SEEING INDIVIDUAL PAIN:

CAN INDIVIDUATION REDUCE RACIAL BIAS IN PAIN PERCEPTION?

by

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ABSTRACT

In the United States, Black Americans are undertreated for their pain. While pain disparities likely arise from a complex interplay of structural, historical, and individual factors, previous research has also highlighted the role of perception. Specifically, perceivers demonstrate consistent biases in the visual recognition of pain on Black versus White faces. As an initial attempt to intervene on this perceptual bias, we conducted three studies examining if providing perceivers with individuating information or motivating their individuation of Black faces could reduce this bias. In Study 1, participants had to consider individuating (e.g., name), categorical (e.g., race), or no personal information (e.g., control) about a target prior to assessing the target's pain level. In Studies 2 and 3, participants were given instructions about the cross-race effect or about racial bias in pain perception, respectively, and informed about how to avoid these race-based errors prior to standard pain perception and treatment tasks. Across these three studies, we observed that individuation-based interventions did not reliably reduce racial bias in pain perception; that said, individuation did produce a small reduction in racial bias in treatment recommendations, compared to comparison and control conditions. Overall, the effects of individuation were inconsistent and small, casting some doubt on the effectiveness of this approach. Taken together, these data speak to the robustness of racial bias in pain perception and suggest that individuation may not be the best means for intervening on this bias.

Chapter 1

INTRODUCTION

There is a long history of mistreating and undertreating Black Americans within medical contexts, which has received particular attention in the case of pain (Green et al., 2003). This history of mistreatment includes clinicians both consciously inflicting pain upon and ignoring the pain of Black people (Trawalter, Bart-Plange, & Hoffman, 2020). Stemming from slavery propaganda, Black people were depicted as being biologically different from their White counterparts, and specifically, as being able to endure more pain (Trawalter & Hoffman, 2015). This false narrative has continued post-slavery, resulting in the widespread contemporary endorsement of these false beliefs—for example, that Black people have thicker skin and fewer topical nerve endings, making them less sensitive to pain (Hoffman, Trawalter, Axt, & Oliver, 2016).

There are consequences to these lies. In the present day, medical professionals prescribe less pain medication to Black Americans across various contexts. When Black individuals do receive pain medication, it tends to be at lower doses compared to their White counterparts. For example, a recent meta-analysis of 13 studies of potential bias in analgesia administration in emergency departments, Lee and colleagues (2019) found that Black and Hispanic patients are less likely to receive analgesic treatment—including opioids—for their acute pain. This disparity also exists within pediatric pain care. For example, in one investigation of in-hospital pain care, Black children were less likely to receive medication to relieve their pain than White children when entering an emergency room for appendicitis (Goyal et al., 2015). This disparity is also well-documented in the context of maternal pain care. During labor, minority women are more likely to receive inappropriate anesthesia (e.g., general, rather than neuraxial) compared to White women, leading to later medical complications (Guglielminotti et al., 2019). Despite attempts to understand and intervene on these disparities (see Nelson, 2002), the pain of Black Americans continues to be underdiagnosed and undertreated.

These gaps in the treatment of Black patients' pain are multiply determined by a variety of well-documented contributing factors. Hoffman, Trawalter, Axt, & Oliver (2016) demonstrate that endorsement of false beliefs about biological differences among Black and White individuals (e.g., that Black people have less sensitive nerve-endings) are associated with biases in pain assessments and treatment recommendations by White laypeople, medical students, and medical residents. Racial stereotypes regarding status also contribute to real-world gaps in pain care, specifically the belief that individuals of a lower status experience (and endure) hardships that make them tougher, and thus more capable of withstanding pain. In other words, experiential suffering leads to physical fortitude (Trawalter, Hoffman, & Waytz, 2012; Deska et al., 2020a; 2020b). Similarly, racial stereotypes regarding strength (e.g., Black individuals are more physically formidable; Wilson, Hugenberg, & Rule, 2017; Johnson & Wilson, 2019) may be linked to more general expectations that Black individuals are able to withstand more pain (and less likely to report pain) than their White counterparts (Wandner et al., 2012). Critically, these false beliefs run counter to both clinical and empirical studies demonstrating if anything, Black individuals tend to express higher sensitivity to pain (e.g., higher self-reported pain experience, lower pain tolerance; Edwards, Doleys, Fillingim, & Lowery, 2001; Riley et al., 2014; Losin et al., 2020).

Racial Bias in Pain Perception

Recent research has also shown that these biases in in pain care and pain attribution are mirrored by gaps in the visual perception of pain. White perceivers tend to see pain less readily on Black faces compared to White faces, even when the expressions and intensity of the pain are the same. Consequently, White perceivers also prescribe less pain reliever to Black faces (Lin et al., under review). Moreover, racial bias in pain perception is exacerbated when cues to racial prototypicality are present: perceivers are worse at recognizing the pain of darker skinned (versus lighter skinned) Black faces, and furthermore, differences in thresholds for pain on Black versus White faces are larger when faces have racially prototypic (versus neutral or nonprototypic) structure (Drain et al., in prep).

What perceptual mechanisms might underlie these differences in thresholds for pain on Black versus White faces? Expert-level face perception is typically characterized by configural face processing. While different researchers use the term "configural processing" to refer to a variety of phenomena, in general, it refers to perceiving a face in terms of the relationships between features (e.g., the order they appear in or the distances between them). Configural processing can be contrasted with featural processing, which involves a focus on the specific details of individual features themselves (see Maurer, Le Grand, & Mondloch, 2002 for an extensive review; see also Piepers & Robbins, 2012). Research has shown that configural face processing is necessary for accurate face and emotion recognition, while disruptions in these outcomes may stem from a comparative reliance on featural processing. Notably, a perceiver's engagement of these two modes of face processing seems to depend on target race, such that same-race faces engage configural processing, while other-race faces engage more featural processing. As a result, disruptions in configural processing have been identified as a potential contributing factor to race-based differences in face memory typically termed the cross-race effect (CRE, also known as the Other-Race Effect or Own-Race Advantage). Research on the CRE demonstrates that people recognize faces belonging to their own race better than faces belonging to another racial group (e.g., Meissner & Brigham, 2001; Vingilis-Jaremko et al., 2020).

To examine whether racial bias in pain perception stems from similar disruptions in configural face processing, previous work used a face inversion approach (Mende-Siedlecki et al., 2019). When faces are presented in an upright orientation, configural processing is conserved, but when faces are inverted, this impairs configural processing (Freire, Lee, & Symons, 2000; Yin, 1969). In two experiments, White perceivers showed robust racial bias in pain perception for upright faces, but their bias was reduced for inverted faces. In other words, when configural processing was impaired for *both* White and Black targets, racial bias in pain perception diminished, suggesting that disruptions in configural processing underlie this bias within upright faces. This work provides an initial account of the perceptual mechanisms supporting racial bias in the visual recognition of pain expressions. Moreover, these data suggest that to further understand this bias, we must continue to explore factors that enhance and impair these perceptual processes.

Individuation as a Means of Reducing Bias in Pain Perception

Previous work on the cross-race effect offers a roadmap for understanding the perceptual and psychological processes that may elicit racial bias in social perception. Numerous models in this literature exist that attempt to characterize the CRE in terms of differences in perceptual expertise for same- and other-race faces (e.g., Rhodes et al., 2009; Tanaka, Kiefer, & Bukach, 2004), differential processing of same- and other-race faces (e.g., Michel, Rossion, Han, Chung, & Caldara, 2006; Rhodes et al., 1989), or differential representation of same- and other-race faces (e.g., Valentine, 1991, 2001). However, more recent work has attempted to integrate these perspectives together with other social cognitive perspectives on the CRE (e.g., Levin, 1996, 2000; Sporer, 2001). One such hybrid model is the Categorization-Individuation Model (CIM; Hugenberg, Young, Bernstein, & Sacco, 2010; Young et al., 2012).

The CIM expands on a long tradition of work in social psychology demonstrating that we form impressions about others on a continuum from categorization-related to individuation-related processes (Brewer, 1988; Fiske & Neuberg, 1990). Generally, people process outgroup members categorically (e.g., focusing on shared group characteristics), while individuating ingroup members (e.g., focusing on characteristics that are unique to a given person). The Categorization-Individuation Model (Hugenberg et al., 2010) suggests that this tendency to cluster outgroup members categorically and to individuate ingroup members has direct consequences for face perception and memory. From this perspective, the cross-race effect results from both the homogenizing effects of social categorization *and* a lack of individuation of other-race faces. Enhancing individuation may be a potential avenue for improving this deficit.

