

Memory for Own- and Other-race Faces: A Dual-process Approach

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SUMMARY

The current studies assessed the phenomenological basis of the cross-race effect by examining predictions of various social-cognitive mechanisms within a dual-process framework for both the perception (Experiment 1) and recognition (Experiment 2) of own- and other-race faces. Taken together, the current studies demonstrated that differential performance on own-race faces was largely due to qualitative differences in the encoding of facial information represented by a recollection process. Furthermore, false recollections with high ratings of confidence occurred more often when participants encoded and responded to unfamiliar other-race faces. The theoretical implications of these findings for the phenomenology of skilled perceptual-memory are discussed, and the applied consequences of the cross-race effect as an encoding-based phenomenon are considered. Copyright © 2005 John Wiley & Sons, Ltd.

The cross-race effect (CRE, or own-race bias, or other-race effect, as it has been variously labelled) refers to the finding that faces of one's own race are better remembered when compared with performance on faces of another, less familiar race. Throughout the past 30 years, a host of studies have investigated this memory phenomenon focusing on its practical and theoretical importance. Although some general agreement regarding the mechanisms responsible for the CRE might have been expected from such a mass of literature, debate continues among researchers regarding potential social-cognitive processes governing the effect (see Meissner & Brigham, 2001; Sporer, 2001). The current investigation seeks to inform this debate by framing the CRE within the constraints of a dual-process theory of memory (Gardiner & Richardson-Klavehn, 2000; Kelley & Jacoby, 2000; Mandler, 1980; for a review see Yonelinas, 2002). Generally speaking, such theories have distinguished between memory processes involving conscious-level conceptual information that is elaboratively encoded and those involving fluent, perceptually-based information that is believed to be encoded in an automatic, non-conscious manner. One example of such a distinction involves the phenomenon of a person looking familiar, yet we are unable to recollect details of who the person is or where we might have seen him or her previously. In such an instance, memory is based largely upon fluency of familiarity,

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but is absent any episodic recollection of a prior encoding event. By exploring such phenomenological differences in the processing of own- and other-race faces, the current study attempts to distinguish between previous social-cognitive accounts of the phenomenon.

POTENTIAL SOCIAL-COGNITIVE MECHANISMS

While a perceptual learning interpretation of the CRE has been central to many theoretical explanations of the effect (Chance & Goldstein, 1996; Meissner & Brigham, 2001), various social and cognitive mechanisms have been proposed to further explain participants' superior performance on own-race faces. Sporer (2001) has recently reviewed many of these proposals, and has summarized their potential influence within a simplified 'in-group/out-group' model (IOM) of the CRE phenomenon. Below we briefly review several of the proposed mechanisms.

Interracial contact

A number of researchers have posited that the quality and/or quantity of interracial contact may play a significant role in the CRE. For example, researchers have proposed that increased contact with other-race individuals may increase memory performance by: (a) reducing the likelihood of stereotypic responses and increasing the likelihood that individuals may look for more individuating information (Malpass, 1981); (b) influencing individuals' motivation to accurately recognize other-race persons through associated social rewards/punishments (Malpass, 1990); or (c) reducing the perceived complexity of unfamiliar other-race faces (Goldstein & Chance, 1971). Two major approaches to investigating contact have been to examine groups of individuals differing in their degree of other-race contact, or to assess individuals' self-reported contact with other-race persons. In general, researchers using the former approach have demonstrated that individuals residing in integrated populations show less of a CRE when compared with same-race individuals residing in more homogeneous populations (cf. Chiroro & Valentine, 1995; Wright, Boyd, & Tredoux, 2003). With regard to self-reported interracial experience, Meissner and Brigham's (2001) meta-analysis indicated a small, yet significant, correlation accounting for approximately 2% of the variance. In a related fashion, several studies have demonstrated short-term improvement in recognizing other-race faces utilizing various discrimination training procedures (Elliott, Wills, & Goldstein, 1973; Goldstein & Chance, 1985; Lavrakas, Buri, & Mayzner, 1976; Malpass, Laviguer, & Weldon, 1973).

Cognitive disregard and categorization effects

A series of experiments by Rodin (1987) demonstrated that individuals will often cognitively disregard, or render 'invisible,' others based upon various categorical dimensions such as age, sex, or attractiveness. Rodin held that as 'cognitive misers' we often attempt to rely upon such broad categorical judgments for determining whether further interaction should occur. Other studies have also indicated that racial information may be used in a similar fashion, and that prejudice or racial attitudes may moderate the extent to which cognitive disregard occurs (cf. Sensening, Jones, & Varney, 1973). Similarly,

studies on the 'out-group homogeneity effect' have demonstrated that out-group members are often perceived to be more homogeneous (in such attributes as attitudes, behaviour, or appearance) than in-group members, and are represented in terms of stereotypic (as opposed to individuating) characteristics (for a review, see Mullen & Hu, 1989). Recent studies have indicated that this effect of racial stereotyping tends to be automatic (Dasgupta, McGhee, Greenwald, & Banaji, 2000; Payne, 2001; Payne, Lambert, & Jacoby, 2002), and under limited conscious control (however, see Monteith, Ashburn-Nardo, Voils, & Czopp, 2002).

Consistent with the effects of cognitive disregard and out-group homogeneity, studies in the face perception literature have demonstrated that other-race faces are racially classified more quickly than own-race faces (Levin, 1996; Valentine & Endo, 1992). With regard to the CRE, research by Levin (1996, 2000) and by MacLin and Malpass (2001, 2003) has suggested that this automatic inclination to categorize other-race faces may distract from the encoding of individuating information, and thereby lead to poorer performance when recognizing other-race faces. In this 'race-feature perspective,' it is proposed that attention directed towards the encoding of race as a facial feature may divert cognitive resources that would otherwise be used to seek-out individuating information.

Levels of processing

In their 'levels of processing' approach to memory, Craik and Lockhart (1972) held that memory strength for any given stimulus is a function of the depth to which the stimulus is processed at encoding. 'Depth' is generally considered a continuum defined by the extent to which various conceptual or semantic attributes of the stimulus are processed. Studies attempting to vary depth of processing often include a manipulation of orienting (or encoding) instructions. In both the word list and face memory literatures, participants' recognition performance has been shown superior when 'deep' encoding instructions are provided (Bower & Karlin, 1974; Sporer, 1991). As some authors have noted, it is important to consider that levels of processing manipulations may actually vary the amount of information encoded, rather than the depth of processing, per se (Sporer, 1991; Winograd, 1981).

Interestingly, evidence has been mixed with regard to a levels of processing explanation of the CRE. For example, Chance and Goldstein (1981) asked participants to describe aloud their reactions to a series of own- and other-race faces. The authors then coded the statements according to the presumed 'depth' that had occurred, and observed that own-race faces were processed at a significantly deeper level than were other-race faces. However, several studies have manipulated level of processing within the cross-race paradigm and have failed to observe the predicted interaction (i.e. that own-race faces might benefit more from a deep-processing instruction; see Burgess & Weaver, 2003; Devine & Malpass, 1985).

