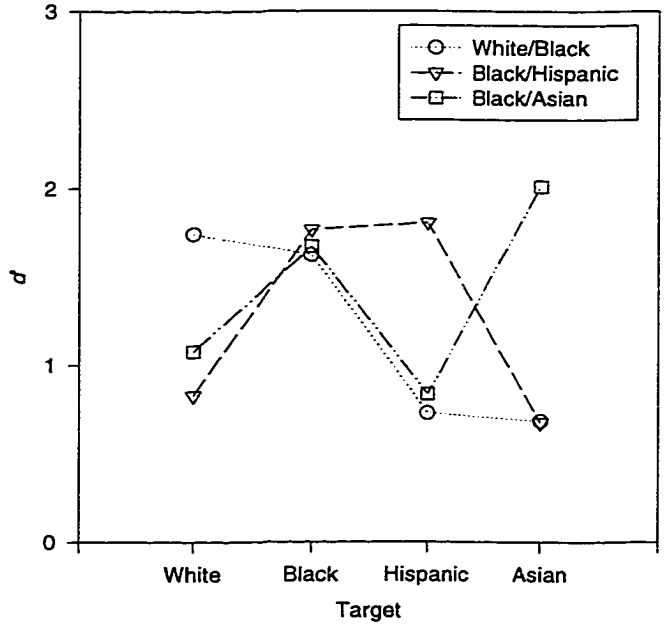
= 13.756, $MSE = 3.348$, $p < .0005$ Scheffé post-hoc analysis for each race of target groups same race observers in significantly different homogeneous subsets than other-race observers (see Table 2, pp. 46-47):

d' White target	B/H, H/A, B/A, W/B, W/H, W/A;
d' Black target	W/H, W/A, H/A, W/B, B/A, B/H;
d' Hispanic target	W/B, W/A, B/A, W/H, B/H, H/A;
d' Asian target	W/H, B/H, W/B, H/A, W/A, B/A.

White Parent Combinations



Black Parent Combinations



(Figure 2 continues)

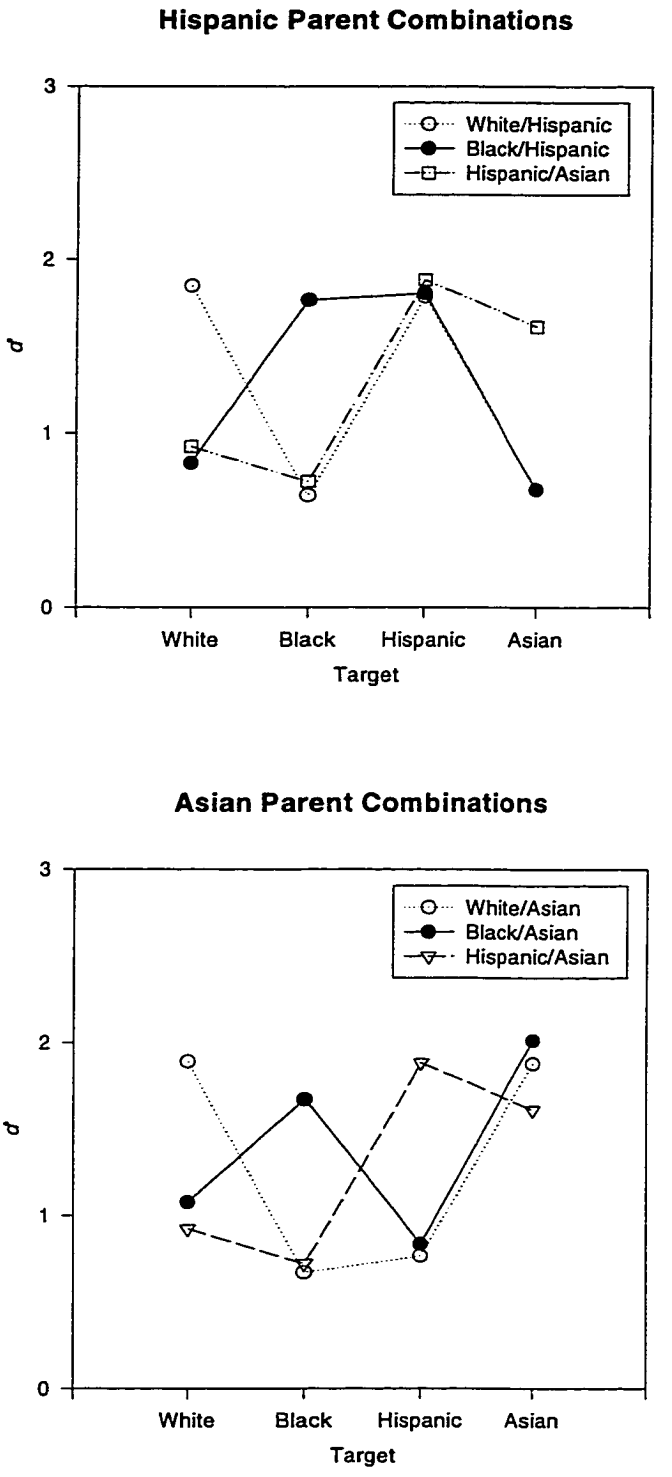


Figure 2. Own-race bias in recognition for multiracial observers.

Table 2.