Indeed, research on this phenomenon demonstrates that motivating or triggering individuation likely facilitates configural (versus featural) processing of other-race faces (Hugenberg et al., 2010; Young et al., 2012). Research has shown that increasing a perceiver's motivation to individuate (specifically by instructing participants to focus on features that distinguished individual faces from each other; Hugenberg et al., 2007) can reduced decrements in memory for other-race faces. Supporting this finding, other work demonstrates that greater amounts of real-world individuating experience are positively associated with smaller differences in memory for same-race versus other-race faces (Walker & Hewstone, 2006). Notably, this benefit due to increased individuating experience is positively associated with enhanced configural (Hancock & Rhodes, 2008; Rhodes et al., 2009b; Zhao et al. 2014) and holistic processing of other-race faces (Bukach et al., 20012).

Even simple (yet unique) identifiers exert an overall influence on face memory: names facilitate the individuation of faces (Gordon & Tanaka, 2011), and as a result, people are better able to recognize faces that are associated with individuating labels (like names) than faces paired with non-meaningful labels (e.g. objects names, symbols; Schwartz & Yovel, 2016).

Consequently, training perceptual individuation of other-race faces by associating them with names can also reduce the CRE (McGugin et al., 2011) and similar paradigms linking faces to unique letter-based indentifiers have also been demonstrated to reduce implicit racial bias more generally (Lebrecht er al., 2009). Beyond motivation or training, learning certain types of biographical information can also spur the individuation of other-race faces—for example, membership in some other meaningful ingroup (Bernstein et al., 2007; Hehman, Mania, & Gaertner, 2010), high status or power information (Ratcliff et al., 2011; Shriver et al., 2008; Shriver & Hugenberg, 2010), or other cues to social significance (e.g., Bernstein et al., 2014) can reduce the CRE.

Thus, connecting a face with meaningful individuating information can improve perceivers' recognition of other-race faces—an improvement potentially facilitated through configural face processing. This is important, given that previous studies show that configural processing supports emotion recognition in general (Calder et al., 2000; Calder & Jansen, 2005) and that disruptions in configural face processing underlie racial bias in pain perception in particular (Mende-Siedlecki et al., 2019). Therefore, considering this work, we sought to test whether motivating individuation (either through identifying information or direct instruction) would ameliorate racial bias in pain perception.

The Current Studies

Across three studies, we explore the perceptual mechanisms supporting racial bias in pain care, with a specific focus on whether individuation may be used as an approach to mitigate this bias. Because biases in face memory and emotion recognition both stem from disruptions in configural face processing, cuing individuation may improve these deficits. Researchers have demonstrated that individuation can reduce the CRE and its consequences. The present studies apply these findings to the context of disparities in pain care and test whether enhancing individuation of Black faces would reduce race-based gaps in pain perception. In Study 1, participants were asked to consider individuating information (i.e., a target's name) prior to evaluating facial expressions of pain, as opposed to considering category-based information (i.e., a target's race) or a neutral control condition. In Studies 2 and 3, participants were either assigned to read instructions designed to promote individuation of other-race faces prior to making pain evaluations, or to read control instructions. We predicted that participants would see pain less readily and prescribe less pain reliever to Black (versus White) faces. However, we predicted that bias in pain perception and treatment would vary by condition—specifically, that while bias would be robust in participants in the categorization condition (Study 1) and control conditions of these experiments (Studies 1-3), bias in perceiving and treating pain on Black versus White faces would be comparatively reduced in the individuation condition.

Chapter 2

STUDY 1

Instructing participants to consider unique identifiers (e.g., names) should promote individuation of those faces, enhancing configural face processing; however, if participants are instructed to consider only categorical information (e.g., race), this should reduce individuation and potentially further disrupt configural face processing. In this study, participants were prompted to answer questions that would either lead to individuation or categorization (plus an additional no-information control condition) of a set of Black and White faces that were in pain and in need of treatment. We predicted that participants with no additional information would show the typical racial bias in pain perception; they would see pain less readily on Black (versus White) faces and recommend more treatment to White (versus Black) targets. Critically, we also predicted that participants prompted to individuate would demonstrate less of a racial bias in both pain perception and treatment recommendations, while participants prompted to categorize would demonstrate more racial bias in both categories.

Method

Participants

We recruited 309 White participants through Amazon's Mechanical Turk (106 in Categorization, 102 in Control, 101 in Individuation; 149 women, 158 men, 2 non-binary or preferred not to say; M_{age} = 37.06, *SD* = 11.82). One hundred and two non-White participants took part in the study (40 Black/African American, 29 Asian, 23 Hispanic/Latino, 5 Native American, 5 identifying with another racial or ethnic group); however, their data are not included in the present analyses. All participants received monetary compensation for participation (~$3.00 on average). Participants were required to be United States residents and had to have an approval rate of 90% on MTurk to be eligible for participation.

This approach to pre-screening, data collection, and data analysis is consistent with our initial studies on racial bias in pain perception (e.g., Mende-Siedlecki et al., 2019). In general, while our data collection typically leads smaller groups of non-White participants (that would be underpowered for separate analysis), we have aggregated across these samples meta-analytically (Lin et al., under review). Thus, we did not restrict our data collection based on race/ethnicity. Our sample size was determined somewhat heuristically; we aimed for at least 100 participants per condition.

Stimuli

We selected eight Black and eight White male faces from the Delaware Pain Database (DPD; Mende-Siedlecki, Qu-Lee, Lin, Drain, & Goharzad, 2020). Each actor was photographed posing various expressions of pain. (Full details of the procedures for collecting and norming these stimuli can be found in Mende-Siedlecki et al., 2020.) Target race and gender were first self-reported by the models themselves, and then confirmed via consensus ratings collected during the norming of the DPD[1].

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[1] All 16 models selected were categorized as male 100% in the norming of the DPD. On average, the eight selected Black targets were categorized as Black 96.84% of the time and as White 0.30% of the time, while the eight selected White targets were categorized as White 85.92% of the time and as Black 0.30% of the time. The most frequent other categorization for these models was Hispanic in both cases, though this was more frequent within the White (11.22%) versus the Black models (1.45%). In line with these figures, the selected Black faces were rated as looking somewhat more racially prototypic than the White faces $t(14) = 1.78$, $p = .096$, $M_{\text{Black}} = 4.32$, $M_{\text{White}} = 4.03$).

For each face, we created 11 morphs using Morpheus PhotoMorpher Pro, from a 100% neutral expression to 100% painful expression. These selections were made prior to the completion of a full norming of the DPD, and as such, the balance of these stimuli across race in terms of normed ratings of pain intensity and various pain-related social evaluations is not optimal. On the one hand, the selected Black and White targets did not differ significantly in terms of evaluations of the intensity ($t(14) = -1.53$, $p = .150$, $M_{Black} = 4.57$, $M_{White} = 4.97$), specificity ($t(14) = -1.49$, $p = .158$, $M_{Black} = 1.48$, $M_{White} = 2.06$), or believability of their pain expressions ($t(14) = -0.09$, $p = .926$, $M_{Black} = 5.77$, $M_{White} = 5.80$), nor did they differ significantly in terms of evaluations of resting pain content ($t(14) = -1.20$, $p = .250$. $M_{Black} = 1.81$, $M_{White} = 1.96$) in their neutral faces, or judgments of strength ($t(14) = 1.52$, $p = .151$, $M_{Black} = 4.17$, $M_{White} = 3.66$), status ($t(14) = -1.51$, $p = .153$, $M_{Black} = 2.86$, $M_{White} = 3.17$), masculinity ($t(14) = 0.48$, $p = .641$, $M_{Black} = 5.15$, $M_{White} = 5.02$), or dominance ($t(14) = 0.78$, $p = .450$, $M_{Black} = 3.96$, $M_{White} = 3.71$) made based on their neutral faces. On the other hand, the patterns of means observed are likely reflected of some unwanted differences across target race[2].

While this may call comparisons across target race into some question (due to potential confounds), this issue is conserved across each level of the between-subjects factor in this experiment (e.g., the Control, Categorization, and Individuation conditions; see below). Ultimately, we recognize that the cross-race variability along

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[2] The comparisons here are independent-samples *t*-tests between average ratings for the eight Black and eight White targets. On average, the 100% neutral versions of the selected stimuli received 43.48 ratings (43.50 within Black targets and 43.38 within White targets) and the expression versions (e.g., the 100% painful faces) received 42.06 ratings (42.50 within Black targets and 41.63 within White targets). For details on the samples used to rate these stimuli see Study 1 in Mende-Siedlecki et al., 2020.

these dimensions is considerably higher than would be ideal—and indeed, higher than what we have aimed for in our other work (Mende-Siedlecki et al., 2019; Mende-Siedlecki et al., 2021; Mende-Siedlecki et al., 2022).

In addition, we note that the selected Black and White faces did not differ in terms of objective measurements of their facial width-by-height ratios (p = .952), a feature that has been linked to judgments of pain tolerance and experience (Deska & Hugenberg, 2018).

