OPEN ACCESS

Journal of Advanced Research in Social Sciences
ISSN 2538-919X

The Role of Implicit Associations and Ingroup Affiliation on Perceptions of Diversity

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ARTICLE INFO

Keywords:
implicit association task,
ingroup affiliation,
minority salience,
numerical estimation,
racial identity

ABSTRACT

Based on previous findings on subjective lengthening effects of unpleasant stimuli and overestimation of minority faces, the present study investigates how implicit associations and ingroup affiliation influence numerosity estimates of racially diverse faces. White and Black participants completed a numerical estimation task where they briefly viewed arrays with varying proportions of Black and White faces and determined which race appeared more numerous. Participants also completed the Implicit Association Test for race to assess implicit associations. Results showed that Black participants tended to overestimate outgroup faces and underestimate ingroup faces. Additionally, individuals with strong positive White associations overestimated the presence of White faces, but only in arrays featuring mostly White faces. These findings offer insights into the relative contributions of implicit associations and ingroup affiliation to perceptual biases.

1. Introduction

We are constantly exposed to large groups of people, and we often have very limited time to make judgments about the nature of, and the composition of these groups. Our cognitive biases tend to shape some of these rapid numerosity estimates. For instance, individuals with social anxiety tend to be more sensitive to negative faces in a group of faces, and overestimate their prevalence (Yang & Baek, 2022).

Similar findings are observed in making judgments based on other factors, such as race. For instance, when observing the world around us, we tend to overestimate the prevalence of minority groups in our environments (Herda, 2010; Nadeau et al., 1993; Wong, 2007). A recent laboratory study investigated this phenomenon (Kardosh et al., 2022), finding that both Black and White participants consistently overestimated the percentage of Black faces shown in arrays of faces. An unanswered question in the literature is the extent to which individual estimates of diversity are driven by implicitly held racial associations.

Some of the role of our cognitive biases on perception could be rooted in the temporal lengthening effect. In the temporal lengthening effect, negative emotional events, such as foot shocks (Meck, 1983) and maintaining eye contact with angry faces (Schiff & Thayer, 1970), tend to be perceived as lasting longer than neutral or positive emotional events (Droit-Volet et

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Cite this article as:
Fireside, E., & Gupta, S. (2024). The Role of Implicit Associations and Ingroup Affiliation on Perceptions of Diversity. *Journal of Advanced Research in Social Sciences, 7*(3): 76-88. https://doi.org/10.33422/jarss.v7i3.1314

al., 2011; Tian et al., 2018). Additionally, these findings are more pronounced in those who find the stimuli particularly negative. For instance, when observing spiders (likely a negative experience for most), temporal lengthening was greater in those who had a fear of spiders compared to those who did not (Waits & Sharrock, 1984). Similarly, as discussed earlier, individuals with high social anxiety are more sensitive to negative emotions than individuals without social anxiety (Yang & Baek, 2022). Several studies also point to the role of the amygdala in making automatic judgments based on group membership. The amygdala is a small, almond shaped structure in the brain that has been associated with social judgments from facial stimuli. For instance, some studies report greater amygdala activation in the presence of other-race faces than own race faces in both White (Lieberman et al., 2005; Phelps et al., 2000) and Black participants (Hart et al., 2000) even when face stimuli are presented too briefly for conscious awareness (Cunningham et al., 2004). This suggests that rapid, unconscious assessments of potential threats based on perceived racial differences and ingroup affiliation play a crucial role in shaping neural responses.

A different theory suggests that overestimation of minority faces might have less to do with their negative associations, but are instead driven by socially learned norms about statistical frequency, and the resulting cognitive biases. Our cognitive system is primed to rapidly detect and respond to novel events. Events that are contextually novel or unexpected draw our attention (Itti & Baldi, 2009), and therefore are more salient in perception (Khaw et al., 2021) and recall (Stangor & McMillan, 1992). Consequently, individuals belonging to minority groups may be perceived as more prevalent in the environment simply due to their heightened salience (Kanaya et al., 2018; Kardosh et al., 2022). A recent laboratory study investigated this phenomenon (Kardosh et al., 2022), finding that both Black and White participants consistently overestimated the percentage of Black faces shown in arrays of faces, suggesting that it is more than just ingroup affiliation that might drive these effects.

