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Impact of similarity on recognition of faces of Black and White targets

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Abstract

One reason for the persistence of racial inequality may be anticipated dissimilarity with racial outgroups. In the present research, we explored the impact of perceived similarity with White and Black targets on facial identity recognition accuracy. In two studies, participants first completed an ostensible personality survey. Next, in a Learning Phase, Black and White faces were presented on one of three background colours. Participants were led to believe that these colours indicated similarities between them and the target person in the image. Specifically, they were informed that the background colours were associated with the extent to which responses by the target person on the personality survey and their own responses overlapped. In actual fact, faces were randomly assigned to colour. In both studies, non-Black participants (Experiment 1) and White participants (Experiment 2) showed better recognition of White than Black faces. More importantly in the present context, a positive linear effect of similarity was found in both studies, with better recognition of increasingly similar Black and White targets. The independent effects for race of target and similarity, with no interaction, indicated that participants responded to Black and White faces according to category membership as well as on an interpersonal level related to similarity with specific targets. Together these findings

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suggest that while perceived similarity may enhance identity recognition accuracy for Black and White faces, it may not reduce differences in facial memory for these racial categories.

KEYWORDS
face perception, intergroup bias, own-race effect, similarity, social categorization

BACKGROUND

A well-known adage is 'birds of a feather, flock together'. Research within social psychology supports this idea that similarity breeds attraction, with people liking and more willing to interact with others who are similar to them (Byrne, 1961, 1971; Montoya et al., 2008; Montoya & Horton, 2012). The goal of the present research was to extend these findings by investigating the impact of perceived similarity on identity recognition accuracy. Specifically, we focused on how perceived interpersonal similarity by non-Black and White participants with Black and White targets influences recognition of faces. To this end, we first briefly describe similarity-attraction research. Next, we explore the potential impact of similarity on identity recognition. Finally, we present two experiments in which we manipulate perceptions of interpersonal similarity to Black and White targets and measure subsequent recognition accuracy for these targets.

Similarity-attraction effects with same-race and other-race targets

Numerous studies have demonstrated that attraction increases when people perceive interpersonal similarity, regardless of whether it is related to personality traits, attitudes, values, physical characteristics, preferred activities, demographic variables, socio-economic status, occupation and fleeting subjective experiences in others (Bond et al., 1968; Byrne et al., 1967; Curry & Emerson, 1970; DeBruine, 2002; Griffitt, 1966; Lemay & Clark, 2008; Montoya et al., 2008; Montoya & Horton, 2012; Murray et al., 2002; Pinel & Long, 2012; Rokeach et al., 1960; Walton et al., 2012). Interestingly, some studies have found more robust effects for *perceived* similarity on attraction than *actual* similarity (Condon & Crano, 1988; Hoyle, 1993; Klohnen & Luo, 2003; Montoya et al., 2008; Tidwell et al., 2013; West, Magee, et al., 2014). Although this similarity-attraction effect may be moderated, for example, by interaction quality over time or by culture (Duck & Craig, 1978; Heine et al., 2009; Montoya et al., 2008), the current literature suggests that in North America, in the early stage of relationships, perceived similarity produces more liking and an increased desire to interact.

Most of the research on similarity-attraction effects has been limited to same-race targets, typically White perceivers and White targets. However, several studies have examined the impact of similarity related to targets who were of a different race than the perceiver. The findings from these experiments indicated that similarity may influence responses to both same-race and other-race targets in a comparable manner—with White participants demonstrating increased attraction for both Black and White individuals who were perceived to be attitudinally similar to them. For example, Byrne and colleagues (Byrne & McGraw, 1964; Byrne & Wong, 1962) found a linear effect of similarity, with greater perceived similarity associated with more liking and an increased willingness to work with a Black or White target. These findings suggest that participants were sensitive not only to similarity information more generally, but to the degree of interpersonal similarity with both own-race and other-race targets.

Research on Belief Congruence Theory (Insko et al., 1983; Moe et al., 1981; Rokeach et al., 1960) provides further evidence for the impact of similarity on attraction. Specifically, studies have indicated that perceived differences in beliefs with a Black or White target (e.g., a Black person who believes in God or a White person who is an atheist) can impact the desire to interact with both Black and White targets (Rokeach et al., 1960). Furthermore, recent research indicates that perceived similarity can reduce anxiety often typical in interactions with other races and can increase interest in sustained contact with members of other races (West, Magee, et al., 2014).

Notably, while people typically assume similarity with members of the same-race, they often expect to share fewer similarities with a person from a different racial or social group than their own (Danyluck & Page-Gould, 2018; Mallett et al., 2008; Vorauer et al., 1998; Vorauer & Sakamoto, 2006; West, Dovidio, & Pearson, 2014). Because discrimination and differential responding across racial lines may be due, in part, to anticipated dissimilarities between Blacks and Whites (Insko et al., 1983; Moe et al., 1981; Rokeach et al., 1960), increasing perceived interpersonal similarity between two individuals can potentially enhance liking and positive responses to members of the same- and other races (Byrne & McGraw, 1964; Byrne & Wong, 1962; Hendrick & Hawkins, 1969; Robinson & Insko, 1969; Silverman & Cochrane, 1972).

Perceived similarity and facial recognition

The primary aim of the present experiments was to extend previous research by investigating the impact of perceived similarity on facial identity memory across same-race and other-race targets. The recognition of others' faces is central to how we form impressions. Specifically, understanding how faces are processed and encoded, and factors that influence facial recognition is vital to our knowledge of how we comprehend our social world (Willis & Todorov, 2006; Zebrowitz, 2006). Moreover, when these processes go awry, the implications can be serious. The consequences of misidentifying faces can range from feelings of embarrassment in not recognizing a person from a previous meeting, to a limited ability to differentiate between job candidates in a hiring situation, to faulty eyewitness identification. In the latter, most extreme case, such errors can result in wrongly incarcerating innocent individuals and creating distrust in the judicial system (Sporer, 2001).

The misidentification of members of other races may be especially prevalent and the costs severe. Recent studies by the Innocence Project and other organizations indicate that approximately one third of wrongful convictions in the United States, Canada and the United Kingdom involve errors in cross-race identification (Scheck et al., 2000; Smith et al., 2004). Given the important interpersonal, intergroup and societal implications for misidentifying members of certain groups, exploring ways to increase facial recognition for members of ingroups as well as majority and minority outgroups is important.

