TRAINED PERSON-KNOWLEDGE OF FACES VARYING IN RACE: LEARNING AND IMPRESSION FORMATION

by

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A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Honors Degree in Bachelor of Science in Neuroscience with Distinction.

Spring 2023

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ACKNOWLEDGMENTS

I would like to thank Dr. Jennifer Kubota and Dr. Jasmin Cloutier for welcoming me into the IFSN Lab and for creating a positive lab environment that has allowed me to grow as a student and research assistant over the past two years. Thank you for your advice as I worked to complete this thesis. I am excited to continue to learn and grow as a member of the lab for another year through the Neuroscience 4+1 program.

I would like to thank Tzipporah Dang and Grace Handley for their support and mentorship. Tzipporah welcomed me onto this project when I first joined the lab, and her patience and guidance gave me the opportunity to create a solid foundation upon which I continue to learn and build. Grace has guided me through the last year of this project, and I am very grateful for all the invaluable advice and assistance that she has offered me throughout this process.

Lastly, I would like to thank my friends and family for their support. I would especially like to thank my parents for their encouragement and my sister for being there for me through the highs and lows of college.

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ABSTRACT

Our impressions of others are influenced by a variety of factors that can ultimately impact our ability to accurately remember them. When we inaccurately identify another, there can be harmful consequences. This is especially the case within the U.S. judicial system, where incorrect eyewitness memory, particularly of racial out-group members, has contributed to a sizeable number of wrongful convictions. We investigated the influence of target race, person-knowledge valence, and perceiver interracial contact on White perceivers' ability to recognize and recall information associated with Black and White male faces. Over five behavioral training sessions, White participants (*n*=60) learned about Black and White male faces that were paired with positive person-knowledge, negative person-knowledge, or no information and were subsequently tested on their memory. On the fifth day, they completed individual difference measures, including a lifetime interracial contact questionnaire. Results revealed that after five days of behavioral training, participants were better able to recognize White faces compared to Black faces and faces paired with person-knowledge compared to faces paired with no information. Additionally, participants demonstrated better recall of person-knowledge statements paired with White faces than with Black faces. These results offer insight into how target race and person-knowledge availability influence memory of learned faces. Future analysis will examine the development of these effects over five behavioral training sessions and the involvement of specific brain regions during impression formation of people varying in race and familiarity.

Chapter 1

INTRODUCTION

Many factors can influence how well we remember another person, particularly someone from a different racial group. Failing to recognize or remember another accurately can lead to consequences for the perceiver and the target. For a perceiver, inaccurately recognizing someone may lead to feelings of embarrassment or criticism, while the misidentified target may feel insulted or stereotyped (Brigham & Malpass, 1985). In more severe cases, a target may face legal consequences such as a wrongful conviction as a result of incorrect eyewitness identification (Brigham & Malpass, 1985). This form of evidence has been valued by the criminal justice system even though it has a high frequency of inaccuracy, especially for other-race targets, such that incorrect eyewitness testimony of other-race targets has previously been found to contribute to at least 36% of wrongful convictions in the United States (Brigham & Malpass, 1985; Scheck, Neufeld, & Dwyer, 2003). As a result, it is important to explore approaches that may lessen one's likelihood of misidentifying another and to better understand the various factors that contribute to our ability to identify others.

In this introduction, I will present existing literature examining some of these factors, beginning with a discussion of how our level of familiarity with another person can influence our impressions of them. Next, I will discuss how the valence of the information we learn about another can impact our evaluations and memories due to a negativity bias. Then, I will examine how our ability to recognize the faces of others is influenced by whether they are a racial in-group or out-group member in accordance with the other race effect (ORE). I will also describe how our characteristics, such as our history of interracial contact, might affect how well we remember a particular target. The goal of the current study was to examine participant face recognition and cued recall of person-knowledge after five days of behavioral training as a function of target race (Black, White), person-knowledge valence (positive, negative, none), and perceiver individual differences (e.g., lifetime interracial contact).

1.1 Impression Formation and Person-Knowledge

Throughout our daily lives, we encounter people with varying levels of familiarity. They can be entirely novel, such as a person you pass by on the sidewalk one day, perceptually familiar, such as a cashier at a grocery store that you frequent, or paired with person-knowledge, such as a close friend you have known since childhood. The level of familiarity that we have with others can influence the impressions that we form of them. For example, when we encounter a stranger, we can utilize perceptual cues, such as skin color or gender, to quickly categorize that person into a social category (Fiske & Neuberg, 1990). On the other hand, as we attend to additional information about that person and learn more about them beyond initial perceptual cues, we can form a more individuated impression (Fiske & Neuberg, 1990). An individual's group membership and our own goals and motivations can affect the degree to which we favor forming a category-based impression versus an individuated impression. For example, perceivers tend to categorize out-group members more than in-group members, and out-group categories are more likely to be negative while in-group categories are more likely to be favorable (Fiske and Neuberg, 1990). Additionally, when we are motivated to attend to additional information about another, we can move beyond our initial rapid category-based impression to form a more individuated impression (Brewer, 1988; Fiske & Neuberg, 1990).

The available perceptual cues and information we use to form impressions of another can influence our memory of that person. One study found that facial appearance properties that led to inferences of trustworthiness and untrustworthiness resulted in increased recognition memory for those faces compared to neutral faces regardless of context (Mattarozzi et al., 2014). Beyond perceptual cues and context, the availability of person-knowledge, such as the beliefs or behaviors that we learn about another person, can also allow us to better individuate and remember them (Fiske & Neuberg, 1990).

Moreover, the type of person-knowledge that we learn can also influence our memory. When an individual is paired with information perceived to be incompatible with a stereotype or an expectation, we tend to individuate them, resulting in more accurate memories of them (Fiske & Neuberg, 1990). For example, a stereotype-congruent pair, such as an aggressive Black man, might be less memorable to a perceiver than a stereotype-incongruent pair, such as a meek Black man. Our memory can also be influenced by whether the available information is valenced. In one study, across two experiments, participants displayed a greater memory for faces that were paired with negative or positive information compared to faces that were paired with neutral or no information after a 1-week delay between the encoding and test sessions (Mattarozzi et al., 2019). These results demonstrate that emotionally charged behavioral information can play a role in facilitating memory of face identity (Mattarozzi et al, 2019).

1.2 Negativity Bias

The positivity or negativity of stimuli can influence our evaluations. We tend to feel more positively than negatively towards mild stimuli due to a positivity offset, while we tend to feel more negatively than positively about more intense stimuli due to a negativity bias (Ito & Cacioppo, 2005; Norris et al., 2011). Individual differences in these phenomena generalize across various stimuli, such as pictures, sounds, words, and monetary outcomes from games of chance, and are stable over time (Ito & Cacioppo, 2005; Norris et al., 2011). Individual differences in the positivity offset and negativity bias were displayed in a study by Ito and Cacioppo (2005), where they found that individuals with a stronger positivity offset displayed a more positive response to neutral information about another, while individuals with a stronger negativity bias displayed a more negative response to negative information about another.

