THE IMPACT OF CHANGING EMOTIONAL EXPRESSONS ON THE OWN-RACE BIAS

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Abstract

People tend to better recognize racial ingroup compared to outgroup faces, a widely demonstrated effect known as the Own-Race Bias (ORB). Past research demonstrating this effect has typically presented the same facial stimuli during encoding and recognition. Across three experiments, I investigated whether changing emotional expressions (angry versus neutral) impacted White perceivers' recognition of White and Black faces. Results from Experiment 1 indicated that participants demonstrated a strong ORB when neutral or angry expressions were presented during both encoding and recognition. Results from Experiment 2 demonstrated that when neutral expressions changed to angry expressions, although overall recognition accuracy decreased, participants still showed a strong ORB. Results from Experiment 3 indicated that when angry expressions changed to neutral expressions, participants showed a larger decrease in recognition accuracy for White compared Black targets, ultimately reducing the ORB. The implications of these findings for facial recognition in an intergroup context are discussed.

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Introduction

Understanding how different aspects of faces are encoded and processed is critical to understanding how we form impressions of others (Willis & Todorov, 2006; Zebrowitz, 2006). Information about a person's fixed traits, such as race, as well as more situationally dependent traits, such as emotional expressions, are often present when perceiving faces (Hugenberg et al., 2010). Being able to accurately recognize faces is critical for positive social interactions, yet a broad literature has demonstrated that facial recognition is often impacted by the social category of targets and perceivers. One of the most widely demonstrated biases in face perception, for example, is the Own-Race Bias (ORB), which is the tendency for people to have better recognition accuracy for faces of racial ingroup compared to outgroup members (Kawakami et al., 2017; Meissner & Brigham, 2001). For instance, White people tend to better recognize White faces compared to Black faces and Black people tend to better recognize Black faces compared to White faces (Brigham et al., 2007; Kawakami et al., 2014; Meissner & Brigham, 2001; Singh et al., 2021). The current research aims to extend previous research on the ORB by investigating whether changing emotional expressions on faces impacts recognition of Black and White faces.

The Own-Race Bias

The ORB has been demonstrated among different racial groups, including Black, East Asian, Hispanic, and White participants (Brigham et al., 2007; Gross, 2009; Vingilis-Jaremko et al., 2020). This bias can have significant consequences for misidentified individuals in a variety of situations, including employment contexts (e.g., hiring disadvantages; Benson et al., 2023; Stoll et al., 2004), social settings (e.g., feeling racially stereotyped; Brigham & Malpass, 1985), and the criminal justice system (e.g., eyewitness misidentification; Hugenberg et al., 2010; Sporer, 2001). Indeed, studies by the Innocence Project and other organizations have found that over one third of wrongful convictions in the United States, Canada, and the United Kingdom were related to errors in cross-race eyewitness identification (Scheck et al., 2000; Smith et al., 2004). Considering the societal implications of the ORB, it is critical to understand factors that impact this bias.

Encoding versus Recognition

A standard ORB study is comprised of two phases, the Learning Phase and the Recognition Phase. In the Learning Phase, participants are shown a set of faces of racial ingroup and outgroup members. In the Recognition Phase, participants are presented with the same faces from the Learning Phase in addition to new facial stimuli. Their task is to identify whether the faces were previously presented (old) or not previously presented (new). Many existing theories of the ORB have focused on initial encoding, which occurs during the Learning Phase, rather than retrieval, which occurs during the Recognition Phase, to explain the bias (Hugenberg et al., 2010; Levin, 1996, 2000; MacLin & Malpass, 2001; Rhodes et al., 1989; Rodin, 1987; Sporer, 2001; Tanaka et al., 2004). This is because information introduced during the encoding stage, for example, a target's social category, motivates preferential attention or differential processing, which subsequently facilitates recognition of ingroup targets. Indeed, perceivers tend to focus on individuating characteristics when viewing racial ingroup members (Hugenberg et al., 2007; Pauker et al., 2009; Rhodes et al., 2009), whereas they tend to focus on shared categorical features when perceiving racial outgroup members (Bijlstra et al., 2010, 2014; Hugenberg et al., 2013; Hugenberg & Sacco, 2008).

Research has demonstrated a link between preferential attention to ingroup targets compared to outgroup targets during initial face encoding and the ORB (Kawakami et al., 2014; Van Bavel & Cunningham, 2012; Young et al., 2010). Goldinger and colleagues (2009) found that participants who demonstrated the ORB showed the most significant variance in their attention patterns toward ingroup versus outgroup faces. Specifically, during the Learning Phase, they spent more time and attention on individuating features, such as the eyes, when viewing ingroup faces compared to outgroup faces. This finding lends support to the idea that the ORB is driven by factors in the initial encoding stage.

Research has shown that manipulations incorporated during the encoding phase, but not during recognition, can impact the ORB. Notably, Hugenberg and colleagues (2007) and Kawakami and colleagues (2014) found that providing instructions or paying participants to individuate racial outgroup targets during encoding in the Learning Phase can eliminate the ORB by improving racial outgroup recognition. Likewise, Bernstein and colleagues (2007) demonstrated that incorporating a social category manipulation where targets were merely categorized as ingroup or outgroup members before encoding in the Learning Phase was enough to influence face recognition and create an ORB. Importantly, Young and colleagues (2010) found that this manipulation was only effective at influencing the ORB when implemented during encoding and had no impact on recognition when applied after encoding.

Furthermore, Bornstein and colleagues (2013) found that providing instructions during the Recognition Phase after encoding which informed participants about the ORB and advised them to be attentive when identifying racial outgroup faces did not improve recognition of racial outgroup faces nor impact the ORB. Overall, presenting information about the social category of a target after encoding has been shown to have no impact on the ORB, as it no longer has the potential for preferential processing or attention to ingroup targets (Young et al., 2010). Therefore, to influence facial recognition, it is critical to present relevant information during encoding in the Learning Phase rather than Recognition Phase. One example of relevant information to consider in an intergroup context is that of emotional expressions.

Emotions in an Intergroup Context

Emotional expressions are an important feature in face perception processes and can have critical implications in an intergroup context. Emotions can be used as cues to understand others, and the ability to accurately identify emotional expressions can facilitate smooth social interactions (Freeman & Ambady, 2011; Hugenberg & Wilson, 2013; Niedenthal & Brauer, 2012). When emotion processing is impaired, it can limit people's ability to communicate with each another, which in turn can have a negative impact on interpersonal relations (Ekman, 1992). Additionally, these affective cues may interact with race in important ways such that a target's race can influence emotion recognition processes (Bijlstra et al., 2010; Friesen et al., 2019; Hugenberg, 2005).

One factor that has been shown to influence emotion perception in an intergroup context is that of cultural stereotypes that associate different social groups with specific emotions. When an individual is categorized as a member of a specific social group, stereotypic associations related to traits or emotions with that group are often activated (Amodio, 2014; Fiske & Neuberg, 1990; Hugenberg & Sacco, 2008). This activation can lead to a greater tendency to perceive emotional expressions in line with that stereotype (Kawakami et al., 2017). For example, a common stereotype in North America associates Black people with anger. Previous findings have shown that due to this stereotype, White perceivers tend to view Black faces as angrier than comparable White faces (Ackerman et al., 2006; Maner et al., 2005, Shapiro et al., 2009) and are faster at categorizing angry expressions on Black than White faces (Hugenberg, 2005; Kang & Chasteen, 2009). A similar pattern of anger bias has also been found with Black children as targets (Halberstadt et al., 2022). Specifically, participants were presented with clips of Black and White boys and girls expressing happiness, sadness, anger, fear, surprise, and disgust, respectively, and were asked to identify the emotion on each face. The results indicated that participants demonstrated anger biases for Black compared to White children in that they tended to incorrectly identify anger on their faces when they were expressing another emotion. Furthermore, a direct link between emotion stereotypes and emotion identification was found by Biljstra and colleagues (2010). Specifically, White participants were more likely to perceive anger than sadness on Moroccan compared to White faces and White perceivers who had stronger stereotypic associations for Moroccans and anger were faster at identifying anger on Moroccan compared to White faces (Bijlstra et al., 2014).

Notably, White perceivers perceive anger appearing earlier and lasting longer on Black compared to White faces (Hugenberg & Bodenhausen, 2003). In one study, for example, researchers examined how long it took White participants to detect the onset and offset of anger on Black and White target faces. In one condition which measured the detection of the onset of anger, White participants watched videos of Black or White computer-generated faces transitioning from a neutral to an angry expression and were instructed to stop each video once they saw a new, unambiguous expression on the target’s face. Results indicated that White participants high in implicit prejudice stopped the video earlier in the transition, when expressions were relatively ambiguous, for Black compared to White faces. These findings suggest that participants are quicker to see anger on relatively neutral Black faces.

The other condition explored how long it took White participants to detect the offset of anger. Specifically, participants watched videos of Black or White computer-generated faces morphing from anger to happiness and were instructed to stop each video when they no longer saw the original expression on the target's face. The findings showed that for White participants high in implicit prejudice the offset of anger occurred later for Black than White faces. These findings indicate that participants saw anger lingering longer on Black than White faces and perceived anger once again on relatively ambiguous, neutral faces. Together, these findings suggest that there are pervasive biases in terms of how emotions, especially anger, are perceived on Black faces.

Emotional Expressions and the ORB

Although the typical ORB paradigm uses facial stimuli with emotionally neutral expressions (Meissner & Brigham, 2001), several studies have incorporated facial stimuli with different emotional expressions in the ORB, including expressions of anger, happiness, and fear. The results related to the impact of emotions on recognition accuracy, however, have been mixed. Some research has found that perceiving angry expressions increased White participants' recognition of Black outgroup faces, resulting in a reversed ORB. In a study by Ackerman and colleagues (2006), for example, although White participants were more accurate at recognizing White compared to Black faces with neutral expressions, when faces with angry expressions were presented, White participants were more accurate at recognizing angry Black compared to White faces. Likewise, Krumhuber and Manstead (2011) found a standard ORB with White participants when Black and White faces with neutral expressions were presented but a reversed ORB when faces displayed anger or fear. Although Young and Hugenberg (2012) found a significant ORB when White participants were presented with Black and White faces with neutral expressions, when presented with angry faces, recognition of Black and White faces did not differ. Together this literature indicates that presentation of racial outgroup faces with angry expressions may decrease or even reverse the ORB.