A large literature related to the own-race effect (ORE) provides strong evidence that people are typically better at recognizing same-race compared to other-race faces (Brigham & Malpass, 1985; Hugenberg et al., 2010; Meissner & Brigham, 2001; Singh et al., 2021). For example, while White participants are typically more accurate in recognizing White than Black targets, Black participants are typically more accurate in recognizing Black than White targets (Hugenberg et al., 2007; Kawakami et al., 2014; Pauker et al., 2009; Vingilis-Jaremko et al., 2020). Notably, recent research has demonstrated that there may not only be differences in recognition accuracy between ingroups and outgroups, but also among different outgroups. For example, Vingilis-Jaremko et al. (2020) found that minority participants demonstrated better recognition for majority outgroup faces compared to minority outgroup faces, an effect that was small but reliable. Specifically, in North America, South Asian (e.g., India and Pakistan) and East Asian (e.g., China and Japan) participants showed better recognition for White than Black faces. Likewise, Black participants showed better recognition for White than East Asian faces. Stelter et al. (2021) further found that majority participants differentiated between outgroups that constituted relatively large and small minority populations in their environment. Specifically, White participants in Germany showed better recognition of Middle Eastern targets (a relatively large minority group) compared to Black or Asian targets (relatively small minority groups). Given these recent findings that racial minorities often demonstrate better recognition of White than Black faces and the importance of examining how racial minorities and majorities process other racial faces, we examined an ORE related to Black and White targets by both non-Black and White participants.

One prominent explanation for the divergent processing of racial faces is differential exposure and experience (Brigham & Malpass, 1985; Kawakami et al., 2022). In particular, because people presumably have more contact and interact more with members of racial ingroups than outgroups, they develop more expertise in processing ingroup faces (Tanaka & Simonyi, 2016). This expertise facilitates their ability to extract, process and integrate facial information from their own group over other groups and to better differentiate between ingroup members (Gauthier et al., 1998, 1999; Hills & Lewis, 2011; Maurer et al., 2002; Richler et al., 2011; Tanaka et al., 2004; Valentine et al., 2016). Notably, both an earlier and a more recent meta-analysis, however, have shown only a small effect of cross-race contact on greater recognition accuracy for own-race over other-race faces (Meissner & Brigham, 2001, $r = -.13$; Singh et al., 2021, $r = -.15$).

In addition to experience, another proposed mechanism for the ORE is related to a greater motivation to know and understand members of the ingroup. In particular, because of commonplace default categorization processes (Fiske & Neuberg, 1990; Kawakami et al., 2017; Macrae & Bodenhausen, 2000; Ostrom & Sedikides, 1992), targets are often construed as either racial ingroup or outgroup members. While outgroups may be seen as relatively homogeneous entities and perceived in terms of their categorical associations (Bernstein et al., 2007; Bijlstra et al., 2014; MacLin & Malpass, 2001), racial ingroups may be seen as individuals worthy of further effort and attention (Henderson et al., 2005; Hugenberg et al., 2010, 2013; Levin, 1996, 2000; Pauker et al., 2009). These motivations to treat members of racial outgroups and ingroups either as another category exemplar or as an individual, respectively, may be one reason for poorer recognition of Black compared to White faces by White participants.

In accordance with a motivational explanation, research has demonstrated that the ORE can be reduced with external incentives, either monetary or social normative (e.g. discouraging bias; providing race atypical target information), that implicate the individuation of outgroup members (Hugenberg et al., 2007; Palma & Garcia-Marques, 2021; Stelter & Degner, 2018). For example, Kawakami et al. (2014) instructed White participants to individuate Black targets, individuate White targets or were given no additional instructions. Specifically, participants in the individuate Black targets condition were told before the initial face presentation phase that, 'For every Black face that you correctly recognize in the memory test you will be given 25¢. Therefore, it is important that you try to remember the Black faces that you are presented with as individuals, paying attention to what makes them unique'. Participants in the individuate Whites condition were compensated for the correct recognition of White faces. The results demonstrated that participants who did not receive any additional instructions or who were instructed to individuate White targets showed the standard ORE with better recognition for White than Black faces. In contrast, participants instructed to individuate Black targets showed an attenuated effect. In fact, these participants were marginally better, not worse, at recognizing Black than White faces.

While not all attempts to individuate outgroup members have demonstrated a reduction in the ORE or differential processing of racial faces (Pica et al., 2015; Tullis et al., 2014; Wan et al., 2015) and there is little evidence for a relationship between racial attitudes and the ORE (Meissner & Brigham, 2001), these findings indicate the potential for social motivations to increase recognition accuracy. In particular, increasing motivations to know outgroup members may enhance recognition of their particular faces and may even reduce differences in facial identification of ingroup and outgroup faces (see also Rhodes et al., 2009; Tüttenberg & Wiese, 2021; Young et al., 2010; Young & Hugenberg, 2012). In the present research, we investigated manipulating perceived interpersonal similarity between the target and the perceiver as a novel way to improve facial recognition accuracy. We propose that boosting perceived similarity between targets and perceivers is closely tied to increasing motivations to process both ingroup and outgroup faces, while not impacting previous experience with outgroup targets.

Specifically, in the present research, we investigated the impact of perceived interpersonal similarity on recognition of White and Black faces by both non-Black and White participants. Importantly, research in an intergroup context has demonstrated that White participants who are motivated to interconnect and know Black targets attend more to the faces of Blacks in general (Ickes, 1984) and that such motives can translate into better facial recognition (Hugenberg et al., 2007; Kawakami et al., 2014). Because there is clear evidence that similarity is related to attraction and an increased desire to interact with both Black and White targets (Byrne & McGraw, 1964; Byrne & Wong, 1962; Mallett et al., 2008; West, Magee, et al., 2014), we explored whether perceived interpersonal similarity with targets by both non-Black and White participants would improve recognition for Black *and/or* White faces.

There are three potential outcomes related to the impact of similarity on recognition of facial identities of Black and White targets. First, perceived similarity may primarily impact recognition of White faces. Given that people often assume similarity with members of the same-race and perhaps even members of the majority White than other racial outgroups (Danyluck & Page-Gould, 2018; Mallett et al., 2008; Vorauer et al., 1998; Vorauer & Sakamoto, 2006; West, Magee, et al., 2014), increasing perceptions of interpersonal similarity may increase recognition of White but not Black targets. Notably, in this case, the size of differences in recognition accuracy between Black and White targets would increase with higher levels of similarity.