Scheffé Post-Hoc Analyses for Homogeneous Subsets From Biracial Parentage

Parent Race	Subset	
	1	2
	d' Means for White Targets	
Black/Hispanic	0.83	
Hispanic/Asian	0.92	
Black/Asian	1.08	
White/Black		1.74
White/Hispanic		1.85
White/Asian		1.89
	d' Means for Black Targets	
White/Hispanic	0.64	
White/Asian	0.67	
Hispanic/Asian	0.72	
White/Black		1.62
Black/Asian		1.67
Black/Hispanic		1.77

(table continues)

Table 2 (continued)

Parent Race	Subset 1	Subset 2
	d' Means for Hispanic Targets	
White/Black	0.73	
White/Asian	0.77	
Black/Asian	0.84	
White/Hispanic		1.78
Black/Hispanic		1.80
Hispanic/Asian		1.88
	d' Means for Asian Targets	
White/Hispanic	0.67	
Black/Hispanic	0.67	
White/Black	0.68	
Hispanic/Asian		1.61
White/Asian		1.87
Black/Asian		2.01

Note. Harmonic mean sample size = 10.655. Scheffé $\alpha = .05$.

EXPERIMENT 3

This experiment compares the influence of racial background for both own- and other-race face recognition by assessing decision-making strategies, reaction time, and accuracy, using a mock crime scene video and subsequent photo lineup. It was expected that an own-race bias would manifest itself for race of "parents" regardless of subjective race of participant. Moreover, own-race bias will be reflected in higher recognition accuracy, faster reaction time, and automatic decision-making processes.

Method

Participants. All participants from Experiments one and two (N=227) served in this experiment. Observers were randomly assigned and individually tested on one of four stimuli presentations.

Stimuli. A VHS surveillance color video depicted a mock crime in a 24 hour convenience store. The perpetrator was a 21-year-old White male, 5'11", 175 lbs., with brown eyes and hair; a 19- year-old Black male, 6'00", 185 lbs., with brown eyes and hair; an 18- year-old Hispanic male 5'10", 160 lbs., with brown eyes and hair; and a 19-year-old Asian male, 5'7", 145 lbs., with brown eyes and black hair. All "perpetrators" were rated by six own-race judges to insure representativeness of the population. No distinctive characteristics, i.e., facial hair, scars, or glasses, were present. Clothing was kept constant—blue jeans, gray sweatshirt with hood, and white sneakers. Movement in the store was directed by script and thus constant across perpetrator.

The video camera in the store was mounted on the wall eight feet above the floor directly over the cash register and focused on the area in front of the register counter which allowed for a view of the entranceway.

The film depicts the perpetrator entering the store and looking at groceries along the main aisle of the store while glancing furtively at the cashier. Two other customers are at the register. The perpetrator waits for them to leave and then moves up to the register and addresses the cashier (no audio track). He reaches into his waistband as if to extract a weapon as he motions to the register with his left hand. The cashier frantically starts pulling bills from the register, stuffing them into a paper bag. The perpetrator grabs the bag, turns, and exits the premises. Total viewing time is three minutes and 15 seconds. The perpetrator's face was clearly discernible upon entering the store and at the register for a total of two minutes and 30 seconds. The salient event at the register took 33 seconds to transpire.

A simultaneous photo lineup (video) was assembled to test recognition for each race of perpetrator. A photo of the perpetrator was presented with five foils. All photos were full figure frontal view and all wore blue windbreakers and jeans. The photos were numbered one thru six at the bottom center. The foils were selected from a pool of 150 and were rated by six own-race judges to be viable alternatives to the target, i.e., of the same height, build, coloring, and hairstyle.

Design and Procedure. Each group of subjects (uni- vs. multi-race parentage) were randomly split and assigned to one of the four video presentations. Participants were run individually with the experimenter present and were instructed that they would be

viewing a video of an actual crime and would be subsequently queried about it. They were seated across from a 19" Sony flatscreen monitor/television at a distance of five feet. After viewing the video, participants answered a five-minute (held constant) questionnaire about own- and other-race contact outside of the home, e.g., schooling, friends, recreational activity. Their attention was redirected to the monitor, and they were told that they would be shown a photographic lineup of six persons, among whom the perpetrator might or might not be present. They were instructed to voice their decision to the experimenter (seated behind them on the far side of the room to avoid experimenter bias). The experimenter surreptitiously clocked participants' reaction time from lineup onset to decision and if questioned redirected participant to task.

A final questionnaire was administered. Participants were asked to reindicate the photo number chosen, or the fact that no choice was made, and their degree of surety. Next, a series of statements, adapted from Hay, Young, and Ellis (1986), queried the nature of their decision-making process. They could select as many responses as deemed sufficient to answer "How did you come to choose, or not choose, a perpetrator?" Three responses concentrated on automatic processing: 1) "The face just 'popped out' at me;" 2) "I recognized him—but can't explain why;" 3) "Right away I was sure he wasn't there." Process-of-elimination/effortful strategies were tapped by three statements: 1) "I compared the photos to one another;" 2) "I ruled out the obvious mismatches and picked from the rest;" 3) "He was the closest to what I remembered." Feature based/effortful recognition was assessed by the statement: 4) "My choice was based on particular features of the face." Finally, they were able to select "other" and describe. Order of the

questions was random, with the exception of "other," which always appeared last so as not to lead the witness.