In contrast, other research has demonstrated that White participants show the typical ORB when presented with Black and White faces with angry expressions. Corneille and colleagues (2007), for example, presented White participants with Black and White faces with either a happy or angry expression and found significantly greater recognition for angry White compared to Black faces. Notably, they found greater recognition for happy Black compared to happy White faces. Gwinn and colleagues (2015) found similar results with White participants when neutral or angry expressions were presented in the Learning and Recognition Phases. Although participants demonstrated the ORB, the effect was more pronounced when they were shown angry compared to neutral expressions. More recently, research by Imhoff and colleagues (2024) found that White participants demonstrated the ORB for both neutral and angry faces, consistently showing better recognition for White than Black faces, regardless of the emotional expression.

Based on these contradictory findings, it is not clear whether White participants are better or worse at recognizing White compared to Black faces that are angry. Given the general importance of emotions in an intergroup context over time (Fang et al., 2021), one goal of the present research was to examine the impact of emotional expressions on recognition accuracy. The primary goal, however, was to explore the impact of changing emotional expressions on recognition accuracy.

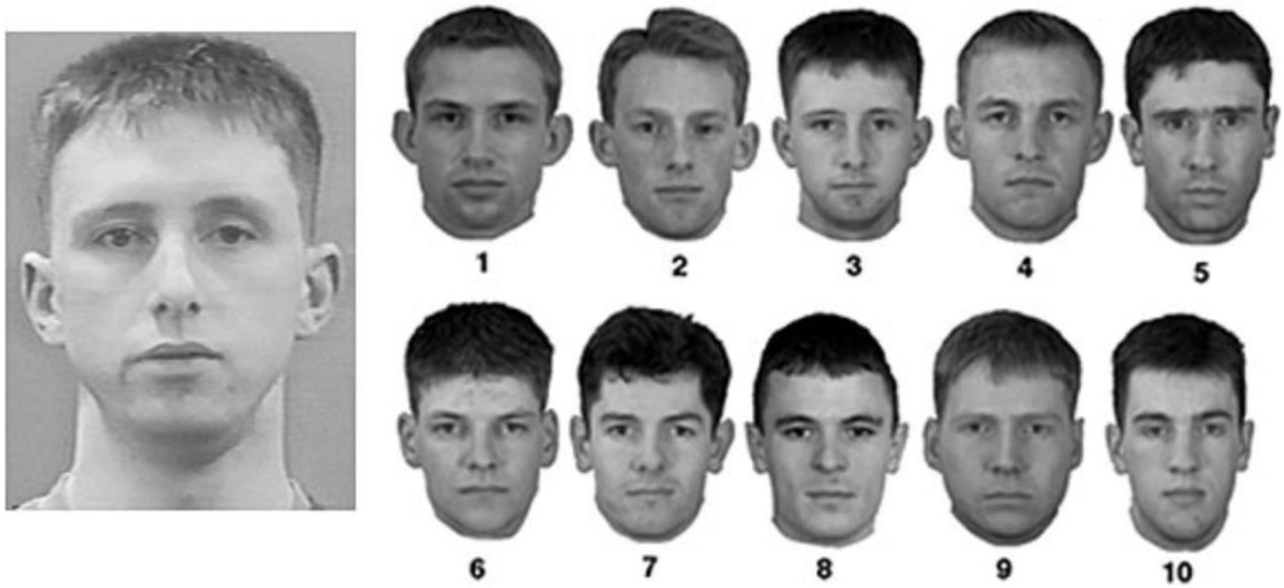
The Impact of Changing Facial Images on Recognition

Although previous studies have incorporated different emotional expressions in the ORB, it is important to emphasize that the expressions typically remained the same across the Learning and Recognition Phases (Ackerman et al., 2006; Corneille et al., 2007; Imhoff et al., 2024; Krumhuber & Manstead, 2011; Young & Hugenberg, 2012). Gwinn and colleagues (2015), however, did include conditions in which emotional expressions changed across the phases, although their analyses focused on the recognition of angry expressions rather than the impact of changing expressions. In general, most ORB studies have examined facial recognition by using identical images of faces in both the Learning and Recognition Phases (Meissner & Brigham, 2001). However, the use of identical images, whether in general or for emotional expressions in the ORB, does not accurately portray how faces are realistically perceived.

An influential face processing model by Bruce and Young (1986) proposes that image-specific recognition and facial recognition are highly distinct processes. Their theory suggests that viewing an image of a face leads to the creation of a pictorial code, defined as a description of that particular image and its qualities, which may include the lighting, the static pose, or the face's expression. Later recognition accuracy is characterized by how closely the image shown during recognition matches the image presented during encoding. In contrast, actual facial recognition requires remembering the fixed, structural aspects of an individual face to distinguish it from other faces. Indeed, the way in which an individual is presented in real-life can fluctuate from one interaction to the next due to variations in lighting, expressions, body poses, or views of one's profile. Therefore, pictorial codes alone are insufficient for recognizing faces in real-life face perception, as people's faces are rarely shown in an identical way over multiple occasions (Bruce, 1982; Longmore et al., 2008, 2017). Notably, extensive research unrelated to the ORB has found a significant decrease in recognition accuracy when images of the targets change from encoding to recognition on various dimensions (Bindemann & Sanford, 2011; Hancock et al., 2000), see Figure 1.

Figure 1

Examples of a Target Identification Task Among a Series of Photographs

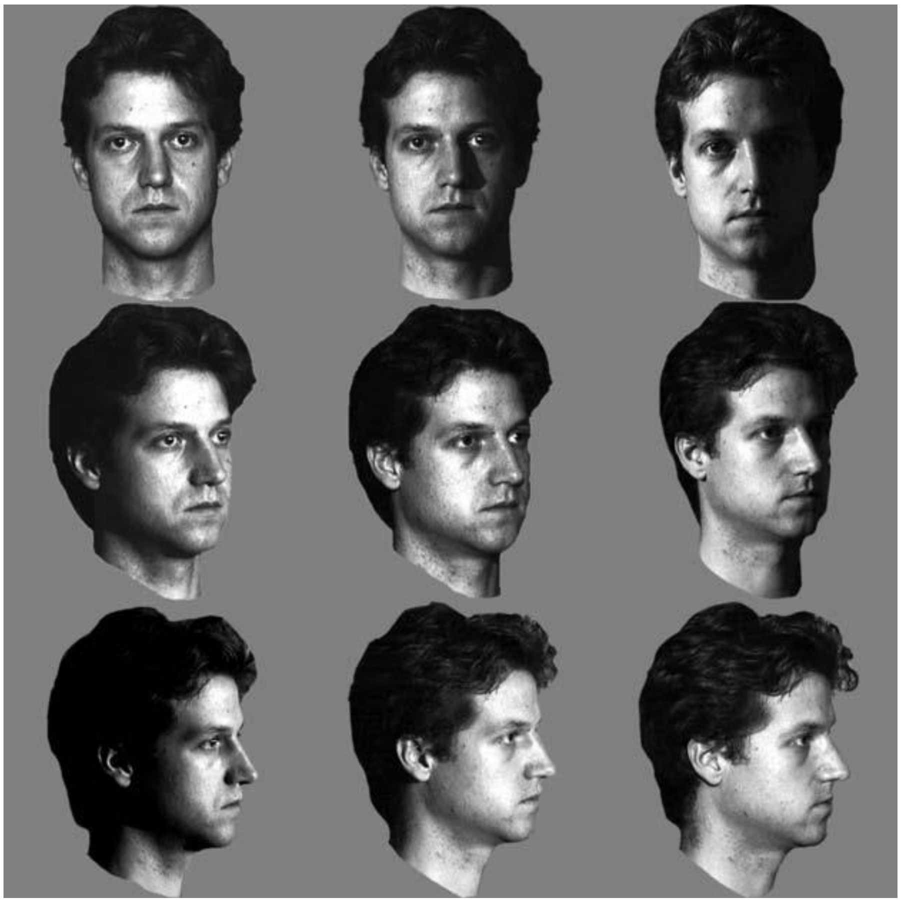


Note. Figure adapted from "Verification of face identities from images captured on video," by Bruce, V., Henderson, Z., Greenwood, K., Hancock, P. J. B., Burton, A. M., & Miller, P., 1999, *Journal of Experimental Psychology*, *5*, p. 344.

Studies have demonstrated that changing the view of a face's profile, for example by alternating from a full face to a profile view from encoding to recognition decreases recognition accuracy (Krouse, 1981; Longmore et al., 2008; Stephan & Caine, 2007; Troje & Bülthoff, 1996). Other studies have found that variations in expression, pose, and the direction of lighting also impair facial recognition (Braje, 2003; Bruce, 1982; Hill & Bruce, 1996; Johnston & Edmonds, 2009; Lim et al., 2022), see Figure 2.

Figure 2

Examples of Variations in Lighting and View of a Face's Profile



Note. Each row shows a different view (full-face, three-quarter view, and near-profile view). Each column shows faces illuminated from a different point (full-face, 30° to the model's right, and 62° to the model's right). Figure reprinted from "Learning faces from photographs," by Longmore, C. A., Liu, C. H., & Young, A. W., 2022, *Journal of Experimental Psychology*, *34*, p. 95.

Considering these findings, it is important to advance beyond the current design of most ORB studies that present the same facial images in both the Learning and Recognition Phases to investigate the impact of changing faces on recognition of ingroup and outgroup members. The primary goal in the present research was, therefore, to examine recognition of faces with changing emotional expressions.