In the present study, Black and White participants were presented with arrays of 16 faces, with the number of Black and White faces varying across trials ranging from entirely White arrays to entirely Black arrays. Additionally, similarly to the Yang & Baek (2022) study, but unlike the Kardosh et al. (2022) study, the trials were kept deliberately brief (0.5 seconds) to ensure that the estimates were truly tapping into subconscious mechanisms. Additionally, proportion judgment tasks, such as those used by Kardosh et al. (2022), are susceptible to characteristic sinusoidal patterns of over- and underestimation (Varey et al., 1990), with an overestimation of small proportions and an underestimation of large proportions. Thus, we employed a forced-choice paradigm, adapted from numerosity comparison task used in prior research (Yang & Baek, 2022), that asked participants to indicate whether they perceived more Black or White faces in each array. This method allowed for a more direct assessment of participants' perceptions of racial composition without the potential confounds associated with proportion estimation tasks.

An unanswered research question in the literature that we are posing here is:

> To what extent is an individual’s estimation of diversity driven by implicitly held racial associations?

To assess implicit associations, we employed the Implicit Association Test (IAT) for race (Greenwald & Banaji, 1995). The IAT is a widely used instrument which measures the automatic attribution of positive and negative evaluations to different social groups, such as Black and White individuals. The IAT has been shown to have large effect sizes (Greenwald et al., 2003; Nosek et al., 2002), and measurable differences between (Greenwald et al., 2003; Rudman et al., 1999) and within (McConnell & Leibold, 2001) groups. For instance, White participants with a stronger implicit negative attitude towards Black individuals, as determined by the IAT, had more negative social interactions with Black experimenters, versus with White experimenters (McConnell & Leibold, 2001). Thus, the use of the IAT should allow us to explore within group individual differences in addition to between group differences (that is, between Black and White participants).

Based on prior research on the tendency to overestimate the prevalence of minority groups in environments regardless of group affiliation, we hypothesized that both Black and White participants would overestimate the presence of Black faces across arrays in our study. Additionally, given the research on subjective lengthening of unpleasant stimuli, we predict that individual differences might emerge – namely, individuals with larger implicit associations against Black faces might show a tendency to overestimate their presence to a greater extent. Furthermore, by incorporating various proportions of Black faces in the arrays, we predict different trends in diversity estimates for varying proportions of minority groups. This could shed further light on the relative role of ingroup affiliations, implicit associations and socially learned norms about group composition, on perceptual biases.

2. Methods

2.1. Experiment Overview

Participants were recruited via word of mouth, social media advertising and SONA, a platform that advertises research conducted by students and faculty of the school to students looking for research participation credits.

The program was coded using EPrime and hosted on EPrimeGo which allowed for remote data collection. Participants were directed to download and run the experiment on their browsers, in which they completed the following three sections of the experiment: Firstly, participants took part in a psychophysical experiment based on the work of Yang and Baek (2022), in which numerosity perception of Black and White faces was measured through EPrimeGo. They then completed a race IAT based on Project Implicit (1998). Lastly, they filled out a self-report measure of racial attitude and a demographic questionnaire. The entire experiment took approximately 30 minutes to complete. Informed consent was obtained via Qualtrics, and participants received course credit or an Amazon giftcard for their participation. The study was reviewed and approved by the Institutional Review Board at the university where the study was conducted.

2.2. Sample

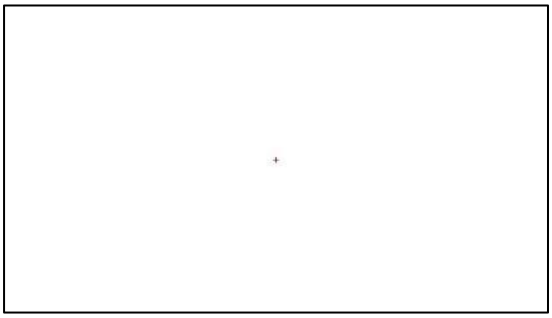
A total of 31 White participants and 31 Black participants were recruited, of which 2 were excluded from further analyses due to pre-determined criteria for outlier detection. The remaining 29 White participants (17 female, 7 male, and 2 nonbinary, with 3 who declined to answer) had a mean age of 29.41 years (SD = 12.52). The remaining 31 Black participants (6 female, 24 male, with 1 who declined to answer) had a mean age of 24.80 (SD = 5.64). There were also 4 additional participants who selected “Other” as their race, and 2 participants who selected more than one race. They were all excluded from further analyses.