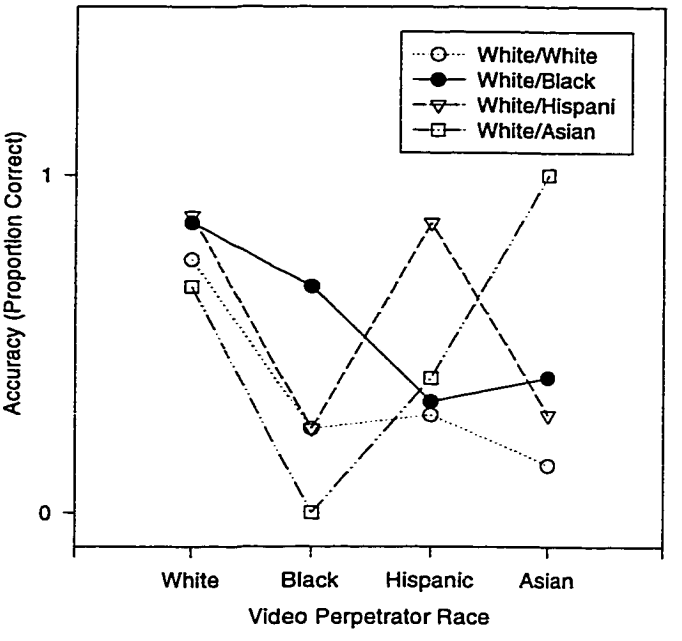
Finally, participants were asked whether these statements adequately addressed their decision-making processes and, if not, to describe the process in their own words.

Subjects were then told the perpetrator was in fact in the lineup, and his position. They were debriefed as to the nature of the study (which was described to them initially, as well), what it hoped to achieve, and that if they wished they could return for the final results. They were asked if they had any questions, requested not to discuss the study with any other students, and thanked for their participation.

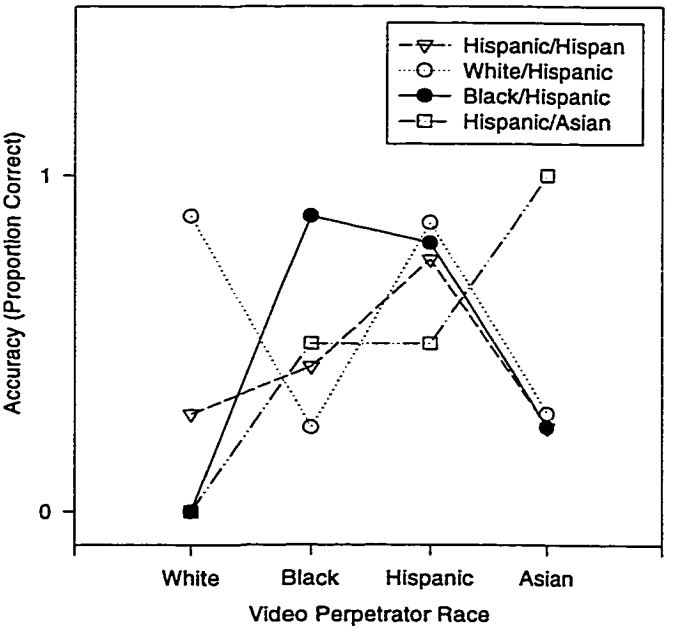
Results

Own-race recognition expertise significantly differs as a function of developmental background/parentage (see Figure 3, pp. 52-53). A General Linear Model univariate analysis of the between-subjects effects comparing accuracy of identification by collapsed race of parents and race of video perpetrator exhibited no main effects, while the interaction between collapsed race of parents and race of video perpetrator was, as hypothesized, significant $F(27, 226) = 3.036$, $MSE = .624$, $p < .0005$. In order to scrutinize this interaction, collapsed race of parent was assessed for each level of video perpetrator (4 levels—White, Black, Hispanic, and Asian). Own-race recognition (uni- and multiracial background) was significantly more accurate than other-race for the following: White perpetrator $F(9, 56) = 2.837$, $MSE = .556$, $p < .009$; Black perpetrator $F(9, 59) = 3.003$, $MSE = .584$, $p < .006$; and Asian perpetrator $F(9, 53) = 2.635$, $MSE = .519$, $p < .016$. For the Hispanic perpetrator no such difference manifested itself.

White Parent Combinations



Hispanic Parent Combinations



(Figure 3 continues)