The Present Research

Across three experiments, I investigated how emotional expressions impacted recognition of Black and White faces by White perceivers. The primary aim of Experiment 1 was to initially examine whether perceiving angry compared to neutral expressions presented in both the Learning and Recognition Phases impacts recognition of Black and White faces. The primary aim of Experiments 2 and 3 was to examine the impact of changing emotional expressions across the Learning and Recognition Phases on the recognition of Black and White faces.

In Experiment 1, participants were presented with one of two conditions. In one condition, White and Black faces with neutral expressions were presented in both the Learning and Recognition Phases (Neutral to Neutral), and in another condition, White and Black faces with angry expressions were presented in both the Learning and Recognition Phases (Anger to Anger). This study replicated the standard ORB paradigm by using the same expressions in both phases and contributed to the existing literature on the impact of angry emotional expressions on recognition. When faces with neutral expressions were shown in both the Learning and Recognition Phases, in line with previous findings (Brigham et al., 2007; Kawakami et al., 2014; Meissner & Brigham, 2001; Singh et al., 2021), I predicted that White participants would demonstrate the typical ORB and show greater recognition for White compared to Black faces. When faces with angry expressions were shown in both the Learning and Recognition Phases, given the mixed results related to the impact of angry expressions on facial recognition accuracy (Ackerman et al., 2006; Corneille et al., 2007; Gwinn et al., 2015; Krumhuber & Manstead, 2011; Young & Hugenberg, 2012), I had no clear predictions.

In Experiment 2, White participants were presented with one of two conditions in which White and Black faces with angry expressions were presented in both the Learning and Recognition Phases (Anger to Anger) or neutral expressions were presented in the Learning Phase and angry faces were presented in the Recognition Phase (Neutral to Anger). In the Anger to Anger expression condition, I expected the results to replicate Experiment 1. Based on these initial findings, I predicted the typical ORB with better recognition of White compared to Black faces. In the Neutral to Anger expression condition, although I predicted an overall effect of changing expression in which there would be a decrease in recognition accuracy compared to when expressions remained the same (Bruce, 1982; Johnston & Edmonds, 2009), it was possible that this effect would interact with the race of the target.

Specifically, I expected that White participants would perceive a large change between the neutral and angry expressions compared to when the expressions remained angry and therefore would be much worse at recognizing these faces for White targets. In contrast, for Black targets, given that White perceivers could potentially misread relatively neutral facial expressions as conveying anger on Black faces (Hugenberg & Bodenhausen, 2003), it was possible participants would see anger on Black faces with neutral expressions during encoding and therefore they may perceive less of a difference when expressions changed from neutral to angry. If the transition from neutral to angry expressions on a Black face was not seen as distinct, I predicted a smaller decrease in recognition accuracy compared to when the expressions remained angry.

However, it is important to note that Hugenberg and Bodenhausen's (2003) findings occurred in the context of transitioning expressions, with participants expecting the initial expression to transition into a new expression. In Hugenberg and Bodenhausen's (2003) paradigm, participants were presented with relatively ambiguous facial expressions that were not clearly neutral or angry. In contrast, in the current research, all facial expressions were distinctly angry or neutral. Given these methodological differences, it was not obvious whether participants would see anger on the neutral expressions. Furthermore, in this experiment, the angry expressions were presented after encoding in the Recognition Phase. Given past research on the importance of presenting information during encoding to impact facial recognition (Young et al., 2010), I predicted that participants' perceptions of neutral expressions would not be impacted since the angry expressions were shown in the Recognition Phase.

In Experiment 3, White participants were presented with one of two conditions in which White and Black faces with neutral expressions were presented in both phases (Neutral to Neutral), or angry faces were presented in the Learning Phase and faces with neutral expressions were presented in the Recognition Phase (Anger to Neutral). In the Neutral to Neutral expression condition, I expected to replicate the results from previous studies and the predicted results for Experiment 1 that demonstrate the typical ORB (Brigham et al., 2007; Kawakami et al., 2014; Meissner & Brigham, 2001; Singh et al., 2021), with better recognition of White compared to Black faces. In the Anger to Neutral expression condition, I predicted an overall effect of changing expression in which recognition accuracy would decrease when the expressions changed rather than remained the same (Bruce, 1982; Johnston & Edmonds, 2009). It was again possible, however, that this effect would be qualified by the race of the target. For White targets, I expected that White participants would perceive a large change between the two expressions and therefore would be worse at recognizing White faces when the expressions changed from anger to neutral compared to when they remained neutral in both phases. In contrast, for Black targets, I predicted that White participants would see anger on even neutral faces in the Recognition Phase (Hugenberg & Bodenhausen, 2003) and therefore they would perceive less of a difference between the two expressions. Furthermore, in this experiment, the angry expressions were presented during encoding in the Learning Phase. Given past research on the importance of presenting information during encoding to impact facial recognition (Young et al., 2010), I predicted that seeing anger during encoding would impact participants' later perceptions of neutral expressions in the Recognition Phase. However, if the transition between the angry and neutral expressions was not seen as distinct, I predicted a small decrease in recognition accuracy compared to when the expressions remain neutral.

Experiment 1

Methods

Design and Participants

The primary goal of Experiment 1 was to examine whether perceiving emotional expressions, specifically stereotypic expressions (i.e., anger), compared to neutral expressions, per se, in both the Learning and Recognition Phases impacted recognition of Black and White faces. To examine this question, participants were randomly assigned to an Emotional Expression condition in a 2 Target Race (Black vs. White) x 2 Emotional Expression (Neutral vs. Anger) mixed design with Target Race as a within-subjects factor. An a priori power analysis in G*Power 3.1 (Faul et al., 2007) based on estimates of the typical effect size in ORB experiments ($\eta^2 = 0.017$; Vingilis-Jaremko et al., 2020), and assuming a correlation among repeated measures of $r = .50$, indicated that a sample size of 119 participants would provide 80% power. To account for potential exclusions related to data quality, I recruited 179 participants on the CloudResearch online platform. Participants were required to speak English for 5 years or more, live in Canada or the United States for 5 years or more, be under 60 years of age, and solely identify as White. Participants were financially compensated $1.90 USD. Because this experiment required participants to pay attention, based on a priori criteria, the data from participants who reported that they had an attentional disorder (e.g., ADHD; n = 7), failed the attention check (see procedure; n = 10) or responded invariantly (e.g., answering "new" for all faces; n = 11) were removed from analysis. The data from 151 White participants (80 female, 67 male, 4 another identity; age range: 20-59 years old, M_{age} = 39.03, SD_{age} = 10.35) were included in the analysis.

Procedure

Participants were randomly assigned to one of two emotional expression conditions, Neutral or Anger, and were presented with two phases, the Learning Phase and the Recognition Phase. In the Learning Phase, participants were informed that they would be presented with a series of faces and were instructed to pay attention to each face because there would be a subsequent memory test. The stimuli used throughout the experiment consisted of 64 faces (16 Black male, 16 Black female, 16 White male, 16 White female) selected from the York Face Database (Fang & Kawakami, in prep), and included two photographs of each person with one neutral expression and one angry expression. The images, used in previous experiments (Kawakami et al., 2021, 2022; Vingilis-Jaremko et al., 2020), were headshots taken at a Canadian university with a Canon PowerShot SX5 digital camera. All images were standardized on luminance and contrast using Adobe Photoshop, with no hair, grey-scaled, and cropped to the same size (360 x 450 pixels), see Figure 3.

Figure 3

Examples of White and Black Target Facial Stimuli

Each trial in the Learning Phase began with a fixation cross for 1000 ms, followed by a Black or White face presented for 5000 ms. In this phase, participants were presented with a total of 32 faces, 16 White (half female) and 16 Black (half female), individually and in a random order. Participants were presented with only faces with neutral expressions or only faces with angry expressions in two blocks of 16 trials with a break in between the blocks.

After the Learning Phase, participants were presented with an attention check in which they were briefly shown a letter on the screen for 5000 ms and were instructed to select the same letter from 4 letters on a subsequent page. The data from participants who failed the attention check were excluded from the analyses. Next, participants completed the Recognition Phase in which they were presented with a total of 64 faces, which consisted of the 32 faces from the Learning Phase in addition to 32 Black and White faces (16 male, 16 female) that they had not previously seen. The images were presented individually and in a random order. For each face, participants were instructed to identify whether it had been previously displayed or not by either selecting the “OLD” or “NEW” response from a multiple-choice list. To eliminate any stimuli-level differences that might affect recall, two randomly generated counterbalanced sets of 32 images were used. Half of the participants were presented with images from Set 1 in the Learning and Recognition Phase and images from Set 2 only in the Recognition Phase. The other half of participants were presented with images from Set 2 in the Learning and Recognition Phase and images from Set 1 only in the Recognition Phase. All participants completed two blocks of 32 trials with a break between the blocks. After completing the Recognition Phase, participants were asked about the goals of the experiment (“What was the purpose of the experiment?” and “What did you think the experimenter expected to find?”) and a set of demographic questions (see Appendix A).