Alternatively, because people expect to share fewer similarities with a person from a different racial minority than their own-racial group or members of the majority White group, increasing perceptions of interpersonal similarity may primarily increase recognition of Black but not White targets. Given anticipated differences, finding out that a Black person responded in similar ways to them, may be impactful and change the way the target is processed. In this case, the size of differences in recognition accuracy between Black and White targets would decrease with higher levels of similarity.

Finally, it is possible that perceived similarity may influence recognition accuracy for both Black and White targets. In accordance with previous literature on the impact of interpersonal similarity on attraction (Byrne & McGraw, 1964; Byrne & Wong, 1962; Insko et al., 1983; Moe et al., 1981; Rokeach et al., 1960), as well as more recent research on its impact on attention to facial features (Kawakami et al., 2021), increasing perceptions of interpersonal similarity may increase recognition of both Black and White targets. In this latter case, although recognition of Black and White faces would increase in a linear trend with more similarity, the size of differences in recognition accuracy between Black and White targets would not differ across levels of similarity.

Our findings have the potential to extend previous research on the similarity-attraction effect in two important ways. First, to our knowledge, no other studies have investigated how interpersonal similarity influences facial recognition. This research can, therefore, contribute in novel ways to the existing literature on top-down influences on basic facial processes (Freeman & Ambady, 2011; Johnson & Adams Jr., 2013; Johnson et al., 2015; Kawakami et al., 2017; Ofan et al., 2011; Ratner & Amodio, 2013). Second, by investigating responses by both non-Black and only White participants to White and Black targets, the present work provides important information on whether similarity can increase recognition of Black and White faces for a variety of social groups and ameliorate differences in processing these targets. While previous studies and theorizing on similarity and belief congruence in an intergroup context have focused on explicit attitudes towards social categories (i.e., prejudice), a willingness to interact or actual interactions with outgroup members, and anxiety (Byrne & Wong, 1962; Rokeach et al., 1960; West, Dovidio, & Pearson, 2014; West, Magee, et al., 2014), the present experiments have the potential to reveal new evidence on how similarity can improve facial recognition for members of racial groups.

Overview

The primary goal of two experiments was to explore the impact of perceived interpersonal similarity on recognition of Black and White faces using a standard ORE paradigm. In Experiment 1, non-Black participants first completed an ostensible personality questionnaire. Next, in the Learning Phase, participants were presented with faces of Black and White targets on three different background colours. They were informed that the background colours indicated the extent to which their responses on the personality survey overlapped with the targets in the image. Increasingly darker background shades indicated low, medium and high overlap. This phase was followed by a Recognition Phase in which participants were again presented with the same faces used in the Learning Phase (i.e., old faces) and a similar set of faces that had not been previously presented (i.e., new faces) on different background colours. Participants were instructed to classify each face as either *old* or *new*.

In Experiment 2, to specifically investigate the ORE, only White participants were recruited. This study employed the same procedure used in Experiment 1, with one additional exception. While the faces in the Learning Phase in Experiment 2, as in the initial study, were presented on three background colours that ostensibly represented the extent of the overlap between responses by the participant and target on the personality survey, all faces in the Recognition Phase were presented on white backgrounds. White backgrounds were used in this study so that background colours could not be used in association with certain faces as memory cues. By providing different background colours in the Learning Phase, but not in the Recognition Phase, we could be more confident that perceived similarity differences were associated with an increased motivation to encode faces in this earlier processing stage (Hugenberg et al., 2010; Kawakami et al., 2014; Levin, 1996, 2000; Stelter & Degner, 2018; Walker & Tanaka, 2003; Young et al., 2010).

EXPERIMENT 1

The primary goal of Experiment 1 was to investigate the impact of perceived similarity on recognition accuracy of Black and White faces. Participants were presented with images of faces on three distinct background colours and were led to believe that the backgrounds colours were related to similarities between them and the target person in the image. Specifically, they were informed that the background colours were associated with the extent to which responses by the target person on a personality survey and their own responses overlapped.

METHOD

Participants and design

To maximize power, we utilized a 2 Race of Target (Black vs. White) × 3 Similarity (low vs. medium vs. high) within-subjects design with stimuli randomly assigned to background colour. The study was described as investigating 'personality and cognition' and participants were undergraduate students who received course credit. Our rule to stop running the study was to end on the day that we recruited 100 participants. Although the initial sample included 105 students, 16 participants were excluded from analyses because, as rated by research assistants, they did not attend to the study procedures/instructions ($n = 4$) or in debriefing they reported strong suspicion of the cover story ($n = 12$). Our final sample consisted of 89 non-Black (30 South Asian, 22 White, 11 Middle Eastern, 8 South American, 7 East Asian, 7 Southeast Asian, 4 other or no response) undergraduates (58 women, 31 men; $M_{age} = 19.11$ years, $SD = 1.74$).[1] A sensitivity analysis using G*Power 3.1 (Faul et al., 2009) indicated that our final sample had 80% power to detect an interaction effect of $\eta^2 = .012$. For both experiments, all measures, manipulations, exclusions and crucial details related to the procedure are disclosed in the text. No data collection took place after analysis began.

[1]In both experiments we used a funnel debriefing modelled after Bargh and Chartrand (2000). Participants were asked (a) What did you think of the experiment? (b) Were any parts odd or confusing? and (c) As you were going through the study, at any point did you start to think that there might be more than meets the eye? Research assistants probed any affirmative responses and rated each participant on a scale of 1 (poor) to 4 (good). Participants were excluded if they expressed suspicion (e.g. 'knew personality test was fake') and were rated <3. When we repeated the reported analyses on the entire sample ($N = 105$), the only effect that changed in a significance test was that the simple linear effect of similarity within White targets became significant, $p = .030$, instead of marginally significant, $p = .075$.

Procedure

All participants first completed a bogus personality survey (Bernstein et al., 2007; Young & Hugenberg, 2010) to set up the cover story related to the perceived similarity manipulation. Next, all participants were presented with the Learning Phase in a standard facial identity recognition paradigm. In this phase, participants were presented with Black and White faces on one of three background shades. In a final Recognition Phase, participants were asked to identify each face as previously seen or not.

Personality survey

Participants first completed a bogus personality survey that would be used to manipulated perceived similarity (Bernstein et al., 2007; Kawakami et al., 2021; Young & Hugenberg, 2010). This questionnaire consisted of 44 innocuous questions such as ‘I usually place myself nearer to the side than in the center of the room’ and ‘I prefer to isolate myself from outside noises’. Participants were instructed to respond to each question on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree).