Rozin and Royzman (2001) assert that negativity bias results from the greater dominance, contamination, and salience of negative stimuli compared to positive stimuli of the same intensity. Due to this negativity bias, we tend to remember extremely negative incidents more than extremely positive incidents (Rozin & Royzman, 2001). In a study by Ratliff and Nosek (2011), the researchers evaluated whether implicit and explicit attitudes towards novel group members could be learned from their associations with learned in-group and out-group members. They found that negative implicit attitudes were transferred more to out-group members than in-group members, while positive implicit attitudes did not transfer (Ratliff & Nosek, 2011). The researchers note that this finding demonstrates the greater potency of negative versus positive information (Ratliff & Nosek, 2011; Rozin & Royzman, 2001). In the second part of this study consisting of only White participants, the researchers found that negative and positive implicit attitudes were transferred to a greater extent to Black targets than White targets (Ratliff & Nosek, 2011). Even though negative implicit attitudes were transferred to Black targets, negative explicit attitude transfer was strongly resisted for these targets, suggesting that participants employed corrective processes to appear unbiased (Ratliff & Nosek, 2011). Overall, these results demonstrate the influence of negativity bias on social interactions and impression formation, especially involving out-group members. In this study, we examined how the availability of negatively or positively valenced person-knowledge influenced White perceivers' ability to remember Black and White faces.

1.3 Other-Race Effect (ORE)

Another factor that influences how well we recognize other people is the ORE. According to the ORE, we have more accurate memory for the faces of racial in-group targets than of racial out-group targets (for review, see Meissner & Brigham, 2001). This effect has been found in studies where White participants viewed Black and White faces and demonstrated greater recognition accuracy for neutral White faces than neutral Black faces (Ackerman et al. 2006).

Even though the ORE has been documented as a robust, reliable, and generalizable phenomenon, there are still debates concerning its underlying mechanisms (Meissner & Brigham, 2001). Theories that attempt to explain the ORE include the perceptual expertise hypothesis and the social cognitive model (Correll et al., 2017; Hugenberg et al., 2007). According to the perceptual expertise hypothesis, perceivers more accurately remember racial in-group faces because they have greater experience in distinguishing these faces over time (Correll et al., 2017). This leads to more individuated visual representations of racial in-group faces and shapes perceivers' expectations about facial appearance (Correll et al., 2017). On the other hand, according to the social cognitive model, the ORE arises due to the tendency of perceivers to individuate racial in-group members and think categorically of racial out-group members (Hugenberg et al., 2007; Hugenberg & Sacco, 2008). In this case, thinking categorically of out-group members reduces a perceiver's ability to differentiate members belonging to a given social category, leading to the difference in face recognition displayed in the ORE (Hugenberg & Sacco, 2008).

When investigating the social cognitive model approach, researchers found that the ORE can be influenced by perceiver motivation (Hugenberg et al., 2007; Hugenberg & Sacco, 2008).

In a previous study, the ORE was eliminated when perceivers were motivated to individuate racial out-group faces and were given knowledge of their tendency to think about racial out-group members categorically (Hugenberg et al., 2007). The researchers argue that this suggests that the ORE is due to differences in perceiver social cognitive processes, where participants changed their thought process from categorizing other-race faces to individuating these faces (Hugenberg et al., 2007). In a follow-up study, Young and Hugenberg (2012) expanded on these findings by observing that motivation and interracial contact may shape this effect.

Additional studies have also demonstrated the influence of perceiver motivation on the ORE. A study by Shriver and Hugenberg (2010) evaluated whether manipulating the perceived power of out-group members motivated participants to process targets in a more individuated manner and influenced their memory of faces (Shriver & Hugenberg, 2010). In two experiments, they found that the ORE was attenuated in White participants for powerful Black targets due to increased recognition for these targets (Shriver & Hugenberg, 2010). Furthermore, in a study by Ackerman et al. (2006), the researchers predicted that compared to neutral faces of out-group members, angry faces of out-group members would be seen as more relevant and receive a greater allocation of cognitive resources, leading to increased recognition accuracy of these faces. In line with this prediction, the ORE was eliminated when participants viewed angry Black and White faces due to improved recognition accuracy for angry Black faces (Ackerman et al. 2006). This elimination of the ORE in White perceivers viewing angry Black and White faces was also displayed in a study by Young and Hugenberg (2012), in which angry facial expressions elicited a high motivation to individuate and led to increased recognition accuracy of Black faces. In this current study, we examined White participants' ability to accurately remember White and Black faces of varying familiarity after five behavioral training sessions.

1.4 Interracial Contact

Moreover, the amount of interracial contact we experience throughout our lifetime also might affect how we perceive and remember others. Previously, researchers found that increased interracial contact throughout one's lifetime, both currently and during childhood, was associated with decreased implicit racial bias in a diverse group of participants (Kubota et al., 2017). Furthermore, differences in interracial contact are associated with changes in the accuracy of inferring mental states of racial in-group and out-group members during a Reading the Mind in the Eyes task, and motivation interacted with interracial contact to play a role in mentalizing accuracy (Handley et al., 2021).

Expanding on the interaction between motivation and interracial contact and their relationship with the ORE, researchers have found that when individuals have greater interracial contact, the ORE can be overcome with motivation to individuate (Young & Hugenberg, 2012). Previously, when White perceivers were motivated to individuate Black faces upon receiving individuation instructions, a decrease in the ORE due to greater recognition of Black faces was associated with greater interracial contact (Young & Hugenberg, 2012). This suggests that perceiver motivation and interracial contact can interact to elicit recognition of other-race faces (Young & Hugenberg, 2012). As a result, we want to examine the influence of interracial contact on participants' memory of faces varying in race and information in this study.

1.5 Current Study

The primary research questions of this study include: (1) is memory of individuating information influenced by person-knowledge valence and target race and (2) to what extent does interracial contact influence memory? To address these questions, White participants underwent five behavioral training sessions. During each session, participants learned about Black and

White male faces that were paired with positive person-knowledge, negative person-knowledge, or no information. They were then tested on their ability to recognize the faces, correctly identify statement valence, and recall person-knowledge statements. This thesis specifically addresses the influence of target race, person-knowledge valence, and perceiver interracial contact on face recognition and cued recall of person-knowledge on the fifth day of training.

1.5.1 Behavioral Training Predictions

By the fifth day of behavioral training, we expected that White participants would display greater memory for White versus Black faces in accordance with the ORE. We also predicted that this preferential memory for White faces would be attenuated in individuals with greater lifetime interracial contact. This prediction was based on a previous study that found that when individuals have greater interracial contact, the ORE can be overcome with motivation to individuate (Young & Hugenberg, 2012). We expected that there would be increased memory for negative face-statement pairs compared to positive face-statement pairs due to a negativity bias (Rozin & Royzman, 2001). Lastly, we predicted that participants would show increased memory for negative-White and positive-Black targets. In this case, these targets may be perceived as being incompatible with favorable in-group and negative out-group associations, leading to greater individuation and more accurate memories of them (Fiske and Neuberg 1990).

Chapter 2

METHOD

2.1 Participants

Participants were recruited from the University of Delaware SONA pool and the local community. Prior to beginning the study, participants completed an eligibility survey. Participation was restricted to individuals who (1) self-identify as White (non-Hispanic), (2) are between the ages of 18 and 35 years old, (3) are right-handed, (4) have lived in the U.S. for at least 5 years, (5) have good command of the English language, (6) have no history of drug abuse, (7) have no history of serious head injury, (8) have no color vision problems, (9) have no current acute illness, (10) are not currently taking psychotropic medication, (11) have no diagnosis of developmental disorders, (12) have no diagnosis of a chronic disease that compromises mental, neural, or autonomic function, and (13) pass a standard MRI safety screen.