Results and Discussion

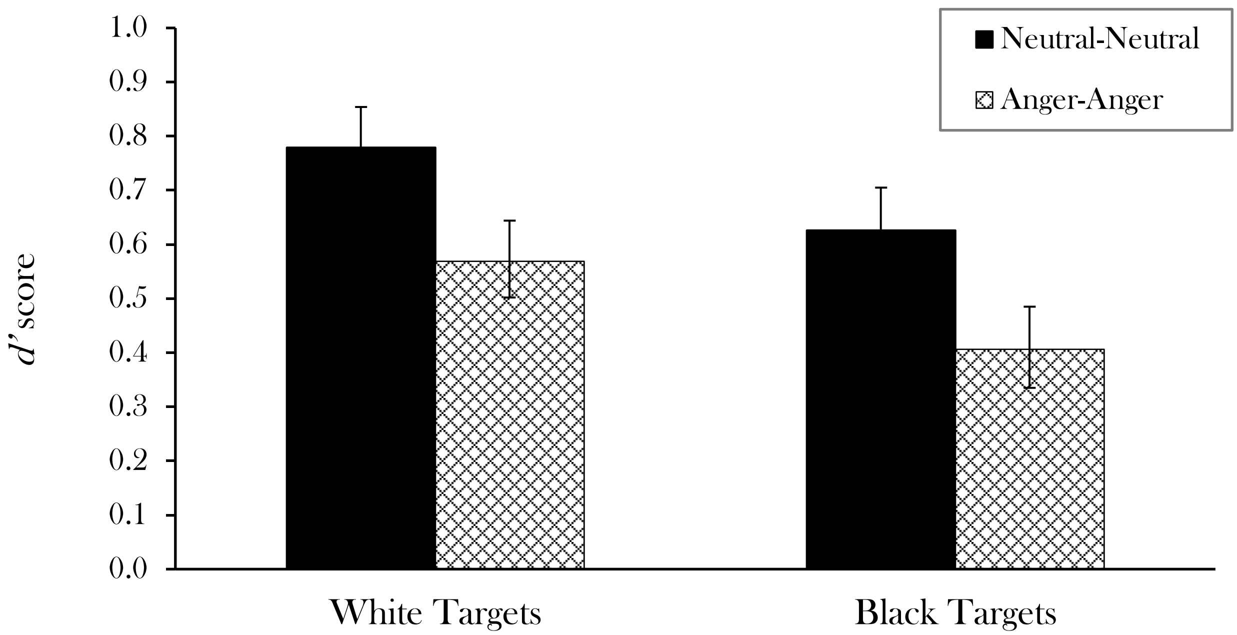
To examine the impact of neutral versus angry expressions on facial recognition, I calculated *d’* scores, a signal detection measure of discriminability, by subtracting the standardized scores for false alarms (incorrect identification of new faces) from the standardized scores for the proportion of hits (correct identification of old faces). Higher *d’* scores indicated greater recognition accuracy. Hit rates of 0 and 1 were replaced, respectively, with 0.5(*n*) and 1–0.5(*n*; Stanislaw & Todorov, 1999).

A 2 Target Race (Black vs. White) x 2 Emotional Expression (Neutral vs. Anger) mixed ANOVA with Target Race as a within-subjects factor was performed on the *d’* scores. The main effect of Target Race was significant, $F(1, 149) = 14.52$, $p < .001$, $\eta^2 = 0.09$, 95% CI [0.10, 0.33], with White participants showing greater recognition for White ($M = 0.71$, $SD = 0.67$) compared to Black ($M = 0.49$, $SD = 0.60$) targets. The main effect of Emotional Expression, *F*(1,

149) = 3.32, p = .070, η^2 = 0.02, 95% CI [-0.33, 0.01], and the Target Race x Expression interaction, $F(1, 149)$ = .009, p = .926, η^2 = 0.000, 95% CI [-0.01, 0.01], were not significant.

Figure 4

Recognition Scores for White and Black Targets in the Neutral and Anger Conditions in Experiment 1



The results of Experiment 1 provided further support for the ORB with White participants showing better recognition for White compared to Black targets (Bernstein et al., 2007; Hugenberg et al., 2010; Kawakami et al., 2014; Meissner & Brigham, 2001; Vingilis-Jaremko et al., 2020). Notably, while past research has found mixed results on the impact of facial recognition accuracy when angry expressions are presented on White and Black targets, the effect of race in the present findings was not qualified by whether expressions were neutral or angry. In contrast to studies demonstrating a reversed ORB in which White participants better recognized angry Black compared to White faces (Ackerman et al., 2006; Krumhuber & Manstead, 2011) or a nonsignificant ORB in which participants did not differ in their recognition of angry White and Black faces (Young & Hugenberg, 2012), the current findings indicated that White participants demonstrated an ORB when presented with faces with both neutral and angry expressions in the Learning and Recognition Phases. These results are consistent with previous findings suggesting that presenting Black stereotypic emotional expressions, such as anger, does not impact the ORB (Corneille et al., 2007; Gwinn et al., 2015; Imhoff et al., 2024).

It is important to note, however, that in Experiment 1, both angry and neutral emotional expressions remained consistent across the Learning and Recognition Phases. Importantly, past research has highlighted that static images do not reflect real-life face perception processes and that facial recognition decreases if images of a target change from encoding to recognition (Bruce & Young, 1986; Krouse, 1981; Longmore et al., 2008, 2015; Stephan & Caine, 2007; Troje & Bülthoff, 1996). Therefore, in Experiment 2, I examined whether emotional expressions impact facial recognition accuracy when they change from their initial presentation during the Learning Phase to the Recognition Phase.

Experiment 2

Method

Design and Participants

In Experiment 2, I explored whether presenting White and Black faces with neutral expressions during encoding in the Learning Phase impacted White participants' subsequent recognition of Black stereotypic expressions (i.e., anger) during the Recognition Phase. Participants were randomly assigned to an Emotional Expression condition in a 2 Target Race (Black vs. White) x 2 Changing Emotional Expression (Anger to Anger vs. Neutral to Anger) mixed design with Target Race as a within-subjects factor. In accordance with the power analysis in Experiment 1, although a sample of 119 participants would provide 80% power, I planned to recruit a total of 200 participants on the CloudResearch online platform. By mistake, however, I recruited 221 participants before stopping. Based on a priori criteria, the data from participants who reported that they had an attentional disorder (e.g., ADHD; $n = 9$) or responded invariantly (e.g., answering “new” for all faces; $n = 12$) were removed from analysis. The data of 200 White participants (100 female, 100 male; age range: 18-59 years old, $M_{age} = 37.51$, $SD_{age} = 8.57$) were included in the analysis. A sensitivity analysis using G*Power 3.1 (Faul et al., 2009) indicated that the final sample had 80% power to detect an interaction effect of $\eta^2 = 0.10$.

Procedure

Experiment 2 used the same procedure and stimuli as Experiment 1 with two exceptions. First, participants were randomly assigned to changing expression conditions, Anger to Anger or Neutral to Anger. Specifically, participants were presented with angry Black and White faces in both the Learning and Recognition Phases or with Black and White faces with neutral expressions in the Learning Phase and angry faces in the Recognition Phase. Second, 13 stimuli images were replaced in this experiment with alternative stimuli.

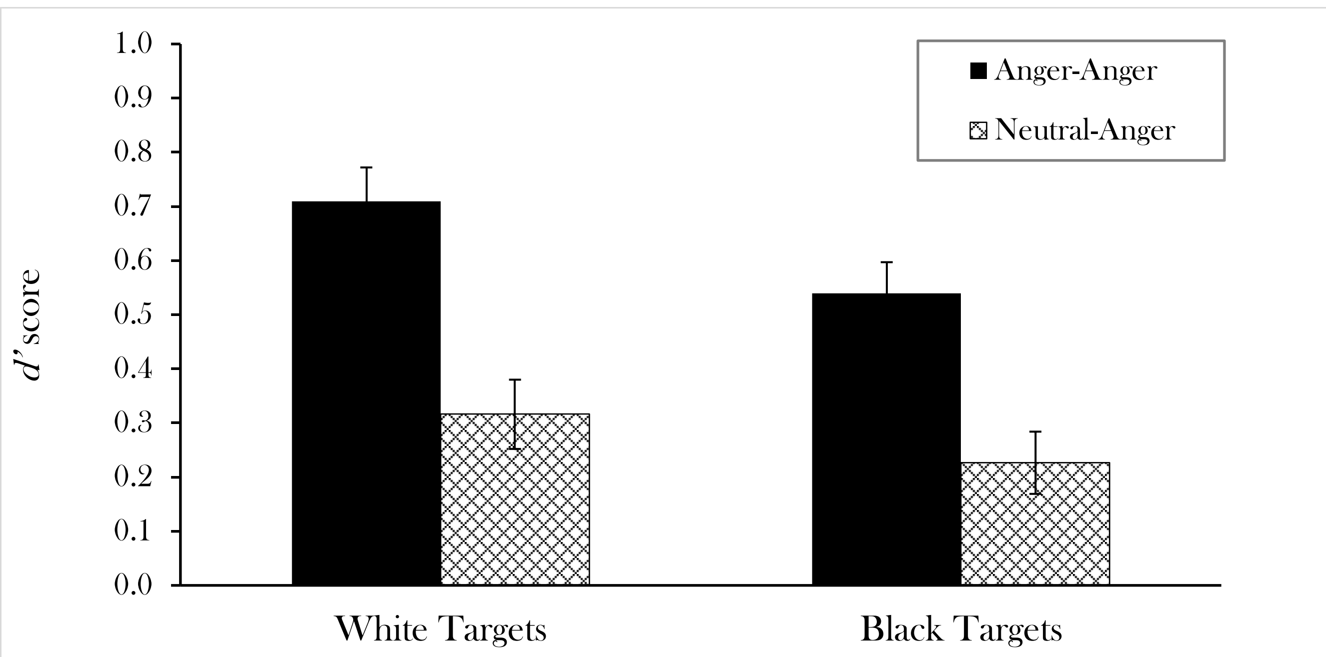
Results and Discussion

To investigate the impact of changing emotional expressions on facial recognition, a 2 Target Race (Black vs. White) x 2 Changing Emotional Expression (Anger to Anger vs. Neutral to Anger) mixed ANOVA with Target Race as a within-subjects factor was performed on *d’* scores. The main effect of Target Race was significant, $F(1, 198) = 5.50$, $p = .020$, $\eta^2 = 0.03$, 95% CI [0.02, 0.24], with White participants showing greater recognition for White ($M = 0.51$, $SD = 0.05$) compared to Black ($M = 0.38$, $SD = 0.04$) targets. The main effect of Changing

Emotional Expression was also significant, *F*(1, 198) = 28.39, $p < .001$, $\eta^2 = 0.13$, 95% CI [0.22, 0.48], with greater recognition accuracy when expressions did not change and were angry in both phases (*M* = 0.624, *SD* = 0.046) compared to when expressions changed from neutral to angry (*M* = .27, *SD* = .05). Furthermore, the Target Race x Changing Emotional Expression interaction was not significant, *F*(1, 198) = .514, $p = .474$, $\eta^2 = 0.01$, 95% CI [-0.01, 0.02]. Regardless of whether the targets were White or Black, changing as opposed to consistent emotional expressions decreased recognition accuracy to a similar extent for both White and Black targets.