Learning phase

After completing the survey, there was a brief delay during which the computer displayed an icon and text stating that it was calculating the results. Participants were told that over 500 other students had taken the same personality questionnaire and that the computer had assessed the degree of personality overlap between them and the other students. The instructions stated that participants would be presented with images of a subset of these students and their similarity to each target would be represented visually via one of three different background colours. Namely, the background colour indicated the degree to which the responses by the person in the photograph overlapped with their responses.

Specifically, on the initial instruction screen in the Learning Phase, participants were presented with a gradient of background colours that ranged from ‘Not at all like me’ to ‘A lot like me’ (see Figure 1). The first shade represented targets that were not very similar, whose test responses only overlapped up to 33% with the participant's responses. The next shade represented targets whose responses overlapped between 34% and 66% with the participant's responses. The final shade represented targets that were very similar, whose responses overlapped over 67% with the participant's responses.

In total, there were 24 Black and 24 White faces randomly assigned to one of the three background colours, resulting in 8 Black and 8 White faces (half female) in each similarity level. These faces, used in previous studies (Kawakami et al., 2021; Vingilis-Jaremko et al., 2020), were headshots taken at a Canadian university with a Canon PowerShot SX5 digital camera. To focus attention on the internal facial features, we used Adobe Photoshop to crop the images to exclude the target's hair. To standardize the stimuli, all images were grey-scaled and equated for size (360 × 450 pixels) and the mean luminance and contrast for Black and White faces was set within a restricted range (136.20–146.96 pixels per intensity level).

Each trial in the Learning Phase began with a fixation cross presented for 1500 ms, followed by a single face in the centre of the monitor for 5000 ms. Participants were instructed to pay careful attention to each photograph because afterwards there would be a memory test. They completed two blocks of 24 trials, with a break in between blocks. In each block, two male and two female Black and White faces in each of the three background colours were presented in a random order.

Recognition phase

In the Recognition Phase, 48 Black and 48 White individual faces (half female) were presented in the centre of the computer monitor. Half of the faces had been shown and half of the faces had not been

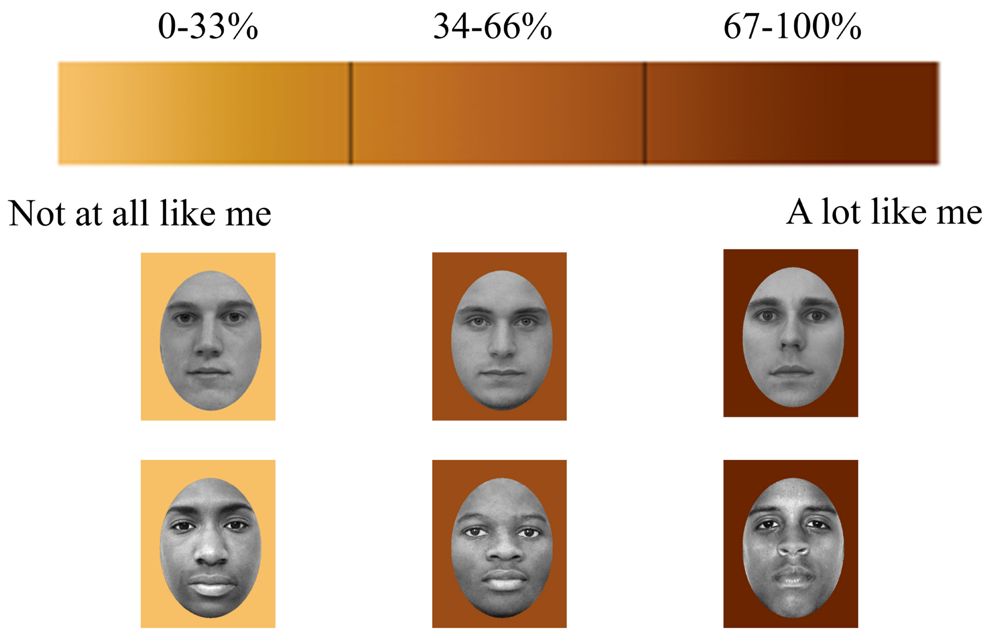

FIGURE 1 Example of the colour gradient used to manipulate perceptions of similarity between targets and participants.

shown during the Learning Phase. On each trial, participants were instructed to identify the face as either 'old' (previously presented) or 'new' (not previously presented) using one of two computer keys. All old faces were displayed on the same background colour used in the Learning Phase. The new Black and White faces were randomly assigned to one of these same three shades. To eliminate any stimuli-level differences that might affect recall, counterbalancing occurred such that one set of stimuli were 'old' (presented in both phases) for half of participants but 'new' (presented only in the recognition phase) for the other half of participants. Participants completed 4 blocks of 24 trials, with a break in between each block. In each block, one old male and female Black and White face and one new male and female Black and White face in each level of similarity were presented in a random order.

RESULTS AND DISCUSSION

Before testing our main hypotheses, to ensure that background colours per se did not influence accuracy in facial identity recognition, we conducted a pilot study (see Appendix S1 for details). Because it is possible that people may process faces differently when presented on some colours compared to others (Gil & Le Bigot, 2015; Young et al., 2013; but see Bernstein et al., 2007), we examined whether the background shades in the current research impacted recognition accuracy even when participants were not informed that these colours were an indicator of similarity. In this study, all participants first completed the same bogus personality survey included in Experiment 1 (Bernstein et al., 2007; Young & Hugenberg, 2010). Although this task was used to manipulate perceived similarity in the focal experiments, the questionnaire was only included in the pilot study to closely match procedures. Next, all participants were presented with the Learning Phase in which participants were presented with Black and White faces on the three background shades. Importantly, participants were not provided with any information related to the backgrounds colours and there was no mention of similarity or overlap. In the Recognition Phase, participants were asked to identify each face as previously seen or not.

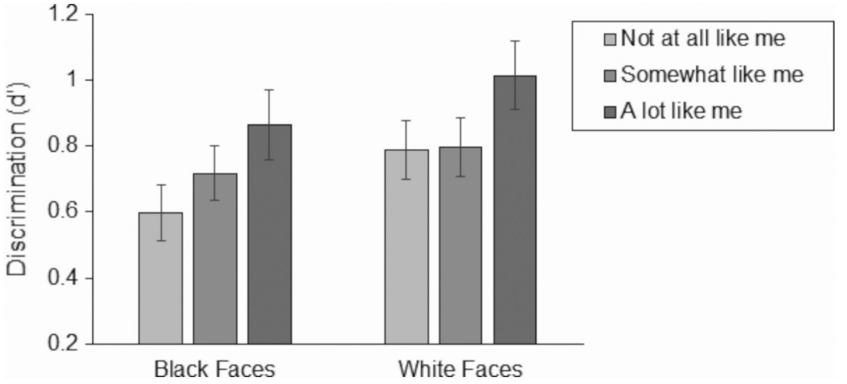

FIGURE 2 Mean face discrimination (*d*') for Black and White faces by level of ostensible similarity in Experiment 1. Error bars indicate standard errors.