Participants were compensated using either course credit, cash, or a combination of both. Outside of the scanner, those that chose to participate for course credit were compensated at a rate of 1 SONA credit per hour and those that chose to participate for cash were compensated at a rate of $10 per hour. All participants were compensated $25 per hour for time inside the scanner.

Of the 93 participants recruited from the SONA pool and the 45 participants recruited from the community, 40 participants were excluded due to missing the attention check criteria, and 38 participants were excluded due to missing more than one training session, not completing a training session, withdrawing from the study, or being unable to complete the fMRI scanning session. 60 participants (mean age = 18.917 years, SD = 1.239 years, 44 female, 15 male, 1 preferred not to answer) completed all 5 training sessions plus the fMRI scanning session.

2.2 Exclusion Criteria

Participants who missed more than one day of participation were eliminated from the study and compensated for their completion to that point. Before the start of each training session, participants were told that there would be catch trials, in which one of four faces (2 Black and 2 White) would appear in the center of the screen with a red number on their forehead. During the encoding phase, the participant needed to enter the number within 2 seconds of the face appearing. During the test phase, the face remained on the screen until the participant entered their response. These catch trials were interspersed throughout the encoding and test phases to ensure that participants paid attention to the task. To complete a training session and remain in the study, participants were required to pass the catch-trial exclusion criteria in the encoding and test phases.

In each encoding phase over the five training days, there were 42 catch trials. After each session, participants who answered at least 32 out of 42 catch trials correctly were permitted to continue participating in the study while those who answered less than 32 out of 42 catch trials correctly were eliminated from the study. Each test phase over the five training days included 8 catch trials utilizing the same faces from the encoding phase catch trials. After each session, participants who answered at least 6 out of 8 catch trials correctly were permitted to continue participating in the study, while those who answered less than 6 out of 8 catch trials correctly were eliminated from the study. Participants who did not pass a given day's encoding or test phase catch trial exclusion criteria were not permitted to continue participating in the study and were compensated for what they had completed to that point. Only participants who completed all five encoding and test phases, passed the catch trial exclusion criteria in the encoding and test phases, and attended a subsequent fMRI scanning session were included in the analysis.

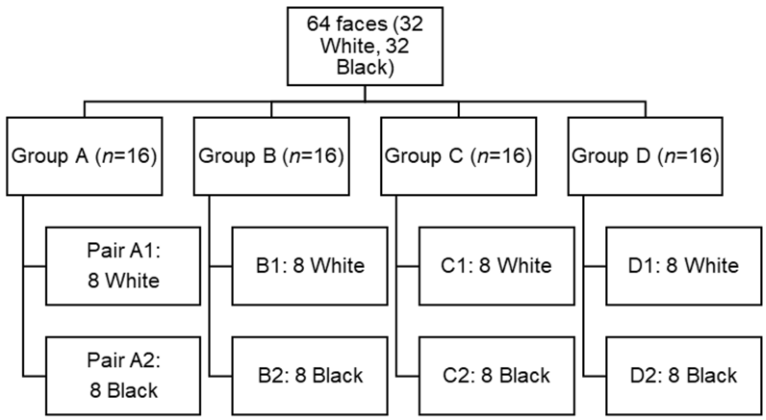
2.3 Stimuli

The face and statement stimuli were equated before the study to ensure that any differences between the groups would not be due to nonessential factors of the stimuli (valence, race). The equating procedure is described below.

2.3.1 Equating Faces

A set of approximately 750 pictures of Black and White male faces with directed eye gaze was collected from online databases and online searches (Burton, White, & McNeill, 2010; DeBruine & Jones, 2017; Eberhardt, Davies, Purdie-Vaughns, & Johnson, 2006; Kennedy, Hope, & Raz, 2009; Ma, Correll, & Wittenbrink, 2015; Mende-Siedlecki, Qu-Lee, Goharzad, & Drain, 2019; Nordstrøm, Larsen, Sierakowski, & Stegmann, 2004; Strohminger et al., 2016; Thomaz, 2006; Tottenham et al., 2009). The stimuli were cropped from the neck up and around the hair, placed in front of a white background, and grayscaled. Amazon Mechanical Turk participants then pretested these pictures. After exclusions, 141 faces (78 Black and 63 White) were equated by participant group and race on nine dimensions: age, attractiveness, distinctiveness, dominance, expression, likeability, quality, race, and trustworthiness. The final set of face stimuli consisted of 64 faces that were divided into four groups of 16, with equal distribution of Black and White faces in each group (Figure 1). For more information on how the faces were equated, see the study preregistration at https://osf.io/4k8ve.

Figure 1: Grouping of Face Stimuli



Note. 64 faces were divided into 4 groups (Groups A-D), with each group containing 16 faces (8 Black, 8 White).

2.3.2 Equating Statements

Person-knowledge statements were collected from statements in a database with pilot data (Mende-Siedlecki & Havlicek, in prep). Statements that utilized the plural, gender-neutral, or female terms or described extreme (e.g., rape) or unusual cases were eliminated. After exclusions, 96 statements were equated on arousal, race stereotypicality, and the absolute value of valence. These statements were then divided into 16 groups containing three negatively valenced statements each and 16 groups containing three positively valenced statements each. For more information on how the statements were equated, see the study preregistration at https://osf.io/4k8ve.

2.4 Training Session Procedure

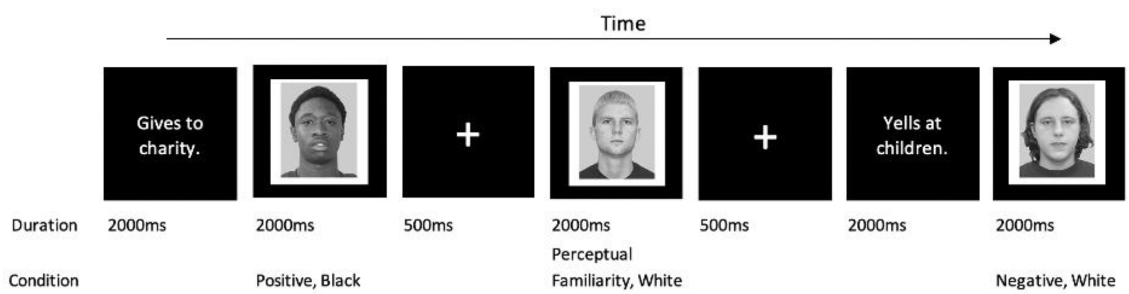
This study was a 2 (Target Race: Black, White) x 4 (Familiarity: positive person-knowledge, negative person-knowledge, perceptually familiar only, novel) x 5 (Session: 1, 2, 3, 4, 5) x continuous (lifetime interracial contact) mixed design. Participants completed the five training sessions over five separate days. Participants were allowed to miss one scheduled day over the course of training. After completing Day 3, participants were called for MRI screening and scheduling. Days 4 and 5 were scheduled based on the scan date. Consequently, Day 4 was scheduled two days before scanning, and Day 5 was scheduled one day before scanning. If a participant's scan had to be rescheduled, they did an abbreviated training the day before their rescheduled scan. During each training session, participants would complete one encoding phase and one test phase. During the encoding phase, they would learn about faces. During the test phase, they were tested on their memory of what they had learned. Participants also completed an independent face recognition task before beginning training on Day 1 and after being scanned. This involved an encoding phase and test phase utilizing faces not included in any other part of the study.