Distinctiveness effects

With regard to memory for human faces, one quality of the face that has been shown to influence recognition performance is that of distinctiveness. Numerous studies have demonstrated that novel faces rated as distinctive or unusual are recognized significantly better (i.e. they receive a higher proportion of hits and a lower proportion of false alarms) than faces rated as typical in appearance (e.g. Brigham, 1990; Shepherd, Gibling, & Ellis,

1991; Valentine, 1991). Given the relevance of this stimulus property to memory performance, researchers in the face memory literature have attempted to use distinctiveness as an example of one characteristic by which individuals represent faces in memory (Byatt & Rhodes, 1998; O'Toole, Deffenbacher, Valentin, & Abdi, 1994; Valentine & Endo, 1992).

Within the cross-race paradigm, researchers have asserted that attention to distinctiveness may differentiate performance on own- and other-race faces. For example, Chiroro and Valentine (1995) examined the effects of race, typicality, and level of perceptual experience within the cross-race paradigm. Based upon the assumptions of Valentine's (1991) *Multi-Dimensional Space (MDS) Framework*, Chiroro and Valentine predicted that only individuals who had considerable previous experience with other-race faces (high contact) would demonstrate distinctiveness effects for both own-race and other-race faces. This was due largely to the notion that such individuals should be able to distinguish between typical and distinctive other-race faces based upon features they had extracted through prior experience. In contrast, low-contact individuals were predicted to demonstrate no differences in performance according to the distinctiveness dimension of other-race faces. Overall, Chiroro and Valentine's results demonstrated the predicted interaction such that distinctiveness effects for low-contact individuals were confined to own-race faces. On the other hand, high-contact individuals demonstrated significant effects of distinctiveness regardless of the race of the face.

Configural-featural hypothesis

One seemingly notable finding in the face memory literature has involved research on the face inversion effect—the phenomenon that inverted (upside-down) photos of faces are identified more poorly than inverted photos of other objects (e.g. houses, cars, etc.). In early work on this effect, Yin (1969) concluded that face recognition was the product of a unique system, different from systems responsible for recognizing other kinds of visual stimuli. In contrast to this 'neural specialization' hypothesis, Diamond and Carey (1986) later proposed that perceptual learning might be operating in face recognition. In several experiments they showed that the inversion effect was not unique to faces, but rather occurred when participants had a great deal of experience with the stimulus materials. In particular, inversion appeared to disrupt the effectiveness with which individuals were able to encode stimuli that were highly familiar to them. Diamond and Carey believed that this effect stemmed from experienced participants' reliance upon configural (or relational) properties of the stimulus. Novice participants, on the other hand, relied upon only the featural (or isolated) aspects of the face that were less influenced by inversion. A number of subsequent studies have supported this general configural-featural hypothesis (see Farah, Wilson, Drain, & Tanaka, 1998).

The notion that expertise leads to configural processing has also been applied to the CRE. In particular, Rhodes, Brake, Taylor, and Tan (1989) proposed that greater experience with own-race faces would lead to a larger inversion effect, due to an increased reliance upon configural information. The encoding of other-race faces, on the other hand, should not be as influenced by inversion due to the featural aspects that are relied upon. As hypothesized, Rhodes and colleagues observed that own-race faces were significantly more susceptible to inversion than were other-race faces for measures of both reaction time and accuracy (see also, Fallshore & Schooler, 1995). However, several other studies have failed to observe this interaction of inversion with the CRE (Buckhout & Regan, 1988; M. C. R. Burgess, unpublished doctoral dissertation, 1997).

In-group/out-group model

In his IOM account of the CRE, Sporer (2001) attempted to bring together these varied social-cognitive explanations. Sporer's IOM assumes that a default or automatic process occurs when an individual encounters an own-race (or in-group) face, such that encoding involves deeper level processing with the individual focused upon relevant, configural properties, or dimensions of the face that are useful for distinguishing it from other similar faces in memory (consistent with Valentine's, 1991, MDS model). In contrast, when an individual encounters an other-race (or out-group) face, racial characteristics first signal an automatic categorization response. This categorization response may then be linked to other cues to cognitively disregard such faces, and may result in attentional processes being allocated elsewhere. This categorization may also signal that less effort should be extended in the encoding process, thereby leading to shallow (or featural-based) encoding of the face, and may signal stereotyping processes that lead to improper inferences regarding salient characteristics of the face in memory. Given the greater homogeneity in representation of other-race faces resulting from the lack of distinctiveness effects, Sporer's IOM also predicts an effect on response bias such that individuals will be more liberal in responding to other race faces (consistent with the general empirical literature, see Meissner & Brigham, 2001). Taken together, the model also proposes to account for other in-group/out-group phenomena in the facial memory literature, such as the effects of age (Wright & Stroud, 2002) and gender (Slone, Brigham, & Meissner, 2000).

A DUAL-PROCESS RECOGNITION PERSPECTIVE

Over the past 30 years, dual-process memory models have influenced our understanding of recognition memory by demonstrating that two qualitatively distinct processes appear to be operating. More specifically, these models distinguish between a *recall-like process* in which episodic information is retrieved at the time of recognition, and a *fluency-based process* in which general familiarity (in the absence of specific episodic information) is used as a basis for recognition. A variety of such models have been proposed over the years, including Jacoby and colleagues' distinction between 'recollection' and 'familiarity' processes (Jacoby, 1991; Kelley & Jacoby, 2000), Tulving, Gardiner, and colleagues' distinction between 'remember' and 'know' judgments of phenomenological experience (Gardiner, 1988; Gardiner & Richardson-Klavehn, 2000; Tulving, 1983), and Mandler's (1980) concepts of 'integration' and 'elaboration'. Across these varied dual-process approaches, there are some similarities in the proposed mechanisms. For example, *recollection* (or 'remember' judgments, or elaboration) is generally influenced by generative or semantic encoding, division of attention, speed of responding, novel learning, and the effects of aging and amnesia. In contrast, *familiarity* (or 'know' judgments, or integration) is generally sensitive to fluency manipulations, forgetting over short retention intervals, and changes in the response criterion (for a review, see Yonelinas, 2002). Over the past decade, the role of recollection and familiarity has also been demonstrated in the facial recognition literature (Bartlett, Strater, & Fulton, 1991; Bastin & van der Linden, 2003; Mantyla, 1997; Mantyla & Cornoldi, 2002; Paller, Bozic, Ranganath, Grabowecky, & Yamada, 1999; Parkin, Gardiner, & Rosser, 1995; Reinitz, Morrissey, & Demb, 1994; Yonelinas, Kroll, Dobbins, & Soltani, 1999). Findings in such studies have been generally consistent with those in the word recognition literature,

Table 1. Dual-process predictions generated from social-cognitive mechanisms of the own-race bias in memory for faces

Social-cognitive mechanisms	Predicted effect on 'recollection'	Predicted effect on 'familiarity'
Racial stereotyping	Own-race = Other-race	Own-race < Other-race
Encoding-based processing (attentional resources, effortful/ semantic encoding, distinctiveness)	Own-race > Other-race	Own-race = Other-race
Configural-featural processing	Own-race = Other-race	Own-race > Other-race

suggesting that recollection and familiarity processes operate in facial memory and that such phenomena may be explained by more general cognitive mechanisms.