Participants in the Individuation condition selected names to pair with each of the faces they encountered (see Procedure). These names were rated by another set of MTurk participants (M_{age} = 36.33, SD_{age} = 11.20; 79 women, 82 men, 1 non-binary; 72.22% White) in terms of how stereotypically Black or White they seemed on a 1 ("very stereotypically Black") to 9 ("very stereotypically White") scale. From that list, twenty names were chosen that were closest to the midpoint of the scale—in other words, the twenty names that were judged as being least stereotypically Black or White (M = .204, SD = .357). These twenty names range from a 4.34 ("Xavier"; SD = 2.67) to a 5.71 ("Sean"; SD = 1.94) on this 1-9 scale.

Procedure

Participants were randomly assigned to one of three conditions: Control, Categorization, or Individuation. Participants in the Control condition completed a standard set of tasks developed previously (Mende-Siedlecki et al., 2019). First, in a *pain rating task*, participants were asked to rate the pain of faces they were told experienced a painful burning sensation from a thermode. Participants had to make a binary Yes/No decision about whether each face was in pain. Above each face was the question, "Is this face in pain?" Individual targets were blocked by identity. Each block began with a target face displaying a neutral expression, followed by the same individual displaying increasingly painful expressions until participants gave a "Yes" response. Once participants responded "Yes" (e.g., that the face in question was in pain), the task advanced to the next block of pain morphs for a new face, starting with a neutral expression. While faces advanced in a successive order within each block, blocks of faces were presented in a random order. Each participant rated four Black and four White sets of morphs, randomly selected from the larger set of stimuli chosen for use in this study. Moreover, pairings of these sets of four were counterbalanced across four versions of the task, to which participants were randomly assigned.

Participants in the Categorization and Individuation conditions completed the same sets of tasks, with one additional manipulation. In the Categorization condition, at the beginning of each block in the *pain rating task*, participants saw the target in question making a neutral expression and were asked, "What race do you think this person is?" to elicit categorization. They were given four options (Black, White, Hispanic, or Asian), presented in random order. After choosing the race of the face, the block of pain ratings began[3]. In the Individuation condition, at

[3] When conducting the current analyses, we chose not to remove trials when targets were categorized as a race other than their self-identified race. Ultimately, miscategorized trials represented a small minority of the overall trial count (M = 8.02%, SD = 9.63%; 68 out of 848 trials) in the Categorization condition, though rates of miscategorization did vary significantly between Black and White targets (M_{Black} = 3.02%, SD_{Black} = 8.50%; M_{White} = 12.74%, SD_{White} = 17.34%; $p < .001$). Moreover, only one Black target was ever categorized as being White (e.g., on one trial out of 816 trials across all participants in the Categorization condition), while White targets were categorized as being Black on three trials in total. The most frequent source of miscategorization was one White target who was categorized as Hispanic 52.46% of the time. Aside from that target, all White targets were categorized as White at least 77.05% of the time and all Black targets were categorized as Black at least 82.35% of the time. Finally, no participant miscategorized more than 62.50% of the targets and the modal correct categorization rate was 100%. All in all, any noise introduced by including the miscategorized trials in the Categorization condition data is minimal, and if anything, would be expected to work against our predictions given some pilot data collected in our lab suggesting that pain is underrecognized on Hispanic/Latinx faces.

the beginning of each block in the *pain rating task*, participants again saw the target in question making a neutral expression and were now asked, “What do you think this person’s name is?” to elicit individuation. They chose between four randomly selected and ordered names from the set of non-stereotypic names discussed in the Stimuli section. For participants in the Individuation condition, trials during the *pain rating task* asked, “Is [name] in pain?”, with participants’ name selections carrying forward on subsequent trials. After a name was chosen, that name was no longer an option in later blocks. As such, names could only be selected once. Both types of judgments (e.g., names and race categorizations) were self-paced.

Following the *pain rating task*, all participants completed a *treatment recommendation task* where they decided how much pain reliever they would give to faces they previously saw in the *pain rating task*. Two Black and two White targets were selected at random and presented again, one at a time, making an ambiguous pain expression (50% pain morph). Participants were told to prescribe between 0 and 20 grams of an experimental non-narcotic analgesic cream meant to alleviate pain to each target. The individuation and categorization manipulations were not reiterated in the treatment recommendations task. All ratings in both the *pain rating task* and the *treatment recommendation task* were self-paced.

Next, in the *social evaluations and demographics* phase of the study, participants completed a collection of additional individual difference measures assessing potential covariates of racial bias in pain perception and treatment. While we typically include these measures in similar work (e.g., Mende-Siedlecki et al., 2019), their associations with our indices of bias show considerable variability from study to study. Thus, while we report details on the measures included below (and in Studies 2 and 3), we do not report analyses of these measures. Instead, we direct the reader to meta-analytic assessments of these relationships that we have presented elsewhere (Lin et al., under review).

First, all participants made 12 social evaluations about the two Black and two White faces they saw previously during the treatment recommendations task. These evaluations were rated on a 7-point scale from 1 (*not at all*) to 7 (*extremely*). These questions related to status (high and low), trustworthiness, attractiveness, competence, confidence, generosity, friendliness, risk-seeking, athleticism, easy-goingness, and strength. (The low status ratings were reverse-scored and then averaged with the high status ratings to create a composite status measure for both Black and White targets.) Participants also completed feeling thermometers measuring their warmth felt towards ten social groups, with “Blacks” and “Whites” randomly intermixed among them (e.g., Wilcox, Sigelman, & Cook, 1989). Finally, participants completed demographic information about themselves, including their age, gender, race, and political ideology (from very liberal to very conservative), and a measure of endorsement of false beliefs regarding biological differences between Black and White individuals that has been demonstrated to predict racial bias in attributions of pain experience (Hoffman et al., 2016). All post-task ratings in the *social evaluations and demographics* phase were self-paced.

Analyses

First, we calculated participants’ average pain perception thresholds for Black and White faces from the pain rating task. The morphs participants chose to indicate pain were converted from an 11-point scale to a 0-to-1 scale. Using the rescaled values, we conducted a 3 (condition: Individuation, Categorization, Control) × 2 (stimulus race: Black, White) analysis of variance (ANOVA) to determine whether pain perception thresholds varied by condition, whether thresholds varied by the race of faces, and how race and condition interact. Next, we conducted a 3 × 2 ANOVA to determine whether condition, stimulus race, and their interaction impacted treatment recommendations.

Last, we tested whether participants' racial bias in pain perception was related to their treatment recommendations for the Black and White faces in pain. Because only a subset of faces was used in the treatment task, we only assessed the relationship between bias in pain perception and treatment using the data from Black and White faces that were in *both* tasks. This is consistent with our approach in previous work (Mende-Siedlecki et al., 2019)[4].

Results

Effects of target race and individuation instructions on thresholds for pain perception

We hypothesized that individuation would reduce the perceptual bias in participants' recognition of pain on Black and White faces. Further, we predicted that the racial differences would still be present for the Control condition and might be exacerbated for the Categorization condition (e.g., Hugenberg et al., 2010).

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[4] In some of our prior work, we have conducted within-subjects mediation analyses (using the SPSS macro MEMORE; Montoya & Hayes, 2017) to test whether bias in pain perception facilitates bias in pain treatment recommendations, to perform a within-subject mediation analyses. (Indeed, in the present Study 3, this approach was part of the preregistered analytic strategy.) As these analyses are less central to our primary question of whether motivating individuation reduces racial bias in pain perception and treatment, we have chosen not to include them in the present manuscript. However, when this work is submitted for publication, these analyses will be made available in supplementary materials, along with other exploratory analyses.

We found a significant main effect of target race on thresholds for pain perception ($F(1,306) = 270.50$, $p < .001$, $\eta_p^2 = .47$; see Figure 1). Specifically, participants had higher overall thresholds for seeing pain on Black faces ($M = 0.314$, $SD = 0.126$) than pain on White faces ($M = 0.237$, $SD = 0.127$), replicating prior findings. We also found a significant main effect of condition on thresholds for pain perception ($F(2,306) = 4.75$, $p = .009$, $\eta_p^2 = .03$). Specifically, participants in the Categorization condition had higher thresholds for seeing pain, across race, compared to participants in the Individuation condition ($MD_{\text{Cat-Ind}} = 0.049$, $p = .009$). Participants in the Control condition did not show significant differences in thresholds compared to participants in the Categorization condition ($MD_{\text{Cat-Con}} = 0.015$, $p = .375$), and compared to participants in the Individuation condition ($MD_{\text{Con-Ind}} = 0.035$, $p = .072$).

