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# **DETECTING ACCURATE EMOTIONS IN FACES**

by

Emma Greenwood

**Capstone submitted in partial fulfillment of  
the requirements for graduation with**

## **University Honors**

with a major in  
Psychology

in the Department of Psychology

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**Logan, UT**

**Spring 2022**

## Abstract

Anger race bias is the tendency to misidentify expressions of emotion, specifically anger, in Black or racially ambiguous faces that are fearful or neutral (Hutchings & Haddock, 2008). Anger is often associated with aggression (Murphy et al., 2005). Therefore, the inaccurate perception of anger and threat may lead to an inappropriate response and could increase the likelihood that a police officer will shoot at a suspect (Correll et al., 2007). From 2015 to 2020, police officers shot and killed over 100 unarmed Black males (Washington Post, 2020). This study examined if anger race bias could be reduced through emotion identification training. Faces from the Chicago Face Database were used to train participants on the emotions of neutrality, fear, and anger. Participants identified emotions on a series of Black, White, LatinX, and Asian faces on pre-and post-test measures. Two weeks following the post-test, participants were invited to complete a follow-up test to determine their retention of the training. We found that the experimental group accurately identified more facial expressions on average than the control group. These preliminary results demonstrate feasibility in developing emotion recognition trainings to decrease anger race bias with the potential to be helpful in police settings.

*Keywords:* Anger-race bias, emotion recognition, racial bias

## **Acknowledgements**

The authors have no conflicts of interest to declare.

We would like to thank Dr. Crissa Levin, Dr. Jennifer Grewe, Janice Snow, and the Factotum Lab within Utah State University's Psychology Department for assisting on and supporting this research. We would like to thank Casey Callentine and Joana Slaugh for contributing to the project's creation and development. We would like to thank Utah State University's Office of Research for funding this project with the Undergraduate Research and Creative Opportunities Grant and for funding academic and advocacy presentations of the research with the Undergraduate Student Travel Award. We also thank Utah State University's Honors Program for supporting this project.

**Detecting Accurate Emotions in Faces**

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### **Introduction**

Research has shown that emotional expressions are universal and that they are used across cultures as guides to behavior (Marsh et al., 2005). For example, Marsh et al. (2005) found that expressions of fear make individuals seem more approachable while expressions of anger make individuals seem dangerous. Therefore, accurate emotion recognition leads to appropriate responses (Marsh et al.). Minority faces can be perceived as being angry when they are actually showing fearful or surprised facial expressions (Hugenberg & Bodenhausen, 2003). Research has also found that on more emotionally ambiguous faces, hostility is identified more quickly and deeply on Black faces than White faces, even when emotion expressions are similar (Hugenberg & Bodenhausen, 2003). Further, individuals who are high in implicit bias are more likely to identify anger as more intense in Black faces than White faces (Hutchings & Haddock, 2008).

Black citizens account for 13% of the population, yet make up 27% of fatal police shootings (Burghart, 2021). When comparing Black and White suspects, Black suspects were perceived as more threatening by police officers, and the likelihood that a Black suspect will be shot and killed by an officer is about twice as high as that of a White suspect (Nix et al., 2017). This discrepancy is partly created by anger race bias and inaccurate perception of emotional expressions (Nix et al., 2017). Anger race bias is the tendency to misidentify expressions of fear and neutrality in Black individuals for the expression of anger (Hugenberg & Bodenhausen, 2003).

### **Racial bias**

Racial bias is still present within our society. An implicit preference in White children for other White children has been seen as early as five years old (Williams et al., 2019). White

participants in one study were asked to rate their levels of explicit racial bias, and their self-reports were used to analyze their interactions with a Black individual (Dovidio et al., 2002). When they rated themselves as being high in bias, they did behave with less friendliness towards Black individuals compared to White individuals (Dovidio et al., 2002). Racial prejudice is present in virtual settings, as seen when individuals who were assigned a Black avatar displayed higher preference for White individuals, thereby supporting stereotype activation theory, which proposes that awareness of a race brings racial stereotypes to mind (Groom et al., 2009). Within the legal system of Metro City, researchers found racist influence in the tendency for Black males to be sentenced to prison more than White males (Spohn et al., 1981).