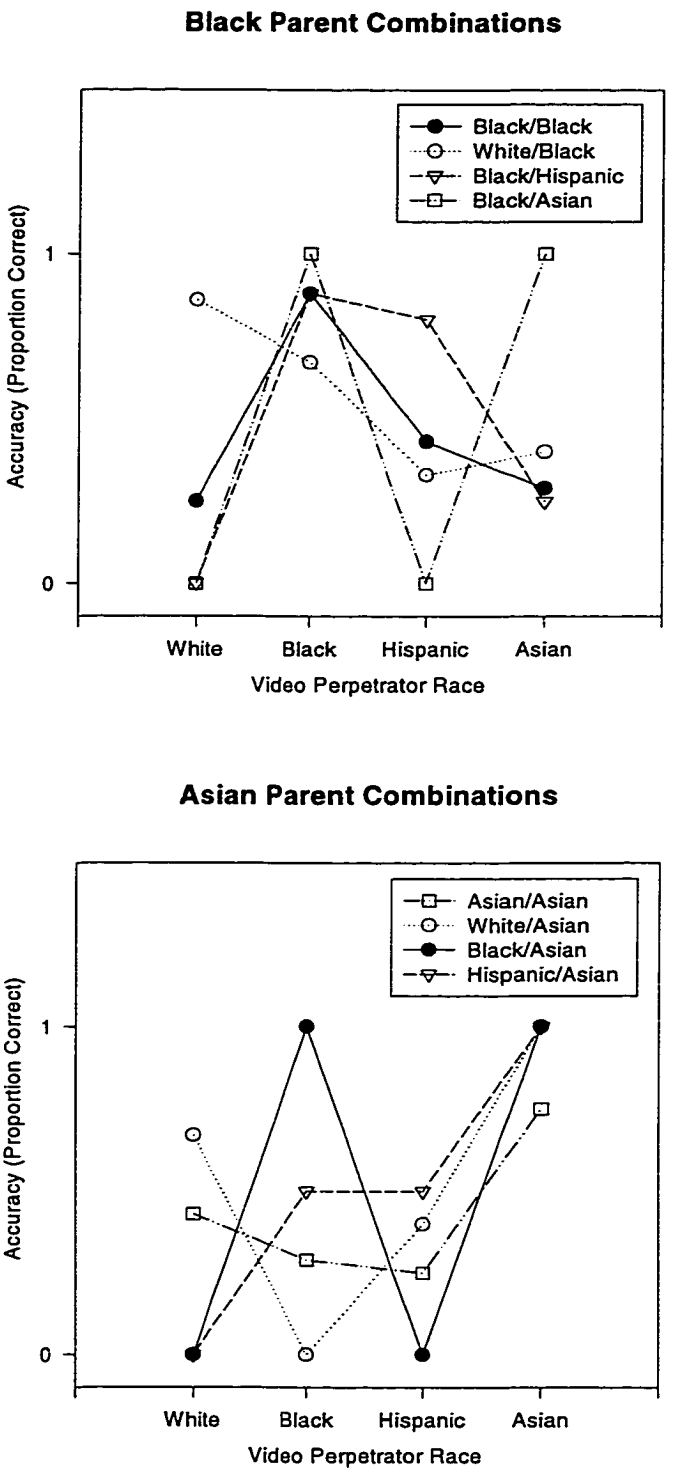


Figure 3. Recognition accuracy for Video Perpetrator Race and Race of Parentage.

Analyses of reaction time by cognitive processing and accuracy reveals main effects for both as well as a significant interaction (Figure 4). Automatic processing is, not surprisingly, performed significantly faster ($N = 126$, $M = 31.28$) than effortful ($N = 101$, $M = 50.31$), $F(1, 226) = 225.622$, $MSE = 29604.0$, $p < .0005$. Accurate responses were significantly faster ($M = 38.76$) than inaccurate ($M = 50.31$), $F(1, 226) = 42.845$,

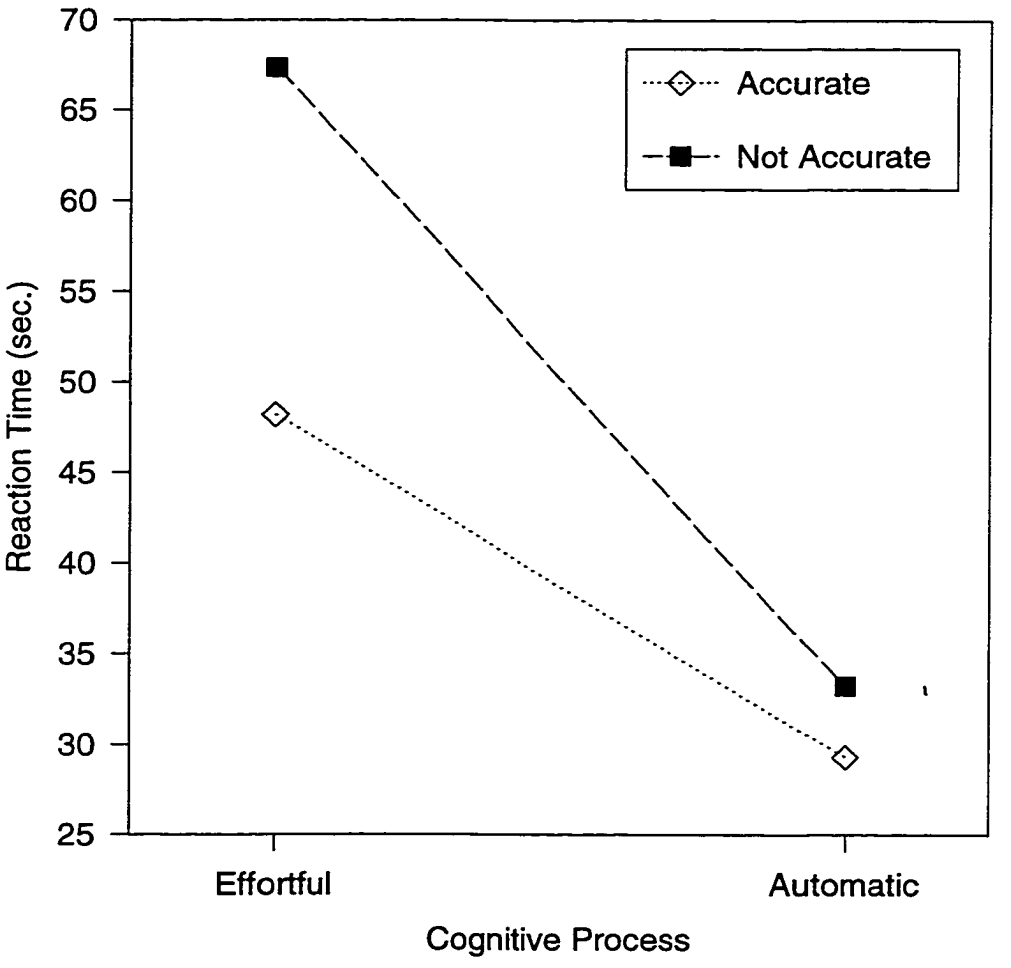


Figure 4. Cognitive processing by reaction time for accurate and inaccurate observers.

$MSE = 5621.763$, $p < .0005$. Exploring the interaction $F(1, 226) = 18.610$, $MSE = 2441.796$, $p < .0005$, reveals that in effortful processing accurate responses are significantly more rapid ($M = 48.21$) than inaccurate ($M = 67.37$), $F(1, 125) = 58.008$, $MSE = 9117.046$, $p < .0005$; while for automatic processing accurate responses ($M = 29.31$) are only marginally more rapid than inaccurate ($M = 33.25$), $F(1, 100) = 2.875$, $MSE = 283.792$, $p < .10$.