Figure 5

Recognition Scores for White and Black Targets in the Anger to Anger and Neutral to Anger Conditions in Experiment 2



In accordance with past research not related to the ORB that recognition accuracy decreases when images changed rather than remained the same (Bruce & Young, 1986; Krouse, 1981; Longmore et al., 2008, 2015; Stephan & Caine, 2007; Troje & Bülthoff, 1996), the results of Experiment 2 indicated that changing from a neutral expression during encoding in the Learning Phase to a Black stereotypic emotional expression (i.e., anger) during the Recognition Phase decreased recognition accuracy for both White and Black targets. Furthermore, the results of Experiment 2 indicated that regardless of whether the emotional expressions were consistently angry or changed from neutral to angry, White participants reliably demonstrated the ORB, showing better recognition for White compared to Black targets.

Although Experiment 2 initially explored the impact of changing emotional expressions across the Learning and Recognition Phases and provided evidence that recognition accuracy could be reduced when faces with neutral expressions were presented during the Learning Phase and changed to anger during the Recognition Phase, the interaction with target race did not emerge. However, it is possible that this was impacted by the direction of change from neutral expressions during encoding to angry expressions during recognition. Consequently, to provide a more comprehensive test of the effect of changing emotional expressions on recognition accuracy by target race, in Experiment 3, I examined the impact of changing angry expressions during encoding to neutral expressions during recognition.

Experiment 3

Method

Design and Participants

The primary goal of Experiment 3 was to examine the impact of presenting faces with Black stereotypic expressions (i.e., anger) during encoding in the Learning Phase and neutral expressions in the Recognition Phase. Participants were randomly assigned to an Emotional Expression condition in a 2 Target Race (Black vs. White) x 2 Changing Emotional Expression

(Neutral to Neutral vs. Anger to Neutral) mixed design with Target Race as a within-subjects factor. In accordance with a power analysis in Experiment 1, although a sample of 119 participants would provide 80% power, to account for data exclusions, I recruited 200 students from the York University Undergraduate Research Participant Pool (URPP) who participated for course credit. Before beginning the analyses, based on a priori criteria, the data from participants who reported that they had an attentional disorder (e.g., ADHD; $n = 8$) or responded invariantly (e.g., answering "new" for all faces; $n = 7$) were removed from analysis. The data from 185 White participants (129 female, 42 male, 4 another gender identity, 10 chose not to identify; age range: 18-34 years old, $M_{age} = 19.24$, $SD_{age} = 2.34$) were included in the analysis.

Procedure

Experiment 3 used the same procedure and stimuli as Experiments 1 and 2, except that participants were randomly assigned to a changing emotional expression condition: Neutral to Neutral or Anger to Neutral. Specifically, participants were presented with either White and Black faces with neutral expressions in both the Learning and Recognition Phases or with angry White and Black faces in the Learning Phase and faces with neutral expressions in the Recognition Phase.

Results and Discussion

To investigate the impact of changing emotional expressions on facial recognition, a 2 Target Race (Black vs. White) x 2 Changing Emotional Expression (Neutral to Neutral vs. Anger to Neutral) mixed ANOVA with Target Race as a within-subjects factor was performed on *d'* scores. The main effect of Target Race was significant, $F(1, 183) = 5.36$, $p = .002$, $\eta^2 = 0.03$, 95% CI [0.02, 0.24], with White participants showing greater recognition for White ($M = 0.57$, $SD = 0.66$) compared to Black ($M = 0.44$, $SD = 0.58$) targets. The main effect of Changing

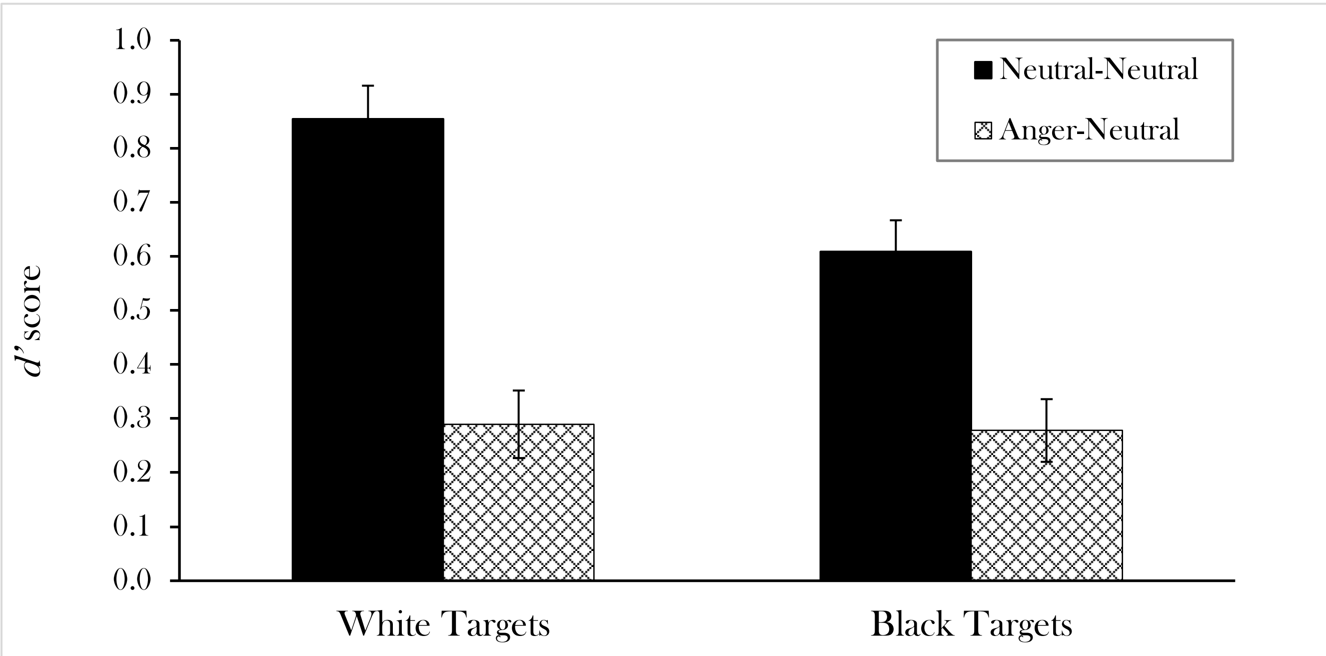
Emotional Expression was also significant, $F(1, 183) = 48.53$, $p < .001$, $\eta^2 = 0.21$, 95% CI [0.32, 0.57], with greater recognition when expressions did not change and were neutral in both phases ($M = 0.73$, $SD = 0.05$) compared to when expressions changed from angry to neutral ($M = 0.28$, $SD = 0.05$). Notably, the Target Race x Changing Emotional Expression interaction was also significant, $F(1, 183) = 4.34$, $p = .038$, $\eta^2 = 0.02$.

Simple effects analyses indicated that although there was a significant decrease in recognition accuracy when the expressions changed from angry to neutral compared to when they remained consistently neutral, this decrease was larger for White ($M_{Neutral\ to\ Neutral} = 0.85$, $SD = 0.66$; $M_{Anger\ to\ Neutral} = 0.29$, $SD = 0.53$), $t(92) = 6.30$, $p < .001$, $d = 0.66$, 95% CI [0.43, 0.88], compared to Black targets ($M_{Neutral\ to\ Neutral} = 0.61$, $SD = 0.61$; $M_{Anger\ to\ Neutral} = 0.28$, $SD = 0.49$), $t(91) = 4.76$, $p < .001$, $d = 0.50$, 95% CI [0.28, 0.72].

Additionally, analyses also indicated that when faces with neutral expressions were presented in both the Learning and Recognition Phases, White participants better recognized White ($M = 0.85$, $SD = 0.66$) compared to Black ($M = 0.61$, $SD = 0.61$) targets, $t(92) = 3.03$, $p = .003$, $d = 0.31$, 95% CI [0.11, 0.52]. However, when emotional expressions changed from anger during encoding in the Learning Phase to neutral during the Recognition Phase, White participants no longer differed in their recognition of White ($M = 0.29$, $SD = 0.53$) and Black ($M = 0.28$, $SD = 0.49$) targets, $t(91) = .17$, $p = .869$, $d = 0.02$, 95% CI [-0.19, 0.22].

Figure 6

Recognition Scores for White and Black Targets in the Neutral to Neutral and Anger to Neutral Conditions in Experiment 3



In summary, the results of Experiment 3 suggested that changing from a Black stereotypic emotional expression (i.e., anger) during encoding in the Learning Phase to a neutral expression during the Recognition Phase decreased overall recognition accuracy. These findings are in line with the results of past research not related to the ORB which found that the recognition of images that change is worse than recognition of static images (Bruce & Young, 1986; Krouse, 1981; Longmore et al., 2008, 2015; Stephan & Caine, 2007; Troje & Bülthoff, 1996). Notably, in Experiment 3, this decrease in recognition accuracy was larger for White than Black targets.