Additionally, implicit racial bias predicts lethal police violence against Black individuals. The percentage of Black people killed by police is about twice their percentage in the overall population (Hehman et al., 2017). The disproportionate statistic is further emphasized in a study that discovered that police officers shot targets in an active shooter simulation faster if the target looked like a Black person rather than if they looked like a White person (Correll et al., 2007). Before training with a computer program on race and weapons, officers were more likely to shoot an unarmed Black target than White target during the computer simulation (Plant & Peruche, 2005). Police shooting situations are stressful because officers need to protect themselves and others, and the anxiety from the situation can lead to inaccuracy in reactions (Landman, 2016). Officers also often have to act quickly which can lead to a reliance on implicit biases such as anger race bias (Sherman et al., 2008).

### **Implicit Bias and Anger Race Bias**

Some of the criticisms of implicit bias include its lack of stability over time, or test-retest reliability, and its lack of ability to reliably predict behavior. However, Brownstein (2020) argues

that differences in the type of bias being measured by different assessments as well as different strategies for measuring bias may account for the lack of ability to predict behavior and lack of stability. The use of less reliable assessments rather than more researched ones including the Implicit Association Test and the Affect Misattribution Producer, may also contribute to these supposed limitations of implicit bias (Brownstein, 2020). Research has shown that the more reliable measures of implicit bias, like the IAT, do have the ability to predict some behaviors. Specifically the stereotype IAT has been found to predict negative behaviors toward members of the outgroup (Rudman & Ahsmore, 2007).

In general, teachers have been found to misidentify anger in Black children at higher rates than White children. Additionally, teachers with high levels of racial bias as measured by the IAT, were more likely to inaccurately perceive anger on Black children compared to White children than those with lower levels of racial bias (Halberstadt et al., 2020). There have also been increased perceptions of hostility for Black students compared to White students by White teachers (Halberstadt et al., 2018). Students of color are more likely to receive a suspension or expulsion than White students who display the same behaviors, likely because of implicit bias (Skiba, 2011).

Outside of school settings, White individuals often have a reduced ability to recognize emotion in out-group members, or those of another race, which is referred to as out-group homogeneity bias (Ackerman et al., 2006) However, white individuals perceive anger on Black faces more often than other emotional expressions (Ackerman et al., 2006). Aggressive acts are often attributed to anger, meaning that the two concepts are often connected and considered together (Averill, 1983). When someone is perceived as being aggressive, the observer may escalate the situation leading to actual aggression from both parties (Anderson et al., 2008). If



Black individuals are seen as harboring aggression when they may not be angry, situations can become hostile and a cycle of violence may begin (Murphy et al., 2005).

Research has shown that emotion recognition can be improved through training and intervention. Grinspan et al. (2003) and colleagues studied an intervention that taught children to discriminate between happy, sad, angry, and fearful facial expressions. The intervention taught children to identify facial expressions by splitting the face into three components and showing what each piece looked like for happy, sad, angry, and fearful faces. This facial expression training improved children's ability to accurately identify emotion which indicates that intervention and training can improve emotion identification (Grinspan et al., 2003). Research has also shown that intervention and training can increase people's awareness of their own implicit bias and decrease that bias (Devine et al, 2012).

Research including a study conducted by Elfenbein (2006) has tested the effectiveness of an emotion recognition training with instant outcome feedback to improve correct identification of emotion across cultures, specifically on Asian faces. For the study, participants were assigned to either a training or a control group and shown photos of American and Chinese individuals portraying the emotions of fear, anger, sadness, surprise and happiness (Elfenbein, 2006). For the training and experimental sessions, participants looked at these photos one at a time (the photos were unique to each segment of the study) and guessed what emotion the model in the photo displayed (Elfenbein, 2006). During the training session, the participants were immediately given outcome feedback on their decision (Elfenbein, 2006). The data indicated that an emotion training has the potential to improve emotion identification across cultures because accuracy scores increased from the training to the posttest sessions of the study (Elfenbein, 2006).

While previous research has shown that emotion recognition trainings can increase cross cultural emotion recognition, there is a gap in the literature studying anger race bias or the ability of trainings to decrease bias in the recognition of fear and anger on Black faces. The present study builds on the findings in previous studies that implicit race bias can be reduced through training and intervention (Elfenbein, 2006; Grinspan et al., 2003) but specifically focuses on expressions of fear, anger, and neutrality. We hypothesize that training participants to identify facial muscles that are used in the expression of fear, anger, and neutrality on both Black and White faces, anger race bias will be reduced.

## **Method**

### **Participants**

Participants were adult undergraduates at Utah State University. This study plans to recruit 352 participants. Currently, data has been collected from 55 participants, 26 of which have been used for analysis. Participants signed up for the study via SONA and were given 0.5 SONA credits for completing the training and pre- and post-test. They also had the option of signing up for a follow up survey two weeks later with a reward of 0.75 SONA credits and were given the option to enter a drawing for one of 25 \$40 gift cards.