2.3. Psychophysical Experiment for Estimating Numerosity Perception of Black and White Faces

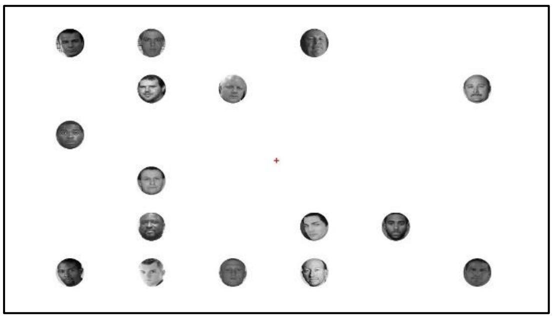
We conducted a numerosity estimation task based on Yang & Baek (2022) to characterize numerosity perception in Black and White faces within our participants. A group of 16 faces was presented in an array on a white background. The images were retrieved from 10K US

Adult Faces Database (Bainbridge et al., Isola, & Olivia, 2013) and used with permission. In the development of the database, all the pictures used were validated in the original study for race and gender, among other attributes. In the present study, faces validated as male and either Black or White, with a neutral male expression were used. All images were set to grayscale. There were a total of 100 usable faces, of which 16 faces (960 x 960 pixels) were randomly displayed on an invisible 6 x 6 grid, excluding the central area with a red fixation point. The proportion of Black faces in the stimulus display varied across nine levels (with 0, 4, 6, 7, 8, 9, 10, 12, and 16 Black faces), with the remainder being White faces. Trials were repeated 40 times for each level, resulting in 360 trials. A pause was given after every 90 trials.

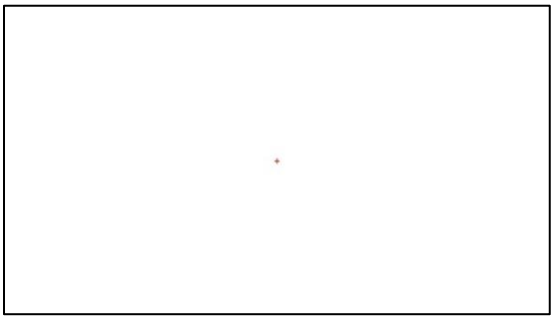
An example of one of the trials is shown in Figure 1. Each trial started with a fixation point of 0.5 seconds, followed by an array of faces for 0.5 seconds. Participants were asked to determine if there were more Black faces or White faces in each array by pressing either the B or the W keys on the keyboard. No feedback was provided.



Fixation (0.5 sec)



Stimulus (0.5 sec)



Response (until response)

Figure 1. Sample of one trial

2.4. Implicit Association Task

This part of the experiment was drawn from the original Race IAT (Greenwald & Banaji, 1995; Nosek et al., 2002) and all the stimuli were selected from the Project Implicit website.

Participants were shown two categories of images (Black and White faces) and two categories of words (positive or negative words) and were asked to classify the faces and/or words as fast as they can by pressing one of two computer keys. There were seven blocks in total, including five blocks of 20 practice trials, and two critical blocks of 40 trials. In one of the critical blocks, participants were asked to press one key (eg: "E") to categorize either White faces or positive words, and another key (eg: "I") to categorize either Black faces or negative words (referred to as "Congruent Trials" in the literature). In the other critical block ("Incongruent Trials"), the categorizations were reversed, such that one key was assigned to White faces and negative words, and another key was assigned to Black faces and positive words. The central idea is that when cognitively linked items, such as White faces and positive words, share the same response key as in the congruent trials, the response rate is faster and more accurate compared to situations where the items are not cognitively linked, such as with Black faces and positive words.