To investigate the impact of background colour on facial recognition, we calculated a signal detection measure of discriminability (*d*') using hits (correct recognition of old faces) and false alarms (incorrect rejection of new faces). To avoid calculation errors associated with extreme values, hit and false alarm rates of 0 were replaced with .01 (0.5/*n*) and rates of 1 were replaced with .99 ([*n* - 0.5]/*n*), where *n* was 48, the number of signal or noise trials (Stanislaw & Todorov, 1999). We calculated *d*' scores separately for Black and White faces for each background colour by subtracting the standardized hits from false alarms within each condition, such that higher scores indicated better recognition.

While the results related to the pilot study demonstrated a significant effect for Race of Target, $p < .001$, in which non-Black participants were better at recognizing White compared to Black faces, the main effect of Background Colour, $p = .541$ and the Race of Target by Background Colour interaction, $p = .190$, were not significant (see OSM). These findings indicate that background colour alone, in the absence of information associating these colours with interpersonal similarity between the target and the participant, did not significantly affect recognition accuracy. Because our primary predictions were related to greater accuracy in identifying faces with increasing similarity, these results suggest that background colour per se cannot be an alternative explanation for the predicted findings.

To test for the effects of background colour in the focal experiment, when it was related to similarity, on recognition accuracy, we used the same strategy to calculate *d*' scores.[2] We then performed a 2 Race of Target (Black vs. White) × 3 Similarity (low vs. medium vs. high) repeated measures analysis of variance on the *d*' scores (see Figure 2). The main effect for Race of Target was significant, $F(1, 88) = 4.25$, $p = .042$, $\eta_p^2 = .046$, 90% CI [0.001, .133].[3] Participants displayed better recognition for White ($M = 0.866$, $SD = 0.626$) compared to Black ($M = 0.723$, $SD = 0.206$) faces. More importantly, a significant main effect for Similarity was found, $F(2, 176) = 4.69$, $p = .010$, $\eta_p^2 = .051$, 90% CI [0.007, 0.105]. As perceived interpersonal similarity with the target increased, facial recognition also increased, linear contrast, $F(1, 88) = 8.17$, $p = .005$, $\eta_p^2 = .085$, 90% CI [0.015, 0.186]. Notably, this effect was not qualified by the Race of Target, $F(2, 176) = .25$, $p = .779$, $\eta_p^2 = .003$, 90% CI [0.000, 0.018]. Although the two-way interaction was not significant, we have also provided the results related to the significant linear contrast of Similarity for Black targets, $F(1, 88) = 4.73$, $p = .032$, $\eta_p^2 = .051$, 90% CI [0.002, 0.140] and the marginally significant linear contrast for White targets, $F(1, 88) = 3.24$, $p = .075$, $\eta_p^2 = .035$, 90% CI [0.000, 0.117].

[2]Although our primary analyses were related to the *d*' scores, a table providing the means of hits and correct rejections and additional analyses related to these indices in both Experiments 1 and 2 were included in the Appendix S1. As expected, in both studies, there was a significant main effect of similarity on recognition accuracy for old faces (i.e. hit rate) but not new faces (i.e. correct rejection rate).

[3]Effect size confidence intervals were calculated using SPSS macros provided by Wuensch (2016a, 2016b). In accordance with recommendations by Steiger (2004), we report 1 - 2α CIs (i.e. 90%) around η_p^2 (also see discussion by Lakens, 2014).

In summary, the results of Experiment 1 provide new evidence that perceived interpersonal similarity can impact facial memory. Notably, the manipulation (see Figure 1) suggested a gradient of interpersonal similarity between the participant with a specific target, ranging from 0 to 100%, and a linear trend was found for similarity suggesting that these incremental steps in ostensible overlap in personalities resulted in increasingly better recognition of targets. Critically, this effect was not qualified by the race of the target. Although in accordance with the findings in the Pilot Study and previous research (Vingilis-Jaremko et al., 2020), non-Black participants were better at identifying White than Black faces, similarity improved recognition accuracy for both White and Black targets, leaving differences in recognition accuracy between the races intact.

EXPERIMENT 2

The primary goal of Experiment 2 was to replicate the pattern of results related to the impact of similarity on facial recognition in the context of the ORE. Specifically, in this study, we recruited only White participants to test whether they would show superior recognition for own-race faces (i.e., White targets) compared to other-race faces (i.e., Black targets). More importantly, we examined whether in this particular intergroup context, similarity increased recognition accuracy for both White and Black targets.

Although in Experiment 1, background colours were used in both the initial Learning Phase and the subsequent Recognition Phase in the facial identity recognition paradigm, in Experiment 2, all faces in the Recognition Phase were presented on white backgrounds. If the results indicate a linear effect in which participants show better recognition of faces of increasingly similar targets, regardless of target race, even when background colours are removed, it would provide strong evidence that participants encoded similarity information for targets in the Learning Phase (Stelter & Degner, 2018; Walker & Tanaka, 2003; Young et al., 2010), rather than relying on memory for target and similarity associations presented in both phases.

METHOD

Participants, design and procedure

The procedure used in Experiment 2 was the same as in Experiment 1, with two exceptions. First, to specifically investigate the ORE, this study only included White participants. Second, to examine whether similarity impacts facial recognition when no similarity information is provided in the Recognition Phase, all faces in this final phase were displayed on a white background (i.e., with no background colours indicating the level of similarity). The study was, therefore, once again a 2 Race of Target (Black vs. White) × 3 Similarity (low vs. medium vs. high) within-subjects design.

In accordance with Experiment 1, our rule to stop running the study was to end on the day that we recruited 100 participants. Although in total 107 undergraduate students participated, 10 students were excluded from analyses because, as rated by research assistants, they reported strong suspicion of the cover story in the debriefing. Our final sample was 97 White undergraduates (67 women, 30 men; $M_{age} = 22.56$ years, $SD = 6.57$).[4] A sensitivity analysis using G*Power 3.1 (Faul et al., 2009) indicated that our final sample had 80% power to detect an interaction effect of $\eta^2 = .011$.

