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An own-race bias in the categorisation and recall of associative information

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ABSTRACT

People tend to better remember same-race faces relative to other-race faces (an "own-race" bias). We examined whether the own-race bias extends to associative memory, particularly in the identification and recall of information paired with faces. In Experiment 1, we presented white participants with own- and other-race faces which either appeared alone or accompanied by a label indicating whether the face was a "criminal" or a "victim". Results revealed an own-race facial recognition advantage regardless of the presence of associative information. In Experiment 2, we again paired same- and other-race faces with either "criminal" or "victim" labels, but rather than a recognition test, participants were asked to identify whether each face had been presented as a criminal or a victim. White criminals were better categorised than Black criminals, but race did not influence the categorisation of victims. In Experiment 3, white participants were presented with same- and other-race faces and asked to remember where the person was from, their occupation, and a crime they committed. Results revealed a recall advantage for the associative information paired with same-race faces. Collectively, these findings suggest that the own-race bias extends to the categorisation and recall of information in associative memory.

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KEYWORDS
Own-race bias; facial recognition; associative memory; face-information binding

We frequently encounter both new and familiar faces and often need to later recognise these faces in a variety of contexts (Young & Burton, 2017). Whether casually conversing with a new acquaintance, waving to the neighbourhood mail carrier, or witnessing a crime unfold, we encounter many individuals throughout the day who we may hope to later remember. When attempting to recognise faces, people often demonstrate an in-group face recognition advantage (Chiroro et al., 2008) such that when presented with faces of different races/ethnicities, learners generally better recognise faces of their own race compared with faces of other races or ethnicities. This effect has been coined the *own-race bias* (Malpass & Kravitz, 1969; Meissner & Brigham, 2001). A similar in-group facial recognition advantage has also been found for gender (Wright & Sladden, 2003), age (Rhodes & Anastasi, 2012), species (Diamond & Carey, 1986), and sexual orientation (Rule et al., 2007).

The in-group recognition advantage (hereafter, "the own-race bias") has been well-documented across cultures, likely governed by a critical period of social contact during childhood (see McKone et al., 2019; Sangrigoli et al., 2005; Wong et al., 2020). To account for the own-race bias, researchers have proposed perceptual expertise (Hills & Lewis, 2006) and social cognitive (Pauker et al., 2009; Sporer, 2001; see Young et al., 2012 for hybrid models and a review) accounts. According to perceptual expertise accounts of the own-race bias, more frequent encounters with members of one's own race compared to members of other races facilitates the development of perceptual expertise when encoding and recognising own-race faces (Chiroro et al., 2008; Lucas et al., 2011; Rhodes et al., 1989, 2014; Young & Hugenberg, 2012). Thus, with increased exposure to same-race faces, people may become better able to identify these faces.

Alternatively, social cognitive accounts of the own-race bias posit that faces are processed according to group membership such that faces are either categorised as in-group or out-group members (Hugenberg et al., 2007; Hugenberg & Sacco, 2008; Levin, 2000). As a result, people may be motivated to think categorically about encountered faces and either classify them as in-group or out-group members, invoking qualitatively different encoding processes based on this classification. For example, when faces are grouped trivially, such as by university affiliation, participants better recognise faces from their own university compared to faces from other universities, suggesting that merely categorising faces as in-group can enhance recognition (Bernstein et al., 2007; Hehman et al., 2010). According to the perceptual-expertise account, the own-race bias should persist regardless of the method of grouping the faces, but such findings

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are better accommodated by social cognitive mechanism accounts. Thus, social cognitive accounts are necessary when there is no physical distinction between faces and an arbitrary label is applied to a face (e.g., Hourihan et al., 2013).

Faces are comprised of multiple complex visual features that need to be bound into a coherent unit in memory with other contextual information (i.e., information about the face), and this form of associative memory involving binding multiple features is likely cognitively demanding compared to single feature memory (Shing et al., 2010). Accordingly, the own-race bias can be reduced if participants' attention is divided (e.g., Zhou et al., 2014) or by directing participants' attention towards the features of other-race faces that are useful for identification (e.g., Hills & Lewis, 2006), indicating that there may be superficial biases occurring when binding facial information during encoding. Additionally, the own-race bias can be reduced by increasing learners' motivation to remember a face (e.g., DeLozier & Rhodes, 2015). For instance, when paired with occupations that vary in perceived prestige, the own-race bias was reduced for faces paired with occupations perceived to be more prestigious than those perceived to be less prestigious (Shriver & Hugenberg, 2010; but see Oates et al., 2019 for a failure to replicate this finding).

Although the own-race bias has been extensively demonstrated in facial recognition (see Meissner & Brigham, 2001 for a review), and pairing information with faces can reduce the own-race bias, it is currently unclear whether an own-race bias occurs for information associated with a face. Previous work has investigated the own-race bias in some forms of associative memory. For example, Horry and Wright (2008) asked white participants to study White and Black faces paired with different backgrounds. On a subsequent recognition test, if participants indicated that they had seen a face before, they then had to select the background that face had been paired with. Results revealed that participants made more associative memory errors for other-race faces compared to own-race faces (see also Horry et al., 2010). Similarly, other work has demonstrated an own-age bias in face-name associative memory such that older adults were better able to remember names paired with older faces compared to names paired with younger faces, with the opposite effect occurring in younger adults (Strickland-Hughes et al., 2020).

In addition to the own-race bias potentially extending to associative memory, the nature of the information paired with a to-be-remembered face may influence associative memory. For example, Kleider et al. (2012) presented participants with a series of Black faces (normed as stereotypical or atypical based on their facial features) along with a role they may be cast in for a movie (i.e., artist, drug dealer, professor). Results revealed that participants' identification of the faces was influenced by the associative information paired with the faces. Specifically, faces previously rated as more stereotypically Black (based on facial features) were correctly identified as being cast into a drug dealer role more than being cast in roles as artists or professors. Additionally, these faces were more likely to be miscategorised as drug dealers when originally labelled as an artist or professor. Thus, if the information associated with to-be-remembered faces is sometimes associated with abhorrent stereotypes, this associative information may lead to biases in facial recognition and associative memory errors.

There is mixed evidence regarding whether people are metacognitively aware of the own-race bias, with evidence both suggesting awareness (Arnold, 2013; Hourihan et al., 2012; Nguyen et al., 2017) and a lack of awareness (Rhodes et al., 2013; Tullis et al., 2014). For instance, Smith et al. (2004) had participants both prospectively and retrospectively indicate their confidence that they would be able to identify a perpetrator in a line-up after watching a video of a crime committed by either an own- or other-race perpetrator. Prospective confidence ratings were not significantly different for own- and other-race perpetrators. However, on a later recognition test where the target was either present or absent, participants attempting to identify an own-race perpetrator were more retrospectively confident and better at recognising the perpetrator than participants attempting to identify an other-race perpetrator, and confidence was greater when the target was present compared to when the target was absent.

Beyond mean levels of confidence, it is perhaps more important to consider whether individuals' range of confidence maps on to accuracy (i.e., the calibration of confidence). For instance, a well-calibrated rememberer will exhibit high levels of confidence when making an accurate decision (e.g., correctly identifying the suspect in a line-up when the target is present) and lower levels of confidence when providing an inaccurate decision (e.g., incorrectly identifying a filler when the target is absent). Recent work suggests that, when solicited under optimal conditions (cf. Wells et al., 2020), confidence can reliably map on to accuracy. To illustrate, Nguyen et al. (2017) analyzed such calibration among several experiments examining recognition of own-race and other-race faces and results indicated that rememberers were similarly well-calibrated for own- and other-race faces. Thus, although prospective judgments may be inaccurate in some instances (e.g., Rhodes et al., 2013; Smith et al., 2004), recent analyses of retrospective confidence judgments suggest that metacognitive accuracy may not systematically differ for own- and other-race faces.