2.5. Self-Report Measures of Racial Attitude

All participants answered three questions to assess their explicit measures of racial attitude (Greenwald et al., 1998). They indicated their preference for Black or White individuals on a 7-point scale ranging from "I strongly prefer White people to Black people" to "I strongly prefer Black people to White people". Following this, they rated their warmth and coldness towards Black and White individuals separately on a 10-point scale, ranging from "Extremely warm" to "Extremely cold". Participants were given the option to skip any questions they did not want to answer.

Note: All data, analyses, and materials used in the study will be made available to any researcher for purposes of reproducing the results or replicating the procedures.

3. Results

3.1. Psychophysical Experiment for Estimating Numerosity Perception of Black and White Faces

To detect outliers, we examined individual responses on extreme trials (trials with only Black faces, and only White faces). The error rate in these trials was calculated as proportion of Black responses in arrays of only White faces, and proportion of White responses in arrays of only Black faces. The overall error rate amongst all participants was low (M=0.10, SD = 0.10), which was similar to prior studies (Yang & Baek, 2022). Two participants, both of whom were White, showed an error rate of greater than 0.32, which corresponds to a mean of +2SD, and were excluded from further analyses. The remaining analyses were conducted on 60 individuals (31 Black, 29 White). The final mean error rate was 0.08 (SD = 0.07).

To test for perceptual bias, the proportion of trials on which participants responded they saw more Black faces (pr_{Black}) was computed for each trial type (i.e., reporting that Black faces were more numerous than White faces), ranging from no Black faces to all Black faces in the array. We then calculated the difference between participants' estimate of Black faces and the actual prevalence of Black faces for each trial type. A score of 0 shows no overestimation (i.e., accurate estimation). In order to assess trends across different arrays, the average degree of perceptual bias was computed over the mostly White arrays (referred to henceforth as "White arrays"; between 0 and 6 Black faces), neutral arrays (equal amounts White and Black faces), and mostly Black arrays (referred to henceforth as "Black arrays"; between 10 and 16 Black faces). It is important to note that on each trial, participants were given a forced choice task: to determine whether they saw more White faces or more Black faces. Therefore, an overestimation of Black faces is equivalent to the same level of underestimation of White faces. To maintain consistency, we will refer to all estimates in terms of a perceptual bias towards estimating Black faces.

A one-way ANOVA testing the degree of overestimation of Black faces across each trial type (White, Black, and neutral) was conducted with participant race as a between-subject variable. There was no difference between White and Black participants on their performance on the neutral arrays [$F(1,58) = .33$, $p = .57$, $\eta^2 = .006$] or Black arrays [$F(1,58) = .67$, $p = .42$, $\eta^2 = .01$]. However, for the White arrays, there was a significant effect of race [$F(1,58) = 5.24$, $p < .05$, $\eta^2 = .083$]. One-sample t-tests, with a cutoff of 0 revealed that while White participants neither over, nor underestimated Black faces ($M = .014$, $SD = .077$), Black participants significantly underestimated Black faces, or overestimated White faces, in the mostly White arrays ($M = -.029$, $SD = .076$, $t(30) = -2.09$, $p < .05$).