[4]When we repeated the reported analyses on the entire sample ($N = 107$), no test statistics changed from statistically significant, $p < .05$, to not significant or vice versa.

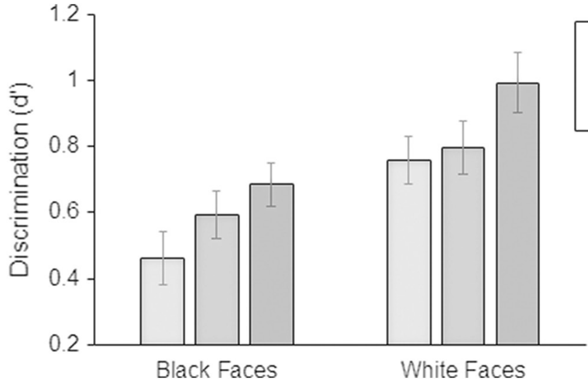

FIGURE 3 Mean face discrimination (*d'*) for Black and White faces by level of ostensible similarity in Experiment 2. Error bars indicate standard errors.

RESULTS AND DISCUSSION

To investigate the impact of perceived interpersonal similarity on facial identity recognition, we first calculated a signal detection measure of discriminability (*d'*) with the same approach used in the pilot test and Experiment 1.[5] We then performed a 2 Race of Target (Black vs. White) × 3 Similarity (low vs. medium vs. high) repeated measures analysis of variance on the *d'* scores (see Figure 3). The main effect for Race of Target face was significant, $F(1, 96) = 22.25$, $p < .001$, $\eta_p^2 = .188$, 90% CI [0.082, 0.298]. As expected, White participants displayed better recognition for White ($M = 0.849$, $SD = 0.606$) compared to Black ($M = 0.579$, $SD = 0.515$) faces. A significant main effect for Similarity was also found, $F(2, 192) = 6.23$, $p = .002$, $\eta_p^2 = .061$, 90% CI [0.014, 0.117]. As perceived interpersonal similarity of the target face increased, facial recognition also increased, linear contrast, $F(1, 96) = 11.78$, $p = .001$, $\eta_p^2 = .109$, 90% CI [0.030, 0.211]. As in Experiment 1, Race of Target did not qualify the impact of Similarity, $F(2, 192) = .43$, $p = .650$, $\eta_p^2 = .004$, 90% CI [0.000, 0.024]. Although the two-way interaction was not significant, we also examined the linear contrast of Similarity for Black and White targets separately. As expected, this contrast was significant for Black targets, $F(1, 96) = 6.80$, $p = .011$, $\eta_p^2 = .066$, 90% CI [0.009, 0.157], as well as for White targets, $F(1, 96) = 7.13$, $p = .009$, $\eta_p^2 = .069$, 90% CI [0.010, 0.161].

The results of Experiment 2 provide further support for the ORE. In accordance with an extensive literature on this effect (Bernstein et al., 2007; Hugenberg et al., 2010; Kawakami et al., 2014; Meissner & Brigham, 2001; Sporer, 2001), our findings demonstrate that White participants were better at recognizing previously seen White than Black faces. Furthermore, the results offer additional evidence for the impact of perceived interpersonal similarity on facial recognition. In accordance with the findings in Experiment 1, a linear trend was found in which participants showed better recognition for targets who were purported to be increasingly similar. Furthermore, for White participants the impact of similarity was found for both own-race and other-race targets. Regardless of whether the images were of White or Black faces, perceived similarity improved recognition accuracy. Differences in recognition accuracy related to ingroup compared to outgroup members, however, remained intact.

It is important to note that although the background colours related to the ostensible overlap between the participant and targets were presented in the initial Learning Phase, the background colour

[5]Although in the Recognition Phase all stimuli were presented with the same (white) background, for purposes of calculating false alarm rates, we divided 'new' stimuli into the 3 similarity levels based on the colours used when they were included as 'old' stimuli in the counterbalanced condition. This meant a separate false alarm rate was used for calculating d' at each level of similarity. An alternative method of calculating *d'* scores in Experiment 2 would be to use a single false alarm rate pooled across all new stimuli. When we used this latter strategy and re-ran all analyses, the pattern of significance tests did not change.

for all targets in the Recognition Phase in Experiment 2 was white. Given this procedure, the present results suggest that White participants differentially encoded individual Blacks and White targets based on similarity in the Learning Phase, and that even after similarity information was removed from the stimuli in the Recognition Phase, this information impacted the recognition of White and Black faces (Stelter & Degner, 2018; Walker & Tanaka, 2003; Young et al., 2010).

META-ANALYSIS

To examine whether the Race of Target by Similarity two-way interaction would be significant if the sample size was increased and to further test the robustness of the similarity effect within Black and White faces separately, we conducted an internal meta-analysis combining the results of Experiments 1 and 2. Although this interaction was not significant in either experiment, to test whether target race moderated the effect of similarity across the two experiments we ran two convergent analyses. First, we calculated a contrast score for each participant representing the strength of the linear effect, separately for both Black and White faces (contrast score = $-1{*}M_{\text{Similarity level 1}} + 0{*}M_{\text{Similarity level 2}} + 1{*}M_{\text{Similarity level 3}}$). A contrast score significantly different from zero indicates a linear effect. We then calculated a difference score (White contrast score – Black contrast score) for each experiment, such that higher scores indicated a stronger linear effect of similarity for White > Black faces. Combined across experiments, the fixed meta-analytic effect was not significant, $M = -0.002$, $SE = 0.094$, 95% CI [−0.187, 0.182], $Z = -0.026$, $p = .979$. Second, we conducted a meta-analysis of all 4 linear contrast scores (Black and White faces, for Experiments 1 & 2) together. The test of heterogeneity was not significant, $Q(3) = 0.101$, $p = .992$. Together, these results indicate that although increasing perceptions of interpersonal similarity improves recognition of both Black and White targets, the size of differences in recognition accuracy for Black and White targets does not differ across levels of similarity.