How might a dual-process perspective account for the CRE in facial recognition? At present, no studies have attempted to blend such an explanation with that of previously suggested social-cognitive explanations. However, given that many of the social-cognitive mechanisms proposed in the CRE literature have been shown to demonstrate certain patterns of influence on recollection and familiarity, they may be separable via predictions regarding their influence on each process. Thus, examining the CRE within the context of a dual-process perspective may provide insights into the specific social-cognitive mechanisms that are likely to be responsible for the phenomenon. Drawing from a review of the dual-process literature by Yonelinas (2002), we discuss below each of the proposed social-cognitive explanations with regard to their dual-process predictions (see Table 1).

First, some researchers have suggested that individuals may generate a *categorization* response when presented with other-race faces (Levin, 1996, 2000; MacLin & Malpass, 2001, 2003; Sporer, 2001). Studies within the stereotyping literature have suggested that such responses tend to be rather automatic (Dasgupta et al., 2000), and are thus supported by an 'accessibility bias' that is under limited conscious control (Payne, 2001; Payne et al., 2002). Consistent with this notion of biased responding, such a stereotyped encoding process for other-race faces might suggest a greater influence of familiarity (or fluency-based) processes on the recognition of other-race faces when compared with performance on own-race faces.

In contrast, categorization may result in cognitive disregard and thereby divert *attentional resources* during the encoding process. Studies both in the word list and facial recognition (Parkin et al., 1995; Reinitz et al., 1994) literatures have demonstrated that limiting attentional resources at study generally reduces the influence of recollection processes, but leaves intact familiarity-based responding. In a similar manner, studies that have manipulated *effortful encoding* (e.g. via a manipulation that asks participants to 'generate' a certain encoding context for a word versus simply 'reading' the word in a given context; cf. Jacoby, 1991), and those that have attempted to increase *semantic or meaning-based encoding* (e.g. via a manipulation that encourages a 'deep' versus 'shallow' level of processing; cf. Rajaram, 1993) have demonstrated large effects on recollection processes. With regard to the CRE, such mechanisms might suggest that own-race faces would yield a rather substantial increase in recollection when compared with memory for other-race faces.

As discussed previously, researchers have attempted to model facial recognition memory based upon various perceptual characteristics, most notably including perceived facial *distinctiveness* (Byatt & Rhodes, 1998; O'Toole et al., 1994; Valentine & Endo,

1992). Furthermore, research has shown that individuals are more attuned to the perception of distinctiveness when processing own-race faces (Chiroro & Valentine, 1995). Within the dual-process memory literature, research by Mantyla (1997) has suggested that encoding faces based upon distinctive characteristics (as opposed to more 'relational' encoding discussed previously) has a similar effect to that of other encoding-based manipulations—namely, distinctiveness processing largely increases recollection-based responding (see also, Mantyla, 1993; Rajaram, 1993, 1996). Given that individuals are more attuned to distinctiveness in own-race faces, one might expect recollection to play a larger role in memory for own-race faces, similar to that of other attentional and encoding-based manipulations.

Finally, studies from the inversion paradigm have suggested that faces may be processed based upon two types of information—*configural* (or relational) and *featural* (or isolated) aspects of the face (Farah et al., 1998). This research has also suggested that the degree of configural versus featural processing may be a function of perceptual expertise, and that the deficit in memory for other-race faces may be due to individuals' inability to process such faces in a configural manner (Fallshore & Schooler, 1995; Rhodes et al., 1989). A recent study by Yonelinas and colleagues (1999) examined the effects of face inversion (and the configural-featural distinction) within the context of a dual-process model of recognition memory. Their results demonstrated that familiarity, but not recollection, was significantly influenced by the inversion manipulation, thereby implicating its role in the configural representation of human faces. As such, the configural-featural hypothesis would indicate that own-race faces should yield a greater degree of familiarity-based responding due to a reliance on configural aspects of the face.

The current studies were designed to examine the influence of recollection and familiarity in memory for own- versus other-race faces, and thus to distinguish between competing social-cognitive explanations of the CRE phenomenon. First, as will be discussed below, Vokey and Read (1992) have demonstrated that rated distinctiveness may be decomposed into two orthogonal components, namely face-specific episodic information (i.e. memorability) and context-free familiarity. While both components have been shown to contribute to recognition, Mantyla (1997) has demonstrated that the effects of rated distinctiveness appear to be related to judgments of recollection. In a similar manner, Deffenbacher, Johanson, Vetter, and O'Toole (2000) have shown that the memorability component of rated distinctiveness is primarily influential during the encoding of faces, and thus might have implications similar to other encoding-based manipulations in the dual-process framework. Furthermore, O'Toole and colleagues (1994) have shown that judgments of memorability tend to be associated with localized distinctive features, while the familiarity component may be related to configural properties. Our initial study attempted to replicate and extend this research to the CRE using a perceptual rating paradigm.

In a second study, we then assessed the contributions of recollection and familiarity to memory for own- and other-race faces by examining phenomenological judgments of Remember-Know (cf. Gardiner & Richardson-Klavehn, 2000) and assessing the relationships between rated perceptual components of memorability and familiarity estimates and recognition performance on own- and other-race faces (cf. Mantyla, 1997; Vokey & Read, 1992). We hypothesized that if the CRE were largely the result of encoding-based processes (e.g. attentional resources, effortful or semantic processing, distinctiveness effects, etc.), then phenomenological judgments should indicate greater recollection-based

responding for own-race faces. In contrast, if the CRE were a function of perceptual categorization of other-race faces, then greater familiarity-based responding might be expected for other-race faces. Finally, if the CRE were the result of reliance upon configural versus featural facial information, then phenomenological judgments should indicate greater familiarity-based responding for own-race faces. As can be seen, these varied predictions generally stand in opposition to one another. Thus, it was believed that a dual-process paradigm might be useful for better understanding the mechanisms responsible for the CRE.

EXPERIMENT 1: PERCEPTUAL RATINGS OF OWN- AND OTHER-RACE FACES

As discussed previously, a variety of studies have demonstrated that unfamiliar faces rated as distinctive or unusual are recognized significantly better than faces rated as more typical in appearance (e.g. Brigham, 1990; Shepherd et al., 1991; Valentine, 1991). Conceptualizations of facial distinctiveness, though, have become increasingly complex in recent years. For example, Vokey and Read (1992) conducted factor-analytic work demonstrating that distinctiveness (or typicality) seemed to be composed of two orthogonal components, namely memorability and context-free familiarity (with distinctiveness crossloading on both factors; see also, Morris & Wickham, 2001; O'Toole et al., 1994). Vokey and Read hypothesized that the familiarity arising from some specific prior exposure (e.g. a face seen before) is not intrinsically separable from the structurally induced familiarity that arises from a lifetime of experience with similar exemplars. Furthermore, the authors proposed that this 'general familiarity' could be shown to include ratings of familiarity, attractiveness, and likability. Memorability, on the other hand, was defined by participants' beliefs about how 'easy to remember' a face would be, and was believed to account for identity-specific episodic information in the face. With regard to recognition performance, Vokey and Read asserted that a distinctive or unusual face is better recognized because it is both low on familiarity (as it resembles few other faces in the recognizer's experience) and high in perceived memorability (because distinctive attributes of the face provide episodic information). Conversely, a typical face is likely to be poorly remembered due to its high similarity to other known faces and its low memorability (or its difficulty in obtaining uniqueness in memory).