One potential reason for this pattern may be that White participants saw a clear distinction between the White faces with angry and neutral expressions and perceived them as two distinct faces. However, for Black targets, given that White perceivers are more prone to detecting anger on Black faces and misinterpreting neutral facial expressions of Black individuals as conveying anger (Ackerman et al., 2006; Hugenberg & Bodenhausen, 2003; Maner et al., 2005, Shapiro et al., 2009), changes from an angry to a neutral expression on Black faces may not have been perceived as substantial. That is, angry and neutral expressions may appear to be more similar on Black faces, which may account for the smaller reduction in recognition accuracy that emerged for Black targets. Notably, although White participants were better at recognizing White compared to Black targets when presented with faces with neutral expressions in both the Learning and Recognition Phases, when the emotional expressions changed from anger to neutral, the ORB was reduced, White participants no longer differed in how accurately they recognized White compared to Black faces.

General Discussion

The primary goal of the present research was to investigate the impact of emotional expressions on recognition accuracy in an intergroup context. Experiment 1 investigated whether presenting angry compared to neutral expressions per se in both the Learning and Recognition Phases differentially impacted recognition accuracy for White and Black faces. The results demonstrated that the type of emotional expression did not impact recognition accuracy. White participants showed better recognition of White faces compared to Black faces for both angry and neutral expressions. Although previous findings were mixed with regard to the impact of angry expressions (Ackerman et al., 2006; Corneille et al., 2007; Gwinn et al., 2015; Imhoff et al., 2024; Krumhuber & Manstead, 2011; Young & Hugenberg, 2012), the present results are consistent with the pattern of findings by Corneille et al. (2007), Gwinn et al., (2015) and Imhoff et al. (2024) in that for both affective expressions, a robust ORB was found.

Experiments 2 and 3 explored the impact of changing emotional expressions on recognition accuracy. Experiment 2 demonstrated that changing from neutral expressions during encoding in the Learning Phase to angry expressions in the Recognition Phase decreased recognition accuracy and the effect was not qualified by race. While these findings provided further support for the impact of changing images on decreased recognition accuracy (Bruce & Young, 1986; Krouse, 1981; Longmore et al., 2008, 2015; Stephan & Caine, 2007; Troje & Bülthoff, 1996), it is notable that this pattern did not differentially impact White participants' recognition of White and Black targets. These findings suggest that White participants perceived neutral expressions in the Learning Phase as distinct from angry expressions in the Recognition Phase on both Black and White faces.

Experiment 3 alternatively demonstrated that changing from angry expressions during encoding in the Learning Phase to neutral expressions during the Recognition Phase notably decreased recognition accuracy, and that this effect was qualified by race. For White targets, participants presumably perceived faces with angry expressions in the Learning Phase and neutral expressions in the Recognition Phase as highly distinct, and therefore their recognition accuracy decreased. In contrast, for Black targets, this decrease was more muted. It is possible that White perceivers continued to perceive anger on Black faces even when expressions changed to neutral in the Recognition Phase, such that this change had less of an impact on their recognition accuracy of these faces.

Overall, when exploring the impact of emotions alone on recognition accuracy, a strong ORB was demonstrated when neutral and angry expressions were presented in both the Learning and Recognition Phases respectively (Experiment 1). These results are important because they suggest the specific expressions (anger and neutral), per se, do not impact the ORB. Instead, my findings suggest that changing emotions and the order in which emotions change are critical. The results indicated that for White participants, changing expressions from the Learning to Recognition Phases (Experiments 2 and 3) created significant decreases in recognition accuracy for White targets. However, when neutral expressions changed to anger, recognition accuracy decreased to a similar extent for both White and Black targets, with a strong ORB in both the Anger to Anger and Neutral to Anger conditions (Experiment 2). In contrast, when angry expressions changed to neutral, White participants showed a larger decrease in recognition accuracy for White compared to Black targets (Experiment 3), ultimately reducing the ORB. Notably, in this condition, no difference in recognition accuracy for White and Black targets was found. Therefore, one possible explanation for the findings of Experiments 2 and 3 may be that Black faces were seen as less perceptually distinct when changing from angry to neutral expressions than vice versa. Specifically, when Black stereotypic expressions such as anger were presented during encoding but not retrieval, they may have influenced the perception of subsequent faces (Hugenberg et al., 2010).

Furthermore, in the ORB literature, there are two main mechanisms which have been proposed to explain the ORB. One explanation has to do with having increased contact and visual experience with racial ingroup compared to outgroup members (Brigham & Malpass, 1985; Kawakami et al., 2022). This increased visual exposure to racial ingroup members is associated with having more well-defined facial prototypes of racial ingroup compared to outgroup members, which leads to better recognition (Hills & Lewis, 2006; Michel et al., 2006; Rhodes et al., 1989; Valentine, 2001). The other explanation is due to increased motivation when processing racial ingroup compared to outgroup members. Categorizing a person as an ingroup or outgroup member motivates differential processing or preferential attention in which racial ingroup targets are processed in an individuated manner and racial outgroup members are processed in a categorical manner (Bernstein et al., 2007; Hugenberg et al., 2010; MacLin & Malpass, 2001). Specifically, racial outgroup members tend to be seen as relatively homogeneous and are perceived in terms of categorical features they share with other outgroup members, such as hair or skin colour (Bijlstra et al., 2014; Hugenberg & Sacco, 2008; MacLin & Malpass, 2001), whereas racial ingroup members tend to be seen as individuals who merit greater processing effort and attention (Henderson et al., 2005; Hugenberg & Wilson, 2013; Levin, 1996, 2000; Pauker et al., 2009). Perceivers engage in more in-depth processing of racial ingroup compared to outgroup faces (Balcetis & Dunning, 2006; Van Bavel et al., 2008) and use holistic, configural processing instead of feature-based based processing (Goldinger et al., 2009; Hugenberg & Corneille, 2009; Michel et al., 2006; Rhodes et al., 1989; Tanaka et al., 2004; Van Bavel et al., 2008).

Both experiential and motivational factors may have impacted recognition of faces with changing emotional expressions in the present research (Hugenberg et al., 2010). Based on the experience mechanism, the current results may be explained by White participants having more visual experience with White ingroup members compared to Black outgroup members. Seeing as White participants are more familiar with perceiving different emotional expressions on White faces, they are better at recognizing White compared to Black faces. However, this perspective suggests that the results for Black targets can be explained by White targets having more experience seeing anger on Black faces, which is not a likely explanation.

Thus, the motivational perspective in which racial ingroup and outgroup members are processed differently may provide a better explanation of the current results. When White perceivers see White faces, they individuate them by focusing on individuating features, which enables them to better recognize White compared to Black faces. In contrast, White perceivers may have been less motivated to process Black faces and focused more on shared categorical features perceiving Black faces. Furthermore, given this decreased motivation, White perceivers may have relied more on racial stereotypes, specifically the Black-anger stereotype, when perceiving changing emotional expressions on Black faces, which may have directed them more towards features that signaled anger. Overall, these findings are important as they highlight how changing emotional expressions reduces recognition accuracy—at least for White targets and certain facial expressions during encoding for Black targets.

Future Research

Although the present experiments provide an interesting initial pattern of findings, it is clear that further research is necessary. First, while I proposed that one reason for differences in the impact of emotion changes on the ORB is the extent to which participants perceived angry and neutral emotional expressions for White and Black targets as distinct, I did not measure this mechanism. An important avenue for future research, therefore, is to measure these changes in perceived distinctiveness to see if they differ based on the race of target and specific emotions during encoding in the Learning Phase. Second, these initial patterns of results need to be replicated. Given that participants demonstrated an ORB when neutral expressions changed to angry expressions in Experiment 2, but the ORB was reduced when angry expressions changed to neutral expressions in Experiment 3, further research replicating these primary results in one study is recommended.

To address these limitations, I propose two additional experiments. In one study, to address the first limitation, White participants' perceived distinctiveness between White and Black faces with angry and neutral expressions could be measured. Specifically, White participants could initially be presented with a series of White and Black target faces. In one condition, the angry expression would be shown first and later change to the neutral expression, and in the other condition, the neutral expression would be shown first and later change to the angry expression. After viewing the first expression for one target, the participant would complete a distractor task, such as an anagram task, before being presented with the second expression. The participant would then rate the extent the face changed from 1 (not at all) to 100 (very much) on a slider scale. An overall score of change would then be calculated for White and Black targets respectively. Based on the findings from the current research, I predict that participants would provide high ratings of change for White targets as they would see the neutral and angry expressions as distinct from one another, regardless of which expression was presented first. For Black targets, I predict that participants would provide high ratings of change when the expressions change from neutral to angry than when the expressions change from angry to neutral. In this later condition, I expect White participants to continue to perceive anger on the neutral expressions to a greater extent.

To address the second limitation, a future experiment could aim to replicate the pattern of results from the changing emotional expression conditions and additionally measure perceived distinctiveness as a potential mediator. Specifically, a new sample of White participants would be randomly assigned to a condition in which the expression in the Learning Phase changed from either neutral to anger or anger to neutral. In the Recognition Phase, I would measure participants' recognition accuracy of the White and Black target faces with the opposite expression. Next, in a Perceived Distinctiveness Phase, I would measure perceived distinctiveness in which participants would be presented with White and Black target faces from the ORB phases with angry or neutral expressions that change to the opposite expression and rate the extent to which the expressions changed from 1 (not at all) to 100 (very much). Using the overall scores of change as the measure of perceived distinctiveness, I would examine whether perceived distinctiveness mediates the impact of changing expressions on White targets' recognition accuracy of White and Black faces.

When the faces change from neutral to anger, based on previous results, I would expect no difference in perceived distinctiveness for White and Black faces. Although recognition accuracy would decrease since the images are changing, I would still expect participants to show the ORB where they better recognize White compared to Black faces. Furthermore, I would expect participants to provide similar ratings of change for both White and Black faces given the same perceived distinctiveness.

When faces change from anger to neutral, I expect that White perceivers will perceive the expression changes as more distinct on White than Black faces. Since anger is shown during encoding, Black faces with neutral expressions in the Recognition Phase may be seen as angry, which would make them seem less distinct from one another. Given this greater perceived distinctiveness on White faces compared to Black faces, I would expect the ORB to be reduced. I would additionally expect participants to provide higher ratings of the extent to which the expressions changed for White than Black faces due to the greater perceived distinctiveness.