To confirm that the linear effect of similarity was significant for both Black and White faces, we used the linear contrast scores representing the effect of similarity within Black and White faces separately, as calculated above, with higher scores indicating a greater linear effect of similarity. A fixed effects meta-analysis found that the average linear contrast scores for Black targets, $M = 0.236$, $SE = 0.070$, 95% CI [0.099, 0.373], $Z = 3.38$, $p = .001$ and for White targets, $M = 0.231$, $SE = 0.072$, 95% CI [0.090, 0.372], $Z = 3.72$, $p = .001$, were highly significant, demonstrating that for both racial categories, increasing similarity had a strong and incremental impact on facial recognition.

GENERAL DISCUSSION

The primary goal of the present research was to investigate the impact of similarity on facial identity recognition for Black and White targets. We explored the possibility that increasing perceived interpersonal similarity would lead to better recognition. The results from two experiments indicated that as the ostensible overlap between targets and participants on a personality questionnaire increased, White and non-Black participants showed better recognition for Black and White faces. Notably, although both non-Black and White participants also demonstrated superior recognition of White than Black faces, target race did not moderate the impact of similarity on recognition. Even when combining the results of Experiments 1 and 2 in a meta-analysis, the Race of Target by Similarity two-way interaction was not significant. The impact of similarity on recognition for both Black faces and White faces, separately, however, was significant.

The present results extend previous findings by demonstrating that similarity not only increases attraction (Byrne & McGraw, 1964; Byrne & Wong, 1962; Insko et al., 1983; Moe et al., 1981; Rokeach et al., 1960) but also facial recognition accuracy. These findings are in accordance with recent theorizing related to the interaction between bottom-up target effects driven by visual cues and top-down effects driven by expectancies, motivation, and situational factors on person perception (Freeman &

Ambady, 2011; Kawakami et al., 2017). We contribute to this literature by showing how top-down influences related to social categorization membership and perceived similarity interact to influence face processing. These findings provide further evidence that facial recognition can be influenced by motivation (Hugenberg et al., 2010, 2013; Kawakami et al., 2014). When targets are more relevant to the perceiver because of same-race or majority-race categorizations and interpersonal similarity, recognition accuracy is enhanced.

Notably, we found a similar pattern of effects for non-Black and White participants. Although for White participants in Experiment 2, there is a clear outgroup and ingroup with Black and White targets, for non-Black participants in Experiment 1 this is not always the case. In this latter group, only 22 of the 89 participants were White. For the other participants, Whites were not the ingroup but the majority outgroup. However, in both studies, an effect was found for Race of Target and Similarity. Replicating Vingilis-Jaremko et al. (2020), non-Black and White participants were better at recognizing White than Black faces. Discovering the extent to which the effects associated with non-Black participants are due to greater perceptual experience with the majority outgroup or motivated processing based on status is an important undertaking for future research (Shriver & Hugenberg, 2010; Stelter et al., 2021; Vingilis-Jaremko et al., 2020). More importantly, in the present context, similarity reliably increased recognition for ingroup faces, majority outgroup faces and minority outgroup faces.

Enhancing the encoding and later recognition of facial information is critical to person construal processes. As noted by Zebrowitz (1997), a face conveys a person's identity and once we have learned its unique design, we are able to subsequently recognize who we have seen before and who we have not. Although familiarity and perceptual experience may play a role in recognizing faces from other ethnicities and races (Meissner & Brigham, 2001; Tanaka et al., 2004), the present results provide additional support that social motivations can also impact such basic face processes (Hugenberg et al., 2007; Hugenberg & Sacco, 2008; Kawakami et al., 2022; Levin, 1996, 2000; MacLin & Malpass, 2001; Pauker et al., 2009; Rhodes et al., 2009). The precise mediating mechanisms driving this motivational effect on the ORE, however, are not clear.

Past research has demonstrated the impact of similarity on attraction and interpersonal liking, a desire to interact, and reduced anxiety (Byrne & McGraw, 1964; Byrne & Wong, 1962; Rokeach et al., 1960; West, Magee, et al., 2014). Which of these constructs influences recognition accuracy for both ingroup and outgroup members, however, is unknown. We, therefore, recommend that future research explores how similarity impacts these potential mediating variables by measuring or manipulating each construct and examining how it influences recognition accuracy. Understanding how and when perceptual qualities of faces are more deeply encoded, helps us not only better comprehend facial identity recognition but also more complex psychological phenomena related to impression formation in general (Willis & Todorov, 2006; Zebrowitz, 2006) and prejudice and discrimination more specifically (Blair et al., 2004; Hugenberg & Bodenhausen, 2003; Maddox, 2004).

Future research should also investigate the type of images used in the Recognition Phase. Notably, some theorists propose that using the same set of facial images in the Learning and Recognition Phase is related to image-specific recognition rather than face recognition (Bruce & Young, 1986; Longmore et al., 2015). Furthermore, these two processes may not only be distinct (with better recognition for specific images rather than multiple images of a single face), especially for unfamiliar faces, but may also be differentially impacted by motivations to reduce the ORE (Bornstein et al., 2013; Bruce, 1982; Duchaine & Nakayama, 2006; Longmore et al., 2008). For example, Wan et al. (2015) demonstrated that instructions to individuate outgroup targets did not reduce facial recognition accuracy when images of targets differed in the initial Learning Phase from the later Recognition Phase across viewpoints (e.g., direct facing, profile, ¾ view). While the dominant procedure in cross-race facial identity recognition experiments presents the same series of facial images in both the Learning and Recognition Phases, with an additional set of new distractor facial images included in the latter phase that were not included in the former phase, it is not clear how the results from this method reflect actual face recognition processes in the wild. In real life, the same faces are rarely depicted in an identical fashion over successive occasions and at least some of the results in the standard ORE paradigm are related to episodic memory for the same image rather than structural codes for faces.

Although the standard ORE procedure was used in the present experiments, in which the same ingroup and outgroup racial faces were presented in the Learning and Recognition Phases, we recommend future research examining the impact of similarity when the facial images in these two phases differ. Furthermore, we propose changing or maintaining affective expressions of a face (e.g., happy, neutral, angry) in the Learning and Recognition Phases to examine the impact of not only similarity but also emotion on facial recognition of Black and White faces by both Black and White participants (Bruce, 1982; Johnston & Edmonds, 2009). This procedure would not only allow us to examine the importance of including the same or different images of a single target in the Learning and Recognition Phases on the ORE, but has the potential to provide additional information about the impact of stereotypical emotions at encoding or recognition on the ORE. For example, because Black people are often associated with anger in North America (Hugenberg, 2005; Hugenberg & Bodenhausen, 2003; Kawakami et al., 2022; Maner et al., 2005; Shapiro et al., 2009), perhaps Black compared to White faces depicting anger in the Learning Phase would be more accurately recognized even when expressions change and may be less impacted by similarity for White but not Black participants.