Distinctiveness has sometimes been discussed in the literature as if it were an inherent quality of a face, but it is important to note that what is really involved is *perceived* distinctiveness—that is, familiarity and memorability *as they relate to the perceiver's experiences and perceptions*. While a distinctive or unusual feature might make some faces seem memorable to virtually all perceivers, other properties of faces may be perceived very differently depending upon one's life experiences (e.g. differential expertise in dealing with own- and other-race people) and one's representational structure for encoding different kinds of faces, such as Black faces and White faces (cf. Chiroro & Valentine, 1995; Valentine & Endo, 1992). Furthermore, researchers have suggested that memorability and familiarity components may be related to the phenomenological basis of recollection and familiarity, respectively (Mantyla, 1997; Vokey & Read, 1992). Thus, we believe that component ratings may provide a means for exploring pre-experimental perceptual variance involving recollection and familiarity-based responding to own- and other-race faces.

The vast majority of work on facial distinctiveness has involved White participants rating White faces. It remains unknown whether Blacks' ratings of Black faces would show the same component structure, or whether ratings of other-race faces would show the same structure as ratings of same-race faces when a full cross-over design is investigated. Preliminary data suggest that this issue merits further study. For example, O'Toole et al. (1994) found that Whites' ratings of White faces showed the same factor structure identified by Vokey and Read (1992); however, for Whites' ratings of Japanese faces, distinctiveness was related to memorability, but not to familiarity.

The present study assessed the degree to which pre-experimental differences in stimulus representation exist within the CRE paradigm. Both White and Black college students rated photographs of White and Black male faces on measures of distinctiveness, familiarity, likability, attractiveness, and memorability. Ratings were examined for differences in overall magnitude and component structure across own- and other-race faces. While we expected to replicate the Vokey and Read (1992) factor structure for own-race faces, it was unclear whether this structure should be expected for other-race faces given the results of O'Toole and colleagues (1994). Our default assumption was that familiarity and memorability components would be evidenced in the perception of other-race faces as well. If these components relate to those conceptualized within a dual-process perspective, then differences in the magnitude of ratings provided for own- versus other-race faces may be predicted by the social-cognitive mechanisms believed operating in the CRE. Furthermore, as will be examined in Experiment 2, the relation between perceptual ratings of memorability and familiarity and subsequent recognition performance on own- and other-race faces should provide insights as to the mechanisms operating in the CRE.

Method

Participants

The sample consisted of 50 White and 50 Black students from an Introductory Psychology course. Participants were tested in mixed-race groups ranging in size from two to five. The mean age of the participants was 19 years and 75% were female.

Materials

Photographs of 80 White and 80 Black college-aged males were randomly selected from our pool of White and Black faces. Photographs were standardized across all targets such that each was wearing an identical burgundy-coloured sweatshirt, standing in front of a grey background, in a full-frontal, non-smiling pose. Photographs were transformed to colour slides, which were projected onto a screen subtending approximately 10×14 visual degrees.

In an attempt to replicate the conditions of Vokey and Read (1992) and O'Toole et al. (1994), we utilized the following five rating indices across faces: (a) distinctiveness; (b) likability; (c) attractiveness; (d) memorability; and (e) familiarity. Each characteristic was assessed on a labelled 7-point scale. There has been some variability in how these dimensions have been defined by earlier researchers. With regard to the measure of *distinctiveness*, we utilized the rating scheme employed previously by O'Toole et al. and Valentine and Bruce (1986), namely: 'How difficult would it be to pick this person out of a crowd?' on a scale with 1 = 'Not Difficult' and 7 = 'Very Difficult'. The *likability* ('Does this person look as if he would be likable?'; 1 = 'Not Likable' and 7 = 'Very Likable'), *attractiveness* ('Is this person attractive looking?'; 1 = 'Not Attractive' and 7 = 'Very

Attractive'), and *memorability* ('Would this face be easy to remember?'; 1 = 'Easy to Remember' and 7 = 'Difficult to Remember') measures were those used by Vokey and Read (1992). Finally, the *familiarity* measure was that used previously by Vokey and Read (1988) and O'Toole et al., namely: 'Is this face confusable with someone you know?' on a scale with 1 = 'Not Confusable' and 7 = 'Very Confusable'.

Design

A 2 (\times 2) mixed multivariate design was used with race of participant as the between-subjects factor, race of face as the within-subjects factor, and the five face-rating indices as dependent measures. Presentation of faces was blocked by race, the order of which was counterbalanced across participant groups. Within each block of race, the presentation of faces was randomized and counterbalanced to control for the effects of order and interference. Finally, participants rated each face on all five rating scales, consistent with the methodology utilized by Vokey and Read (1992). Although asking participants to rate faces on all five scales may inflate the correlations between ratings, our intent was to follow previous methodologies and replicate such findings in the cross-race domain. In light of this concern and to control for any response biases, the order of presenting the five rating scales was randomized for each target face presented and across participants.

Procedure

Upon entering the lab, participants were familiarized with the general face-rating procedure. Participants were then presented with each face for 15 s. They were instructed to view each face for several seconds prior to rating it on the various indices. A short break was given to participants following the first block (race) of faces.

Results

Ratings of own- and other-race faces

Participants' ratings for each face were subjected to a 2 (\times 2) mixed multivariate analysis of variance (MANOVA), with race of participant as the between-subjects factor, race of face as the within-subjects factor, and face-rating index as the dependent measures. Results indicated a significant multivariate race of participant by race of face interaction, $F(5, 94) = 19.43$, $p < 0.001$, across the five rating scales. A significant race of face main effect was also observed, $F(5, 94) = 3.08$, $p < 0.05$; however, no differences were observed across participant race, $F(5, 94) = 0.96$, *ns*. All subsequent univariate analyses were corrected for alpha inflation by utilizing a modified criterion of $p < 0.01$. Univariate analyses indicated a significant CRE for both White (Cohen's *d*: distinctiveness = 0.26, memorability = 0.35, familiarity = 0.61, likability = 0.36, and attractiveness = 0.58) and Black (Cohen's *d*: distinctiveness = 0.77, memorability = 0.70, familiarity = 0.30, likability = 0.44, and attractiveness = 0.38) participants on each of the five rating scales, $F_s(1, 96) > 12.30$, $0.13 < MSEs < 0.30$, $p_s < 0.001$. Table 2 displays the pattern of results indicating that own-race faces were perceived as yielding greater memorability and greater familiarity. Although effect size comparisons indicate some variation in the magnitude of the CRE for memorability and familiarity ratings, there were no statistical differences in the effects, $Z_s < 0.45$, *ns*. (It should be noted that blocking faces by race did not significantly influence participants' perceptual ratings either as a main effect, $F(15, 270) = 0.97$, *ns*, or as an interaction with the observed CRE, $F(15, 270) = 0.28$, *ns*.)