In addition to measuring participants' perceptions of change, future research could also manipulate perceived distinctiveness. In particular, researchers could experimentally manipulate the extent to which emotional expressions on faces objectively change. Although the facial stimuli used in the present research was counterbalanced and equated to ensure there were no significant differences between the stimuli and sets, the incorporation of a facial manipulation software, such as FaceGen Modeller (Singular Inversions Inc., 2022), would make it possible to incrementally manipulate emotional expressions with greater precision and to different degrees (Corneille et al., 2007; Sacharin et al., 2012). By modifying specific facial action units (Ekman et al., 2002), a set of White and Black computer-generated faces could be created with angry expressions that range in intensity from low to high. By examining whether participants' perceptions of change differ depending on the intensity levels of anger and target race, this experiment could provide important insight into emotional identification processes and the ORB.

Another important step for future research would be to explore the moderating effect of participants' implicit prejudice. Because previous research has demonstrated that participants who scored high on implicit prejudice showed a greater readiness to perceive anger on Black but not White faces (Hugenberg & Bodenhausen, 2003, 2004; Hutchings & Haddock, 2008), this bias may also impact the extent to which faces with angry and neutral expressions are perceived as distinct on White and Black faces. In particular, in a future study, after completing the Recognition Phase and the Perceived Change Phase, participants could complete an implicit prejudice measure, such as the Implicit Association Test (IAT; Greenwald et al., 1998). Using participants' scores on the implicit prejudice measure as a moderator, this research could examine whether implicit prejudice significantly moderates participants' perceptions of distinctiveness between the faces and its impact on the ORB.

Notably, the focus of the present research was on the impact of angry and neutral expressions on White perceivers' recognition accuracy. Another way to extend the current research is to explore other emotional expressions. In general, different emotions vary as to how morphologically distinct they appear from one another. For example, although anger and disgust have been characterized as distinctly different emotions (Ekman & Cordaro, 2011), these expressions are considered morphologically similar as they share features, such as narrowed eyes and lowered eyebrows (Cordaro et al., 2018; Ekman, 1993; Ekman et al., 2002; Goeleven et al., 2008; Langner et al., 2010). Similarly, fear and surprise also show partial overlap in their facial morphology due to shared features, such as widened eyes and raised eyebrows (Ekman, 1993; Ekman et al., 2002; Young et al., 1997). Research has demonstrated that perceivers have greater difficulty distinguishing between emotional expressions with morphological similarities, including anger and disgust as well as fear and surprise (Jack et al., 2009; Sacharin et al., 2012). In contrast, examples of morphologically dissimilar expressions include happiness and sadness (Calder et al., 1996) and anger and fear (Aviezer et al., 2008; Susskind et al., 2007).

Importantly, stereotypic associations between race and emotions may interfere with perceptions of morphological differences between expressions. People may infer emotions on certain faces, as seen by the greater tendency to perceive anger on Black faces, even when these faces do not contain unambiguous features related to that emotion (Ackerman et al., 2006; Shapiro et al., 2009). Indeed, research has demonstrated that race-emotion stereotypes guide face perception even when they directly conflict with structural facial cues. For example, even though White faces structurally resemble anger more than Black faces, and Black faces structurally resemble happiness, surprise (Zebrowitz et al., 2010) and fear (Adams et al., 2022) more than White faces, people are faster to see anger on Black faces due to stereotypic associations. In turn, these associations may make changes between morphologically different facial expressions appear less distinct. The results from the present experiment demonstrated that although angry and neutral expressions have objective morphological differences, due to the stereotypic association between anger and Black people, White perceivers' perceptions of neutral expressions were impacted.

Furthermore, there are other factors to consider beyond stereotypes in face perception. For example, research has demonstrated a happy categorization advantage in which participants tend to be faster at categorizing happy expressions compared to negative expressions that is impacted by race (Leppänen & Hietanen, 2003; Kauschke et al., 2019). In general, researchers propose a happy categorization advantage for racial ingroup but not racial outgroup targets. Specifically, participants showed a recognition advantage for happy racial ingroup faces over angry (Craig et al., 2012; Becker et al., 2007; Hugenberg & Sczensny, 2006; Lipp et al., 2015), sad (Hugenberg, 2005), fearful, and surprised (Craig et al., 2017) faces. Although happiness is not stereotypically associated with White or Black people in North America, White participants recognized happy expressions faster on White targets, whereas the opposite was found for Black faces where they were faster at recognizing anger or other negative expressions (Biljstra et al., 2010; Craig et al., 2012; Hugenberg, 2005; Lipp et al., 2015).

Given these findings, future research could look at changes between happiness and negative emotions, such as anger. Although expressions of happiness are morphologically distinct from anger (Calvo & Lundqvist, 2008; Halamová et al., 2022), because people have associations or categorization biases when perceiving happy and angry faces, it would be important to investigate how these associations impact participants' perceptions of changes between these two emotions. Based on the findings of the happy categorization advantage, happiness may be more easily inferred on ingroup faces and may appear more distinct compared to negative expressions on racial ingroup members.

When changing emotional expressions, the results of the present experiments indicate that the emotion shown during encoding in the Learning Phase is the most important for the ORB. Since happiness is not stereotypically associated with any racial group and there is an ingroup advantage for recognizing happiness, it is possible that the pattern of results would replicate those from the current experiments which used neutral expressions. Specifically, when happy White and Black faces change to anger, White perceivers may demonstrate the ORB as they may see the happy expressions from the Learning Phase as distinct from the angry expressions in the Recognition Phase on both White and Black faces. In contrast, if the expressions change from angry to happy, the results may replicate the pattern from Experiment 3 where participants no longer differentiated between White and Black faces. White participants may perceive the transition from anger to happiness as highly distinct on White faces, but due to the Black-anger stereotype, the two expressions may appear less distinct on Black targets as participants may continue to perceive anger on the Black faces after the emotions changed.

Moreover, emotions may be seen differently for different social categories. Specifically, it is important to investigate whether the pattern of results found generalizes across other participant and target groups as well as other stereotypes. Apart from the extensive literature on the Black-anger stereotype (Ackerman et al., 2006; Halberstadt et al., 2022; Hugenberg, 2005; Kang & Chasteen, 2009; Maner et al., 2005, Shapiro et al., 2009), findings have also indicated that Hispanic targets are stereotyped as being aggressive and violent (Bodenhausen, 1990) and in the Netherlands, there are stereotypic associations between Moroccan-Dutch targets and danger (Bijlstra et al., 2010, 2014; Dotsch & Wigboldus, 2008; Verkuyten & Zaremba, 2005).

Given that research on stereotypic emotions has predominantly focused on anger, another future direction could be to explore a broader range of stereotypic emotional expressions. Although research on emotions that are stereotypically associated with other social groups is limited, research has shown that some emotions are associated with East Asians, including shyness (Ho & Jackson, 2001; Ruble & Zhang, 2012) and shame (Wong & Tsai, 2007). A recent pilot study found that sadness, guilt, and embarrassment were also associated with East Asians, and that Latina women were highly associated with love and admiration, but also hate and jealousy (Manokara et al., in prep). Therefore, an important step for future research would be to extend these findings and explore a broader range of associations between emotions and racial groups.

Another avenue for future research is to examine other important social categories such as gender. One of the most prevalent gender stereotypes is that women are generally more emotional than men (Birnbaum et al., 1980; Brody & Hall, 2000; Rosenkrantz et al., 1968; Ruble, 1983; Shields, 2000; Williams & Best, 1990). Although there are mixed findings in the literature regarding gender differences in emotional experience and expression, research has largely demonstrated that men and women *experience* most emotions to a similar degree, but women tend to *express* more emotions than do men (Barrett & Bliss-Moreau, 2009; Brody & Hall, 1993; Fischer et al., 2004; Givon et al., 2023). This finding has largely been attributed to gender display rules regarding emotionality that are held across many cultures. In particular, men are expected to suppress their emotions to display emotional control and stoicism to maintain their masculinity (Brody & Hall, 2008; Chaplin, 2015; Fischer & Manstead, 2000), whereas women are expected to be more emotional and to display more nurturing behaviours and empathy compared to men (Kring & Gordon, 1998; Zahn-Waxler et al., 1991). Garside and Klimes-Dougan (2002) found that parents often discouraged negative emotions like sadness, anger, and fear in boys, while encouraging these same emotions in girls. Furthermore, men are commonly expected to express emotions that signal power, such as anger, contempt, and pride (Brody & Hall, 2000; Fabes & Martin, 1991; Fischer, 1993; Plant et al., 2000, 2004) and women to express happiness, sadness, and fear more often than men (Becker et al., 2007; Briton & Hall, 1995; Hess et al., 2007, 2009; LaFrance et al., 2003). Other emotions that are more strongly associated with women compared to men include awe, embarrassment, distress, guilt, sympathy, love, surprise, shame, and shyness, and that these stereotypes held across various groups including African American, Hispanic American, Asian American, and European American groups (Durik et al., 2006; Plant et al., 2000).

Considering these stereotypic associations between specific emotions and gender, it is important to explore whether these gender stereotypes differentially impact recognition of women compared to men. For instance, since women are stereotyped as being more emotional than men, perceivers may expect women to express more emotions and may be more familiar with seeing a large range of emotions on women's faces (Brody & Hall, 2008; Plant et al., 2000). Thus, perceivers may be able to perceive changes between emotions on women's faces as distinct and may be worse at recognizing women when their emotional expressions change across different contexts compared to men. Alternatively, the stereotypic association between women and emotionality may yield the opposite effect. Since women expressing emotions is in line with a prevalent gender stereotype, perceivers may not see the different expressions as perceptually distinct from one another and may simply perceive the woman as being "emotional" overall, therefore showing less of a decrease in recognition accuracy for changing expressions on women's faces. Overall, it would be important for future research to look at gender when considering changes in emotional expressions as gender stereotypes may impact recognition accuracy.