### **Design**

This study was a between groups experimental design. The independent variable was the type of training participants received. It had two levels, an experimental emotion recognition training, or a control emotional intelligence training. The dependent variable in this study was participant score improvement on the emotion identification task from pretest to post-test. The study design consisted of a pre-test, training, post-test, and a follow-up two weeks after submission of the post test. This study was run through Qualtrics, an online survey software.

## Measures

### *Demographics*

Age and student status were obtained before the informed consent. Participants who were younger than 18 years old or were not current undergraduate students were not permitted to participate. Participants also completed a demographics questionnaire before the pretest measure. Race, ethnicity, gender, disability status, and sexual orientation were obtained in the demographics questionnaire.

### *Survey*

**Pretest.** The pretest consisted of 21 faces. Faces were selected from version 3.0 of the Chicago Face Database (University of Chicago, 2021). There were nine Black faces and nine White faces. They each included four faces showing anger, four showing fear, and one showing neutrality. There were two Latinx faces, both showing neutrality, and one Asian face showing neutrality. Participants were shown an image of a face and then asked their best guess of the emotion shown on the face. They could select either anger, fear, neutral, or an emotion not listed. Faces were randomized for participants.

**Emotion Recognition Training.** Participants were randomly divided into an experimental group or control group. Both groups watched a recorded presentation with slides and narration/explanation from our research team (Levin). The experimental group was shown an emotion recognition training that was approximately thirteen minutes long. It instructed them on how to identify the emotions of fear, anger, and neutrality based on three sections of the face: the forehead, eyes, and mouth. These sections of the face were shown separately and then as a whole face and explained in terms of muscle movement (e.g. the eyebrows move upward and outward in the expression of fear).

**Control Training.** Participants in the control group watched a training on various elements of emotional intelligence, such as mimicry and validation, that was approximately fifteen minutes long. The control group training was not designed to have any effect on the post-test, but images and verbiage were included to provide a likely story on how this training may help to better identify emotions automatically. In fact it was meant to serve as a time control.

**Posttest.** After watching either the experimental or control training video, participants completed another emotion identification post-test with the same format and structure (including number of faces and types of emotional displays) as the pre-test, although different faces were used.

**Follow Up.** Two weeks after the completion of the post-test, participants received an email reminder from SONA to participate in a follow-up test. This had the same structure as the pre- and post-test and included faces from each of them. At the completion of the follow-up test, participants could choose to follow a link to a new survey where they could input their email information to be entered into a random drawing for a one in nine chance to win a \$40 gift card after recruitment ended. Gift cards would be distributed via email.

**Debriefing.** One month after completion of the pre- and post-test (regardless of follow-up completion), participants were sent an email explaining the true purpose of the study: namely, that it was in fact looking at accuracy differences between races (the rest of the information provided in informed consent was accurate). The debriefing email included a link to a survey where participants could select to have their de-identified data removed from the study if they wanted to do so following discovering the true purpose of the study.

## **Procedure**

Participants found and registered for the study on SONA systems, which allows students to receive course credit for participation. From there students followed a link to the Qualtrics study, which guided them through the consent process, including a screening to ensure that the participants were undergraduate students over the age of 18 who consented to participate. Participants then completed the pre-test, followed by being randomized to one of the two trainings, followed by the post-test. Two weeks later, SONA automatically emailed participants to take the follow-up test. One month after completion of the first portion of the study, participants were emailed the debriefing information.

### **Data Analysis**

We conducted an independent samples  $t$  test, comparing overall score improvement from pre to posttest between the test and control groups. We ran the same test comparing score improvement in Black faces from pre to posttest between the test and control groups. An independent samples  $t$  test will be conducted comparing the scores from the follow up test with those of the posttest when more data has been collected.

### **Preliminary Results**

We are still in the process of collecting data, therefore these results are not complete and will be updated when we have a greater effect size. Currently, our results demonstrate that our emotion identification training can feasibly improve participants' ability to recognize emotions in races overall, 95% CI [0.050, 6.213],  $t(20.16) = 2.118$ ,  $p = .047$ . Participants in the experimental group had a mean improvement of 3.714 ( $SD = 3.138$ ) from baseline to posttest, and participants in the control group had a mean improvement of 0.583 ( $SD = 4.21$ ).