Table 2. Ratings of distinctiveness, memorability, familiarity, likability, and attractiveness with reference to own- and other-race faces (Experiment 1)

	Own-race faces		Other-race faces	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Distinctiveness	4.83	0.96	4.34	0.92
Memorability	5.06	0.84	4.59	0.88
Familiarity	2.12	0.82	1.76	0.80
Likability	3.73	0.58	3.49	0.60
Attractiveness	2.39	0.70	2.06	0.70

Interracial agreement in ratings across race of face

We also assessed whether participants of both races would agree as to rankings of the full set of faces on the five scales. Correlations were calculated across the 80 faces between the mean ratings given by Whites and by Blacks. With the exception of the familiarity scale, White and Black participants demonstrated high general agreement in their ratings of both races. For White faces, between-race $r_s(80)$ were: memorability = 0.75, $p < 0.001$; distinctiveness = 0.69, $p < 0.001$; attractiveness = 0.87, $p < 0.001$; likability = 0.83, $p < 0.001$; and familiarity = 0.52, $p < 0.001$. For Black faces, between-race $r_s(80)$ were: memorability = 0.88, $p < 0.001$; distinctiveness = 0.87, $p < 0.001$; attractiveness = 0.82, $p < 0.001$; likability = 0.66, $p < 0.001$; and familiarity = 0.24, $p < 0.05$.

Principal components analysis of own- and other-race face ratings

In an attempt to replicate the results of earlier studies with regard to the component structure of rated distinctiveness, a principal components analysis, with Varimax rotation, was conducted on the ratings for own- and other-race faces, separately. As displayed in Table 3, two components with Eigenvalues > 1.00 emerged from the analyses, consistent with previous research (Vokey & Read, 1992). Given our attempts to replicate previous research, a rather stringent criterion loading of 0.50 was established for evaluating the contribution of each rating scale. The two components for each cell appeared to converge in generating two independent components, which have been labelled by previous researchers as *memorability* (memorability and distinctiveness) and *familiarity* (attractiveness, likability, and familiarity). However, counter to the findings of Vokey and Read (1992), rated distinctiveness failed to crossload on the two components. Similar principal component analyses were also conducted for White and Black faces separately as rated by

Table 3. Exploratory principal component loadings for ratings of distinctiveness, memorability, familiarity, likability, and attractiveness and across own- and other-race faces (Experiment 1)

	Own-race faces		Other-race faces	
	Memorability	Familiarity	Memorability	Familiarity
Distinctiveness	0.98	0.07	0.97	0.09
Memorability	0.98	-0.04	0.98	0.04
Familiarity	0.15	0.84	0.22	0.87
Likability	-0.09	0.83	-0.16	0.84
Attractiveness	-0.02	0.91	0.12	0.78
Proportion of variance	39%	45%	35%	47%

Bold values refer to primary perceptual dimensions for each component.

White and Black participants. Although not displayed, results replicated those of the combined analyses in each of the four cells of the design.

Discussion

Taken together, the results of Experiment 1 indicated that own-race faces were perceived as exuding greater perceptual memorability and familiarity than other-race faces (see Table 2). Such a pattern of effects is consistent with encoding-based manipulations in the dual-process literature demonstrating that superior encoding leads to increases in both recollection and familiarity-based responding. The greater familiarity that was perceived for own-race faces may also be indicative of configural processes that have been shown to operate in own-race face recognition. While the CRE has been demonstrated with perceptual tasks (see Lindsay, Jack, & Christian, 1991), it remains to be seen whether the current pattern of results might also be responsible for the recognition memory deficits observed when responding to other-race faces.

Across the ratings of Black and White faces there was also a surprising degree of interracial agreement, with the exception of the familiarity scale. However, given the low degree of interracial contact that generally exists, such an absence of agreement on the familiarity scale (which asked participants whether the face was 'confusable with someone you know') may reasonably be understood. With regard to the representation of rated distinctiveness, both own- and other-race faces generally yielded the same component structure involving memorability and familiarity (see Table 3). Our results also replicated the pattern observed by O'Toole et al. (1994) in which rated distinctiveness (or typicality) failed to crossload on the familiarity component.

EXPERIMENT 2: DUAL-PROCESS ESTIMATION FOR RECOGNITION OF OWN- AND OTHER-RACE FACES

Based upon the social-cognitive explanations proposed by previous researchers (see Meissner & Brigham, 2001; Sporer, 2001), it is possible that one of three general patterns may emerge when a dual-process perspective is applied to the CRE (see Table 1). In the following study, we tested dual-process predictions of the CRE by assessing the contributions of recollection and familiarity to performance on own- and other-race faces in a recognition memory paradigm. First, we took an experiential approach by asking participants to provide phenomenological judgments of recognition using Remember, Know, and Guess alternatives (cf. Gardiner & Richardson-Klavehn, 2000). Second, using a stimulus-based approach (cf. Mantyla, 1997), perceptual ratings of memorability and familiarity from Experiment 1 were used to predict recognition performance on own- and other-race faces in Experiment 2. Taken together, it was believed that these two approaches would converge to isolate the contributions of recollection and familiarity in the CRE paradigm, and thereby distinguish between competing social-cognitive accounts of the phenomenon.

Method

Participants

The sample consisted of 32 White and 32 Black students from an Introductory Psychology course. Participants were tested in mixed-race groups ranging in size from two to five. The mean age of the participants was 19 years and 77% were female.

Materials

The 80 White and 80 Black male photographs used in Experiment 1 were also used here. Photographs presented at study involved the targets wearing their everyday clothes, standing in front of a grey background, in a full frontal, smiling pose. Photographs presented at test involved the targets wearing a burgundy-coloured sweatshirt, standing in front of a grey background, in a full frontal, non-smiling pose. These changes in photos were implemented such that the only remaining variability across study-test involved the invariant features of the target's face. Photographs were projected onto a screen to approximately life size, subtending approximately 10×14 visual degrees.

Design

A $2 \times 2 \times 2$ mixed repeated measures design was used, with race of participant as the between-subject factor, race of face as the within-subject factor, and a repeated test of participants' recognition for own- and other-race faces. In addition, participants responded to characteristics of their memory for a given face at test via the Remember-Know-Guess procedure. Each testing involved a mixture of own- and other-race faces, and the order of presentation for faces was randomized and counterbalanced across participant groups at both study and test, with the restriction that no more than three faces of the same race were presented in sequential order.