Another line of future research could explore how other forms of emotional expression, such as body poses, impacts recognition of racial targets. In real life person perception, people may not always be able to see someone's face clearly and may need to rely on body cues to identify a person and extract emotional cues (Fisher & Geiselman, 1992; Wells & Loftus, 2013). For example, during the recent COVID-19 pandemic, when mask mandates were implemented, key information from facial expressions was no longer available, and people had to rely on other cues, such as body poses or vocal tone, to recognize others' emotions. Body poses have been shown to be an important source of information for emotion recognition (Aviezer et al., 2008; Bijlstra et al., 2019; Dael et al., 2012; De Gelder, 2006; Johnson et al., 2011; Martinez et al., 2016; Van den Stock, et al., 2007). Indeed, findings have demonstrated that people show similar accuracy at recognizing emotions through body poses as they are when perceiving facial expressions (Atkinson et al., 2004; de Gelder, 2009; Ross et al., 2022). However, research has yet to explore whether perceiving changing body poses differentially impacts recognition accuracy of targets in an intergroup context compared to changing facial expressions.

Conclusion

The current research examined the ORB and how changing between angry and neutral emotional expressions from initial presentation during the Learning Phase to the Recognition Phase impacts recognition of White and Black faces by White perceivers. The findings indicate that changing emotional expressions of White and Black target faces from the Learning Phase to the Recognition Phase reduced overall recognition accuracy for White participants compared to the presentation of the same expressions. Importantly, for Black targets, while changing from neutral expressions to angry expressions did not differentially decrease recognition accuracy compared to White targets, changing from angry expressions to neutral expressions resulted in a more muted decrease in recognition than for White targets. These findings extend the existing literature and underscore how it is critical to be attentive to recognition accuracy when emotional expressions change, since using the same images during encoding and recognition does not accurately represent real-world face perception in which people's emotions and emotional expressions change across different contexts (Bruce & Young, 1986; Longmore et al., 2008, 2017). Given worldwide increases in immigration, multiculturalism, and racial diversity, understanding how subtle changes, such as shifts in emotional expressions, impact recognition accuracy in an intergroup context is crucial. Furthermore, given the current findings and the serious potential consequences of misidentifying individuals, such as hiring disadvantages or wrongful convictions due to eyewitness misidentification, it is especially important to consider how changing emotional expressions from exposure to recognition may exacerbate these issues for Black individuals, especially in cases where emotions run high. Although further research is necessary to replicate these results and to measure perceptions of change between the angry and neutral expressions on White and Black faces, these initial findings indicate that stereotypic emotional expressions can have important consequences for facial recognition accuracy.

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Appendices

Appendix A: Backend and Demographic Questions

"What was the purpose of the experiment?"

"What did you think the experimenter expected to find?"

"With which gender do you most identify?"

"What is your age in years?"

"What is your ethnicity/cultural background? You may choose as many categories as you identify with."

"How many years have you lived in Canada or the United States?"

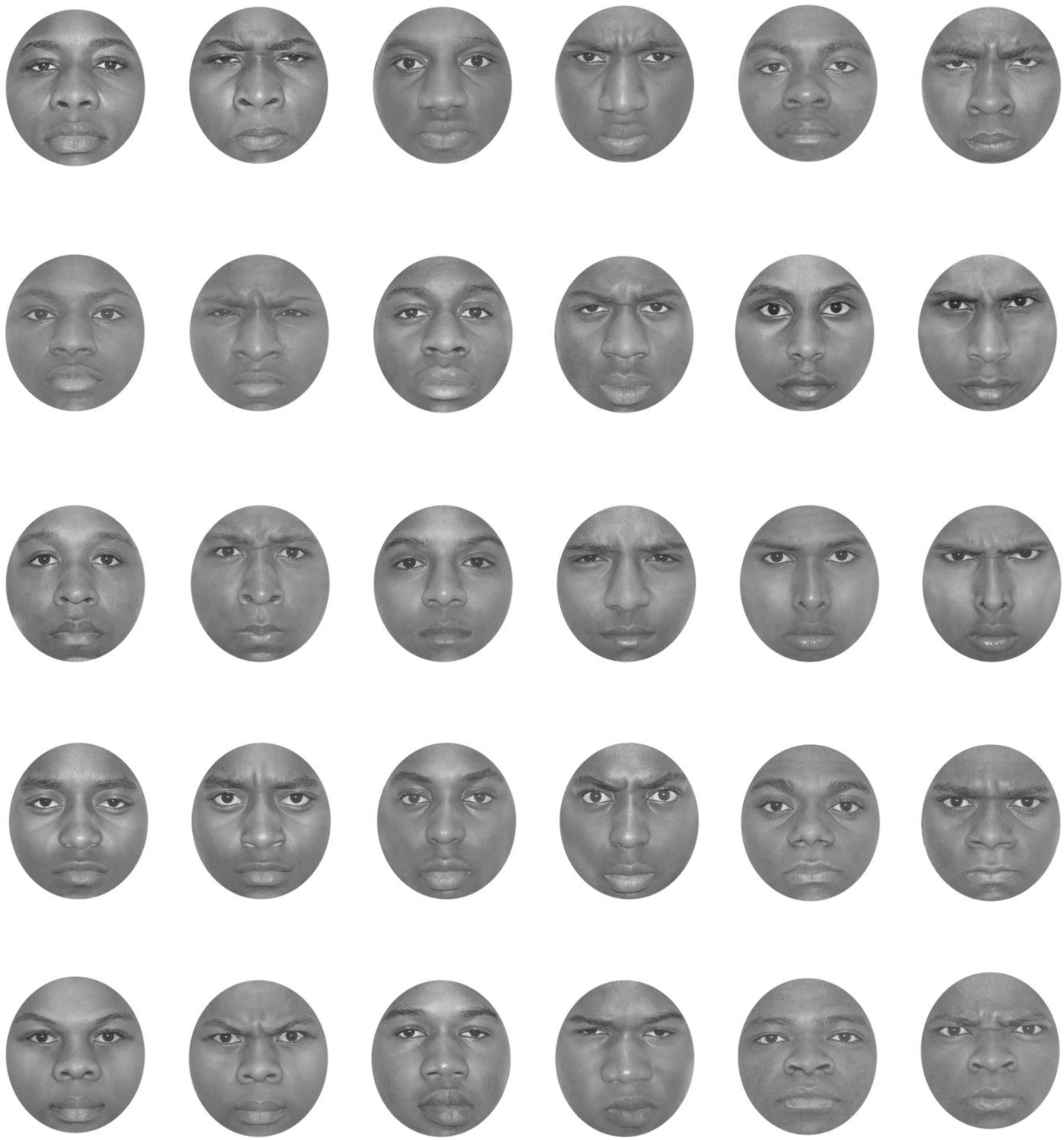
"How many years have you been speaking English?"

"Have you ever been diagnosed with a mental illness? If so, please describe the illness. If not, select "No"."

Appendix B: Stimuli with Neutral and Angry Expressions Used in Experiments 1, 2 and 3

Black Female

Black Male

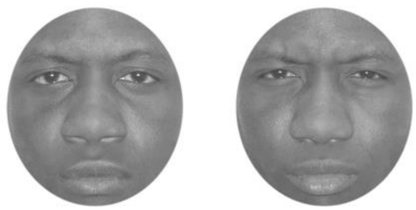


White Female

White Male

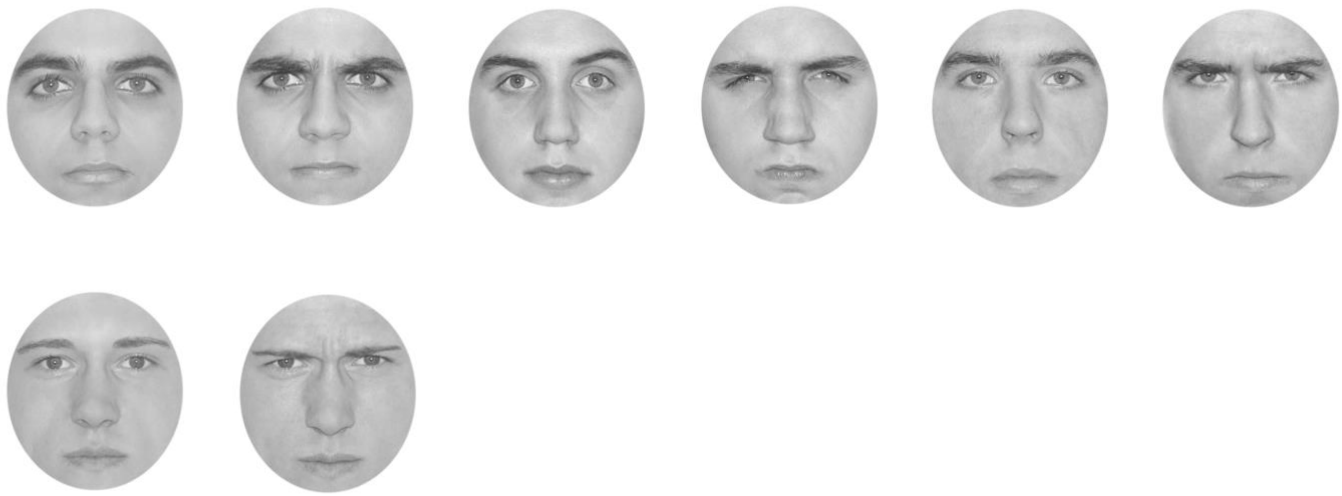
Appendix C: Stimuli with Neutral and Angry Expressions Used Only in Experiment 1

Black Male



White Female

White Male



Appendix D: Angry and Neutral Stimuli Used Only in Experiments 2 and 3

Black Male

White Female

White Male