The current study

In the current study, we examined whether the own-race bias in facial recognition is impacted by associative information paired with own- and other-race faces, whether the own-race bias extends to associative memory, and if there is an own-race bias in the recall of information paired with faces. Specifically, we presented White participants with own- and other-race faces either alone or with accompanying associative information. We expected participants to demonstrate the own-race bias by better recognising White faces, having better associative memory for White faces, and more accurately recalling information associated with White faces. Additionally, we expected participants' retrospective confidence judgments to map onto this potential own-race bias in both associative memory and the recall of associative information such that participants would generally be more confident in their memory for White faces.

Experiment 1

In Experiment 1, we investigated the effect of pairing associative information with own- and other-race faces on subsequent facial recognition. White participants were presented with same- and other-race faces and the faces were either presented with no accompanying information or were arbitrarily labelled as a "criminal" or a "victim", as these labels may activate racial stereotypes and impact the encoding of each face. We expected participants to demonstrate an own-race bias by better recognising same-race faces when studied without any labels; however, when faces are labelled as a "criminal", we expected participants to both (1) show a reduced own-race bias, as increased motivation to remember faces has led to a reduced own-race bias in previous work (e.g., DeLozier & Rhodes, 2015; Hourihan et al., 2013; Shriver & Hugenberg, 2010; but see Oates et al., 2019; Rhodes et al., 2010), and (2) demonstrate elevated recognition of criminals. Specifically, although reduced recognition of victims may lead to negative downstream consequences in eye-witness testimony over and above that of criminals, we expected the "criminal" labels to be perceived as comparatively more important to remember, thus leading to an increased motivation to remember them (see Murphy & Castel, 2021).

Method

Participants

Participants were 80 white younger adults ($M_{age} = 19.57$, $SD_{age} = 1.30$) recruited from the University of California, Los Angeles (UCLA) Human Subjects Pool. Participants were tested online and received course credit for their participation. Participants were excluded from analysis if they admitted to cheating on a post-task questionnaire (they were told they would still receive credit if they cheated). This exclusion process resulted in zero exclusions. A sensitivity analysis based on the observed sample was conducted using G*Power (Faul et al., 2007). For a 2 (condition: *labels, no labels*) × 2 (race: *Black, White*) mixed ANOVA, assuming alpha = .05, power = .80, and a correlation of $r = .35$ between repeated measures (A′), the smallest effect the design could reliably detect is $\eta^2 = .06$.

Materials

Faces were of male and female young adults taken from Meissner et al. (2005). Each image displayed only the face and neck, with no distinctive cues (e.g., jewellry, hair accessories, clothing), and was presented on a white background. To ensure that the task tested facial recognition rather than photo recognition, the faces presented in the recognition test had a different expression than in the study phase (e.g., a smiling face from the study phase would have a neutral expression in the recognition test and vice versa). Half the studied faces (and lures) were smiling, and half had no expression. For participants presented with faces paired with labels, each face in the study phase was randomly labelled as either a criminal or a victim. Labels appeared atop each face in the study phase but did not appear in the test phase.

Procedure

Participants were told that they would be viewing a series of faces to remember for a later recognition test where they would see the faces again and need to identify whether they had studied the face or not. Participants were randomly assigned to either view the faces without labels ($n = 40$) or with the criminal/victim labels ($n = 40$). For participants studying the faces with labels, they were told that some of the faces would be labelled as criminals, and some will be labelled as victims. For those faces, participants were told to imagine that they either committed a serious crime or were victims of a serious crime. Each face was studied for 4 s, and participants studied 64 faces, consisting of 32 White faces and 32 Black faces. Faces were presented in counterbalanced blocks by race, and each block consisted of equal numbers of male and female faces (similar to DeLozier & Rhodes, 2015; Rhodes et al., 2013; see also Meissner & Brigham, 2001). After the study phase, participants were shown the 32 studied faces as well as 32 lures one at a time, in a randomised order, and were asked to indicate whether each face was "old" (previously studied) or "new" (not previously studied). After indicating "new" or "old," participants indicated their confidence in the correctness of their response on a scale from 0 (not confident at all) to 100 (very confident) and were given as much time as they needed for this portion of the task.

Results

The results are divided into two primary sections: recognition, and confidence.[1] In each section, we investigated differences as a function of race (Black, White) and the presence or absence of labels. All ANOVAs were conducted in *JASP* (see Love et al., 2019) and 95% confidence intervals ($CI_{95\%}$) of the mean were conducted in *R* (R Core Team, 2013) using a 10,000-iteration bootstrap procedure assuming a normal distribution of bootstrapped means.

Recognition

To determine whether there were differences in participants' ability to distinguish between studied and new faces, A′ was calculated for each participant's recognition of each race using hits (i.e., calling a studied face "old") and false alarms (i.e., calling a lure "new"; see Zhang & Mueller, 2005). A′ was used in place of more traditional measures, such as proportion correct or *d′*, as proportion correct can be confounded with response bias and *d′* assumes equal variance for old (studied) and new (non-studied) response distributions (Glanzer et al., 1999; Hennessee et al., 2017; see Stanislaw & Todorov, 1999 for a review).

To examine differences in A′ between White and Black faces (see Figure 1), a 2 (condition: *labels, no labels*) × 2 (race: *Black, White*) mixed ANOVA revealed that discriminability for White faces ($M = .75$, $CI_{95\%}$: .72-.77, $SD = .11$) exceed that for Black faces ($M = .72$, $CI_{95\%}$: .69-.74, $SD = .10$), [$F(1, 78) = 5.10$, $p = .027$, $\eta^2 = .06$]. However, recognition of faces with labels ($M = .74$, $CI_{95\%}$: .71-.77, $SD = .10$) was similar for faces without labels ($M = .73$, $CI_{95\%}$: .71-.75, $SD = .07$), [$F(1, 78) = .57$, $p = .451$, $\eta^2 = .01$], and the presence of labels did not interact with race [$F(1, 78) = .75$, $p = .391$, $\eta^2 = .01$]. Thus, participants demonstrated an own-race bias, but there was no significant effect of labelling each face as a criminal or as a victim.

Since status was not presented in the test phase (and thus the lure faces did not have a status), A′ could not be calculated for criminals and victims. Instead, we examined differences in hits by face race and status (see Appendix A for more information on hit and false alarm rates in Experiment 1). A 2 (status: *criminal, victim*) × 2 (race: *Black, White*) mixed ANOVA revealed that hits for criminal faces ($M = .61$, $CI_{95\%}$: .57-.65, $SD = .13$) were similar to those for victim faces ($M = .61$, $CI_{95\%}$: .57-.65, $SD = .13$), [$F(1, 39) = .02$, $p = .895$, $\eta^2 < .01$]. Additionally, there was not a main effect of race [$F(1, 39) = .67$, $p = .417$, $\eta^2 = .02$], and race did not interact with status [$F(1, 39) = .58$, $p = .452$, $\eta^2 = .02$].

Confidence

Figure 2 displays calibration curves for same-race and other-race faces (a) and victim and criminal faces (b). As can be seen, participants were reasonably well-calibrated, with greater accuracy at higher levels of confidence, but calibration did not differ by face type.[2] Overall confidence ratings were examined via a 2 (condition: *labels, no labels*) × 2 (race: *Black, White*) mixed ANOVA, which revealed that confidence for White faces ($M = 65.96$, $CI_{95\%}$: 62.87-69.06, $SD = 14.36$) was similar to confidence for Black faces ($M = 64.94$, $CI_{95\%}$: 61.68-68.20, $SD = 15.04$), [$F(1, 78) = 1.47$, $p = .229$, $\eta^2 = .02$]. However, results did not reveal a main effect of the presence of labels [$F(1, 78) = .14$, $p = .713$, $\eta^2 < .01$], and race did not interact with the presence of labels [$F(1, 78) = 1.20$, $p = .276$, $\eta^2 = .02$].