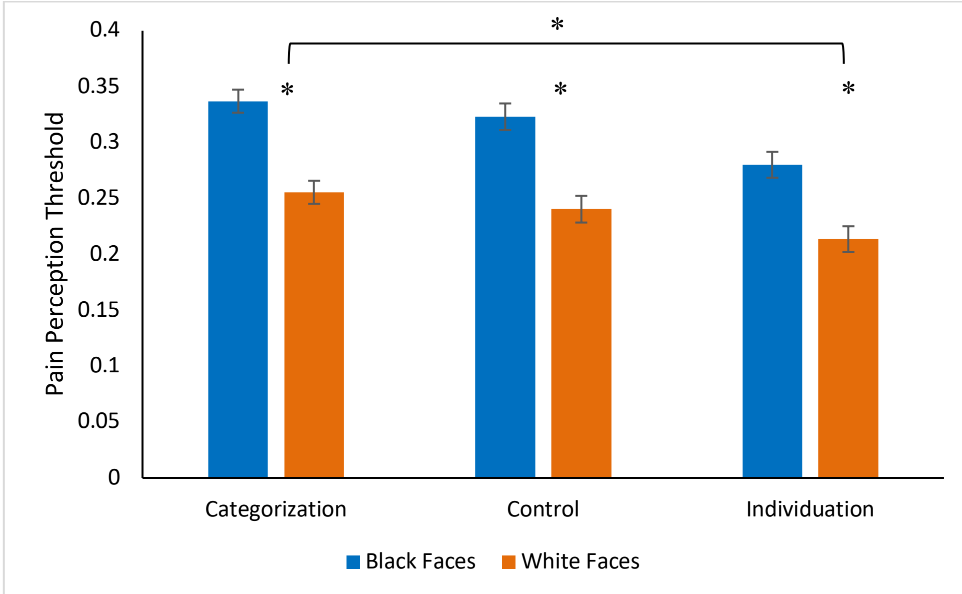

Figure 1 White perceivers showed more stringent thresholds for recognizing pain on Black faces versus White faces. Perceivers in the Categorization condition had higher thresholds overall compared to those in the individuation condition. Bracket represents main effect of condition. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Critically, we did not, however, observe an interaction between condition and race ($F(2,306) = 1.21$, $p = .301$, $\eta_p^2 = .01$). Though mean differences between participants' thresholds for seeing pain on Black versus White faces were in line with our overall predictions ($MD_{\text{Categorization}} = 0.081$, $SD_{\text{Categorziation}} = 0.076$; $MD_{\text{Control}} = 0.083$, $SD_{\text{Control}} = 0.087$; $MD_{\text{Individuation}} = 0.067$, $SD_{\text{Individuation}} = 0.083$), the effect of target race on pain perception did not vary by condition.

Effects of target race and individuation instructions on treatment recommendations

We predicted that individuation would also reduce differences in how much analgesic cream participants recommended prescribing to Black and White targets, but that the racial bias would still be present for the Control and Categorization conditions. We found a significant main effect of target race on treatment recommendations ($F(1,306) = 27.04$, $p < .001$, $\eta_p^2 = .08$; see Figure 2). Once again in line with previous work, participants recommended less pain reliever to Black targets ($M = 10.91$, $SD = 4.81$) compared to White targets ($M = 11.97$, $SD = 4.88$). We did not, however, observe an effect of condition ($F(2,306) = 0.88$, $p = .416$, $\eta_p^2 < .01$) nor an interaction between target race and condition ($F(2,306) = 1.55$, $p = .214$, $\eta_p^2 = .01$) on treatment recommendations.

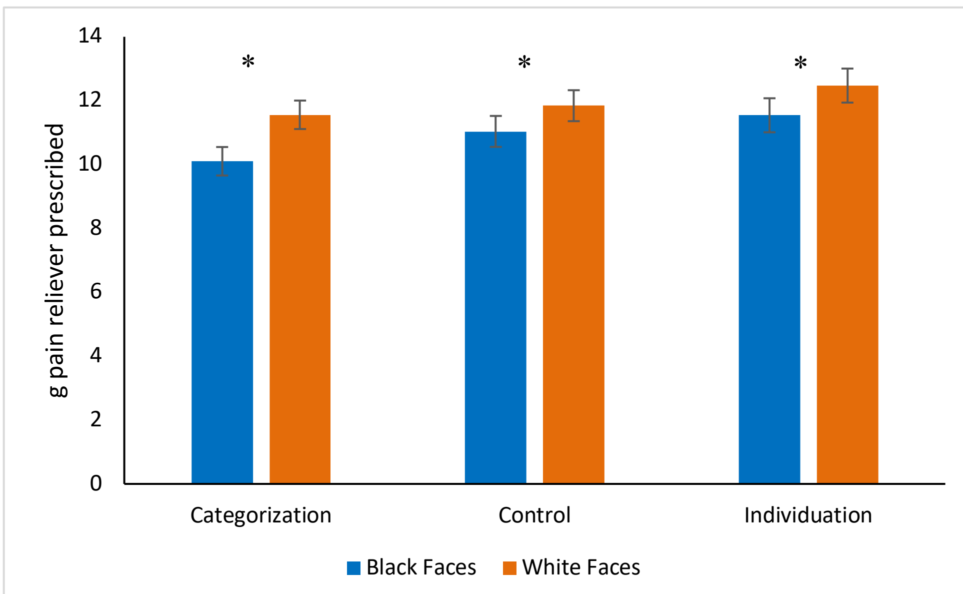

Figure 2 White perceivers recommended less pain reliever to Black faces compared to White faces across all conditions. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationships between bias in perception and bias in treatment

Our secondary hypothesis was that biased perception of painful expressions would be associated with biased treatment recommendations. First, we assessed the zero-order correlation between bias in pain perception thresholds (treated Black thresholds – treated White thresholds) with bias in treatment recommendations (White prescriptions – Black prescriptions). In line with the pattern robustly observed in prior work (Lin et al., 2020), there was a significant positive relationship (r(307 = .281*,* p < .001). Within participants in the control condition, biased pain perception was associated with biased treatment recommendations (r(100) = .288*,* p = .003. This relationship was also significant for participants in the categorization condition (r(104) = .308*,* p < .001) and the individuation condition (r(99) = .255*,* p = .010).

Discussion

Study 1 delivered mixed results regarding the effects of individuating information on racial bias in pain perception. While participants in the Individuation condition did, in fact, perceive pain more readily (compared to participants in the Control or Categorization conditions), differences in perceivers' thresholds for seeing pain on Black and White faces were still present. Individuation also did not lead to an improvement in pain reliever recommended, and more importantly, racial bias in treatment recommendations was still present across conditions. It may be the case that prompting participants to consider unique identifying information alone, such as a name, was not enough to induce individuation. Instead, informing participants of such gaps in social perception and directly motivating them to individuate Black targets may be a more effective means of reducing racial bias in pain perception and treatment.

Chapter 3

STUDY 2

Previous work (Hugenberg, Claypool, & Miller, 2007) demonstrates that educating perceivers about the CRE *and* motivating them to individuate other-race faces effectively reduces differences in memory for Black versus White faces. Given that the CRE and racial bias in pain perception are likely supported by similar mechanisms (e.g., disruptions in configural face processing), we adapted this manipulation to the context of pain perception. Specifically, we examined whether instructions meant to motivate individuation would improve participants' ability to perceive the pain on Black faces (and increase the amount of pain reliever they recommend prescribing to Black targets), resulting in a reduction of participants' bias favoring White faces. Thus, we predicted that participants receiving individuation-enhancing instructions would show less racial bias in both pain perception and treatment recommendations compared to participants receiving no instructions.

Method

Participants

We recruited 490 participants through Mechanical Turk. All participants received monetary compensation for participation (~$3.00 on average). Participants were required to be United States residents and had to have an approval rate of 90% on MTurk to be eligible for participation. 152 of these participants were non-White (65 women, 86 men, 1-non-binary; 63 Black/African American, 39 Asian, 35 Hispanic/Latino, 3 Native American, 1 Pacific Islander, and 11 identifying with another racial or ethnic group), and their data are not included in the present analyses (as in Study 1). An additional 84 White participant failed two manipulation check questions specific to the Individuation condition, and their data were also not included in analyses (see below in Procedure). While the exclusion criteria specific to these questions were not pre-registered, they were included for the express purpose of identifying participants who we could not be certain had read and understood the instructions containing our manipulation.

Our sample size was once again determined somewhat heuristically; we aimed for at least 100 participants per condition, but also tried to account for exclusion rates based on race in prior studies and manipulation check failures in a pilot study we conducted in a University of Delaware student sample (see Footnote 7). The final analyzed sample comprised 254 White participants (137 in Control, 117 in Individuation; 134 women, 118 men, 1 non-binary, and 1 who preferred not to say; $M_{\text{age}} = 35.74$, $SD_{age} = 11.21$).