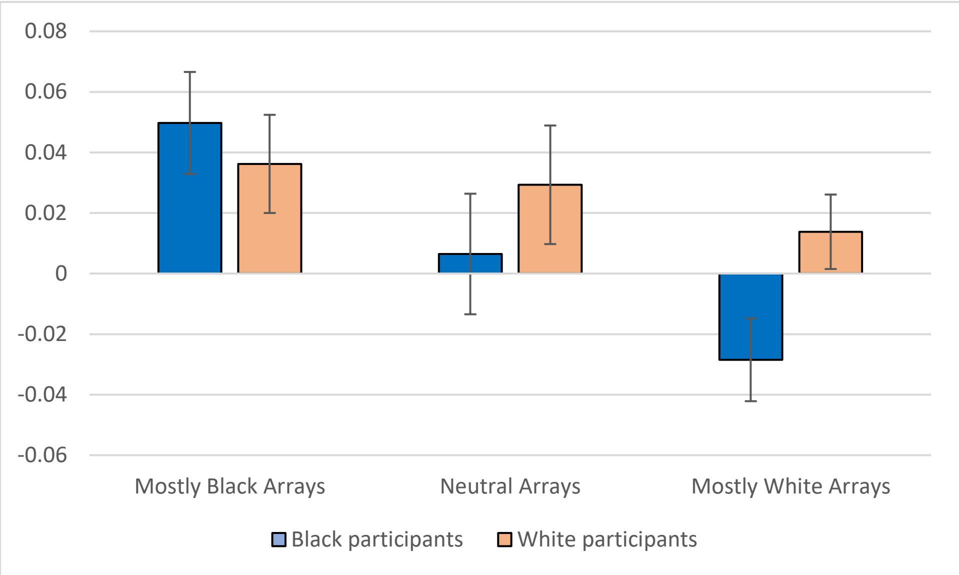


Figure 2. Overestimation across Varying Types of Arrays
Note: Patterns of estimation over Black arrays, neutral arrays and White arrays, with a score of 0 depicting no bias, a positive score depicting overestimation, and a negative score depicting underestimation for White and Black participants. Error bars represent standard error of mean.

An important question was the extent to which these patterns were driven by ingroup affiliation, versus implicit associations for different races, regardless of group affiliation, or a combination of both the factors. Therefore, the next question was the extent to which these results were driven by individual differences in implicitly and explicitly held associations for Black and White faces.

3.2. Effect of Implicit Associations on Bias

Participants' implicit associations for Black versus White faces were measured for each participant. The data were scored and interpreted based on the recommended algorithms in the literature (Greenwald et al., 2003; Richetin et al., 2015). The measure of implicit association in the IAT is the difference in response time between the Black + good/White + bad trials and the Black + bad/White + good trials. This measure, referred to as the IAT effect (D) ranges between -2 and 2, with larger numbers suggesting a pro-White association, and smaller numbers suggesting a pro-Black association (Nosek et al., 2005). A score of 0 indicates no measurable association. The IAT effect differed significantly between the two groups [$t(58) = 2.71$, $p <$

0.05, d = .70]. While White participants showed a strong pro-White association [*M* = 0.29, *SD* = 0.27; *t*(29) = 4.29, $p < 0.001$, d = .80], Black participants showed no significant association in either direction [*M* = 0.043, *SD* = 0.34; *t*(29) = 0.72, *p* = 0.48, d = .13], as revealed by one-tailed t-tests and in Figure 3 below.

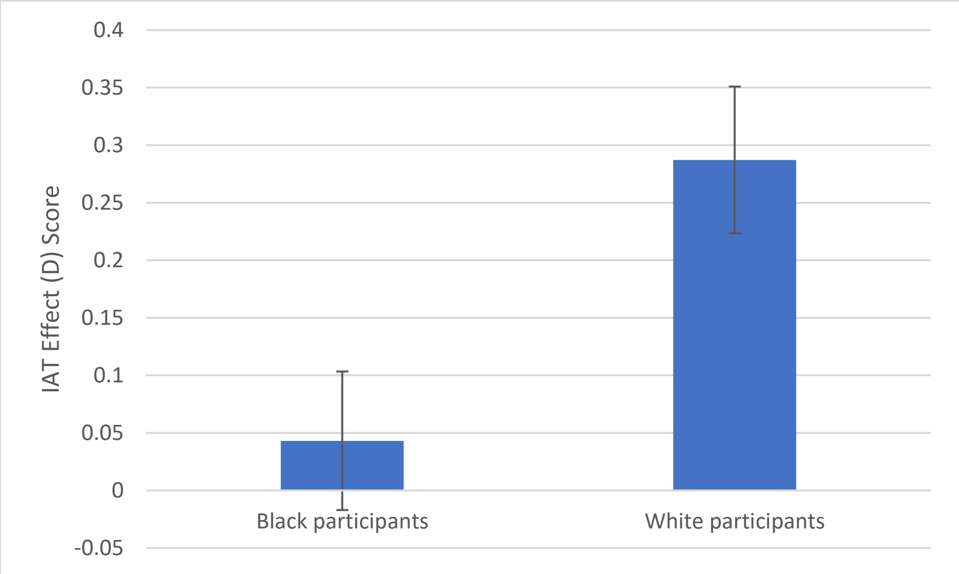


Figure 3. Mean IAT scores for Black and White participants
Note: Scores above zero reflect an implicit pro-White over Black bias; Scores below zero reflect an implicit pro-Black over White bias. Error bars represent the standard error of the mean.