To examine differences in confidence as a function of status and race, a 2 (status: *criminal, victim*) × 2 (race: *Black, White*) mixed ANOVA revealed that confidence for criminal faces ($M = 71.54$, $CI_{95\%}$: 68.16-74.92, $SD = 11.06$) was significantly greater than that for victim faces ($M = 66.98$, $CI_{95\%}$: 62.82-71.15, $SD = 13.61$), [$F(1, 39) = 25.45$, $p < .001$, $\eta^2 = .40$]. However, race did not interact with status [$F(1, 39) = .10$, $p = .749$, $\eta^2 < .01$].

To examine the relative accuracy of participants' confidence judgments, we computed gamma correlations between participants' confidence judgments and whether each face was correctly identified as a studied face or a lure (see Goodman & Kruskal, 1954; Nelson, 1984; but see Benjamin & Diaz, 2008; Masson & Rotello, 2009, for criticisms and alternative measures). Gamma correlations indicate the degree to which an individual correctly discriminated new and old faces that they were confident in and incorrectly discriminated new and old faces that they were not confident in (Higham et al., 2016; Rhodes, 2016). A perfect positive correlation between confidence and performance would exemplify the highest confidence for correct discriminations and the lowest confidence for incorrect responses.

To examine differences in gamma correlations between White and Black faces, a 2 (condition: *labels, no labels*) × 2 (race: *Black, White*) mixed ANOVA revealed that relative accuracy for White faces ($M = .27$, $CI_{95\%}$: .23-.31, $SD = .19$) was similar to that for Black faces ($M = .28$, $CI_{95\%}$: .23-.32, $SD = .22$), [$F(1, 78) = .01$, $p = .924$, $\eta^2 < .01$]. Additionally, results did not reveal a main effect of the presence of labels [$F(1, 78) = 1.54$, $p = .218$, $\eta^2 = .02$], and race did not interact with the presence of labels [$F(1, 78) = 2.15$, $p = .146$, $\eta^2 = .03$].

To examine differences in relative accuracy as a function of status and race, a 2 (status: *criminal, victim*) × 2 (race: *Black, White*) mixed ANOVA revealed that gamma correlations for criminal faces ($M = .47$, $CI_{95\%}$: .37-.57, $SD = .32$) were similar to those for victim faces ($M = .35$, $CI_{95\%}$: .23-.48, $SD = .41$).[3] Furthermore, there was not a main effect of status [$F(1, 38) = 3.60$, $p = .065$, $\eta^2 = .09$], and race did not interact with status [$F(1, 38) = .01$, $p = .924$, $\eta^2 < .01$].

Discussion

In Experiment 1, we investigated the effect of pairing associative information with to-be-remembered faces on the own-race facial recognition advantage. We presented participants with White and Black faces either with no accompanying information or labelled as a "criminal" or a "victim". Consistent with previous work (Meissner & Brigham, 2001), White participants better recognised White faces compared with Black faces, exemplifying the own-race bias. However, participants did not differ in their confidence for White or Black faces, or the relative accuracy of their confidence judgments. Furthermore, arbitrarily labelling the faces as criminals or victims did not impact face recognition; however, participants were more confident in their identification of criminal faces,

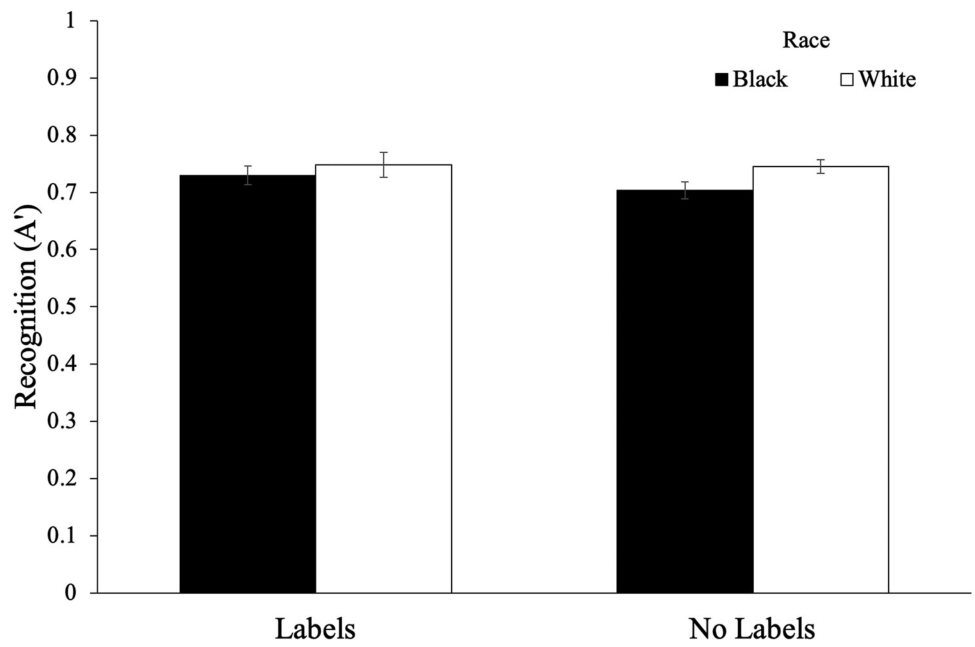

Figure 1. Recognition performance as a function of face race and the presence of labels in Experiment 1. Error bars reflect ±1 standard error of the mean.

despite not demonstrating better recognition of these faces.

Collectively, Experiment 1 demonstrated a slight own-race facial recognition advantage and illustrated that not just any information paired with a face can influence subsequent recognition (compared with point values or occupations, see DeLozier & Rhodes, 2015; Shriver & Hugenberg, 2010). Although labelling each face as either a criminal or a victim did not influence face recognition, this information may still have been encoded. Specifically, participants' memory may be sensitive to each face's status (i.e., a criminal or a victim) as a function of the face's race. For example, a witness to a crime may encode the faces of a variety of people on the scene (i.e., the criminal, victim, and bystanders) and it is imperative that a witness correctly identifies the role of each person when identifying faces, and we tested this hypothesis in Experiment 2.

Experiment 2

In Experiment 1, participants demonstrated an own-race bias, but labelling each face as either a "criminal" or a "victim" did not impact facial recognition. In Experiment 2, we investigated whether participants' associative memory for the information paired with each face was impacted by the race of the faces. Specifically, we again presented participants with own- and other-race faces with each face labelled as either a "criminal" or a "victim". However, rather than an item recognition test, in the test phase participants indicated whether each face had been labelled as a criminal or a victim.

Similar to the own-race bias for face-background associative memory (Herzmann et al., 2017; Horry et al., 2010; Horry & Wright, 2008), we expected participants to demonstrate better associative memory for information paired with same- compared to other-race faces. Additionally, we expected participants to demonstrate better associative memory for "criminal" faces compared with "victim" faces. Specifically, although both criminals and victims are important to remember for eyewitness recounts of a crime, we expected that "criminal" labels may be perceived as more important to remember, thus increasing motivation to remember them (see Murphy & Castel, 2021). We also expected an interaction between an own-race bias for White faces and enhanced motivation to remember "criminal" faces such that associative memory may be best for White faces paired with "criminal" labels.

Method

Participants

Participants were 42 white younger adults ($M_{age} = 20.45$, $SD_{age} = 1.37$) recruited from the UCLA Human Subjects Pool. Participants were tested online and received course credit for their participation. Participants were excluded from analysis if they admitted to cheating on a post-task questionnaire (they were told they would still receive credit if they cheated). This exclusion process resulted in zero exclusions. A sensitivity analysis based on the observed sample indicated that for a 2 (status: *criminal, victim*) × 2 (race: *Black, White*) within-subjects ANOVA, assuming alpha = .05, power = .80, and a correlation of r = .45 between repeated measures (categorisation accuracy for White and Black faces), the smallest effect the design could reliably detect is $\eta^2 = .05$.