Automatic processing leads to significantly more accurate recognition $F(1, 226) = 49.852$, $MSE = 10.011$, $p < .0005$. Nonparametric analysis of video perpetrator (4 levels) by cognitive process (2 levels) by collapsed race of parents (10 levels) robustly demonstrates that own-race recognition involves automatic decision-making processes $\chi^2(1) = 113.397$, $p < .0005$. This own-race automatic processing pertains to all races tested. Within this small sample population confidence was barely related to the use of automatic or effortful decision-making processes. In this sample, confidence showed a small positive—but non-significant—correlation, $r(227) = .217$, with accuracy. Self-reported other-race contact was slightly higher for multiracial parentage groups, however the difference across all groups was insignificant, $F(9, 226) = 1.283$, $p > .230$.

Hypothesis 5 was not supported by the data. The recognition task scores from Experiments 1 and 2 were not reliable predictors of own- or other-race accuracy in Experiment 3. The preponderance of subjects were accurate on both identification tasks, however approximately 15% were accurate on one and not the other.

DISCUSSION

This study's experimental findings are supportive of a viable theory of early developmental contact in explanation of own-race recognition expertise. Experiment one, comparing observers from uniracial homes with same and different race targets, unequivocally demonstrated, and thus replicated, the own-race bias for the four races under investigation. Experiment two, using observers from multiracial homes, found the own-race bias to generalize to both parentage races. Experiment three, with a more dimensionally realistic stimulus, affirmed the accuracy of own-race identification both within and across races while evidencing the decision-making parameters that can differentiate own- from other-race recognition performance. Own-race recognition emerged from automatic decision making processes which were more rapid and accurate than the effortful processes underlying other-race recognition.

As predicted, in Experiment one, own-race recognition was significantly better for own- compared to other-race for all studied races. This replicates, again, the well established own-race bias/cross-race effect (for reviews, see Brigham, 1986; Brigham and Malpass, 1985; Chance and Goldstein, 1996; Lindsay and Wells, 1983; Malpass, 1981, 1982; Shepherd, 1981). One caveat mentioned by these researchers was that most of the studies cited were confined to some combination of Black and White observers/subjects. The present study expands the literature to both Asian and Hispanic races and allows generalizability of the findings to a broad spectrum of the population.

With this established, Experiment two sought to address the elusive raison d'être for the own-race bias. A host of theories have been advanced (see Chance and Goldstein,

1996, for review), but none have adequately explained the phenomenon. As previously posited, all theories were engendered, subsumed, and thus confounded by their common denominator—contact. Consequently, one could conclude that contact, either qualitatively or quantitatively, was responsible for the effect. Testing of contact/experience had been demographically inferred or self-reported and suffered methodologically as a result. This paper advances the theory of "differential contact" in explanation of the own-race bias/cross-race effect.

Experiment two, manipulating contact/experience through multiracial parentage for observers found own-race recognition performance on targets corresponding to both races of parents, as hypothesized. Order of Race of Father/Race of Mother was immaterial. Understandably, self-declared race of observer did not interact with race of target as would normally be expected in own-race recognition due to the nesting of parentage in race. Scheffé post hoc testing of the robust interaction between race of parents and race of target revealed that race of observer's parents played a decisive role in target recognition—the races of the parents became an multi-own-race bias for the observer.

Experiment three was performed to reaffirm the role of early developmental contact through comparison of uniracial and multiracial parentage; to test race perception and recognition with a three dimensionally informative target (more realistic and generalizable stimulus); and to assess the fundamental decision making processes underlying own- and other-race recognition. Additionally, comparison between d' scores on a general recognition task (Experiment 1 and 2) and video perpetrator accuracy might

engender a predictor of eyewitness identification accuracy. If own-race bias is a learned expertise then, consistent with other human learning processes, recognition operations should be automatic, rapid, and accurate. Conversely, other-race recognition processes, with its axiomatically lesser degree of developmental exposure, should be effortful, slower, and less accurate.

As hypothesized, own race recognition expertise/accuracy appears to be a function of developmental exposure. For Black, White, and Asian perpetrators, any observer, regardless of race, with same race as target parent(s) demonstrated an own-race recognition bias. However, for the Hispanic target no such effect was found. Absence of this expected effect could be indicative of an across race ability to identify Hispanic targets through their phenotypical multiplicity. It could not be attributed to the video perpetrators' appearance as each was no more memorable than the other. Nor can it be ascribed to more substantial intragroup (Hispanic) contact, as the degree of self-reported other-race contact was not significantly different across the groups (perhaps due to the urban setting of the research).

Decision-making parameters were hypothesized to be related to accuracy along two continua: cognitive processes and reaction time. Greater own-race accuracy was accompanied by rapid automatic cognitive processes, while slower effortful processes resulted in poor other-race accuracy. Automatic processing was dramatically faster than effortful, and accurate responses were significantly more rapid than inaccurate. These findings replicate Hosch et al. (1989) and Sporer (1993), who found accuracy directly related to rapidity. A literature review, (Sporer, 1994), revealed a slight, but reliable,

correlation between reaction time and eyewitness accuracy. This study strongly supports this relationship. Interactively, for automatic processing accurate responses were only marginally more rapid than inaccurate, yet this automaticity lead to significantly more accurate recognition. This rapid accuracy is supportive of Schneider and Schiffrin (1977) in that own-race recognition processes are so rapid they seem unconscious. Nonparametric analysis clearly demonstrates that, across all races, own-race recognition involves automatic decision making. Thus, as predicted own-race accuracy was clearly accompanied by rapid automatic decision making. This is in keeping with Dunning and Stern (1994), who found that automatic recognition, as assessed by participants' inability to detail any explicit decision-making strategy, yielded significantly more accurate target identifications from lineups compared to inaccurate witnesses who reported deliberative process-of-elimination strategies. The accurate identifications were made more rapidly than inaccurate, replicating Sporer (1993) and supported by this study.