Individual IAT scores were negatively correlated with degree of overestimation but only in the White arrays, [*r*(60)=-.32, $p < .05$]. That is, individuals with a higher IAT score (indicating stronger pro-White implicit associations) tended to underestimate the presence of Black faces (i.e. overestimate White faces) but only in the White arrays. There were no other significant correlations ($p > .05$).

3.3. Effect of Self-Reported Measures of Racial Attitudes on Bias

Participants' explicit racial attitudes were assessed via two self-report questions to yield a measure of relative warmth towards White versus Black people ($Warmth_w$) and one towards preference towards White versus Black people ($Preference_w$). For $Warmth_w$, the level of warmth for White people was subtracted from the level of warmth for Black people to yield scores ranging from -10 to 10. Negative scores indicate greater warmth towards Black people, positive scores indicate greater warmth towards White people, and a score of 0 indicates no direction of warmth in either direction. Within our sample, there was no significant difference from 0 for either of the groups [Black participants: *M* = -.66, *SD* = 2.33, *t*(28) = .79, *p* = .43; White participants: *M* = -.15, *SD* = 2.21, *t*(26) = .34, *p* = .73] and no significant difference between the groups [*t*(54) = .83, *p* = .41, d = .22]. The scores for $Preference_w$ ranged from 0 to 7 with scores lower scores reflecting a Black preference, higher scores reflecting a White preference, and a score of 3.5 reflecting no preference in either direction. Within this sample, the groups significantly differed on $Preference_w$ [*t*(52) = 3.81, $p < 0.001$, d = 1.04]. Black participants showed a significant Black preference [*M* = 2.25, *SD* = 1.00, t(27) = 6.59, $p < 0.001$], but White participants reported no preference for either group [*M* = 3.27, *SD* = .86, *t*(25) = 1.22, *p* = .23], based on one-sample t-tests with a test value of 3.5 (see Figure 4).

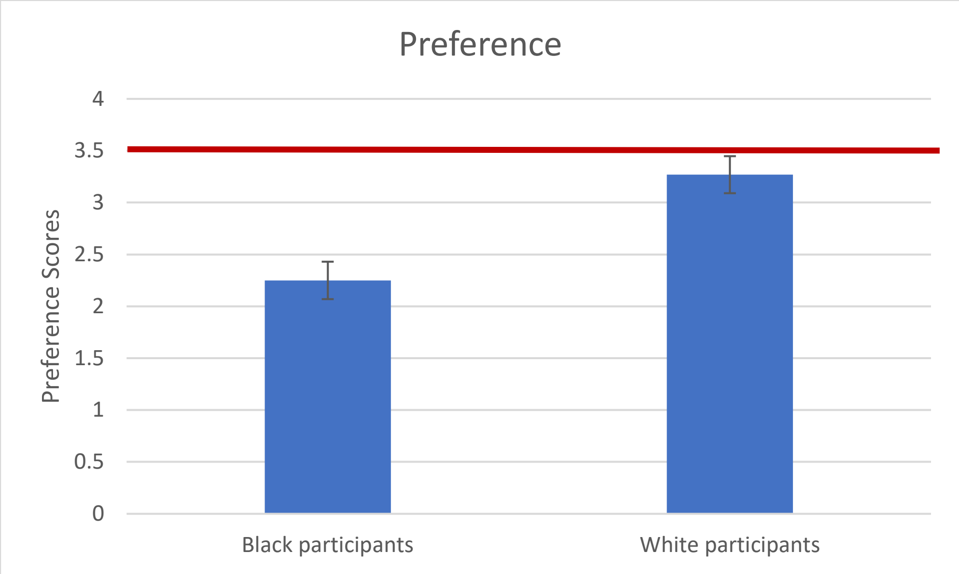


Figure 4. Mean Preference$_w$ scores for Black and White participants

Note: Scores above 3.5 (denoted by red line) reflect a White preference, scores below 3.5 reflect a Black preference. Error bars represent the standard error of the mean.