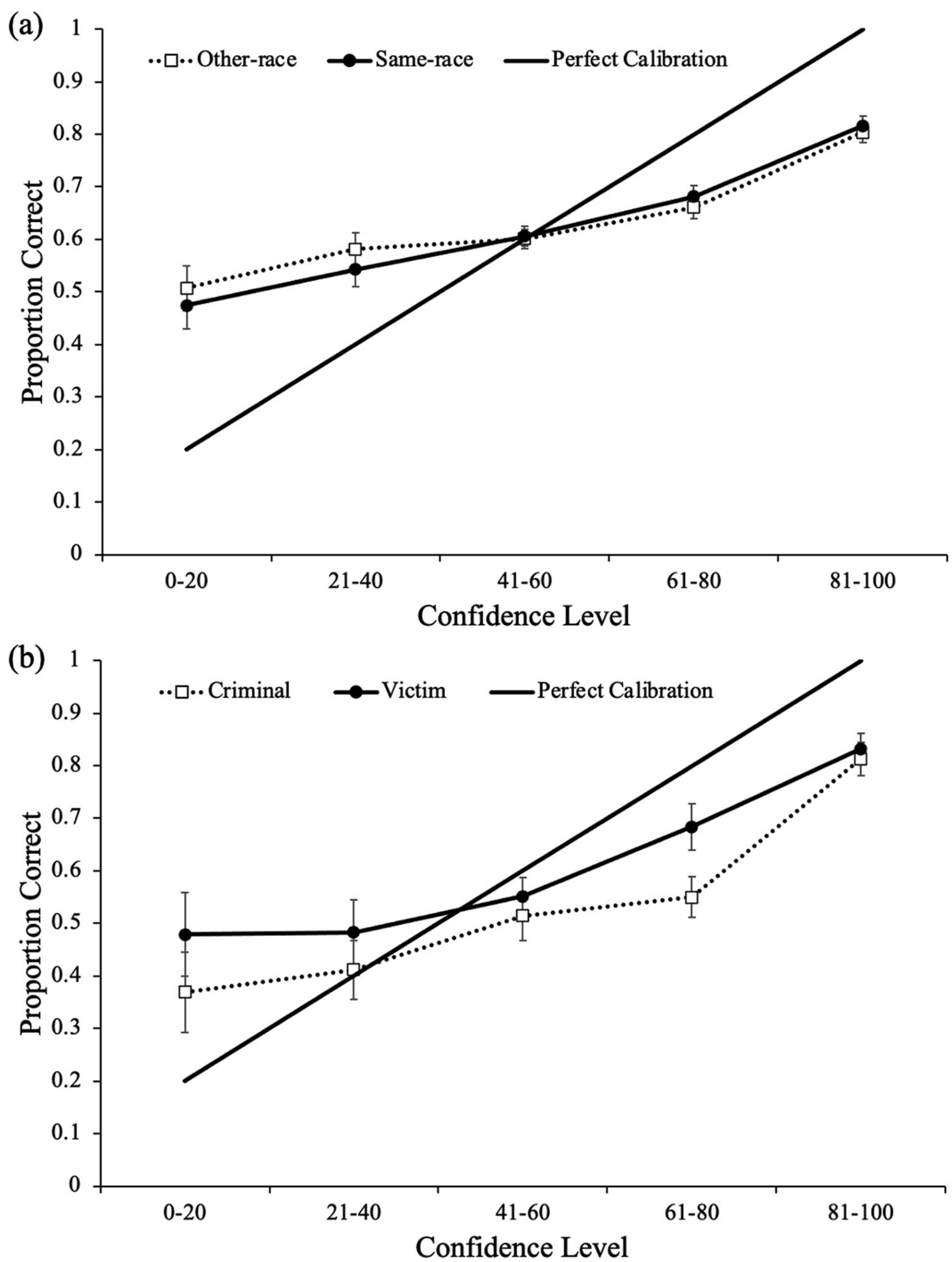

Figure 2. Confidence-specific accuracy assessed with confidence-accuracy characteristic curves as a function of race (a) and status (b) in Experiment 1. Error bars reflect ±1 standard error of the mean.

Materials and procedure

The materials and procedure were similar to Experiment 1. However, each face was studied twice for 4 s each (non-consecutively) in a randomised order.[4] Additionally, rather than completing a recognition test after the study phase, participants completed a categorisation test whereby they were shown the faces from the just-presented block (in a randomised order) and asked to indicate whether each face had been presented as a criminal or as a victim. Participants then reported their confidence in the correctness of their response on a scale from 0 to 100 (with 0 being not at all confident and 100 being very confident) and were given as much time as they needed for this portion of the task.

Results

Performance

Since the task asked participants to distinguish between criminals and victims, we first used a signal detection approach to evaluate the degree to which participants could discriminate between criminal and victim faces. Specifically, we examined these data based on the probability of categorising each face as a "criminal", resulting in four possible outcomes: 1) a criminal face is correctly categorised as a criminal (hit); 2) a criminal face is incorrectly categorised as a victim (miss); 3) a victim face is incorrectly categorised as a criminal (false alarm); 4) a

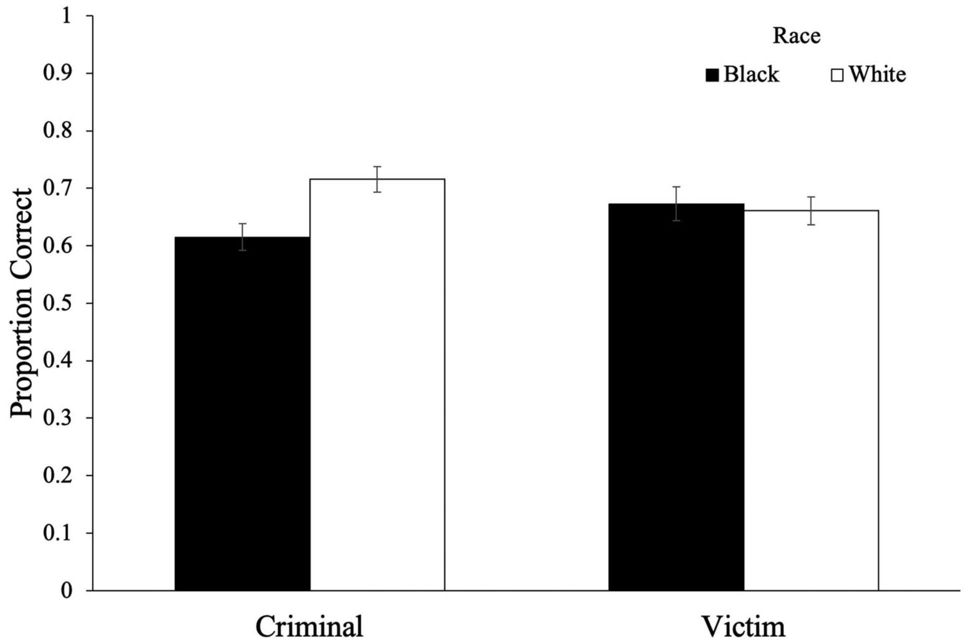

Figure 3. Categorisation performance as a function of face race and status in Experiment 2. Error bars reflect ±1 standard error of the mean.

victim face is correctly categorised as a victim (correct rejection). We then calculated A′ for each participant's categorisation of faces of each race using these hit and false alarm rates as well as response criterion (B″D; cf. Snodgrass & Corwin, 1988).