The lack of relationship between confidence (and the use of automatic or effortful decision-making) and accuracy for both own- and other-race observers/targets is reflective of the literature. A meta-analysis of 40 independent tests of postjudgment confidence found a .25 correlation with accuracy (Bothwell, Deffenbacher, and Brigham, 1987), and in keeping with the literature (for review, see Narby, Cutler, and Penrod, 1996).

Unexpectedly, there was no relationship between other-race performance on the recognition task from Experiments 1 and 2 and the accuracy of identification in Experiment 3. Although the expected relationship did exist for approximately 80% of

each group, it was negated by the few observers who were good performers on the first task and inaccurate on the second. Perhaps this intrasubject variability was stimulated as a function of task difference eliciting different strategies (Klatzky, 1984). There is no reason to think that this phenomenon would not exist in the real world, therefore the use of a recognition test as an indicator of eyewitness accuracy is not indicated.

General Discussion

The theory herein, that face recognition is primarily developmentally based on qualitative exposure/contact, is consistent with the development of other nurtured complex human performances. Recognition expertise develops not merely by exposure, or quantitatively, but through timing of exposure, or qualitatively, as well. Quantitatively based learning and memory studies, using a host of variables, have demonstrated that exposure to task results in improved learning, long term memory, and performance (Charness, 1979, 1981; Ericsson and Chase, 1982; Glaser, 1984; Peeck and Zwarts, 1983; Shiffrin and Schneider, 1977). A classic illustration of expertise based on quantitative exposure compared performance of three levels of chess player (master, good, novice) on the recreation of previously seen board arrangements (Chase and Simon, 1973; deGroot, 1965). Performance was directly related to the level of player and indicative of the ability of the expert to construct perceptual groupings based on previously seen board arrangements. This type of learning may be an additive factor to the developmentally based foundation of own-race face recognition.

Performance is not as much related to memory as it is to the processes of encoding and categorizing specific information. The human brain has many specialized processing

systems for tasks such as language and face recognition (Squire, 1987). The capacity humans have for own-race face recognition may be based upon a species-specific specialized brain mechanism for analyzing faces (Yin, 1970), which is supported by the research into prosopagnosia.

This premise intermeshes well with studies that suggest behavioral/performance learning occurs as changes in neural circuitry that is specialized for type of information (Kandel, 1976). What would be natural, if these are species-specific abilities or not, would be the interdependent cultivation of neural pathways through exposure-based implicit processing during early development.

The mirror image of the aforementioned memory retrieval/recognition work of Schneider and Schiffrin (1977) is the input/encoding processes proposed by Hasher and Zacks (1979; 1984). They suggested that certain environmental information (through exposure) is encoded into memory directly, without intention or deliberate attention, and as such is automatically processed. This is conceptually comparable to a psychologically or physiologically related phenomenon—implicit learning (Reber, 1967; 1976). Implicit learning is fundamentally unconscious, thus comparable to automatic processing of fundamental information from the environment, e.g., item or event frequency.

Exemplar provided rule based learning demonstrated that through exposure, unconscious learning of a complex grammar was possible (Reber, 1967; 1976). Conscious effort to discover/understand the rules impaired performance (Reber, 1977, 1980, 1985). Observer ability to appropriately apply the rules and inability to correctly verbalize the rule system support unconscious/implicit learning. Investigating the

dichotomy between expression of cognitive processes and performance, Broadbent, Fitzgerald, and Broadbent (1986), demonstrated good complex performance through practice without the ability to verbalize the underlying processes. This is similar to face recognition statements of automaticity as well as experts' inability to verbalize cognitive processes (Dodson et al., in press; Fallshore and Schooler, 1995; Ryan and Schooler, 1995) and are reflective of the aforementioned developmentally/exposure based expertise in own-race/parentage face recognition.

Neisser (1967, 1976), regarding information processing and cognition, observed that humans are unconsciously able to select, process and store essential information, either through practice or inherent mechanism (like that proposed by Yin, 1970), from a myriad of sensory input—he coined the term "preattentive processes." Zajonc (1984) demonstrated the mere exposure effect to have its foundation in unconscious learning. The automatic/implicit/unconscious learning of complex relationships, like that of face recognition and language, appears to be accomplished by multitudinous exposure to complex stimuli. Additionally Reber's (1967) implicit learning and Hasher and Zacks'(1984) automaticity are resistant to a host of conscious processing impairments and pathologies (Ceci, 1983; Remien, 1986; Vakil, 1985).

Conceivably, unconscious/implicit learning is mediated by primitive brain areas and is thus resistant to, or unavailable for, conscious verbal expression. Chomsky (1980) proposed the brain has specific systems for language, arithmetic, and other performance domains. Marcel (1983a, 1983b) suggested a combined innate automaticity and acquired automaticity that guide decision-making. Lewicki (1985, 1986) demonstrated social

judgments to be unconsciously founded and posited them to be based upon event covariation.