In terms of correlations between different measures, IAT scores positively correlated with Preference$_w$ [r(60)=.38, p < .01], but not with Warmth$_w$ [$r(56)=.20$, $p = .19$]. That is, individuals with a strong pro-White association also tended to explicitly report more preference for White people. Neither Warmth$_w$ nor Preference$_w$ correlated with degree of overestimation of Black faces [all $r < .15$, all $p > .26$].

The next step was to assess how various factors can contribute to and predict perceptual bias in numerical estimation tasks. A multiple regression analysis was performed to identify possible predictors of perceptual bias (overestimation of Black faces in the different trial types), with an entry-criterion of 0.05. Each trial type (Black, White, and neutral) was analyzed separately. For the Black arrays and neutral arrays, the predictors did not significantly predict the degree of overestimation [mostly Black arrays: $R^2 = .037$, Adj. $R^2 = .019$, $F(1, 53) = 2.00$, $p = .16$; neutral arrays: $R^2 = .024$, Adj. $R^2 = .005$, $F(1, 53) = 1.28$, $p = .26$]. However, when the analysis was run to predict perceptual bias in White arrays, interesting trends emerged. The predictor variables significantly predicted perceptual bias in these arrays, $F(4, 52) = 5.68$, $p < .001$, $R^2 = .32$. The individual predictors were examined further and indicated that IAT ($\beta = .45$, $t = 3.47$, $p < .001$) and participant race ($\beta = .51$, $t = 3.72$, $p < .001$) were significant predictors. However, Warmth$_w$ ($\beta = .21$, $t = 1.67$, $p = .10$) and Preference$_w$ ($\beta = .075$, $t = .54$, $p = .56$) were not.

Table 1.

Summary of Correlations with Warmth$_w$ and Preference$_w$ for White Arrays, Neutral Arrays, and Black Arrays

Variable	Black Arrays	Neutral Arrays	White Arrays
IAT	.19	-.064	-.32*
Warmth$_W$	-.016	.066	.14
Preference$_W$	.051	.15	.066

[*] Correlation is significant at the 0.05 level (2-tailed).

4. Discussion

The primary aim of the present study was to investigate the influence of implicit racial associations and ingroup affiliation on perceptual biases. Drawing upon previous research highlighting the tendency to overestimate the prevalence of minority groups in various environments, we sought to explore whether similar biases manifest when individuals are presented with arrays containing different proportions of Black and White faces. By adapting the numerosity comparison task utilized in prior studies (Yang & Baek, 2022), incorporating brief presentation durations to tap into subconscious mechanisms, and including extreme proportions of diversity within the arrays, we aimed to assess how implicit associations and ingroup affiliations may shape perceptual biases and perceptions of racial composition.

Our study revealed the conflicting roles of ingroup affiliation and implicit association in our perceptual biases. Firstly, there was a tendency for Black participants to consistently overestimate outgroup faces (underestimate ingroup faces) in mostly White arrays, a phenomenon consistent with previous research on minority salience (Kardosh et al., 2022; Sklar et al., 2021). A potential explanation for the heightened overestimation could lie in the activation of the amygdala by threatening faces (Adolphs et al., 1995). As described in an earlier section, there is greater amygdala activation in the presence of other-race faces than own race faces in both White and (Lieberman et al., 2005; Phelps et al., 2000) and Black participants (Hart et al., 2000), suggesting that rapid, unconscious assessments of potential threats based on ingroup affiliation may play a role in shaping neural responses and perceiving estimates of diversity.