Overall, a paired samples *t*-test did not reveal significant differences in A′ for White faces ($M = .75$, $CI_{95\%}$: .70-.80, $SD = .16$) related to Black faces ($M = .69$, $CI_{95\%}$: .63-.75, $SD = .20$), [$t(41) = 1.78$, $p = .082$, $d = .28$], indicating that participants' discrimination did not markedly differ by race of the face. A similar analysis of response criterion (B"D) revealed that participants' criterion was more liberal for White faces ($M = -.14$, $CI_{95\%}$: -.25–.02, $SD = .38$) than Black faces ($M = .14$, $CI_{95\%}$: .01-.27, $SD = .44$), [$t(41) = 3.85$, $p < .001$, $d = .59$]. That is, participants had a more conservative response criterion for categorising a Black face as a "criminal" relative to White faces.

Categorisation performance (scored as proportion correct) as a function of face race and status is shown in Figure 3. To examine differences in performance on the categorisation test[5], a 2 (status: *criminal, victim*) × 2 (race: *Black, White*) within-subject ANOVA on pairing accuracy revealed that White faces were better categorised ($M = .69$, $CI_{95\%}$: .65-.73, $SD = .13$) compared with Black faces ($M = .64$, $CI_{95\%}$: .60-.68, $SD = .13$), [$F(1, 41) = 4.33$, $p = .044$, $\eta^2 = .10$]. However, categorisation accuracy was similar for criminal ($M = .67$, $CI_{95\%}$: .63-.70, $SD = .13$) and victim faces ($M = .67$, $CI_{95\%}$: .62-.71, $SD = .15$), [$F(1, 41) < .01$, $p = .951$, $\eta^2 < .01$], but status significantly interacted with race [$F(1, 41) = 11.07$, $p = .002$, $\eta^2 = .21$]. To further examine this interaction, post-hoc *t*-tests revealed that White criminals ($M = .72$, $CI_{95\%}$: .67-.76, $SD = .14$) were significantly better categorised than Black criminals ($M = .62$, $CI_{95\%}$: .57-.66, $SD = .15$), [$t(41) = 4.30$, $p < .001$, $d = .66$], but White victims ($M = .66$, $CI_{95\%}$: .61-.71, $SD = .16$) were similarly categorised relative to Black victims ($M = .67$, $CI_{95\%}$: .62-.73, $SD = .19$), [$t(41) = .40$, $p = .692$, $d = .06$].

Confidence

Calibration curves are depicted in Figure 4. Similar to Experiment 1, calibration was similar for own- and other-race faces[6] and indicated that high levels of confidence were associated with higher levels of accuracy. To analyze overall levels of confidence on the categorisation test, we conducted a 2 (status: *criminal, victim*) × 2 (race: *Black, White*) within-subject ANOVA on confidence judgments. Overall, participants were similarly confident for White faces ($M = 65.03$, $CI_{95\%}$: 60.50-69.80, $SD = 15.68$) as Black faces ($M = 63.50$, $CI_{95\%}$: 59.22-67.76, $SD = 14.08$), [$F(1, 41) = 1.34$, $p = .253$, $\eta^2 = .03$]. Participants were also similarly confident for faces that had been labelled as a criminal ($M = 64.79$, $CI_{95\%}$: 60.59-68.95, $SD = 14.13$) versus a victim ($M = 63.92$, $CI_{95\%}$: 59.36-68.38, $SD = 15.18$), [$F(1, 41) = .64$, $p = .428$, $\eta^2 = .03$] but status significantly interacted with race [$F(1, 41) = 4.08$, $p = .050$, $\eta^2 = .09$]. To further examine this interaction, post-hoc *t*-tests revealed that participants were significantly more confident when identifying White criminals ($M = 66.92$, $CI_{95\%}$: 62.14-71.71, $SD = 16.02$) than Black criminals ($M = 62.61$, $CI_{95\%}$: 58.17-67.05, $SD = 14.90$), [$t(41) = 2.16$, $p = .036$, $d = .33$]. However, participants were similarly confident when identifying White victims ($M = 63.37$, $CI_{95\%}$: 58.27-68.48, $SD = 17.03$) as they were for Black victims ($M = 64.37$, $CI_{95\%}$: 59.74-68.99, $SD = 15.68$), [$t(41) = .53$, $p = .602$, $d = .08$].

Finally, to examine differences in the relative accuracy of participants' confidence judgments (as measured by gamma correlations), we conducted a 2 (status: *criminal, victim*) × 2 (race: *Black, White*) within-subject ANOVA. Participants were similarly relatively accurate for White faces

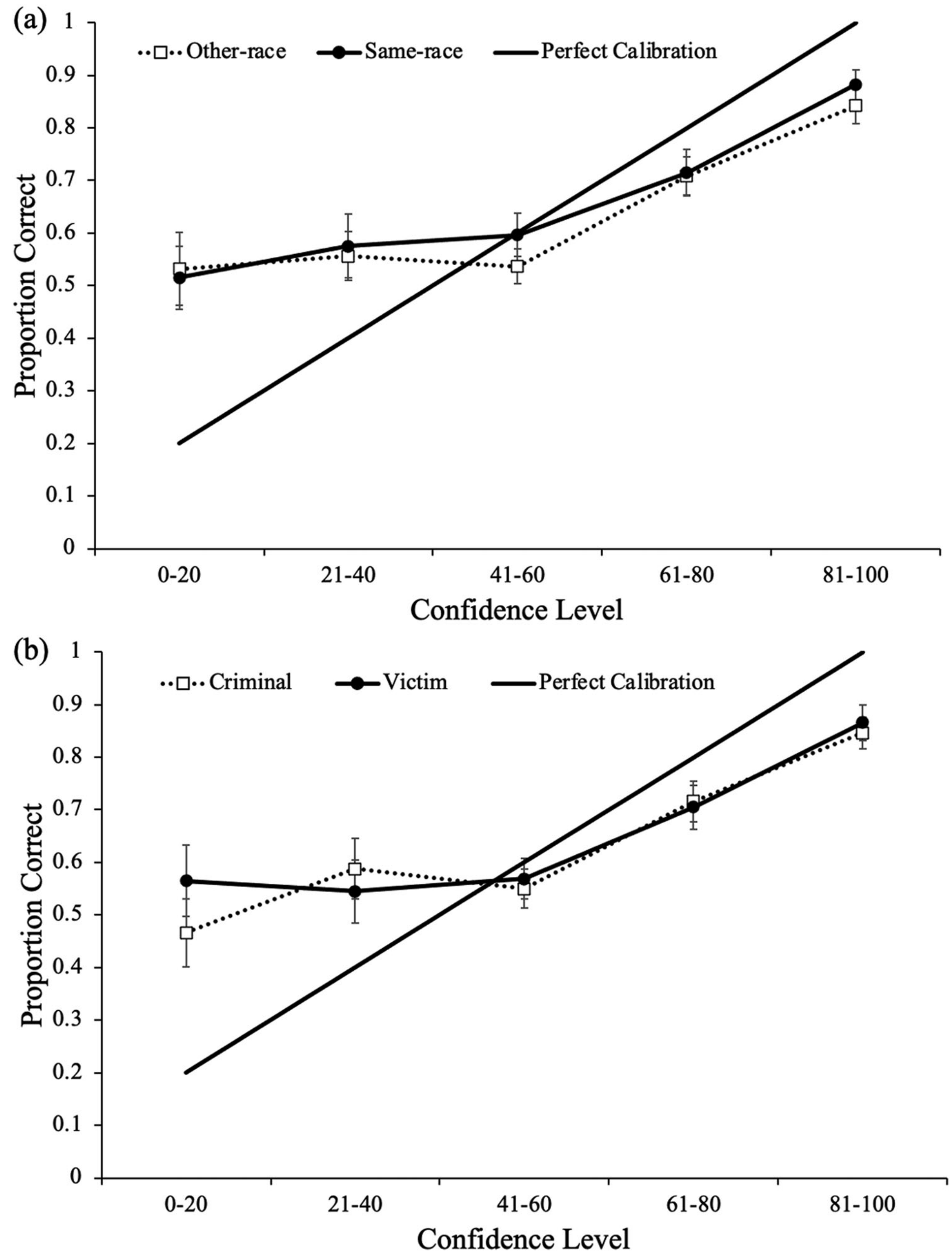

Figure 4. Confidence-specific accuracy assessed with confidence-accuracy characteristic curves as a function of race (a) and status (b) in Experiment 2. Error bars reflect ±1 standard error of the mean.