2.4.1 Encoding Phase

During the encoding phase, participants were directed to an Inquisit program in which they learned about 48 Black and White male faces (24 Black, 24 White). Prior to beginning the encoding phase, participants were given instructions and a chance to practice the task. They were also told that they would be tested on their memory for the type of information and for the specific statements with which each face was paired.

One-third of the faces were paired with three unique positive statements in the positive person-knowledge condition, one-third were paired with three unique negative statements in the negative person-knowledge condition, and one-third were paired with no statements in the perceptually familiar condition. Each condition contained an equal number of Black and White faces. All 48 faces were presented in the center of the screen and shown nine times for 432 trials per encoding phase. As a result, the participants saw each specific face-statement pair in the positive and negative person-knowledge conditions three times. In the person-knowledge conditions, a given statement was presented on the screen for 2000ms and was followed by the presentation of its face-pair for 2000ms. The perceptually familiar faces were each presented on the screen for 2000ms without any preceding statements nine times. After each face, a fixation cross appeared in the center of the screen for 500ms to separate each trial.

Figure 2: Encoding Phase



Note. Participants learn about Black and White male faces that are paired with positive person-knowledge, negative person-knowledge, or no information. The first face shown is a Black target paired with positive person-knowledge. The second face shown is a White target preceded by no information (perceptually familiar condition). The third face shown is a White target preceded by negative person-knowledge.

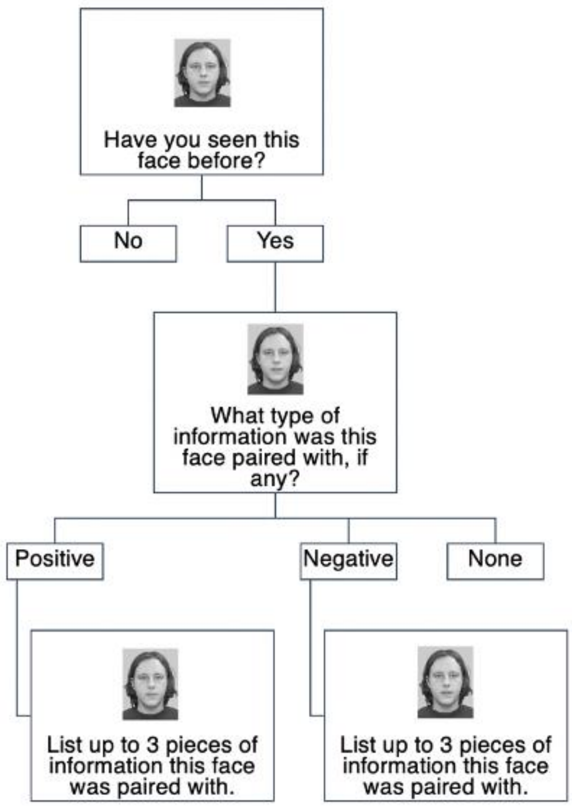
2.4.2 Test Phase

Directly following the encoding phase, participants completed the test phase. The test phase evaluated three dependent variables (DVs): Face Recognition, Valence Attribution, and

Cued Recall of Person-Knowledge. This thesis will analyze two of these DVs: Face Recognition and Cued Recall of Person-Knowledge. Before beginning the test phase, participants were given instructions and a chance to practice the task. During the test phase participants were shown a total of 72 faces consisting of the 48 familiar faces they had learned about in the encoding phase and 24 novel Black and White male faces that they had not seen before. The novel faces presented in each test phase over the course of the five-day study were different, resulting in a total of 144 novel faces. Participants were shown each of the 72 faces once.

During the test phase, participants were asked up to three questions for each face in a stepwise manner (see Figure 3). At the beginning of each trial, a face appeared in the middle of the screen with the first question below. The first question evaluated the participant's ability to recognize the faces they had learned and asked, "Have you seen this face before?" The participant would respond "Yes" or "No" to indicate whether they thought the face was familiar or novel. If the face was novel or the participant incorrectly identified a familiar face as novel, they moved on to the next trial. If they correctly identified a familiar face, they were presented with a new question below the face. This second question evaluated valence attribution and asked, "What type of information was this face paired with, if any?" The participant would respond either "Positive," "Negative," or "None." If they correctly selected "None" or incorrectly selected "None," "Positive," or "Negative," they moved on to the next trial. If the participant correctly identified the valence of the face-statement pair, the face was presented with a new question below it. This third question evaluated the participant's cued recall of person-knowledge and asked the participant to "List up to three pieces of information that this face was paired with." After submitting their answer, the participant was shown the three correct person-knowledge statements before moving on to the next trial. For each question asked, the participant would not move on until they answered. Whenever they answered incorrectly, the participant moved on to the next trial. Whenever a question did not require any further recall (e.g., if a face was novel and the participant correctly identified it as novel), the participant moved on to the next trial.

Figure 3: Test Phase



Note. Participants are shown the learned faces in addition to novel faces and are tested on their memory. First, participants identify whether they have seen the face before. If they correctly answer “Yes”, they are asked what type of information the face was paired with, if any. If they correctly answer “Positive” or “Negative”, they are asked to list up to 3 pieces of information that the face was paired with.

2.4.3 Individual Difference Measures

Following the fifth training session, participants were directed to Qualtrics where they answered demographic questions and completed several individual difference measures, including the Race Implicit Association Test (IAT), Internal and External Motivation to Respond without Prejudice Scales (IMS/EMS), Symbolic Racism Scale (SRS), Modern Racism Scale (MRS), Perceived Stress Scale (PSS), Fear of the Coronavirus, Interracial Contact Questionnaire, and Feeling Thermometers. The Interracial Contact Questionnaire was the only confirmatory individual difference measure collected.

The Interracial Contact Questionnaire assessed participants' lifetime level of interracial contact by examining the racial composition of their childhood and current social networks (Asian, Black, Hispanic, White, and other) (Cloutier et al., 2014). Participants were asked to report their familiarity with racial out-group members across several social categories of closeness, such as friendships, peers, and neighbors. For example, they would be asked "What percentage of your neighbors (think about the closest 100 households) belonged to each of the following categories?" Participants were asked to respond so that each racial group percentage estimate added up to 100%. This was recorded for four stages of their lives: 0–6 years old, 7–12 years old, 13–18 years old, and currently.

We calculated participants' average childhood (encompassing all contact before the age of 18) and current contact scores with Black and White people. Then we subtracted their average contact with White people from their average contact with Black people to compute a difference score that ranged from -100 (0% contact with Black people) to +100 (100% contact with Black people). A composite measure of lifetime interracial contact was calculated by averaging participants' childhood and current contact difference scores.

2.5 Analysis

Coding of the person-knowledge statements recalled by the first 27 participants during the test phase was done independently by two lab research assistants. If there was no consensus among the two raters, a third tie-breaker rater was used for the non-consensus items. One lab research assistant coded the person-knowledge statements recalled by the last 33 participants during the test phase. Coding was done to evaluate whether each participant-generated statement matched the gist of the provided statements and gave the same impression of the face they were paired with. For example, if the provided statement was “Fell out of a tree while doing yard work,” the participant's answer of “fell out of a tree” would be correct.