While analyzing for improvement specifically in Black faces from pre to posttest, there was no statistical significance. However, there was a mean difference of 1.202 between the test

and control group, with the control group improving 2.286 points ( $SD = 2.128$ ) from baseline to posttest and the control group improving 1.083 points ( $SD = 2.392$ ) from baseline to posttest, 95% CI [-0.627, 3.031],  $t(24) = 1.357$ ,  $p = .187$ .

### **Discussion**

While data is still being collected, the preliminary data show a significant improvement in emotion recognition across faces for participants who watched the emotion recognition training video (showing greater improvement in the test group than the control group). More data is needed to power the statistical testing in order to determine there is statistically significant improvement in recognizing emotions in Black faces compared to white faces. Even with our underpowered participant pool however, we already have significant findings suggesting that even a brief emotion recognition training can be useful in the correct identification of emotion, and we can see that there are differences between the groups in the expected direction such that if the trend continues while the sample grows this would be expected to be significant by or before we reach the sample deemed appropriate from our power analysis.

The goal of this study was to test feasibility of an emotion recognition training in decreasing anger race bias, and while we will need to continue to recruit participants to power our analysis, our current results show promise that this is a feasible route for future research and interventions.

### **Alignment with Past Research**

Like previous studies, our research supports the efficacy of interventions in improving emotion recognition and decreasing some forms of implicit bias (Grinspan et al., 2003; Elfenbein, 2006). This study uniquely addressed anger race bias, although more data is needed to determine statistical significance in decreasing this bias.

### **Limitations**

There are several limitations surrounding the generalizability of this study. These include recruitment via a convenience sample, which in this case was an exclusively undergraduate student sample. In addition, there are issues with generalizability. In our study, participants were in a low-stress setting, and faces used in the training and tests were static photographs. Officers in the field must identify emotions on faces that are moving and may not always be perfectly visible or head-on. Additionally, officers are often in high-anxiety situations and therefore are more likely to act on impulse (Landman, 2016), leading to an increased risk of relying on implicit biases (Sherman et al., 2008). There was no high-risk or high-anxiety correlate for our participant sample taking an online survey. In sum, this test of feasibility was particularly different from real-world emotion recognition. In order to increase generalizability and test the efficacy of this intervention specifically for police settings, the intervention should include dynamic faces and be tested on a more diverse sample of police officers in a high stress environment to simulate what decision making and emotion recognition are like in the field. Pending the evidence for our full feasibility hypothesis, further study ought to be implored if this style of simple training continues to have feasible utility.

### **Implications**

Questioning the feasibility of a simple intervention to ward off a robust implicit bias is an important step toward creating interventions to decrease discrimination. The ultimate goal of reducing anger race bias is to increase the safety of police officers and particularly to civilians. Emotion recognition trainings like the one developed for this study have the potential to keep both officers and civilians safe. More data and exploration are necessary, but this study shows feasibility not just of what is problematic, but of how we might intervene.

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Throughout my undergraduate experience I've discovered a passion for learning about bias and social justice. Several classes and book labs that have focused on racism, sexism, and intersectionality have helped me develop this passion. However, in the classroom, all I can do is learn. Researching anger race bias was a perfect capstone experience for me because it allowed me to apply the knowledge I have gained about bias and social justice toward solving a real world problem. Creating a capstone experience also allowed me to connect with other students and faculty members. Because I worked in the Factotum Lab, which is a distance lab, I was able to create relationships with students and professors across the state which really enriched my experience working on this project. Over the course of the last year, I've been able to help develop study materials including emotion recognition trainings and tests, complete an IRB, collect data, run data analysis, and present at four different conferences. All of these tasks that I completed made this an incredibly valuable capstone experience.

One of the most valuable parts of creating this capstone was the confidence it gave me. I'm used to working in the background. I do not enjoy presentations or public speaking and I'd much rather be behind the scenes. Because of this, presenting my research was a very daunting task at first. However, getting to present something that means so much to me and that I've spent so much time and energy working on changed the way that I think about public speaking and presentations. Presenting this project gave me so much more confidence in my ability to communicate with others and advocate for myself and my research. Marisa, my research partner, was a big part of this shift as well. She has a background in debate and communications and was an incredible resource for learning how to communicate effectively. She was also an incredible moral support when I was nervous about presentations. In the end, taking our research to conferences was one of my favorite parts of this project. I loved getting to share what I'm

passionate about with others and to use my voice to advocate for research that I know can make a big difference. Gaining confidence in my speaking ability has already helped ease my stress about presentations in my classes and I know it is a skill that I will be able to take with me no matter what career I choose to pursue.