($M = .43$, $CI_{95\%}$: .34-.52, $SD = .30$) as Black faces ($M = .40$, $CI_{95\%}$: .30-.50, $SD = .33$)[7], [$F(1, 38) = .10$, $p = .749$, $\eta^2 < .01$]. Additionally, participants were similarly relatively accurate for criminal faces ($M = .45$, $CI_{95\%}$: .34-.56, $SD = .36$) as victim faces ($M = .36$, $CI_{95\%}$: .26, .47, $SD = .35$), [$F(1, 38) = 2.18$, $p = .148$, $\eta^2 = .05$], and status did not interact with race [$F(1, 38) = 1.35$, $p = .253$, $\eta^2 = .03$].

Discussion

In Experiment 2, we presented participants with same- and other-race faces where each face was labelled as either a "criminal" or a "victim". Participants then completed a categorisation test where they were presented with the faces again and asked to identify whether each face had been presented as a criminal or as a victim. Results revealed that White criminals were better categorised than Black criminals, and participants' confidence generally mapped on to this pattern. This may reflect participants' being more aware of criminal faces matching to their own race with an implicit bias to not falsely incriminate them, evident in a somewhat more conservative criterion to indicate "criminal" for Black faces. Additionally, criminals may be considered more important to remember (see Murphy & Castel, 2021), leading to a greater focus on these faces and a subsequent in-group memory advantage for the criminal faces. Nonetheless, Experiment 2 revealed an own-race bias in associative memory (i.e., the categorisation of information paired with faces) based on each face's status as either a criminal or a victim. However, when witnessing a crime, you may also need to recall what the suspect was doing, where they were, and other specific details of the incident. Thus, in Experiment 3, we investigated whether this own-race bias for associative information extends to the recall of associative information.

Experiment 3

In Experiment 2, face-race and face-status differentially influenced participants' categorisation accuracy of each face as either a criminal or a victim such that White criminals were better categorised than Black criminals (but there were no differences between White and Black victims), indicating that there may be an effect of race as learners attempt to bind contextual information with faces (consistent with Horry et al., 2010; Horry & Wright, 2008). In Experiment 3, we investigated whether an own-race bias exists in the recall of information paired with own-race compared to other-race faces. Specifically, participants were presented with White and Black faces and asked to remember where each person was from, their occupation, and a crime they committed. We expected that participants would better remember information paired with same-race faces.

Method

Participants

After exclusions, participants were 91 white younger adults ($M_{age} = 19.85$, $SD_{age} = 1.32$) recruited from the UCLA Human Subjects Pool. Participants were tested online and received course credit for their participation. Participants were excluded from analysis if they admitted to cheating on a post-task questionnaire (they were told they would still receive credit if they cheated). This exclusion process resulted in two exclusions. A sensitivity analysis based on the observed sample indicated that for a 2 (race: *Black, White*) × 3 (category: *location, occupation, crime*) within-subjects ANOVA, assuming alpha = .05, power = .80, and a correlation of $r = .88$ between repeated measures (recall accuracy for White and Black faces), the smallest effect the design could reliably detect is $\eta^2 = .01$.

Materials and procedure

Participants were told that they would be viewing a series of profiles that would include faces of people and information associated with those people. For each presented face, participants were told the individual's state of origin (a US state), occupation, and a crime they committed (e.g., From: Alabama; Occupation: Banker; Crime: Murder; see Appendix B for stimuli). Participants were instructed that they should remember this information for a later test where they would see the faces again and would need to recall the information associated with each person. The faces were similar to those used in Experiment 1 except we only included male faces to avoid any potential influence of gender stereotypes on memory for particular crimes (Ahola, 2012) or occupations (Wilbourn & Kee, 2010). On each list, half of the faces were Black, and the other half were White; half were smiling, and half had no expression. Each piece of associative information was used only once and was randomly paired with faces.

On each study-test trial, participants were shown two Black faces and two White faces, in random order, and each face's picture and information were presented for 20 s. After the study phase, participants were cued with the faces, one at a time, in a randomised order, and asked to recall the associated information with each face (they could recall information in any order they wished). The test phase was user-paced. This was repeated for a total of six study-test cycles, with new locations, occupations, and crimes paired with different sets of faces on each list (for a total of 24 faces).

After the recall test, participants completed a surprise face recognition test. Participants were shown the 24 studied faces in addition to 24 lures (half of the lures were Black, half were White; half were smiling, half had no expression) one at a time, in a randomised order, and were asked to indicate whether each face was old (previously studied) or new (not a studied face). Similar to Experiment 1, the old faces presented in the recognition test had a different expression from the previous study phase and the associative recall test phase (and participants were informed that the old faces in the test phase may carry a different expression than when studied). After indicating "new" or "old," participants indicated their confidence on a scale from 0 (not confident at all) to 100 (very confident) and were given as much time as they needed for this portion of the task.

Results

Recall

To examine differences in recall (see Figure 5), a 2 (race: *Black, White*) × 3 (category: *location, occupation, crime*) within-subject ANOVA was conducted. Overall, the proportion of information recalled for White faces ($M = .64$, $CI_{95\%}$: .59-.68, $SD = .23$) was significantly greater than for Black faces ($M = .60$, $CI_{95\%}$: .56-.65, $SD = .23$), [$F(1, 90) = 7.77$, $p = .006$, $\eta^2 = .08$]. There was a significant main effect of category [$F(2, 180) = 3.77$, $p = .025$, $\eta^2 = .04$] and post-hoc paired samples *t*-tests revealed that this significant main effect was driven by crimes ($M = .64$, $CI_{95\%}$: .59-.68, $SD = .22$) being better recalled than locations ($M = .60$, $CI_{95\%}$: .54-.65, $SD = .26$), [$p_{bonf} = .020$, $d = .29$], but not occupations ($M = .63$, $CI_{95\%}$: .58-.67, $SD = .23$), [$p_{bonf} > .999$, $d = .08$]; additionally, recall for the locations and

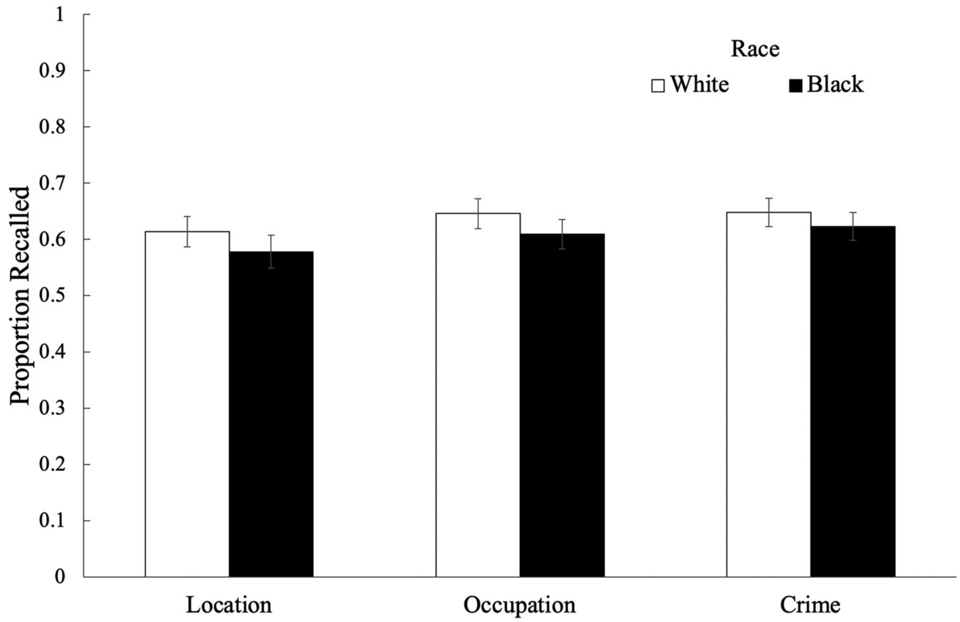

Figure 5. Recall performance across lists for each category as a function of race in Experiment 3. Error bars reflect ±1 standard error of the mean.

occupations was similar [$p_{bonf} = .087$, $d = .23$]. Furthermore, race did not interact with category, [$F(2, 180) = .16$, $p = .853$, $\eta^2 < .01$].