Stimuli

We used eight Black and eight White faces of men from the DPD (Mende-Siedlecki et al., 2020) that were imported into FaceGen Modeller Pro (v3.18). Importing these faces allowed for the pain expressions used in the study to be uniform across race, because a given pain expression could be rendered on both a Black face and a White face and then presented in the same task. Prior to rendering these expressions on the selected "imported" faces, we confirmed a) that the selected Black and White faces did not differ on any sociodemographic or emotional evaluations of their baseline (e.g., neutral) images (via norming data collected in a separate sample[5])

[5] The sample that normed these imported faces comprised 164 individuals recruited from MTurk (M_{age} = 35.49, $SD_{\text{age}} = 10.62$; 101 men, 63 women; 97 White, 33 Black/African American, 14 Asian, 16

and b) that the selected pain expressions[6] are robustly perceived as pain, rather than any other emotion (via norming data collected in Study 2 of the DPD).

The FaceGen-imported versions Black and White did not differ significantly in terms of evaluations of fear ($t(14) = -0.27$, $p = .788$, $M_{\text{Black}} = 2.40$, $M_{\text{White}} = 2.44$), anger ($t(14) = -0.20$, $p = .848$, $M_{\text{Black}} = 3.18$, $M_{\text{White}} = 3.24$), disgust ($t(14) = -0.09$, $p = .927$, $M_{\text{Black}} = 3.02$, $M_{\text{White}} = 3.04$), happiness ($t(14) = 0.22$, $p = .829$, $M_{\text{Black}} = 2.54$, $M_{\text{White}} = 2.48$), sadness ($t(14) = 0.12$, $p = .905$, $M_{\text{Black}} = 2.82$, $M_{\text{White}} = 2.79$), or critically, pain content ($t(14) = -0.70$, $p = .497$, $M_{\text{Black}} = 2.49$, $M_{\text{White}} = 2.61$) present in their neutral expressions. Moreover, these selected stimuli did not differ significantly in terms of evaluations of status ($t(14) = -0.45$, $p = .658$, $M_{\text{Black}} = 3.75$, $M_{\text{White}} = 3.83$), masculinity ($t(14) = 0.67$, $p = .511$, $M_{\text{Black}} = 2.87$, $M_{\text{White}} = 2.74$), strength ($t(14) = -0.13$, $p = .897$, $M_{\text{Black}} = 4.96$, $M_{\text{White}} = 4.98$), trustworthiness ($t(14) = 0.50$, $p = .627$, $M_{\text{Black}} = 3.73$, $M_{\text{White}} = 3.65$), attractiveness ($t(14) = 0.60$, $p = .558$, $M_{\text{Black}} = 3.83$, $M_{\text{White}} = 3.70$), or the degree to which they appeared to be lifelike ($t(14) = 0.06$, $p = .954$, $M_{\text{Black}} = 5.01$, $M_{\text{White}} = 5.00$). The selected White faces were more likely to be categorized as White, compared to the Black faces ($t(14) = -23.60$, $p < .001$, $M_{\text{Black}} = 5.98$, $M_{\text{White}} = 1.97$), while the Black faces were more likely to be categorized as Black, compared to the White faces ($t(14) = 20.50$, $p < .001$, $M_{\text{Black}} = 6.06$, $M_{\text{White}} =$

Hispanic, 2 Native American, 1 Pacific Islander, and 1 participant who identified with another racial/ethnic group).

[6] In this case, we use "expression" similarly to our usage elsewhere (Mende-Siedlecki et al., 2019; Mende-Siedlecki et al., 2021; Mende-Siedlecki et al., 2022)—to refer to one possible configuration of facial action units representing a particular emotion, in this case, pain. Throughout our work, we have avoided relying on individual "prototypical" displays of pain, and instead, we tend to make and use multiple expressions that vary in specific details (e.g., mouth closed and clenched versus teeth visible and gritted, eyes shut tight versus eyes open) that allow us to capture some of the variability in pain displays, even when equating pain expressions across race.

1.88). (At the same time, the two sets did not differ significantly in terms of categorization as their “intended” race, defined in terms of the original model’s self-identification [$t(14) = 0.38$, $p = .713$].) Each of these stimuli was rated approximately 32.75 times on average (32.63 within the Black targets, 32.88 within the White targets) for each of the dimensions listed here.

To select the expressions that were ultimately rendered on these FaceGen-imported faces, we used data from a previous sample (N = 81, Study 2, Mende-Siedlecki et al., 2020) that rated a large set of manually created FaceGen expressions in terms of how much they resembled pain, fear, anger, disgust, happiness, sadness, surprise, and confusion. We selected eight expressions that were rated as looking more like pain than any other emotion (average $M_{\text{pain}} = 4.98$ [range = 4.43 to 5.59 on a 1-to-7 scale]; all other emotion *M*s < 3.06 on average [range = 1.26 to 3.41 on a 1-to-7 scale]; all *p*s [for pain versus other emotion comparisons within *each* selected expression] < .0033).

Finally, we systematically varied the pairings between the selected faces and the selected expressions across four different (and counterbalanced) versions of the task. Though not every possible face/expression combination was represented, this ensured that our results could not be the consequence of one idiosyncratic pairing of faces to expressions. Within each version, pain intensity was equated across race—the same eight expressions of pain were rendered on the eight Black faces *and* the eight White faces. For each face/expression combination, we created 11 morphs also in FaceGen Modeller Pro, from a 100% neutral expression to 100% painful expression. As we have done previously, we vignetted the resulting morphs to remove the bald appearance that is typical of FaceGen stimuli (as in Freeman, Stolier, Ingbretsen, & Hehman, 2014).

Procedure

Participants were randomly assigned to one of two conditions: Control or Individuation. Similar to the tasks described in Study 1, participants did a pain rating task, a treatment recommendations task, social evaluations, and a demographics survey. Prior to starting the pain rating task, participants in the Individuation condition read individuation-enhancing instructions adapted from Hugenberg and colleagues (2007). Those instructions were:

> Previous research has shown that people reliably show what is known as the Cross-Race Effect (CRE) when processing faces. Basically, people tend to confuse faces that belong to other races. For example, a White perceiver will tend to mistake one Black face for another. Now that you know this, we would like you to try especially hard when processing faces in this task that happen to be of a different race. Do your best to try to pay close attention to what differentiates each person by focusing on the features and expression of each face—especially when that face is not of the same race as you.
>
> Remember, pay very close attention to what differentiates each of the faces, especially when they are of a different race than you, in order to try to avoid this Cross-Race Effect.

Participants in the Control condition did not receive any additional instructions[7]. Following these instructions, participants completed the *pain rating task* as in the

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[7] A pilot study conducted in a University of Delaware student sample, though underpowered (N = 90 in the Control condition and N = 73 in the Individuation condition), suggested that this approach had some promise. Here, though interaction between target race and condition on pain perception was not statistically significant ($F(1,188) = 2.49$, $p = .116$, $\eta_p^2 = .01$), it suggested the potential efficacy of motivating individuation. Specifically, the effect of target race was larger in the Control condition ($F(1,89) = 19.60$, $p < .001$, $\eta_p^2 = .18$; $M_{White} = .293$, $SD_{White} = .147$; $M_{Black} = .348$, $SD_{Black} = .191$) than it

Control condition of Study 1. Next, participants completed the *treatment recommendations task*; in this study, participants made treatment recommendations for *all* faces that appeared in the *pain rating task* (instead of just a random subset, as in Study 1). All ratings in the *pain rating* and *treatment recommendations tasks* were self-paced, as were the additional instructions in the Individuation condition. Following the *treatment recommendations task*, participants in the Individuation condition were asked two manipulation check questions to ensure they understood the instructions given to them.

Specifically, we asked "How would you define the cross-race effect, as we described it at the outset of this study?" (with the options "People tend to confuse faces of other races more than faces of their own race" [Correct], "People tend to confuse faces of their own race more than faces of other races," "People are more likely to perceive mixed-race faces as Black than White," and "People show better memory for positive facial expressions on own-race faces but negative expressions on other-race faces") and "How did we ask you to try to avoid the cross-race effect at the outset of the study?" (with the options "Pay attention to what differentiates each face, by focusing on their features and expressions" [Correct], "Pay attention to the features that different faces have in common," "Pay attention to whether each face is of your own race or a different race," and "Pay attention to positive expressions on other-race faces and negative expressions on own-race faces"). Participants who did not answer both questions correctly were not included in subsequent analyses.

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was in the Individuation condition ($F(1,72) = 14.34$, $p < .001$, $\eta_p^2 = .166$, $M_{White} = .299$, $SD_{White} = .163$; $M_{Black} = .329$, $SD_{Black} = .185$).

In Study 2, we did not collect target-specific social evaluations of targets, but rather, participants were asked to make judgements at the group level. Following a standard demographic survey (collecting information regarding age, gender, race, and political ideology), participants were asked to judge the status, physical strength, threat, trustworthiness, and competence of 12 social groups (with “Black Americans” and “White Americans” randomly intermixed). Each scale ranged from 0 to 100 (e.g., 0 = “not at all physically strong,” 100 = “very physically strong”). We also collected ratings of warmth felt towards these groups and subtracted warmth felt towards Black Americans from warmth felt towards White Americans as a proxy for explicit racial bias. Finally, participants also completed individual difference measures of intergroup contact (adapted from Cloutier, Li, & Correll, 2014) and blatant dehumanization (Kteily et al., 2015)[8].