Procedure

Upon entering the lab, participants were familiarized with the general recognition task. For each study phase, participants were presented with 20 Black and 20 White faces for 3 s each. They were instructed to study each face for a later memory test. Following the study phase, participants were given a 5 min distractor task involving a digit search puzzle. Testing resumed thereafter and involved the presentation of 40 Black and 40 White faces (40 New, 40 Old) in a randomized sequential order for 7 s each. Participants were asked to indicate whether the face was 'New' or 'Old', and to provide an estimate of their confidence on a 6-point Likert scale with end-point labels of 'sure new' and 'sure old'. If they reported that an item was Old, they were also asked to describe their memory for the face using the Remember, Know, and Guess responses provided. Following completion of the first recognition task, participants were given a brief break, after which the study phase for the second recognition task was begun. Procedures of the second recognition test replicated that of the first with a different set of Black and White faces.

Results

Own- and other-race recognition performance

Table 4 provides estimates of performance on measures of hits, false alarms, discrimination accuracy (A'), and response criterion (B''_D). A $2 \times 2 \times 2$ mixed MANOVA assessed the influence of race of participant, race of face, and repeated testing on the proportion of hit and false alarm responses. A significant multivariate CRE, or race of participant \times race of face interaction, was obtained, $F(2, 61) = 18.66$, $p < 0.001$. A significant multivariate main effect of repeated testing was also present, $F(2, 61) = 20.22$, $p < 0.001$. All other effects were non-significant, $F_s(2, 61) < 1.36$, $p_s > 0.25$. Univariate tests on the CRE indicated a significant race of participant \times race of face interaction on both hit, $F(1, 62) = 7.05$, $MSE = 0.01$, $p < 0.01$, and false alarm responses, $F(1, 62) = 30.42$, $MSE = 0.01$, $p < 0.001$, resulting in the 'mirror effect' pattern demonstrated across

Table 4. Recognition performance for own- and other-race faces (Experiment 2)

	Own-race faces		Other-race faces	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Hits	0.69	0.17	0.64	0.17
False alarms	0.22	0.13	0.30	0.14
A'	0.81	0.10	0.75	0.12
B''_D	0.21	0.42	0.10	0.44

previous studies (Meissner & Brigham, 2001). Effect sizes were somewhat larger for White than for Black participants on both hits (Cohen's $d = 0.32$ vs. 0.28 , respectively) and false alarms (Cohen's $d = 0.92$ vs. 0.61 , respectively); however, this variation in effect size for hits and false alarms was not statistically significant ($Z_s = 0.08$ and 0.49 , $p_s = 0.94$ and 0.62 , respectively). Univariate tests on the effect of Time were significant for both hit, $F(1, 62) = 20.60$, $MSE = 0.01$, $p < 0.001$, and false alarm responses, $F(1, 62) = 30.33$, $MSE = 0.01$, $p < 0.001$. The pattern of means increased from Time-1 to Time-2 for both hit ($M_s = 0.64$ and 0.69 ; $SD_s = 0.12$ and 0.13 , respectively) and false alarm ($M_s = 0.22$ and 0.30 ; $SD_s = 0.08$ and 0.12 , respectively) estimates, suggesting a shift to a looser criterion of responding at Time-2.

A $2 \times 2 \times 2$ mixed MANOVA analysis of signal detection estimates of discrimination accuracy (A') and response bias (B''_D) was also conducted. A significant multivariate CRE, or race of participant \times race of face interaction, was obtained, $F(2, 61) = 18.36$, $p < 0.001$. In addition, a significant multivariate main effect of repeated testing was also observed, $F(2, 61) = 21.94$, $p < 0.001$. All other effects were non-significant, $F_s(2, 61) < 1.46$, $p_s > 0.20$. Univariate tests on the CRE indicated significant race of participant \times race of face interactions on both A' , $F(1, 62) = 30.55$, $MSE = 0.01$, $p < 0.001$, and B''_D estimates, $F(1, 62) = 5.81$, $MSE = 0.13$, $p < 0.05$. The CRE again was larger for White than for Black participants on estimates of A' (Cohen's $d = 0.91$ vs. 0.60 , respectively) and B''_D (Cohen's $d = 0.39$ vs. 0.21 , respectively); however, this variation in effect size for A' and B''_D was not statistically significant ($Z_s = 0.46$ and 0.34 , $p_s = 0.64$ and 0.73 , respectively). Univariate tests on the repeated measures effect were significant only for B''_D estimates, $F(1, 62) = 42.94$, $MSE = 0.02$, $p < 0.001$. As expected, participants' response criterion became significantly less conservative from Time-1 to Time-2 ($M_s = 0.31$ and 0.01 ; $SD_s = 0.31$ and 0.42 , respectively).

Reliability of recognition performance for own- and other-race faces

Given the repeated design employed in the present study, we were interested in assessing the reliability of face recognition for own- and other-race faces, as well as the reliability of the CRE over time. With regard to participants' discrimination accuracy (A') scores, performance on both own- and other-race faces was significantly reliable, $r_s(64) = 0.36$ and 0.38 , $p_s < 0.01$, respectively, but of small-to-moderate size. The consistency of participants' response bias (B''_D) on own- and other-race faces was also significant across testing sessions, $r_s(64) = 0.56$ and 0.48 , $p_s < 0.001$, respectively. Finally, with regard to the reliability of the CRE itself, differences in own- and other-race performance on A' and B''_D were not significantly related over time, $r_s(64) = 0.20$ and 0.21 , $p_s = 0.11$ and 0.09 , respectively. However, the magnitude of this reliability estimate for A' is comparable to that observed by Slone et al. (2000) in a similar analysis: $r(127) = 0.21$, $p < 0.05$.

Table 5. Estimates of remember and know for recognition of own- and other-race faces (Experiment 2)

	Hits				False alarms			
	Own-race faces		Other-race faces		Own-race faces		Other-race faces	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Remember	0.57	0.23	0.44	0.26	0.15	0.23	0.23	0.22
Know	0.28	0.13	0.34	0.15	0.44	0.28	0.37	0.24
Know _C	0.65	0.31	0.60	0.32	0.51	0.44	0.52	0.41

Remember-know judgments across own- and other-race faces

When participants responded 'Old' to a face at test, they were asked to describe their memory for the target using the Remember-Know-Guess procedure (see Gardiner & Richardson-Klavehn, 2000). Given the general assumptions of independence governing the dual-process model (cf. Kelley & Jacoby, 2000), estimates of Know were corrected for independence for each subject using the *independence remember/know* procedure (i.e. $K_C = K/[1 - R]$; see Yonelinas & Jacoby, 1995), and this corrected version was used in all subsequent analyses. Table 5 provides estimates of Remember, Know, and Know_C judgments on hit and false alarm responses for own- and other-race faces.