However, our findings on implicit associations show divergent findings. Namely, we found that individuals with a strong positive White association overestimated the presence of White faces, but only in arrays featuring mostly White faces. In other words, individuals with stronger pro-White implicit associations tended to underestimate the presence of Black faces in these arrays. While purely speculative, these findings might be driven by increased competitive threat that emerges when there is an increase in the proportion of a minority group, both at the level of the group (Taylor, 1998) and at the level of the individual (Semyonov et al., 2004). Furthermore, drawing from social identity theory (Bey et al., 2019), individuals with pro-White implicit associations may exhibit a stronger ingroup bias, perceiving arrays with Black faces as incongruent with their ingroup norms and expectations. Consequently, they may be more prone to underestimating the presence of Black faces (and overestimating White faces). Additionally, the underestimation of Black faces in Black arrays might actually be driven by an overestimation of White faces in those arrays. Similar trends are observed in individuals with social anxiety, and their estimates of angry versus neutral faces (Yang & Baek, 2022). Specifically, individuals with high social anxiety tended to focus more on negative stimuli, leading to biased attention and overestimation of negative faces in arrays. Alternatively, individuals with a pro-White association may prefer environments and stimuli that align with their implicit associations and societal norms, which often prioritize White individuals. Thus, when presented with arrays of faces, individuals with a pro-White association might naturally gravitate towards and focus more on White faces, leading to an overestimation of White faces, and a consequent underestimation of Black faces.

When looking at the relative contribution of implicit associations and ingroup affiliations, there appears to be a general tendency for individuals to rely more on implicit associations rather than on minority salience or group affiliation. Therefore, the findings of our study provide valuable insights into the role of between group and within group effects in shaping perceptions of racial diversity. These findings are particularly significant in the context of addressing issues of racial representation and inclusivity in various societal domains. Thus, the results of this study will benefit further research into the development of targeted interventions for strong implicit biases. With the acknowledgement of the role implicit associations play on our perceptions, diversity, equity, and inclusion (DEI) committees can focus program and training designs around aiding people in understanding their biases and mitigating their influences.

4.1. Limitations and Next Steps

Despite the novel findings within our study, we acknowledge several limitations and future considerations. Firstly, our sample size was limited in scope, due to the challenges in recruitment and the difficulty in ensuring legitimacy of online behavioral data gathering. Additionally, we need to be cautious about the generalizability of these findings. All our participants, including our Black participants, were drawn from environments predominantly populated by individuals of White backgrounds, such as predominantly White institutions. Further, it is important to note that we did not gather detailed data on each individual's specific background and environment which may limit the generalizability of the findings to more diverse populations and limit our understanding of the contextual factors influencing our results. Conducting similar studies in environments where Black individuals constitute the majority might yield different results and provide deeper insights. Future research could also use experimental designs to disentangle the role of exposure to racial diversity.

Secondly, while the IAT is a widely used tool for assessing implicit associations, it has been subject to criticism regarding its construct and predictive validity (Oswald et al., 2013, 2015). Some researchers argue that the IAT may not accurately capture individuals' true implicit biases due to various methodological and conceptual limitations. For instance, the IAT relies on reaction times to assess implicit associations, which may be influenced by factors unrelated to bias, such as familiarity with the task or individual differences in cognitive processing speed. Additionally, the IAT measures associations between concepts (e.g., Black and White faces) rather than direct attitudes or beliefs, raising questions about the interpretation of results. Therefore, while our study provides insights into the relationship between implicit associations and perceptions of racial composition, the reliance on the IAT as a measure of implicit associations introduces a potential limitation that should be considered in the interpretation of our findings. Future research could explore alternative measures of implicit biases or employ multiple methods to triangulate findings and enhance the robustness of conclusions. Furthermore, research examining the effectiveness of interventions targeting implicit biases and ingroup dynamics could provide valuable insights into strategies for promoting diversity and inclusion in various settings.

Acknowledgements and Author Contribution Statement

Data and experimental programs are made openly available. This study was funded by the Office of the Provost and Summer Research Institute grant of Hood College. Portions of these findings were presented as a poster at the Rocky Mountain Psychological Association conference in April 2024. We have no conflicts of interest to disclose.

ELF and SG equally conceptualized the study, recruited participants, maintained the data, and designed the methodology. ELF took the lead on project administration and writing original draft. SG took the lead on formal analyses, funding acquisition, and reviewing and editing. SG also supervised the project. Both authors take full responsibility for the paper as a whole and all of the data.

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