All post-task measures (including the manipulation check items in the Individuation condition) were self-paced. As in Study 1, we do not present analyses of these measures. Instead, we direct the reader to meta-analyses of these measures (and their relationships with bias in pain perception and treatment) presented elsewhere (Lin et al., under review).

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[8] Dehumanization is shown to impair configural processing of marginalized group members’ faces (Fincher & Tetlock, 2016), including Black individuals (Cassidy et al., 2017). Moreover, meta-analysis of our work demonstrates that perceivers who more strongly dehumanized Black (versus White) individuals (e.g., on the Ascent of Man scale; Kteily et al., 2015) showed larger degrees of racial bias in pain perception (Lin et al., under review). Therefore, we collected this same scale here to be able to explore if participants’ individual differences in blatant dehumanization are associated with racial bias in pain perception.

Analyses

The analyses for Study 2 were similar to those in Study 1. We calculated participants' average pain perception thresholds for Black and White faces from the pain rating task. We then conducted a 2 (condition: Control, Individuation) × 2 (stimuli race: Black, White) ANOVA to determine whether pain perception thresholds varied by condition, whether thresholds varied by the race of the faces, and how race and condition interact. We also conducted a 2 × 2 ANOVA to determine if condition and stimuli race impacted treatment recommendations. Finally, we also tested whether participants' racial bias in pain perception was correlated with their treatment recommendations for the Black and White faces in pain. In Study 2, we used all the faces that appeared in the pain rating task, instead of a random subset, so we were able to assess the relationship between bias in pain perception and treatment using data collected across *all* stimuli.

Results

Effects of target race and individuation instructions on thresholds for pain perception

We predicted an interaction between target race and condition, such that reading individuation-enhancing instructions would reduce participants' racial bias in pain perception, compared to the Control condition. We again observed a significant main effect of target race on thresholds for pain perception ($F(1,252) = 4.16$, $p = .043$, $\eta_p^2 = .02$; see Figure 3). Specifically, participants had higher thresholds for seeing pain on Black targets ($M = 0.310$, $SD = 0.163$) than pain on White targets ($M = 0.301$, $SD = 0.181$), replicating our finding in Study 1.

We did not, however, observe a main effect of instructions ($F(1,252) = 1.52$, $p = .218$, $\eta_p^2 = .01$), nor an interaction between target race and instructions condition

($F(1,252) = 1.17$, $p = .280$, $\eta_p^2 = .01$). The pattern of results was in line with what we observed in Study 1 (overall thresholds: $M_{Control} = 0.317$, $SD_{Control} = 0.177$; $M_{Individuation} = 0.291$, $SD_{Individuation} = 0.159$; racial bias in thresholds: $MD_{Control} = 0.013$, $SD_{Control} = 0.067$; $MD_{Individuation} = 0.004$, $SD_{Individuation} = 0.065$).

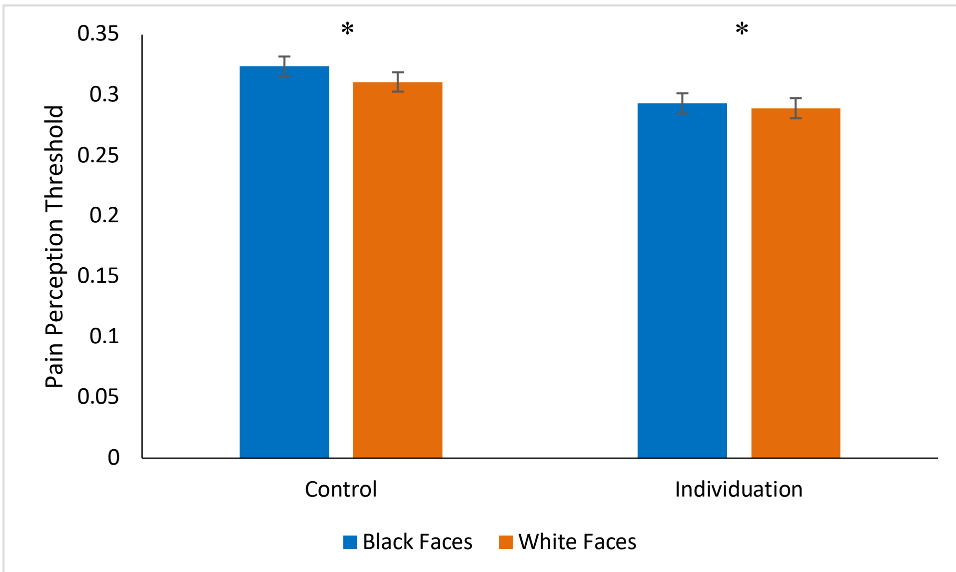

Figure 3 White perceivers showed a more stringent threshold for recognizing pain on Black versus White faces across both conditions. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Effects of target race and individuation instructions on treatment recommendations

We predicted that the individuation-enhancing instructions would also reduce differences in how participants recommended pain relieving cream to Black and White faces. Moreover, we predicted that this disparity would still be present in the Control condition. While we observed a significant main effect of target race on treatment recommendations ($F(1,252) = 68.12$, $p < .001$, $\eta_p^2 = .21$; see Figure 4), participants surprisingly recommended *more* pain reliever to Black targets (*M* = 10.27, *SD* = 4.52) than White targets (*M* = 9.20, *SD* = 4.65), contrary to the prevailing patterns observed in prior work (Lin et al., 2020). We did not, however, observe main effect of condition ($F(1,252) = 0.35$, $p = .553$, $\eta_p^2 < .01$), nor an interaction between target race and condition ($F(1, 252) = 1.51$, $p = .221$, $\eta_p^2 = .01$).

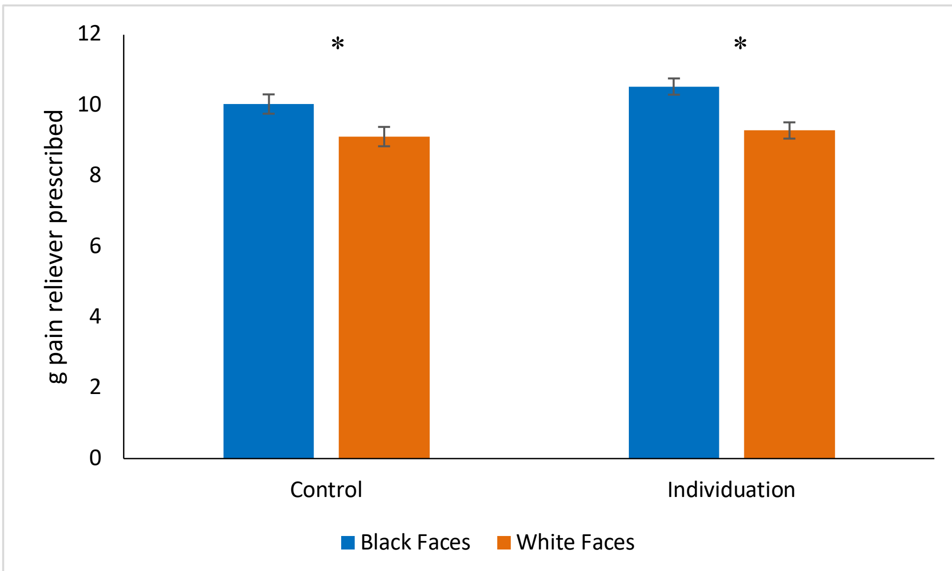

Figure 4 White perceivers recommended *more* pain reliever to Black faces compared to White faces across all conditions. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationships between bias in perception and bias in treatment

In line with Study 1, there was a significant positive relationship between perceptual bias and treatment bias ($r(252) = .302$, $p < .001$). This relationship was maintained within both groups of participants. Biased pain perception was associated with biased treatment recommendations within participants in the Control condition

($r(135) = .329$, $p < .001$), as well as the Individuation condition ($r(115) = .255$, $p =$ .006).

Discussion

Mirroring Study 1, racial bias in pain perception and treatment did not vary based on whether participants were motivated to individuate or not. Similarly, motivating individuation did not reduce overall thresholds for pain perception (compared to the Control condition), nor were treatment recommendations increased in the Individuation condition (compared to Control). That said, the general patterns of means were largely consistent with both Study 1 and our overall predictions. While we adapted our individuation manipulation directly from prior work (Hugenberg et al., 2007), it may be that we did not observe an effect of individuation due to the lack of relevance of these instructions to the task. To ensure that a null effect would not be attributable to an alteration of the manipulation, we left the previously used references to the CRE in the instructions. As such, it is possible that a stronger effect of individuation might be obtained if these instructions were edited to be germane to pain.