This project also taught me about the importance of perseverance and collaboration. Completing an undergraduate lead project was one of the hardest things I've ever done. There were so many roadblocks and challenges that had to be overcome. We seemed to hit every snag you could think of during our data collection, and we had to learn to roll with the punches. In the moment, this was incredibly difficult and led to a lot of sleepless nights. However, looking back, it taught me the importance of perseverance. We had to learn to problem solve and to use the resources we had to overcome the challenges we faced. We learned to work with professors and graduate students, including Janice Snow who is amazing and offered so much help and support, to fix the problems we faced. I usually like to do things on my own and don't always ask for the help that I need. This project was something that I couldn't do on my own, so I had to learn to collaborate and lean on other students and professors. This is a skill that I believe will help me succeed in graduate school and a career. It's important to know when to ask for help and support and I'm grateful for the opportunity that this project gave me to develop this skill.

Dr. Crissa Levin was also a big reason that this project made such an impact on me. She was an incredible support and mentor during our project. She pushed us to work things out on our own which was difficult but instilled a lot of confidence in myself. Even though she is a distance professor, she worked hard to develop a relationship with myself and Marisa and really pushed us to be our best selves. She advocated for us and encouraged us to apply for as many conferences and grants as we could. She was also the first person to cheer us on when we

succeeded and helped us use challenges as opportunities to learn. Her mentorship was invaluable, and she is a big reason that I stuck with the project and graduated with honors.

This project really enriched my study of psychology because it dealt with real life applications of topics like bias and emotion perception. At the beginning of my undergraduate experience, I worked in a behavioral rat lab, which I enjoyed, but I had a difficult time connecting with the research because it was difficult to apply to real life. This project was so powerful for me because I was able to work with human beings and create an intervention that has potential to create real change in the lives of people right now. While any research on behavior and social issues is important, as a psychology student who is passionate about combating social injustice, this lab deepened my understanding of bias and the social implications of ignoring it.

Another lesson that I learned from this project and as a part of the Factotum Lab in general is the importance of thinking critically about the world around me. This project was born out of an awareness of the disproportionate number of Black victims of police violence. This is a problem I was aware of before becoming a part of this project, but I learned to think more critically about it as a part of the lab. I learned that we need creative problem solvers in order to combat social issues and that I can be a part of the problem-solving process. In psychology, we learn a lot about using psychological knowledge and practices to improve the lives of people in our community. I learned that this applies much further than just therapy and that I have a responsibility to use what I've learned about the field of psychology to look at systematic issues rather than exclusively individual ones.

Presenting our findings at research conferences helped me understand the cross disciplinary importance of this project. While at conferences, we were able to discuss our

research with people of a variety of different backgrounds and learn more about ways this research could be applied. We specifically focused on implicit bias in police departments, but we talked to individuals who were interested in its application in school settings, behavioral research, and even business settings. Accurately recognizing emotion is an important skill for any individual in any field and could lead to more equity and connection between people of different races.

Over the course of the semester, we had the opportunity to present our research at the university, state, regional, and national level. Two of the conferences we presented at were advocacy conferences where we were able to talk to legislators about the importance of our work. This was one of my favorite parts of completing this project because it was a way for us to share our research with individuals who can make real change. We learned to cater our presentation to people of different backgrounds in order to engage with the largest number of people possible. The focus of this project was to begin researching a solution to the problem of bias in police forces and its disproportionate effect on communities of color. This taught me to engage with a country wide problem and think creatively about how to solve it. I'm incredibly grateful for the opportunity to apply what I have learned in my three years of undergraduate study to a project that has the potential to make a big difference. I could not have done it without such an incredible mentor and research partner. I feel so much more prepared to take on graduate school armed with the confidence and problem-solving skills that have come from my honors capstone experience.

Word Count: 1373

Emma Greenwood graduated from Utah State University with a Bachelor of Science in psychology with a minor in intersectional gender studies. She graduated with Honors and with an undergraduate research transcript designation. While at Utah State University, she worked in several psychology labs including the Factotum Lab, the Self-Regulated Learning Lab, and the Behavioral Economics Lab. As part of the Factotum Lab, she researched anger race bias and presented findings at Research on Capitol Hill, the Rocky Mountain Psychological Association Convention, Utah State University's Student Research Symposium, and Posters on the Hill. She plans to attend graduate school in the fall of 2023.