The present research not only advances theorizing on facial recognition but also contributes to our understanding of the impact of perceived similarity. In contrast to prior results related to typical similarity-attraction paradigms (for the exception see Kawakami et al., 2021), the present effects were found using a method that included multiple responses to multiple targets, thereby increasing generalizability and construct validity (Dierendonck, 2005; Furr, 2011; Judd et al., 2012). Furthermore, because the expected relationship between race and perceived similarity on recognition accuracy is less obvious, these effects were less vulnerable to alternative explanations such as demand characteristics (Sunnafrank, 1991). Given strong norms against responding differently to people from different racial categories in North America (Apfelbaum et al., 2008; Crandall et al., 2002; Norton et al., 2006; Nosek et al., 2012), testing the impact of perceived similarity with a more subtle measure of bias, such as facial recognition, is especially important because it can reduce the influence of such situational motivations and self-presentation concerns.

Interestingly, in Allport's (1954) seminal work on *The Nature of Prejudice*, he proposed that contact with outgroup members under the right circumstances would lead to increased perceptions of similarity. For example, he described a study that examined the social impressions of White people living in integrated versus segregated housing. When asked, 'Are they (Black people in the project) pretty much the same as the White people who live here or are they different', those who had closer contact in the integrated housing units perceived fewer differences than those who had less contact. Interpersonal contact with even one outgroup member was assumed in the original contact theorizing to have an important impact on attributions of personality traits and stereotypes. Furthermore, perceiving outgroup members as having more similar personalities was expected to subsequently reduce prejudice and discrimination. Although the distinction between interpersonal (between two individuals) similarity and intergroup (between two groups) similarity is sometimes blurred in this theorizing (Dovidio et al., 2000), the potential for interpersonal similarity to increase approach tendencies and improve relations between two individuals from distinct social categories is an underlying assumption in this work.

In the present research, the focus was on interpersonal similarity. While an emphasis on intergroup similarity may or may not lead to greater liking and positive outcomes for the outgroup (Brown & Abrams, 1986; Brown & Lopez, 2001; Danyluck & Page-Gould, 2018; Diehl, 1988; Roccas & Schwartz, 1993), our results indicate that perceived interpersonal similarity can facilitate face recognition related to Black and White targets. The possibility that similarity has a comparable effect for others that differ in ethnicity/race is encouraging. In particular, whereas previous results indicate that we are attracted to all people who appear to have similar personalities and attitudes, regardless of race (Byrne & McGraw, 1964; Byrne & Wong, 1962; Insko et al., 1983; Rokeach et al., 1960), the present results suggest that perceived interpersonal similarity between White and other non-Black participants and Black targets increased face recognition in ways akin to White targets.

Interestingly, perceived similarity may not only impact recognition accuracy for racial outgroups but may also enhance the ability of minorities to adapt and thrive in certain situations. In particular, perceiving similarity and fit with other individuals in a given social environment may be critical for minorities to flourish and persist in intergroup contexts. For example, Walton and Cohen (2007, 2011) have demonstrated that highlighting similarities between first-year Black college students and other students (e.g., that the social struggles and transitional difficulties they experienced in college were the same) improved the health, retention, and grades of Black students. Notably, these effects were still evident in a three-year follow-up. Likewise, Walton et al. (2012) found that sharing similar attributes (e.g., a birthday) or preferences (e.g., Bon Jovi as a favourite musician) enhanced motivation, persistence, and goal pursuit on domain relevant tasks. Together these findings suggest that perceived similarity may significantly impact intergroup relations between Black and White individuals, as well as minorities' quality of life.

It is important to note, however, that while perceived similarity enhanced facial recognition for members of other races in the current experiments, it did not ameliorate differences related to category membership. These results suggest that although we may better process Black faces who are similar to us, we may also still respond to them as members of a distinct group. In particular, when presented with both Black and White targets, White and non-Black participants in Experiments 1 and 2 showed better recognition accuracy for White over Black faces. Thus, although the present research potentially provides a new tool for improving recognition for both Black and White faces, it also reveals that these participants may still demonstrate greater accuracy in recognizing White over Black faces.

Discovering independent effects for both race and similarity and no interaction between these two variables, raises the possibility that participants responded to Black targets according to their racial group membership as well as interpersonally according to their individual relationship with specific targets. While it is clear that further research is necessary to explore this prospect, the implications of these findings for our current conceptualization of social categorization is significant. If individuated and categorical impression formation processes are not two ends of a continuum and hydraulically interrelated as often implicitly assumed (Brewer, 1988; Fiske & Neuberg, 1990; Macrae & Bodenhausen, 2000; Tajfel & Turner, 1986; Turner et al., 1987), but separate processes, such that increasing one does not necessarily decrease the other, how we view these processes may fundamentally change.

Furthermore, if individuation and categorization are two parallel and independent processes, our approach to reducing bias may need to adapt to this perspective. Although current models of prejudice reduction often stress the intergroup approach related to changing group boundaries to include outgroup members (Brewer & Miller, 1984; Brown & Lopez, 2001; Dovidio et al., 1997; Gaertner et al., 1999), perhaps depending on the goal and the context, strategies that target interpersonal relationships may be preferred. For example, in some environments, it may be advantageous to focus on interpersonal similarity and in other environments on increasing a common ingroup identity or on decreasing the salience of existing social categories. It may even potentially be fruitful to attempt a two-prong approach (Dovidio et al., 2000) in which distinct but complementary interpersonal and intergroup strategies are implemented to improve relationships with individuals while also decreasing outgroup bias. Although future research is clearly necessary to better understand how categorization processes and interpersonal processes interact, the present results are encouraging in that they suggest new ways to enhance facial recognition for members of both same-race and other-race categories.

AUTHOR CONTRIBUTIONS

Kerry Kawakami: Conceptualization; funding acquisition; methodology; project administration; resources; supervision; writing – original draft; writing – review and editing. **Larissa Vingilis-Jaremko:** Conceptualization; data curation; formal analysis; investigation; methodology; software; writing – original draft; writing – review and editing. **Justin Friesen:** Formal analysis; investigation; writing - review and editing. **Chanel Meyers:** Investigation; writing – review and editing. **Xia Fang:** Investigation; writing – review and editing.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available on the Open Science Framework at: https://osf.io/s2qjk/?view_only=ba2b39a1cefe4dc69def8b499a3c37f6.

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