Chapter 4

STUDY 3

While Study 2 suggested that individuating instructions did not have a robust influence on racial bias in pain perception, it is possible that this occurred because our Study 2 manipulation was not specific to pain. In Study 3, we expanded on our findings in Studies 1 and 2. We were still interested in whether instructions meant to motivate individuation would improve participants' ability to perceive painful expressions on Black faces and enhance their treatment recommendations, resulting in a reduction of participants' bias to see and treat pain more readily on White faces. However, this time, participants read instructions that couched individuation in the context of pain bias rather than the CRE. We predicted that participants who receive the new individuation-enhancing instructions would demonstrate less racial bias in both pain perception and treatment recommendations, compared to participants receiving no instructions.

Method

Participants

We recruited 916 participants via Prolific. All participants received monetary compensation for participation (~$6.83 on average). Participants were required to be United States residents to be eligible for participation. In a posted preregistration (https://osf.io/qp5fv), we stated we would aim for a final sample of 132 White participants assigned to both the Control and Individuation conditions (in order to achieve 90% power to detect the target race × condition interaction, based on the observed effect size in Study 2). In addition, we stated we would prescreen participants out who attempted to access our study via virtual private servers (VPNs) as a means of evading location restrictions (Dennis et al., 2020; Kennedy et al., 2020). We also stated we would exclude participants who failed various attention and manipulation checks from analyses.

Despite screening based on participant race on Prolific, 50 non-White participants took part in the study (4 Black/African American, 5 Asian, 31 Hispanic/Latino, 3 Native American, and 7 identifying with another racial or ethnic group). In addition, 575 White participants failed either pre-registered manipulation check questions (N = 555) or pre-registered attention/interruption check questions (N = 20; details below in Procedure). Finally, since these exclusion criteria necessitated collecting participants on a rolling basis until 132 participants were obtained in both conditions (and since we could not determine if a participant would pass exclusion until their responses to our attention and manipulation checks were assessed), 27 additional White participants passing exclusion took part in the study *after* our preregistered totals were achieved. None of these participants were included in analyses.

Our final analyzed comprised 264 White participants (132 in Control, 132 in Individuation; 126 women, 129 men, 6 non-binary, and 1 who preferred not to say; $M_{age} = 35.83$, $SD_{age} = 12.17$).

Stimuli

We used six Black and six White faces of men generated within FaceGen Modeller Pro (v3.18). Rather than using imported faces as in Study 2 (which originated from photos of models who self-identified as members of a particular racial group), these faces were created from identical base heads by manipulating the African and European sliders in FaceGen.

We began by randomly generating six racially ambiguous male target heads in FaceGen. Next, to make Black-appearing versions of these heads, we set the African slider to a value of 1.5, and set the European, East Asian, and South Asian sliders to -1.5. To make White-appearing versions of these heads, we then set the European slider to a value of 1.5, and the African, East Asian, and South Asian sliders to -1.5. As such, Black faces had both Afrocentric structural features and darker skin, while White faces had both Eurocentric structural features and lighter skin. To standardize gender appearance across these stimuli, we gave all faces a value of -1 on the gender slider, which ranges from masculine (negative values) to feminine (positive values). In prior work where we have explicitly attempted even more fine-grained manipulation of race and gender-appearance, these approaches have been effective (e.g., Drain et al., in prep; Goharzad et al., in prep). Moreover, since we presented both Black- and White-appearing versions of each base head to each participant (rather than different models making different expressions of pain as in Study 1 or FaceGen-imported versions of different models making equated expressions of pain as in Study 2), there was thus no need to pilot these stimuli on any of the dimensions assessed in Studies 1 and 2.

We used the same approach as in Study 2 to select painful expressions to be rendered on these target heads. We selected six expressions that were rated as looking more like pain than any other emotion (average $M_{\text{pain}} = 5.04$ [range = 4.43 to 5.59 on a 1-to-7 scale]; all other emotion *M*s < 2.97 on average [range = 1.26 to 3.26 on a 1-to-7 scale]; all *p*s [for pain versus other emotion comparisons within *each* selected expression] < .0006).

We equated pain intensity across race, by ensuring that each pair of Black and White versions of the same head also displayed the same pain expression within each participant. For each face, we created 11 morphs in FaceGen Modeller Pro (v3.18), from a 100% neutral expression to 100% painful expression. We counterbalanced pairings of heads to expressions across four versions of the task so that our results could not be solely attributable to one idiosyncratic combination of target heads and expressions.

Procedure

The procedures were the same (e.g., in terms of tasks, task order, and trial timing) as Study 2 except for several minor changes. First, we made a change to the instructions participants read in the individuation-enhancing instructions condition. These instructions (originally adapted from Hugenberg et al., 2007) were edited to focus on racial bias in pain perception, rather than the CRE. These new instructions read:

> Previous research has shown that people reliably show a racial bias for seeing pain, meaning more pain must be expressed on a Black face for it to be recognized compared to the pain on a White face. Now that you know this, we would like you to try especially hard when processing pain intensity on faces in this task that happen to be of a different race. <u>Do your best to try to pay close attention to what differentiates each person by focusing on the features and expression of each face -- especially when that face is not of the same race as you</u>.

Second, we amended the manipulation check questions, in line with the alterations to the individuating instructions. We asked, “How would you define racial bias when it comes to recognizing pain, as we described it at the outset of this study?” (with the options “More pain needs to be expressed on a Black face for it to be recognized, compared to pain on a White face” [Correct], “Less pain needs to be expressed on a Black face for it to be recognized, compared to pain on a White face," "There is no racial bias when it comes to recognizing pain," and "Pain is expressed differently on Black and White faces, which leads to the racial bias described") and "How did we ask you to try to avoid this racial bias?" (with the options "Pay attention to what differentiates each face, by focusing on their features and expressions" [Correct], "Pay attention to the features that different faces have in common," "Use each face's race to guide your responses," and "Pay equal attention to expressions on other-race faces and on own-race faces"). Participants who did not answer both questions correctly were not included in subsequent analyses.

In the post-task portion, we once again collected a measure of blatant dehumanization (Kteily et al., 2015) and feeling thermometer ratings of feeling of warmth towards Black and White Americans, as well as their overall threat, strength, and status. (Within these social evaluations, we dropped items related to competence and trustworthiness.) Moreover, since this study took place during the height of the COVID-19 pandemic, we also included the Fear of Coronavirus scale. In our pre-registration template we used, these variables are listed under a section labeled "third variables acting as covariates or moderators." As in Studies 1 and 2, the relationships between these individual difference measures and bias in pain perception and treatment have been assessed meta-analytically and presented elsewhere (Lin et al., under review).

Finally, we also added compliance check questions related to participants' attention and interruptions during the task. Specifically, we asked participants, "Which of the following options describes the circumstances under which you completed the main task?" and excluded any participants who indicated "I was interrupted several times while completing the main task." (Participants who were interrupted only once or who were not interrupted but completed the task while someone else was in the room were not excluded, as these experiences would be similar to participants in an in-lab experiment.) We also asked about whether participants were doing anything besides focusing on the task and excluded any participants who didn't respond "I focused solely on completing the main task." In other words, participants who said that they were listening to music, watching something else, or doing other work simultaneously were excluded. All post-task items (including manipulation checks and compliance checks) were self-paced. No additional attention checks were embedded within the task itself.

Analyses

Analyses for Study 3 were identical to the analyses conducted in Study 2. All information about methods were preregistered and can be found on OSF (https://osf.io/qp5fv). As noted in an earlier footnote, while we preregistered several within-subjects mediation analyses examining whether differences in thresholds for perceiving pain facilitate the effect of target race on treatment recommendations, these analyses are not included in the present work.

Results

Effects of target race and individuation instructions on thresholds for pain perception

We hypothesized that reading individuation-enhancing instructions specific to racial bias in pain perception would reduce this perceptual bias. However, we once again predicted that the racial differences would still be present for participants in the Control condition.

We observed a significant main effect of individuation instructions on thresholds for pain perception ($F(1,262) = 5.32$, $p = .022$, $\eta_p^2 = .02$; see Figure 5). Specifically, participants who received the individuation instructions had lower thresholds for seeing pain across both Black and White targets ($M = .243$, $SD = .134$) compared to participants in the Control condition ($M = .207$, $SD = .120$). Surprisingly, we did not observe an effect of target race ($F(1,262) = 0.14$, $p = .714$, $\eta_p^2 < .01$) nor an interaction between target race and condition ($F(1,262) < 0.01$, $p = .976$, $\eta_p^2 < .01$; $MD_{Control} = 0.002$, $SD_{Control} = 0.118$; $MD_{Individuation} = 0.002$, $SD_{Individuation} = 0.060$).