It is this covariation that consolidates exposure, implicit learning, automatic processes and face recognition. Initially, the connection was drawn between implicit learning and Hasher and Zacks' automatic processing by proposing that if observers keep a frequency count of single event occurrence, then a count of covariational events is conceivable and could account for implicit learning (Reber, 1986). In fact, Reber and Lewis (1977) demonstrated the logging of bigram covariations of relational form in that the representation of observers' acquired synthetic grammar was "virtually completely accounted for by a bigram invariance system" (Reber, 1986, p.2). Lewicki (1986, p.28) concluded:

> The most basic category involved in processing information such as concrete episodes and general concepts or procedures, is a notion of co-occurrence or, more generally, covariation. To encode any kind of information, a cognitive system has to process data in terms of covariations. For example, there is no other way to acquire a concept than to discover co-occurences between some of its features; the only way to interpret any stimulus is to check whether features co-occur in a stimulus. Processing information about covariations is a basic aspect of any act of cognition.

For developmental domains such as language or face recognition, it does not functionally matter whether processing seems or becomes unconscious through practice and thus is no longer attentional, or, whether these processes are innately unconscious. Ultimately, as in own-race face recognition research, the theories in explanation of behavior/performance are dependent upon contact/exposure.

Environmental exposure is the basis for frequency and covariation counting which is a fundamentally simple process without high level cognitive demands. Classical conditioning within simple creatures demonstrates the use of relational covariation, in that it is dependent on the animal's ability to distinguish "genuine covariation from fortuitous co-occurrence" (Rescorla, Grau, and Durlach, 1985). This allows the animal the ability, without conscious effort, to associate location with positive (food) or negative (predator) outcomes. Humans learn through both conditioning and abstraction.

The linkage between the fundamental learning systems and the complex and conscious processes is relational as well. Cognitive theories of memory (and learning) posit linkages between related memories. McClelland and Rumelhart's hierarchical representation (McClelland and Rumelhart, 1982), and Anderson's propositional networks (Anderson, 1983) are examples of related connectivity. Such systems begin with a fundamental counting process, with each perception categorized and stored in such a way as to allow its association with related perceptions. The more complex models, describing tasks such as face recognition, can be built from memory of these related perceptions or covariations. Thus, humans' learn both implicitly and consciously through related perceptions or the memory of covariations obtained from exposure.

The difference between implicit and conscious learning and automatic and effortful performance is illustrated in the literature on the effects of training on own- and other-race recognition. Own-race recognition cannot be improved upon and attempts to do so have impaired performance. Other-race recognition usually improves through training or increased exposure, however the improvement does not persist (for review, see Chance and Goldstein, 1996). These findings are consistent with implicit learning and automatic processing.

Wiseman and Neisser (1974) proposed that increased familiarity with faces permitted the development of an internal representation of faces which incorporates knowledge of their distinctive features, organization, and range of variability. A number of authors (Goldstein and Chance, 1980; Valentine, 1988; Valentine and Bruce, 1986) have postulated that through frequent exposure a schema or prototypical representation of familiar faces develops. Faces closer to the schema are encoded and discriminated more effectively or automatically while other faces require more effort and are less well discriminated. Valentine and Endo (1992) view the representation of faces as the interrelationship between points in a multi-dimensional space. Autoassociative memory/neural networks have been able to model some qualitative aspects of face processing (O'Toole, Deffenbacher, Abdi, and Bartlett, 1991; Valentine and Ferrara, 1991), yet these systems are again all dependent upon the amount of exposure/detail that is input. In a direct assessment of the other-race effect using an autoassociative model, O'Toole, Deffenbacher, Valentin, and Abdi (1994), with face images represented in a parallel and distributed way loaded/trained the model using a majority of Caucasian faces

and a minority of Japanese faces and found an own-race effect. Typicality was interactively composed of two components: memorability and familiarity. The global or structurally based typicality disturbed Caucasian observers of Japanese faces more than own-race faces. They conclude this finding is reasonable and consistent with the own-race effect, as Caucasian observers have greater expertise through greater exposure and can therefore code small variations in facial form for own-race targets.

Conclusions

All the aforementioned research can be construed as variations/developments on the concept that face recognition is based upon an implicitly learned frequency counting of covariation amongst salient features of own race(s) enabled through developmental exposure. From birth exposure/contact in the development of own-race bias is critical as this is the foundation upon which the quantitative loading of covariant information rests. In summary, no matter what method of learning or which model of processing is entertained the foundation for the own-race bias/other-race effect is in developmental exposure.

This is supported within this paper by the finding of an own-race bias/expertise for targets matching race of parents. Measures of this expertise, e.g. reaction time and cognitive processes are robustly related to accuracy of own-race face recognition. Theoretically, these measures, combined with developmental background assessment, can provide support for, or refutation of own- and other-race eyewitness identification.

Limitations

The use of response variables to predict accuracy in forensic applications, no matter how strong the relationship, can be problematic. For instance, the general recognition task in Experiments 1 and 2 reflected own-race/ parentage bias but was not a reliable indicator of accuracy in Experiment 3 even though this task reflected the same biases. This could follow from the different nature of the tasks or be reflective of intrasubject variation in performance that exists within the population. What was apparent from the data was that observers who were correct on the first task and incorrect on the second made their lineup choice inordinately quickly. Unfortunately, this anomaly makes the use of reaction time, with its robustly significant relationship to accuracy, difficult to use as a standalone predictor of accurate eyewitness identification. Whether this impulsiveness is task/demand related or reflective of a dynamic that exists within the population needs to explored. Cognitive processes, very strongly related to accuracy/reaction time were not absolutely correct when utilized to predict accuracy/inaccuracy. In fact, when adding cognitive process into a hierarchical regression analysis of reaction time and accuracy, reaction time demonstrated the more significant relationship. One of the most difficult aspects of this study was acquiring observers with varying multiracial background. This problem created a number of cell values that were disproportionally high or low due to the very small number of subjects. Despite these caveats, this study furthers our knowledge of the only variables that are available to the trier of fact to assess accuracy. It is necessary to have a viable theory in explanation of the

own-race effect/cross-race bias to assess underlying variables. This study offers and supports such a theory.