Analyses were conducted in R (R Core Team, 2018) using the glmer and lmer function of the lme4 package (Bates, Maechler, Bolker, & Walker, 2015). A logistic regression model was used to analyze the dependent variable of Face Recognition. The omnibus model was: glmer (Accuracy ~ Race * Condition * Contact + (1 + Race * Condition | subject), data = data). In two separate models, condition was contrast coded as 1) Perceptually Familiar (-0.66), Positive Person-Knowledge (0.33), Negative Person-Knowledge (0.33), Distractor (0) or 2) Perceptually Familiar (0), Positive Person-Knowledge (+0.5), Negative Person-Knowledge (-0.5), Distractor (0). In both models, race was contrast coded as White (-0.5) and Black (+0.5) and contact was entered as a *z*-scored continuous variable.

A mixed effects linear regression model was used to analyze the dependent variable of Cued Recall of Person-Knowledge. The omnibus model was: lmer (Accuracy ~ Race * Valence * Contact + (1 + Race * Valence | subject), data = data). Statement valence was contrast coded as Positive Information (+0.5) and Negative Information (-0.5). Target race was contrast coded as White (-0.5) and Black (+0.5). Lifetime contact was entered as a *z*-scored continuous variable.

We decomposed the highest-order significant interaction in each model to test simple differences and simple slopes.

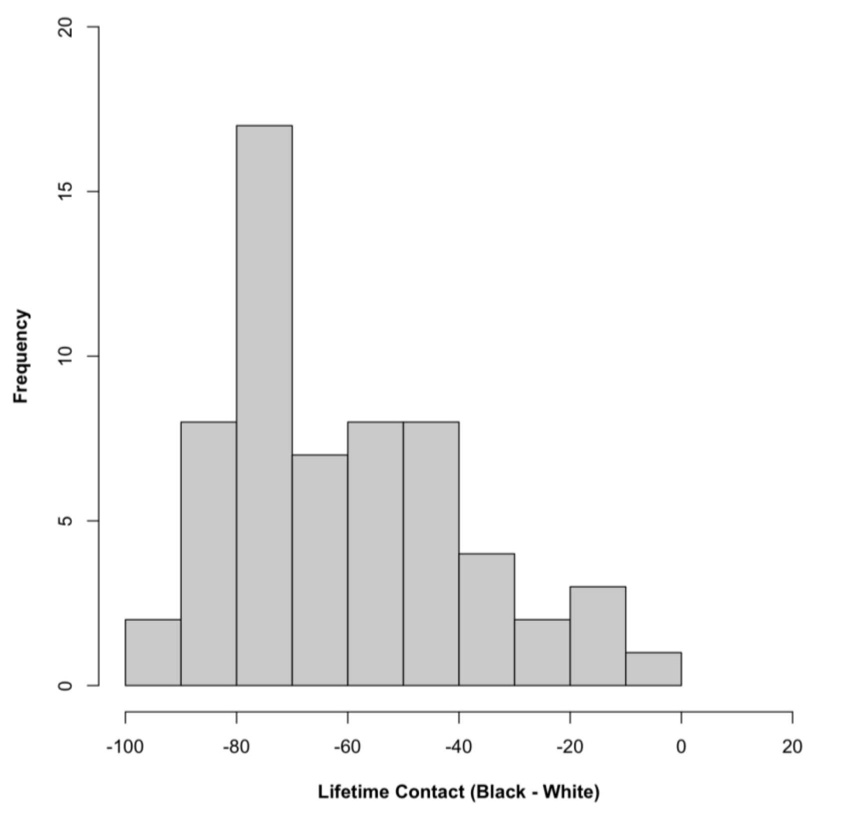
Chapter 3

RESULTS

3.1 Participant Lifetime Interracial Contact

The average participant lifetime interracial contact score collected through the Interracial Contact Questionnaire was -60.891 with a standard deviation of 20.951 (Figure 4). The minimum score was -91.403 and the maximum score was -4.916.

Figure 4: Distribution of Lifetime Interracial Contact Scores



3.2 Face Recognition

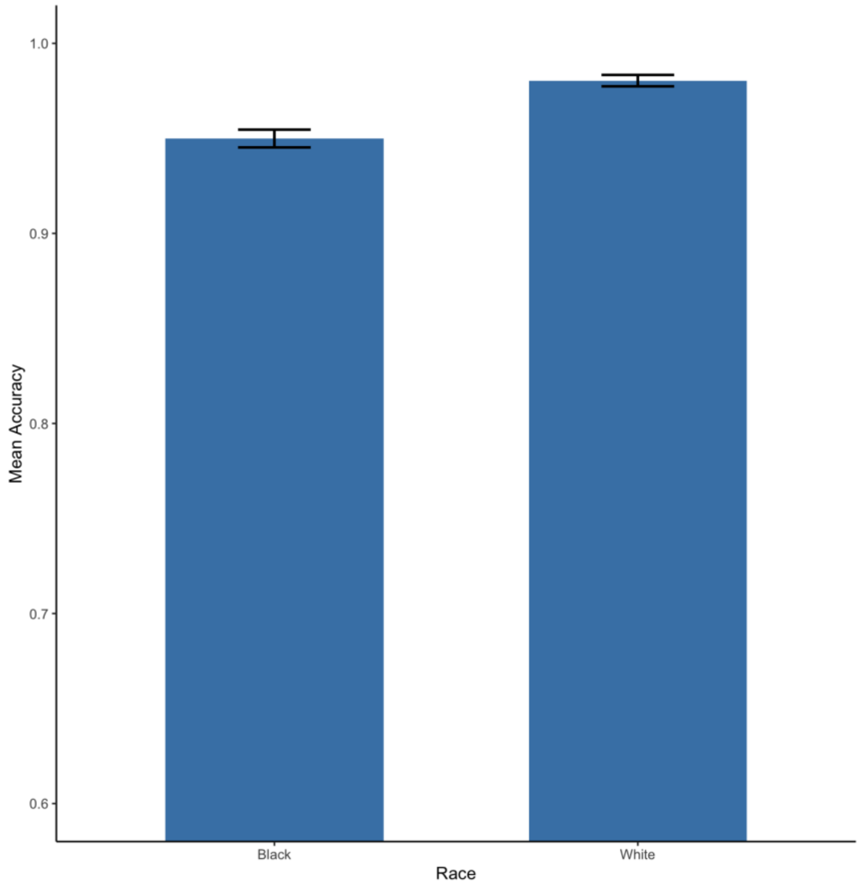
We measured participants' ability to accurately recognize faces depending on target race (Black, White), condition (person-knowledge, perceptually familiar), and participant lifetime interracial contact scores. The model failed to converge; however, results revealed a significant main effect for target race, *b* = -1.811, *SE* = 0.780, *z* = -2.321, *p* = 0.020; and condition, *b* = 3.724, *SE* = 0.786, *z* = 4.740, *p* < .001 (Table 1). Participants had greater recognition accuracy for White targets than Black targets (Figure 5). Participants also had greater recognition accuracy for faces that were paired with person-knowledge than perceptually familiar faces (Figure 6). Participants accurately recognized 97.343% (SD = 16.084%) of faces paired with any person-knowledge and 90.938% (SD = 28.722%) of faces paired with no person-knowledge. There were no significant effects for lifetime interracial contact.