A $2 \times 2 \times 2$ mixed MANOVA examined the proportion of Remember and Know_C responses on correct identifications (i.e. 'hits') across race of participant, race of face, and repeated testing. A significant multivariate CRE, or race of participant \times race of face interaction, was obtained, $F(2, 61) = 26.93$, $p < 0.001$. All other effects were non-significant, $F_s(2, 61) < 2.60$, $ps > 0.08$. Univariate analyses of the CRE demonstrated a significant race of participant \times race of face interaction only on Remember judgments, $F(1, 62) = 33.72$, $MSE = 0.02$, $p < 0.001$. Consistent with the recognition data, this CRE was somewhat larger for White than for Black participants (Cohen's $d = 0.86$ vs. 0.60 , respectively); however, the variation in effect sizes was not statistically significant ($Z = 0.38$, $p = 0.70$). Although Know_C judgments were numerically greater for own-race faces, this effect failed to reach the conventional level of statistical significance, $F(1, 62) = 3.14$, $MSE = 0.04$, $p = 0.08$. The effect sizes were small, but equivalent, for White and Black participants (Cohen's $ds = 0.11$), and power to detect the effect was quite limited with the present sample ($1 - \beta = 0.16$).

Remember-Know_C judgments for incorrect identifications (i.e. 'false alarms') demonstrated a similar pattern. A $2 \times 2 \times 2$ mixed MANOVA indicated a significant multivariate CRE, or race of participant \times race of face interaction, $F(2, 61) = 3.39$, $p < 0.05$. A significant effect of repeated testing was also present, $F(2, 61) = 21.94$, $p < 0.05$. All other effects were non-significant, $F_s(2, 61) < 1.89$, $ps > 0.15$. Univariate analyses of the CRE demonstrated a significant race of participant \times race of face interaction that was isolated to Remember judgments, $F(1, 62) = 6.88$, $MSE = 0.04$, $p < 0.01$. This CRE was somewhat larger for Black than for White participants (Cohen's $d = 0.42$ and 0.27 , respectively), although this variation in effect sizes was not statistically significant ($Z = 0.30$, $p = 0.76$).

An alternative manner to assess the influence of recollection and familiarity is to compute estimates of A' for judgments of both Remember and Know, and subsequently to assess differences in performance across own- versus other-race faces. A $2 \times 2 \times 2$

mixed MANOVA was again used to estimate differential performance. Results indicated a significant multivariate CRE, or race of participant \times race of face interaction, $F(2, 61) = 14.32$, $p < 0.001$. All other effects were non-significant, $F_s(2, 61) < 1.43$, $p_s > 0.20$. Univariate analyses of the CRE demonstrated a significant race of participant \times race of face interaction that was isolated to A' for Remember judgments, $F(1, 62) = 28.86$, $MSE = 0.02$, $p < 0.001$. The effect was comparable for White and Black participants (Cohen's $d = 0.75$ vs. 0.77 , respectively), and demonstrated that A' for Remember judgments was greater for own-race faces ($M = 0.78$, $SD = 0.12$) than for other-race faces ($M = 0.68$, $SD = 0.14$).

Memorability-familiarity components and recognition of own- and other-race faces

Perceptual ratings of memorability and familiarity in Experiment 1 indicated that own-race faces were perceived as exuding greater memorability and greater familiarity when compared with other-race faces. While the CRE has been demonstrated in perceptual tasks (cf. Lindsay et al., 1991), we were interested in whether such stimulus attributes might relate to participants' ability to recognize faces, and further whether such attributes might capture the same essence of episodic recollection and fluent familiarity as that described in the dual-process literature. Mantyla (1997) has previously demonstrated that the effects of rated distinctiveness appear to be related to judgments of recollection from a stimulus-level analysis. As a manner in which to confirm the role of recollection processes observed in Experiment 2, we conducted a stimulus-level correlational analysis linking the components of memorability and familiarity collected in Experiment 1 to the estimates of recognition for each face collected in Experiment 2. Similar to the regression analyses conducted by Vokey and Read (1992), we computed partial correlations between estimates of memorability and familiarity, and recognition performance as measured by proportion of hits and false alarms, as well as the signal detection parameters A' and B''_D . This pattern of partial correlations for own- and other-race faces replicated the findings of Vokey and Read, particularly with regard to hit and false alarm responses. As displayed in Table 6, while memorability was significantly related to hit responses, both memorability and familiarity combined to predict false alarm responses. Although Vokey and Read found that both components combined to predict discrimination accuracy (A'), the familiarity component in our analyses failed to reach the conventional level of significance ($p_s < 0.10$). Finally, while neither memorability nor familiarity significantly predicted own-race response criterion, familiarity did contribute to other-race response criterion.

When partial correlations were tested for any differential CREs, results replicated findings from the Remember-Know_C responses presented previously. In particular,

Table 6. Partial correlations observed between rated estimates of memorability/familiarity in Experiment 1 and estimates of recognition accuracy in Experiment 2

	Own-race faces		Other-race faces	
	Memorability	Familiarity	Memorability	Familiarity
Hits	0.42*	0.07	0.22*	0.11
False alarms	-0.38*	0.19*	-0.20*	0.23*
A'	0.42*	-0.14	0.28*	-0.15
B''_D	0.01	-0.11	0.08	-0.21*

Note: * $p < 0.01$.

memorability was more highly correlated with responding for own-race than for other-race faces in both hits, $Z = 2.31$, $p < 0.05$, and false alarms, $Z = 2.07$, $p < 0.05$. A similar pattern was observed for memorability and estimates of A' ; however, the difference in the size of the relationship between own- and other-race faces failed to reach the conventional level of significance, $Z = 1.90$, $p = 0.06$. Overall, familiarity was not differentially diagnostic across own- and other-race faces, $Z_s < 1.50$, $p_s > 0.14$.

Discussion

Experiment 2 examined the CRE from a dual-process perspective by way of several approaches. First, an experiential approach was taken by asking participants to provide phenomenological judgments of recognition using Remember, Know, and Guess alternatives (cf. Gardiner & Richardson-Klavehn, 2000). Our results demonstrated that memory for own-race faces involved greater recollection of information from the prior study episode when compared with performance on other-race faces. While own-race faces also showed a numerical increase in familiarity-based responding when compared with other-race faces, this difference was not statistically significant. Second, using a stimulus-based approach (Mantyla, 1997; O'Toole et al., 1994; Vokey & Read, 1992), perceptual ratings of memorability and familiarity from Experiment 1 were used to predict recognition performance on own- and other-race faces in Experiment 2. While the overall patterns of correlation between memorability and familiarity estimates and recognition performance replicated those observed previously by Vokey and Read, our results further demonstrated a differential effect of memorability on the recognition of own- versus other-race faces. Consistent with prior analyses, this stimulus-level analysis indicated that memorability significantly influenced both hit and false alarm responses to own-race faces, whereas familiarity failed to differ as a function of race of face. Taken together, the results of Experiment 2 appear to be consistent with the effects of attentional and encoding-based mechanisms, but are largely inconsistent with the possible role of stereotyping or configural-featural information in differentiating performance on own- and other-race faces.

GENERAL DISCUSSION

Although 30 years of research has examined this phenomenon, no one theoretical account has generally been accepted (see Meissner & Brigham, 2001; Sporer, 2001). The current studies attempted to inform this debate by framing the CRE within the constraints of a dual-process framework. In general, such theories (Gardiner & Richardson-Klavehn, 2000; Kelley & Jacoby, 2000; Mandler, 1980; Yonelinas, 2002) have typically distinguished between memory processes involving conscious-level conceptual information that is elaboratively encoded and those involving fluent, perceptually-based information that is encoded in an automatic, non-conscious manner. It was believed that identifying the contributions of recollection and familiarity to the CRE would provide insights regarding possible social-cognitive mechanisms.