Recognition

A paired samples *t*-test did not reveal differences in discriminability (A′) between White faces ($M = .83$, $CI_{95\%}$: .80-.86, $SD = .14$) and Black faces ($M = .83$, $CI_{95\%}$: .80-.85, $SD = .12$), [$t(90) = .12$, $p = .902$, $d = .01$].

Confidence

Calibration curves are depicted in Figure 6. Calibration was similar for own- and other-race faces[8] and indicated that high levels of confidence were associated with higher levels of accuracy. To analyze overall levels of confidence on the recognition test, a paired samples *t*-test revealed that participants were more confident in their recognition of White faces ($M = 73.27$, $CI_{95\%}$: 69.97-76.57, $SD = 16.09$) than Black faces ($M = 70.11$, $CI_{95\%}$: 66.59-73.62, $SD = 17.22$), [$t(90) = 3.93$, $p < .001$, $d = .41$]. However, an analysis

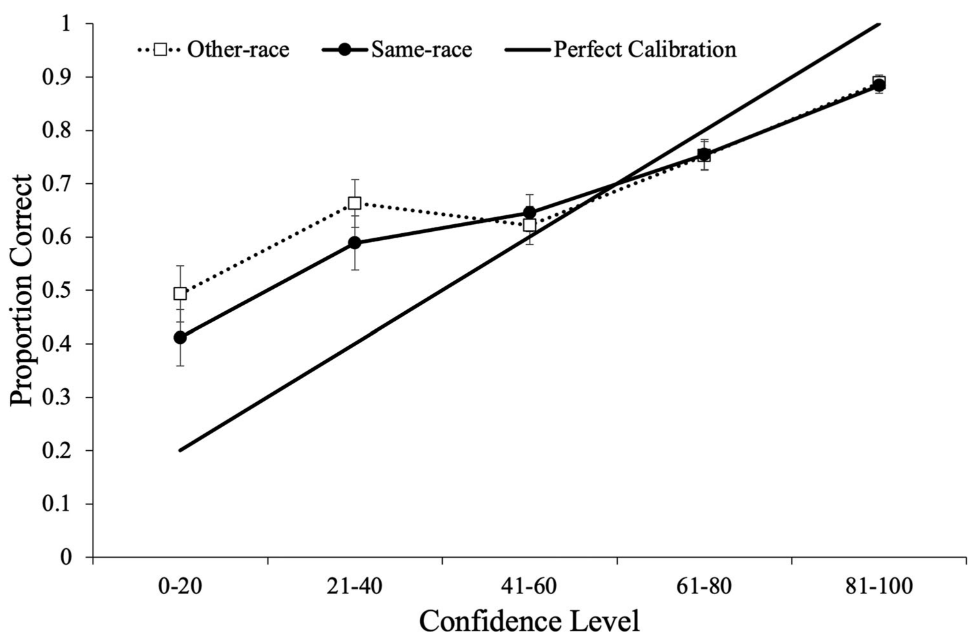

Figure 6. Confidence-specific accuracy assessed with confidence-accuracy characteristic curves in Experiment 3. Error bars reflect ±1 standard error of the mean.

of gamma correlations[9] between confidence and accuracy showed that participants were similarly relatively accurate for White ($M = .51$, $CI_{95\%}$: .44-.57, $SD = .32$) and Black faces ($M = .48$, $CI_{95\%}$: .41-.54, $SD = .32$), [$t(90) = .46$, $p = .646$, $d = .05$].

Discussion

Participants in Experiment 3 studied faces paired with arbitrary information (where they were from, their occupation, and a crime they committed). Results showed an own-race bias in recall such that participants best recalled information paired with own- compared to other-race faces. However, on a subsequent recognition test, participants did not demonstrate an own-race face recognition advantage but some caution is warranted when interpreting this finding since participants completed a cued-recall test before the final recognition test. Additionally, the use of a mixed study list may have contributed to the reduced own-race bias (see Meissner & Brigham, 2001). Together, Experiment 3 provides unique evidence that the own-race bias can extend to the binding *as well as the* retrieval of associative information.

General discussion

Faces are complex visual features that we typically encounter throughout each day in a variety of contexts and environments that we may later need to recognise. Prior face recognition research has revealed that perceptual features indicating group membership like gender (Wright & Sladden, 2003), age (Rhodes & Anastasi, 2012), and species (Diamond & Carey, 1986) can influence one's ability to discriminate between studied and novel faces. A similar in-group face recognition advantage (Chiroro et al., 2008) has also been demonstrated for race/ethnicity whereby people better recognise same-race faces compared to other-race faces (Malpass & Kravitz, 1969; Meissner & Brigham, 2001; the *own-race bias*).

In the present experiments, we investigated whether an own-race bias exists in face-information associative memory such that white participants may be better able to identify and recall information paired with White faces compared to information paired with Black faces. First, in Experiment 1, we presented participants with own- and other-race faces either with no accompanying information or with each face labelled as a "victim" or a "criminal". Results revealed that labelling faces as either criminals or victims did not eliminate the own-race bias in facial recognition (cf. Oates et al., 2019).

Next, in Experiment 2, we presented participants with own- and other-race faces, all labelled as either a "victim" or a "criminal," to determine if participants' associative memory was influenced by race or the labels. Results revealed that while face-race did not influence the categorisation of victims, White criminals were better categorised than Black criminals, perhaps indicating that the own-race bias in associative memory manifests in consequential situations. These data provide some evidence that information associated with each face may influence the binding of information paired with each face, consistent with prior work (Herzmann et al., 2017; Horry et al., 2010; Horry & Wright, 2008). However, we note that these conclusions do not represent a full factorial design (i.e., race of face completely crossed with the race of participants) and suggest that future research explore these patterns within such an experimental design.

Finally, in Experiment 3, we investigated whether an own-race bias exists for recall of associative information paired with same- and different-race faces. Participants studied Black and White faces paired with a profile of information that included where they were from, their occupation, and a crime they committed. Results revealed a recall advantage for associative information paired with same-race faces, demonstrating that the own-race bias in associative memory (e.g., Herzmann et al., 2017; Horry et al., 2010; Horry & Wright, 2008) may extend to the binding and retrieval of face-information pairs.

Perceptual expertise accounts of the own-race bias posit that people better recognise same-race faces due to more previous experience with these faces, resulting in the support of perceptual expertise when recognising own-race faces (Chiroro et al., 2008; Lucas et al., 2011; Rhodes et al., 1989; Rhodes et al., 2014). When studying just a face, participants focus on the morphological features of the face (e.g., mouth, eyes, nose; see Barton et al., 2006), but when the faces are labelled, some attentional recourses used to process and encode the morphological landmarks and characteristics of these faces may be directed towards the paired associative information, reducing the benefits of perceptual expertise. Since the associative information paired with faces should not receive the same memory benefits of perceptual expertise as facial recognition (perceptual expertise for the details of same-race faces may help recognition but are unlikely to provide support for semantic information), the present results may not fit perceptual expertise accounts. However, given that expertise with own-race faces may require the allocation of fewer attentional resources when encoding own-race faces, there may be more attentional resources available for the successful binding of associative information, leading to better memory for information paired with same-race faces.