Future Research

Avenues for future research include the use of perpetrator absent lineups that should elicit the use of effortful processing with longer reaction times. Conversely, it would be interesting to reduce effortful processing through the use of a sequential lineup procedure. Sporer (1993) demonstrated inaccurate identifications were made more slowly than accurate using a sequential lineup. Would presenting real lineups sequentially engender the use of automatic and thus accurate decisions? The failure of the own-race bias for the Hispanic target needs to be investigated. This was not thought to be due to target distinctiveness as this dimension was assessed by own-race judges. One possibility is that the Hispanic population may be influenced by a complex of racial backgrounds. Additionally, Hispanics may need to be broken down into demographic subgroups.

Regarding the theory of developmental contact, it would be revealing to use children of one race who were placed at differing ages into foster care of another race. Within this study only three observers reported foster care parents of differing race. Another avenue to pursue would be to use actual cases of wrongful conviction attributable to cross-racial mis-identification in order to assess eyewitness background, decision-making process and recognition ability. Finally, the use of new computer face morphing technology will afford researchers the ability to perform what may well be the definitive test of the underlying processes for own- and other-race face recognition. Such a program allows for the manipulation of covariation amongst features in order to

determine definitively if it is the exposure based process that is implicitly performed and governs recognition expertise.

APPENDIX A

Background Questionnaire

Age:

Gender:

Race:

Race of Father/Male caregiver: White/Black/Hispanic/Asian/Other (specify:_____)

Was Father/Male caregiver present in the home until you were three years old? Yes/No

Race of Mother/Female cargiver: White/Black/Hispanic/Asian/Other (specify:_____)

Was Mother/Female caregiver present in the home until you were three years old? Yes/No

Were you born into this home? Yes/No

If not, at what age were you placed into this home?

How many members of Father/Male caregiver's family did you have contact with during your formulative years?

How many members of Mother/Female caregiver's family did you have contact with during your formulative years?

Did you go to public or private school?

Estimate the percentage of each race present in the grade school you attended:

Black:___ White___ Hispanic___ Asian___ Other___

in Junior High:

Black:___ White___ Hispanic___ Asian___ Other___

in High School:

Black:___ White___ Hispanic___ Asian___ Other___

Do you have contact with races other than your own? Yes/No

What percentage of each?

Black:___ White___ Hispanic___ Asian___ Other___

What was the percentage of each race amongst your group of friends as you were growing up?

Black:___ White___ Hispanic___ Asian___ Other___

What is the percentage of each race amongst your present group of friends?

Black:___ White___ Hispanic___ Asian___ Other___

APPENDIX B

Supreme Court Letter to Subjects

STATE OF NEW YORK
SUPREME COURT CHAMBERS
ALBANY COUNTY COURT HOUSE
ALBANY, NEW YORK 12207
(518) 487-5140

JOSEPH C. TERESI
JUSTICE

MICHAEL J. CONNOLLY
LAW CLERK

To all study participant's,

Welcome, you are about to become an important member of a growing body of research. The study you are to be involved in has important ramifications for protecting the innocent. Please do your very best to pay attention throughout the experiment. The justice community thanks you for your help and interest.

Very truly yours,

Joseph C. Teresi

JOSEPH C. TERESI

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APPENDIX C

General Memory Questionnaire

THOUGHTS ABOUT MEMORY

We're going to ask you to consider your thoughts concerning memory processes. Base your responses on your opinion, not upon the "approved" opinion of anybody else or anything official that you may have heard. We would like to explore how you operate your own memory on a day to day basis and what you think are the underlying processes. Let us start, as they say, at the beginning.

Question 1: What is the earliest age at which you can remember an event that pleased you. What kind of event was it?

Question 2: Where specifically is that memory stored?

Question 3: When you think about that earliest memory, do you see it in precisely sharp detail or as a fuzzy global outline of a particular event? Please pick one approach or the other and write down your thoughts.

Question 4: Do you have personal knowledge of any individual whom you would describe as having photographic memory?

Question 5: We often think of machines or devices when we describe what goes on in the body or the mind. When you think of memory, is there any one device that comes to mind?

Question 6: On the average, what is the longest length of time that memory for a fairly ordinary event or person is held before it is totally forgotten?

Question 7: Is it easier or harder to remember a face of a person encountered under very emotion arousing circumstances?

Question 8: When you try to remember a face of a person seen some time in the past, do you remember a list of details or do you remember and visualize the whole face?

Question 10: For any group of 100 people, how many people having photographic memory would you expect to be present.

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Question 12: Imagine you see an accident and notice two men nearby. You are asked as a witness, one week later, to describe and then to identify an individual by the police. One of the men is from your particular racial group, while the other is of a different race. Which one are you more likely to remember accurately and be able to identify? Why?

Question 13: In order to test your long term memory, for the picture that you were shown just before you started to fill out the questionnaire, think back to that scene. Imaging that you were an observer of what was being portrayed in that picture. Imagine that you are now being asked by an assistant questioner what was going on and what you remember of the descriptions of the individuals who were shown in this scene. Please be as accurate as possible, and write your information in the space provided.

Question 14: Do you think that children under the age of six are more accurate or less accurate in remembering faces and events than adults? Please explain your answer.

Question 15: In general, who makes a better witness and memorizer of past events and faces - a woman or a man?

Just a few questions about who you are:
Age:
Sex:
Race:

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