Overall, the results of our studies have demonstrated that the CRE appears to be due to a greater reliance upon recollection for own-race faces, in which individuals qualitatively encode more information about own-race faces, creating a more diagnostic representation for subsequent identification. While familiarity was also greater for own-race faces in

several analyses, this effect was rather weak in comparison. Such a pattern of effects is quite consistent with attentional and encoding-based manipulations in the dual-process paradigm (see Yonelinas, 2002), including divided-attention, generation, and semantic encoding tasks. In addition, the role of recollection is consistent with the differential effects of distinctiveness observed in the CRE paradigm (Chiroro & Valentine, 1995; Mantyla, 1997). If the effect of categorization for other-race faces was considered as an attentional diversion to encoding (Levin, 1996, 2000; MacLin & Malpass, 2001, 2003), then the current pattern of effects would also support such a mechanism. In contrast, the primary role of recollection in the CRE does not appear to provide support for differential reliance upon configural versus featural information (Yonelinas et al., 1999) or for the role of stereotyping other-race faces.

The phenomenology of skilled perceptual-memory

More generally, the current findings may extend a dual-process interpretation to other perceptual learning phenomena. In particular, the role of recollection in differentiating performance on own- and other-race faces further validates the influence of conscious-level, conceptual processes in skilled perceptual-memory, a proposition set forth early in the skilled memory research of Chase and Simon (1973). This finding, however, does not negate the potential role of a more pure perceptual advantage in the performance of skilled participants. For example, Reingold and colleagues (Reingold, Charness, Pomplun, & Stampe, 2001) have observed a perceptual-encoding advantage for chess masters involving a larger visual span (compared with novice players) when responding in a check-detection paradigm. Interestingly, this perceptual advantage was observed only when chess masters were provided a 'meaningful' board arrangement. In contrast, when participants were provided a 'scrambled' arrangement of pieces, the differences in visual span across the skill levels were negated. Thus, it appears that conceptual and perceptual processes may act in concert with one another to provide performance advantages in perceptual-memory tasks (see also, Charness, Reingold, Pomplun, & Stampe, 2001).

Similar to that of other studies in the skilled memory literature, the CRE demonstrated in the present research provides only a 'snapshot' of performance differences in memory for own- and other-race faces. Further research is required to better understand the changes in phenomenological responding that develop throughout the skill acquisition process leading to successful (and replicable) differentiation. Reder, Angstadt, Cary, Erickson, and Ayers (2002) have recently demonstrated such a multi-trial training paradigm to examine frequency-based effects in recognition. Gauthier, Tarr, and colleagues have also used a training paradigm to explore the development of object recognition expertise and its relation to the processing of human faces (Gauthier, Williams, Tarr, & Tanaka, 1998; Rossion, Gauthier, Goffaux, Tarr, & Crommelinck, 2002). Linking such a paradigm with the assessment of both performance-based and phenomenological responses should permit researchers to gain a better understanding of the mechanisms underlying the perceptual learning process.

Applied considerations

The present experiments, in concert with other recent research, lead us to the proposition that the CRE occurs because people encode more qualitative information about own-race faces, information that is diagnostic for subsequent identification situations. If the CRE

were seen as an encoding-based phenomenon, then factors present at encoding would be particularly important in determining the magnitude of the CRE that would be likely to occur. Consistent with this perspective, our recent meta-analysis (Meissner & Brigham, 2001) found that an encoding-based factor, study time, was a significant moderator of the CRE—namely, the CRE was stronger, largely due to higher false alarm rates, in conditions that employed shorter study times. Given this perspective, other attentional factors, such as the ‘weapon focus’ effect (Stebly, 1992), may also be found to exacerbate the CRE. The role of encoding-based factors would seem to correspond closely to a perceiver’s ‘opportunity to observe’ the target’s face, which was listed by the US Supreme Court in *Neil v. Biggers* (1972) as one of five factors to be taken into account in evaluating the likely accuracy of an eyewitness’s identification (Brigham, Wasserman, & Meissner, 1999). So for this factor (but not several others), the Court’s ‘educated guess’ appears to have been supported by subsequent research.

Another important factor in identification situations is the confidence that an eyewitness expresses in his/her identification. A witness’s ‘degree of certainty’ was also one of the five factors listed in *Neil v. Biggers*, and subsequent research has shown that mock jurors are indeed strongly influenced by the degree of confidence/certainty that a witness expresses (e.g. Cutler, Dexter, & Penrod, 1990). However, research examining the utility of confidence as a postdictor of accuracy has generally demonstrated a weak relationship between degree of certainty and identification accuracy (see meta-analyses by Bothwell, Deffenbacher, & Brigham, 1987; Sporer, Penrod, Read, & Cutler, 1995). Yet, there do appear to be some conditions in which a stronger relationship may exist. For example, when conditions vary widely across witnesses, confidence has been shown to be associated with identification accuracy (Lindsay, Nilson, & Read, 2000). Furthermore, initial judgments made with very high confidence have been shown to be quite diagnostic of witness accuracy (Juslin, Olson, & Winman, 1996). In contrast, Wright, Boyd, and Tredoux (2001) have observed that the confidence-accuracy relationship is significantly *weaker* for other-race than for own-race identifications. The current study extends this finding by demonstrating that individuals experience a greater proportion of *false recollections* for other-race faces—namely, incorrect identifications that are made with *high* confidence. This differential rate of false recollections and the lack of diagnosticity for other-race confidence ratings would seem to be valuable information for those working in the justice system who must decide how much credence to assign a disputed identification.

As far as the reliability of the CRE, this has only been assessed in two published studies, to our knowledge—Slone et al. (2000) and the present Experiment 2. On both occasions, the effect showed only a small degree of test-retest reliability: $r(127) = 0.21$ in Slone et al.: $r(64) = 0.20$ in the current study. This low level of reliability, coupled with the absence of relationships to individual measures of memory or potentially relevant attitudes (except for degree of interracial contact for Whites; see Slone et al., 2000), indicates that there is no measure at present that would be forensically useful in predicting which individuals are most likely to manifest a strong CRE in face identification. It remains to be seen whether other potentially useful individual-difference variables can be identified.

Conclusions

The current analysis interpreted the CRE in terms of a dual-process framework, and attempted to distinguish between competing social-cognitive accounts of the phenomenon.

Taken together, our findings suggested that the CRE occurs as a result of superior encoding-based processing of own-race faces, particularly with regard to the greater qualitative selection of facial information and the allocation of sufficient attentional and cognitive resources to their storage in memory. In contrast, the role of racial stereotyping and the potential for a configural-featural encoding distinction between own- and other-race faces was not supported by these studies. From a practical standpoint, identifying the CRE as an encoding-based phenomenon provides insight to factors present at encoding (e.g. study time or distractions to attention such as 'weapon focus') that may be important in determining the potential magnitude of the CRE in everyday practice.

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