Table 1: Significant Main Effects for Target Race and Condition for Face Recognition

Contrast	***b***	***SE***	***z value***	***p-value***
Intercept	5.512	0.538	10.239	**< .001**
Race	-1.811	0.780	-2.321	**0.020**
Condition (PK vs. PF)	3.724	0.786	4.740	**< .001**
Lifetime Contact	0.301	0.353	0.852	0.395
Race x Condition	-1.058	1.307	-0.810	0.418
Race x Lifetime Contact	- 0.330	0.318	-1.036	0.300
Condition x Lifetime Contact	0.532	0.422	1.260	0.208
Race x Condition x Lifetime Contact	-0.685	0.578	-1.185	0.236

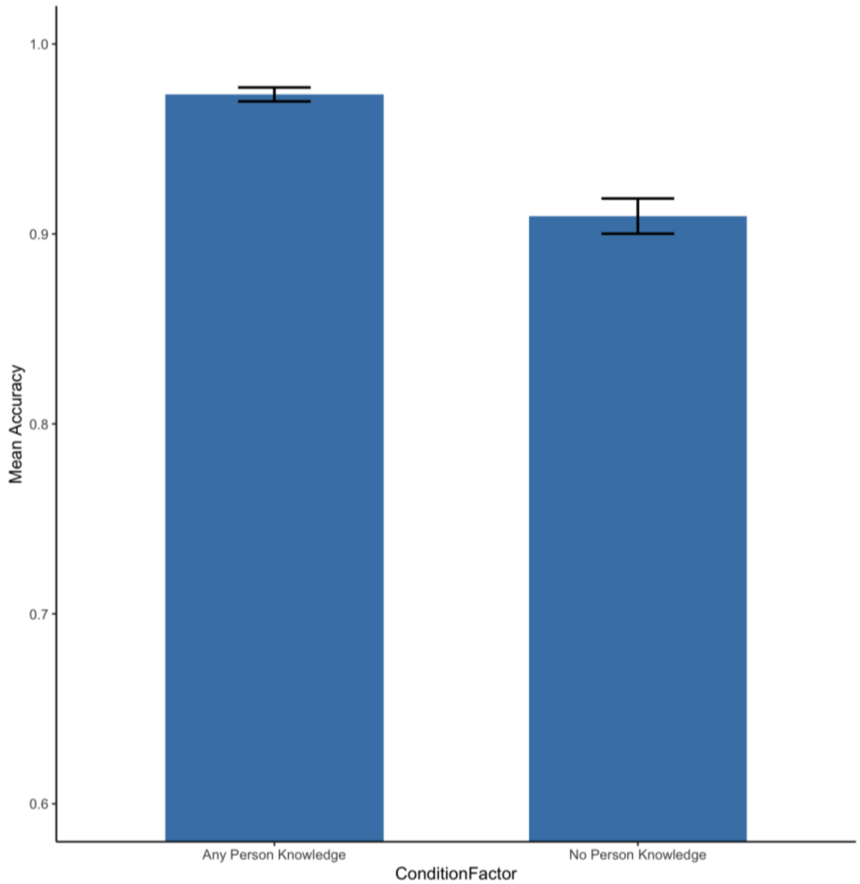
Note: Significant effects are bolded. Target race was contrast coded: White (-0.5) and Black (+0.5) Condition was contrast coded: Perceptually Familiar (-0.66), Positive Person-Knowledge (0.33), Negative Person-Knowledge (0.33), Distractor (0). The model failed to converge. PK= person-knowledge, PF= perceptually familiar.

Figure 5: Greater Recognition Accuracy for White Targets vs. Black Targets



Note: Standard error bars are displayed.

Figure 6: Greater Recognition Accuracy for Faces Paired with Person-Knowledge vs. Faces Paired with No Person-Knowledge



Note: Standard error bars are displayed.

We also analyzed participants' ability to accurately recognize faces depending on target race (Black, White), condition (positive person-knowledge, negative person-knowledge), and participant lifetime interracial contact scores (Table 2). The model failed to converge, and there were no significant effects found for person-knowledge valence. Participants accurately recognized 97.813% (SD = 14.635%) of faces paired with negative person-knowledge and 96.875% (SD = 17.408%) of faces paired with positive person-knowledge. However, this model replicated the main effect of race from the first model.

Table 2: No Significant Difference in Recognition Accuracy for Faces Paired with Positive Person-Knowledge vs. Negative Person-Knowledge

Contrast	***b***	***SE***	***z value***	***p-value***
Intercept	4.117	0.306	13.451	**< .001**
Race	-1.647	0.424	-3.881	**< .001**
Condition (Pos PK vs. Neg PK)	-0.283	0.486	-0.581	0.561
Lifetime Contact	0.131	0.246	0.534	0.594
Race x Condition	0.130	0.970	0.134	0.893
Race x Lifetime Contact	-0.041	0.224	-0.184	0.854
Condition x Lifetime Contact	0.005	0.257	0.019	0.985
Race x Condition x Lifetime Contact	0.016	0.514	0.031	0.975

Note: Significant effects are bolded. Target race was contrast coded: White (-0.5) and Black (+0.5) Condition was contrast coded: Perceptually Familiar (0), Positive Person-Knowledge (+0.5), Negative Person-Knowledge (-0.5), Distractor (0). The model failed to converge. Pos PK= positive person-knowledge, Neg PK= negative person-knowledge.

3.3 Cued Recall of Person-Knowledge

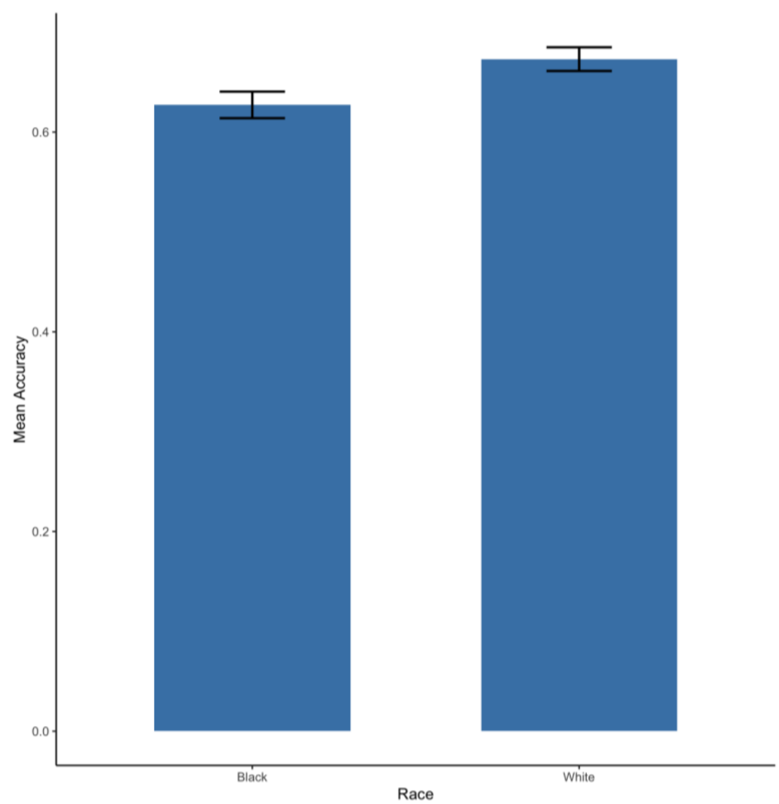
A third model analyzed participants' ability to accurately recall person-knowledge statements depending on target race (Black, White), statement valence (positive, negative), and participant lifetime interracial contact scores. The model failed to converge; however, results revealed a significant main effect for target race, b = -0.070, SE = 0.014, t (57.147) = -4.874, p = < .001 (Table 3). Participants more accurately recalled person-knowledge statements paired with White targets than statements paired with Black targets, regardless of statement valence (Figure 7). Participants recalled 62.798% (SD = 36.350%) of statements paired with Black targets and 67.717% (SD = 34.037%) of statements paired with White targets. There were no significant effects observed for person-knowledge valence or lifetime interracial contact.