In contrast to perceptual expertise accounts, social cognitive mechanism accounts of the own-race bias suggest that faces are processed according to group membership (i.e., in-group or out-group members; Hugenberg et al., 2007; Hugenberg & Sacco, 2008; Levin, 2000). Specifically, people may categorise each encountered face as either an in-group or out-group member and subsequently allocate more attentional resources towards in-group faces yielding better memory for these faces. In the current study, in addition to perceptual expertise accounts, the own-race bias in categorising and recalling associative information may also fit with social cognitive mechanism accounts. Specifically, participants may have categorised each face as either an in-group or out-group member and subsequently more deeply encoded the information associated with same-race faces. Collectively, the present results are consistent with both perceptual expertise and social cognitive mechanism accounts of the own-race bias.

In the current study, we did not collect a measure of interracial contact and experience, which has been used in prior work to distinguish between the perceptual expertise and socio-cognitive mechanism accounts of the own-race bias (e.g., Hancock & Rhodes, 2008). Additionally, Young and Hugenberg (2012) found that when participants were given explicit instructions to attend to the differences between other-race face exemplars, the motivation to remember those faces only enhanced recognition for participants with considerable experience distinguishing between other-race faces. Therefore, future studies should investigate the effects of the own-race bias on recall for information associated with own- and other-race faces while considering individual differences in contact and experience with other races.

Together, the present study revealed that in addition to an own-race bias in some forms of associative memory (see Herzmann et al., 2017; Horry et al., 2010; Horry & Wright, 2008), the own-race bias may extend to the categorisation of associative information as well as the recall of information associated with faces of different races. However, future research may benefit from investigating how participants allocate attentional recourses when studying face-information pairs (e.g., eye-tracking; see Goldinger et al., 2009). Specifically, understanding which features individuals most rely on to guide facial processing, and subsequently how pairing associative information with faces detracts from that process, could be highly informative for extending the facial recognition and face-information binding literature.

Additionally, future work may benefit from examining memory for non-face objects such as the recall of associative information about cars in car experts versus non-experts. Future work could also examine whether any condition that produces better recognition accuracy also results in superior associative memory. For example, associative memory may be more accurate for own-race faces studied for a longer duration than own-race faces studied for a shorter duration. Finally, additional research should investigate the external validity of these findings using other race-face and associative information pairs, as well as including non-associative information control conditions as comparison groups for associative binding conditions.

In conclusion, the current study provides evidence that, in addition to an own-race bias in facial recognition, people demonstrate an own-race bias in the categorisation and recall of information associated with faces. Despite disagreement as to the validity of eyewitness testimony (see Akan et al., 2020; Lindsay et al., 2011; Wells, 2018), if a victim of a crime or an eyewitness demonstrate an own-race bias for associative information or make a source memory error (i.e., mistaking someone as a criminal rather than a victim or bystander), any memory errors or biases could result in wrongful imprisonment and injustice (see the Innocence Project: Scheck et al., 2000; Thompson-Cannino et al., 2009). Additionally, in some cases, low levels of confidence could indicate strong evidence of poor initial recognition accuracy (see Wixted et al., 2018). Thus, it is of utmost importance to understand under which circumstances the own-race bias can influence confidence, memory for faces, and the recall of information associated with faces.

Notes

1. Given that all experiments were conducted online, the fidelity of response time measures may be questionable. Therefore, we did not analyze participants' response times.
2. Confidence in the calibration curves was broken into five bins (0-20, 21-40, 41-60, 61-80, 81-100). Paired samples *t*-tests comparing differences in recognition accuracy in each bin did not reveal any significant differences for own- and other-race faces [all *ps* > .447] but there were differences for criminal and victim faces in the 61–80 bin [$p = .011$; all other *ps* > .119].
3. A one-sample sample *t*-test revealed that these correlations were different from 0 for White criminals [$t(38) = 7.82$, $p < .001$, $d = 1.25$], White victims [$t(39) = 4.66$, $p < .001$, $d = .74$], Black criminals [$t(39) = 6.77$, $p < .001$, $d = 1.07$], and Black victims [$t(39) = 4.86$, < .001, $d = .77$].
4. In a pilot study, we presented each face a single time for 4 s each, but associative memory performance was not greater than chance. Therefore, we decided to present participants with each face twice to increase performance.
5. Participants selected "criminal" on 50% of the trials and "victim" on 50% of the trials. However, participants were more likely to indicate that a Black face was a victim ($M = .53$, $SD = .11$) than White faces ($M = .47$, $SD = .10$), [$t(41) = 3.08$, $p = .004$, $d = .48$].
6. Paired samples *t*-tests comparing differences in categorization accuracy in each bin did not reveal any significant differences for own- and other-race faces [all *ps* > .182] or criminal and victim faces [all *ps* > .338].
7. A one-sample *t*-test revealed that these correlations were different from 0 for White criminals [$t(40) = 8.71$, $p < .001$, $d = 1.36$], White victims [$t(41) = 5.16$, $p < .001$, $d = .80$], Black criminals [$t(41) = 5.40$, $p < .001$, $d = .83$], and Black victims [$t(39) = 5.05$, $p < .001$, $d = .80$].
8. Paired samples *t*-tests comparing differences in categorization accuracy for own- and other-race faces in each bin did not reveal any significant differences [all *ps* > .102].
9. A one-sample sample *t*-test revealed that these correlations were different from 0 for White faces [$t(90) = 14.99$, $p < .001$, $d = 1.57$] as well as Black faces [$t(88) = 13.96$, $p < .001$, $d = 1.48$].

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Open practices statement

The experiments reported in this article were not formally preregistered. The stimuli, data, and analysis code for each experiment have been made available on the Open Science Framework (https://osf.io/6sa3j/).

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Appendices

Appendix A. Hit and false alarm rates as a function of race and label in Experiment 1.

Variable	Black Faces	White Faces	Black Criminal Faces	Black Victim Faces	White Criminal Faces	White Victim Faces
Labels Mean Hit Rate	0.60	0.62	0.59	0.61	0.63	0.62
Labels SD Hit Rate	0.12	0.14	0.15	0.15	0.18	0.15
Labels Mean False Alarm Rate	0.29	0.27	–	–	–	–
Labels SD False Alarm Rate	0.14	0.13	–	–	–	–
No labels Mean Hit Rate	0.58	0.59	–	–	–	–
No labels SD Hit Rate	0.15	0.15	–	–	–	–
No labels Mean False Alarm Rate	0.32	0.27	–	–	–	–
No labels SD False Alarm Rate	0.14	0.13	–	–	–	–

Appendix B. Stimuli used in Experiment 3.

Locations		Occupations	Crimes
Alabama	Missouri	Accountant	Arson
Alaska	Montana	Actor	Assault
Arizona	Nebraska	Architect	Battery
Arkansas	Nevada	Artist	Blackmail
California	Ohio	Assistant	Bribery
Colorado	Oklahoma	Banker	Burglary
Connecticut	Oregon	Carpenter	Counterfeiting
Delaware	Pennsylvania	Cashier	Extortion
Florida	Tennessee	Chef	Forgery
Georgia	Texas	Doctor	Fraud
Hawaii	Utah	Electrician	Harassment
Idaho	Vermont	Fireman	Kidnapping
Illinois	Virginia	Garbageman	Manslaughter
Indiana	Washington	Janitor	Murder
Iowa	Wisconsin	Lawyer	Perjury
Kansas	Wyoming	Mailman	Rape
Kentucky		Nurse	Shoplifting
Louisiana		Plumber	Soliciting
Maine		Priest	Stalking
Maryland		Reporter	Terrorism
Massachusetts		Secretary	Theft
Michigan		Teacher	Treason
Minnesota		Translator	Trespassing
Mississippi		Waiter	Vandalism