Table 3: Significant Main Effect for Target Race for Cued Recall of Person-Knowledge

Contrast	*b*	*SE*	*df*	*t-value*	*p-value*
Intercept	0.600	0.034	56.633	17.816	**< .001**
Race	-0.070	0.014	57.147	-4.874	**< .001**
Valence (Positive vs. Negative)	-0.012	0.014	174.395	-0.846	0.399
Lifetime Contact	0.046	0.034	56.379	1.364	0.178
Race x Valence	0.023	0.030	58.835	0.769	0.445
Race x Lifetime Contact	-0.013	0.014	55.266	-0.921	0.361
Valence x Lifetime Contact	0.002	0.013	165.968	0.150	0.881
Race x Valence x Lifetime Contact	-0.010	0.030	56.597	-0.340	0.735

Note: Significant effects are bolded. Target race was contrast coded: White (-0.5) and Black (+0.5). Valence was contrast coded: Positive Information (+0.5) and Negative Information (-0.5).

Figure 7: Better Cued Recall of Person-Knowledge for Statements Paired with White Faces vs. Black Faces



Note: Standard error bars are displayed.

Chapter 4

DISCUSSION

The goals of this study were to examine the impact of target race, person-knowledge valence, and perceiver interracial contact on memory of faces varying in race and familiarity. In order to address these goals, White participants underwent five behavioral training sessions during which they learned about faces varying in race and information and were subsequently tested on their memory. On the fifth day, participants also filled out an Interracial Contact Questionnaire to assess lifetime interracial contact.

The first dependent variable we examined was Face Recognition, which reflects the test phase question, “Have you seen this face before?” By the fifth day of behavioral training, participants were more accurate in identifying whether they had seen a White face before than whether they had seen a Black face before. This result agrees with our prediction that White participants would display greater memory for White versus Black faces in accordance with the ORE, which states that we are better able to remember the faces of racial in-group members than of racial out-group members (Meissner & Brigham, 2001). A previous study by Young & Hugenberg (2012) found that greater interracial contact was associated with a reduction in the ORE in White perceivers that were motivated to individuate. However, our prediction that the ORE would be attenuated in individuals with greater lifetime interracial contact was not reflected in our results. Participant lifetime interracial contact scores ranged from -91.403 to 4.916 with an average score of -60.891. It is possible that general low variability in scores and low overall levels of cross-race contact in the population at large may have made it more difficult to observe contact effects.

Overall, by the fifth day of training, participants demonstrated high recognition accuracy in both the presence and absence of person-knowledge, where the average percent accuracy scores in both conditions were greater than 90%. Moreover, participants had significantly greater memory for faces paired with person-knowledge compared to perceptually familiar faces that were not paired with any person-knowledge. This result agrees with the notion that we are better able to remember another when they are paired with person-knowledge (Fiske & Neuberg, 1990; Mattarozzi et al., 2019). Preferential memory for faces paired with person-knowledge was present regardless of statement valence. While participants' recognition accuracy for faces paired with negative person-knowledge (97.813%) was slightly greater than that for faces paired with positive person-knowledge (96.875%), this result was not significant. This was contrary to our prediction that participants would have greater memory for negative face-statement pairs than positive face-statement pairs due to a negativity bias. It is possible that we were unable to observe a significant effect due to a ceiling effect given high accuracy in both conditions. In this case, participants reached the upper limit of accuracy scores on the fifth day of behavioral training, which contributed to less variability in what participants could remember.

Fiske and Neuberg (1990) have noted that out-group categories are more likely to be negative while in-group categories are more likely to be favorable, and that when targets are perceived to be incompatible with their categories, a perceiver is more likely to individuate and remember them. As a result, we predicted that participants would have greater recognition accuracy for negative-White and positive-Black targets. This prediction was not reflected in our results, as there was no significant association found between target race and statement valence on face recognition accuracy. A ceiling effect by the fifth day of behavioral training may again have contributed to this lack of a significant effect. It is also possible that we were unable to observe an effect for faces violating expectations because participants may have resolved any expectancy violations during their prior training sessions. Future analyses on this data set will be able to test this prediction.

The second dependent variable that we examined was Cued Recall of Person-Knowledge, which reflects the third test phase question to “List up to three pieces of information that this face was paired with.” We found that participants had greater memory for statements paired with White faces compared to those paired with Black faces regardless of whether the statements were positive or negative. As a result, in addition to having greater memory for faces of racial in-group members than of racial out-group members, participants also had preferential memory for information associated with racial in-group members, as shown by their greater recall of person-knowledge associated with these faces. There was no significant effect of statement valence or interracial contact. There was also no significant interaction of statement valence and race on recall of person-knowledge. As with face recognition, it is possible that participants may have resolved any expectancy violations during their prior training sessions, and as such, we were unable to observe an effect.

4.1 Limitations

One limitation of this study is that all participants were recruited from the University of Delaware campus community, were between the ages of 18 and 35, and identified as White. This limits the generalizability of these results when considering individuals from different educational backgrounds, age ranges, and races. The generalizability of these results is also limited by the fact that all stimuli were either Black or White men. These findings may not generalize to targets of different races and genders. Additionally, our ability to make causal claims when considering the influence of interracial contact on memory is limited because the participants' levels of lifetime interracial contact were measured using a survey and not experimentally manipulated.

Furthermore, two research assistants independently coded the person-knowledge statements recalled by the first 27 participants during the test phase. A tie-breaker rater was used to resolve any disagreements among the two raters. On the other hand, due to time constraints, only one research assistant coded the person-knowledge statements recalled by the last 33 participants. This may influence the reliability of the coded values assigned to these participants' generated statements.

An additional limitation of this study concerns participants' ability to accurately recognize the faces. As previously noted, by the fifth day of training, participants had high average accuracy scores. This ceiling effect may have contributed to little variability in terms of what participants remembered upon completion of the behavioral training sessions.

4.2 Future Directions

In order to increase the generalizability of these results, future studies should seek to include more diverse samples and stimuli. This study was limited to White participants recruited from a college campus. Consequently, future studies should seek to use samples with more diverse racial identities and backgrounds in order to expand on the generalizability of these results. Future studies should also aim to use more diverse stimuli across race and gender, as this study was limited to Black and White male faces. Additionally, in this study, participants' interracial contact scores were determined using a subjective questionnaire. A future study in the Impression Formation Social Neuroscience (IFSN) Lab will seek to examine how experimentally manipulating participants' levels of interracial experience influences social cognition. This can create opportunities to explore the effects of interracial experience in a controlled laboratory setting.

As previously noted, only one rater completed coding of the last 33 participants' recalled person-knowledge statements from the test phase. In future analyses, it would be ideal to include a second independent rater and a tie-breaker rater in cases where there is no consensus. This can increase the reliability of the coded values assigned to the participant generated statements. These results specifically focus on participants' memory on the fifth day of behavioral training. In the future, we plan to examine how participants' learning rates across all five training sessions are influenced by target race, person-knowledge valence, and perceiver interracial contact. These analyses we will allow us to observe how participants' memory of the faces and statements varied from one training session to the next and from the first training session to the fifth. This may offer an opportunity to detect trends and effects that may not have been observed when focusing solely on the results from the fifth day of training.

Following the fifth day of behavioral training, participants completed an impression formation task during an fMRI scanning session at the Center for Biomedical and Brain Imaging (CBBI) at the University of Delaware. Data from this part of the study will be used to assess the neural correlates of impression formation involving the faces that participants had learned about over the course of the five behavioral training sessions in addition to novel faces. Due to time constraints, these results were not included in this thesis and will be analyzed in the future. We plan to examine neural activity in specific regions of interest (ROIs) including the dorsomedial prefrontal cortex (DMPFC), ventromedial prefrontal cortex (VMPFC), precuneus, and amygdala. This expands on the behavioral results, as it offers an opportunity to examine brain regions involved in retrieving person-knowledge, social cognition, and face perception during impression formation of faces varying in race and information.

The DMPFC has been implicated in representing and retrieving person-knowledge (Cloutier et al., 2011). Previously, when perceivers were asked to form impressions of novel faces, novel faces paired with person-knowledge, perceptually familiar faces, and perceptually familiar faces paired with person-knowledge, researchers observed preferential activation in the DMPFC for faces paired with person-knowledge irrespective of whether the face was novel or perceptually familiar (Cloutier et al., 2011). This preferential DMPFC activation in response to faces paired with information was also observed in a study by Baron and colleagues, (2011) in which the DMPFC responded more strongly to faces that were preceded by positive or negative behaviors versus faces that were not preceded by any behaviors. Furthermore, the valence of the behaviors paired with the faces did not produce a differential response in the DMPFC (Baron et al., 2011).

Additionally, DMPFC activity has been associated with expectation violation during person perception. For example, Hehman et al. (2014) examined neural responses as participants viewed faces that were stereotypically congruent or incongruent according to race and emotion, where angry Black faces and happy White faces were seen as stereotypically congruent and happy Black faces and angry White faces were seen as stereotypically incongruent. They found that the DMPFC displayed stronger activity for stereotypically incongruent faces versus stereotypically congruent faces in a linear manner, where activity increased as faces became less stereotypical, such as when Black faces became happier (Hehman et al., 2014). This preferential response to stereotype incongruent faces was also observed by Li et al. (2016) when examining the neural response of White perceivers' positive and negative impressions of Black and White faces, in which there was greater DMPFC activity for faces paired with stereotypically incongruent traits (e.g., Black faces paired with positive traits and White faces paired with negative traits). This preferential DMPFC activity was only present in participants with higher internal motivation to respond without prejudice (IMS) (Li et al., 2016).

The VMPFC has been found to be involved in the integration of conceptual information in order to direct future responses (Roy et al., 2012). Dang et al. (2019) examined the influence of the availability and use of person-knowledge on VMPFC activity as participants made either perceptual- or knowledge-based evaluations. In cases when person-knowledge was available, regardless of whether this information was relevant or irrelevant for the evaluation, increased VMPFC activity was observed as evaluations became more positive (Dang et al., 2019). Furthermore, VMPFC activity increased more when person-knowledge was available and relevant for the evaluation versus when it was available, but not used for the evaluation (Dang et al., 2019). These findings suggest that the VMPFC is sensitive to person-knowledge availability and its use when making positive evaluations (Dang et al., 2019). These effects seen in the VMPFC were not observed in the DMPFC, highlighting differences in social evaluation in the MPFC (Dang et al., 2019).

Activity in the precuneus has been associated with the perception of faces varying in familiarity, particularly the perception of visually familiar faces (Gobbini & Haxby, 2006; Lee et al., 2013). Previous research has observed greater activity in the precuneus during the perception of familiar faces compared to unfamiliar faces (Lee et al., 2013; Cloutier et al., 2011). In one study by Gobbini and Haxby (2006), the researchers observed increased activity in the precuneus for trained visually familiar faces compared to novel faces. Additionally, as novel faces were repeatedly presented, activity in the precuneus increased up to the twentieth presentation, where these highly repeated novel faces responded similarly to the trained familiar faces (Gobbini & Haxby, 2006). These findings reflect the precuneus's role in acquiring facial familiarity (Gobbini & Haxby, 2006). Familiar faces themselves can also express differential activity in the precuneus. One study by Gobbini et al. (2004) examined participants' neural responses to personally familiar faces and famous familiar faces, thus dissociating the role of social and emotional attachment from visual familiarity. The researchers found that personally familiar faces elicited greater activity in the precuneus than famous familiar faces and suggested that this greater response for personally familiar faces may reflect the activation of information associated with that personally familiar individual (Gobbini et al., 2004).

The amygdala is sensitive to socially salient information such as emotional expressions, potential threat, and trustworthiness (Haxby et al., 2002; Baron et al., 2011). In studies involving the perception of novel faces and familiar faces, novel faces have been shown to elicit a stronger response than visually familiar faces in the amygdala (Gobbini & Haxby, 2006). In the study by Gobbini et al. (2004) examining participants' neural responses to personally familiar faces and famous familiar faces, the researchers found that the amygdala response was stronger for faces of strangers compared to personally familiar faces and famous familiar faces and that famous familiar faces evoked a stronger amygdala response than personally familiar faces (Gobbini et al., 2004). They suggested that this may reflect the amygdala's involvement in the appraisal of unknown faces and that viewing personally familiar faces may be associated with reduced vigilance compared to viewing famous familiar faces or strangers (Gobbini et al., 2004).

Amygdala activity is also influenced by target race and a perceiver's amount of interracial contact. One study conducted by Cloutier et al. (2014) examined amygdala activity of White perceivers as they viewed familiar and novel Black and White faces and observed that the amygdala response was attenuated for familiar Black faces compared to novel Black faces. This reduction in amygdala response to familiar Black faces was attenuated in more prejudiced participants, which may reflect that these faces underwent less individuation (Cloutier et al., 2014). On the other hand, participants with greater childhood interracial contact showed a more pronounced reduction in amygdala activity for familiar Black faces, reflecting increased perceptual individuation of familiar racial out-group members (Cloutier et al., 2014). Analyses of the fMRI scanning session data will allow us to learn more about the involvement of these regions in remembering and forming impressions of people varying in race and familiarity.

After five behavioral training sessions, White participants had greater facial recognition accuracy and cued recall of person-knowledge for White targets compared to Black targets. Additionally, they were better able to recognize faces paired with person-knowledge than faces paired with no information. Overall, these results reinforce previous work that has shown that White perceivers tend to better individuate and remember own-race versus other-race individuals. As members of a diverse society, we have many opportunities to interact with people that have different identities and backgrounds from our own. Consequently, it is important that we gain a better understanding of the factors that can affect our impressions and memory of others. Future studies should aim to uncover the factors that shape how we learn and remember information about others and seek to develop strategies that may lessen the likelihood of misidentifying another, particularly those from different racial groups.

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