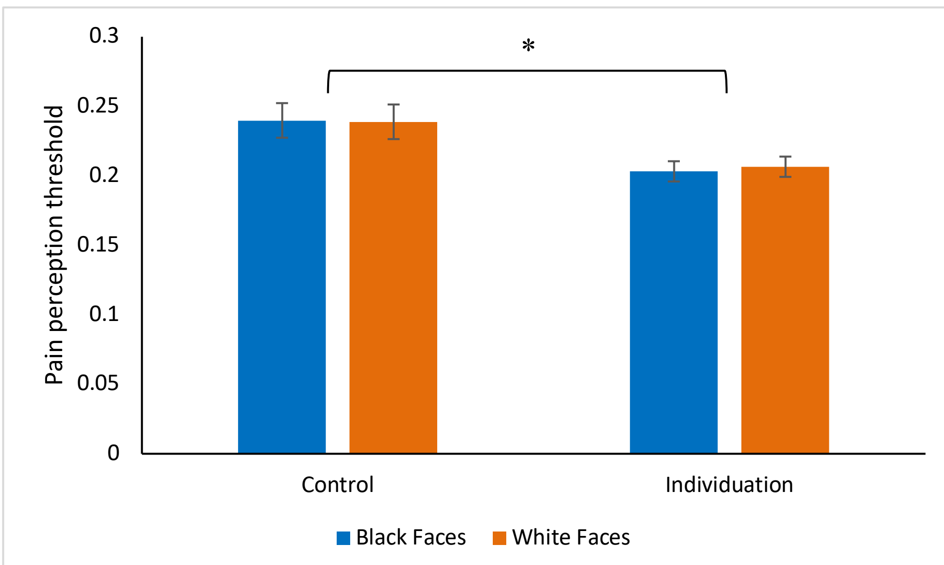

Figure 5 White perceivers in the Control condition showed a more stringent threshold for recognizing pain on faces compared to perceivers in the Individuation condition. There was no difference in recognizing pain based on race of faces. Bracket represents main effect of condition. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05

Effects of target race and individuation instructions on treatment recommendations

We predicted that the individuation-enhancing instructions would also reduce the differences in how participants recommended prescribing pain-relieving cream to Black and White faces, but that this bias would still be present in the Control condition. We observed a significant main effect of target race on treatment recommendations ($F(1,262) = 6.12$, $p = .014$, $\eta_p^2 = .02$; see Figure 6). Contrary to prior work (Lin et al., 2021) but in line with Study 2, participants recommended more pain reliever to Black targets (*M* = 12.54, *SD* = 4.61) than White targets (*M* = 12.25, *SD* = 4.56). We also observed a significant effect of condition on treatment ($F(1,262) = 9.03$, $p = .003$, $\eta_p^2 = .03$). Specifically, participants in the Individuation condition recommended more pain reliever to targets overall (*M* = 13.21, *SD* = 4.54) than participants in the Control condition (*M* = 11.58, *SD* = 4.28).

These main effects were qualified by a significant interaction between target race and instructions condition ($F(1,262) = 3.98$, $p = .047$, $\eta_p^2 = .02$). Unpacking these results, for participants that received the Individuation instructions, there was a significant effect of target race on treatment recommendations ($F(1,131) = 16.72$, $p < .001$, $\eta_p^2 = .11$), such that these participants prescribed more pain reliever to Black targets (*M* = 13.47, *SD* = 4.65) than to White targets (*M* = 12.95, *SD* = 4.55). However, there was no effect of target race on treatment recommendations for participants in the Control condition ($F(1,131) = 0.08$, $p = .776$, $\eta_p^2 > .01$). Taken together, these results suggest individuation did have an impact on racial bias in treatment recommendations—ultimately, it reversed the trend we typically observe.

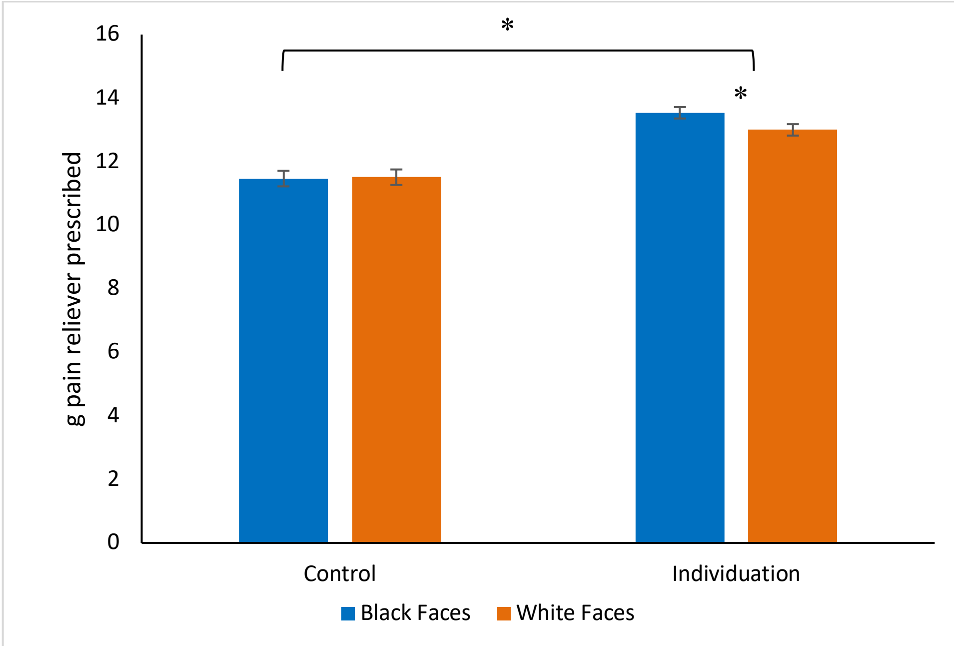

Figure 6 White perceivers who received individuation instructions recommended *more* pain reliever to Black faces compared to White faces; no difference was observed based on race in the Control condition. Bracket represents main effect of condition. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationships between bias in perception and bias in treatment

In line with the pattern robustly observed in prior work (Lin et al., 2020) and Studies 1 and 2, there was a significant positive relationship between racial bias in pain perception and treatment ($r(289) = .481$, $p < .001$). Once again, this association did not vary across the two groups of participants. Biased pain perception was associated with biased treatment recommendations within both participants in the Control condition ($r(154) = .496$, $p < .001$) and the Individuation condition ($r(133) = .453$, $p < .001$).

Discussion

In line with the general patterns observed across Studies 1 and 2, participants in the Individuation condition perceived pain more readily, compared to participants in the Control condition. That said, we did not observe evidence of racial bias in pain perception in Study 3, either overall, or within either condition considered separately. Participants who received the individuation instructions also prescribed more pain reliever overall than participants in the Control condition; more specifically, participants in the Individuation condition gave significantly more pain reliever to Black (versus White) targets. Taken together, these findings may suggest that task-specific individuating instructions are useful in improving overall pain perception and treatment, though an influence on racial bias in pain outcomes was only observed for treatment.

Chapter 5

META-ANALYSES ACROSS STUDIES

The general patterns of data across this work suggested that individuation can enhance visual perception of pain overall and further, that it may reduce racial bias in pain perception typically observed in our work. That said, results were mixed across these studies, and we were potentially underpowered to detect these effects in individual studies. To better understand the overall impact individuation has on pain perception and pain treatment, we aggregated the results of Studies 1 through 3 *and* the original pilot study conducted in a student sample to address several research questions. First, we assessed the overall effect of individuation on pain perception and treatment. Second, we assessed whether the effect of target race observed in previous work was replicated in the present experiments. Finally, we assessed if individuation reduced bias in pain perception and treatment. For each measure of interest, we conducted separate sample-size-weighted meta-analyses in *R* (Version 3.5.1) using the *metafor* package (Viechtbauer, 2010).

Results

Main effects of individuation on pain perception and treatment

Across this work examining the influence of individuation on pain perception, we observed that visual thresholds for perceiving painful expressions were lower when participants were instructed to individuate or were given individuating information, compared to Control conditions[9] (meta-analytic estimate = -0.033, z = -3.595, p < .001; 95% CI [-0.052, -0.015]. We also observed a similar effect of individuation on pain treatment recommendations. Across studies, participants in the Individuation conditions recommended 0.914 grams more pain reliever on average than participants in the Control conditions (z = -2.671, p = .008; 95% CI [0.244, 1.585]).

Main effects of target race on pain perception and treatment

Collapsing across the condition participants were assigned to, participants tended to see pain significant less readily on the faces of Black targets compared to White targets, though this difference was only marginally significant (z = 0.033, p = .073; 95% CI [-0.003, 0.069]). That said, the effect of target race on treatment recommendations was not statistically significant (z = 0.567, p = .571; 95% CI [-0.650, 1.179]). These effects are necessarily qualified by the interactions between target race and condition assessed next.

Does individuation moderate the effect of target race on pain perception and treatment?

Aggregating across this work, we did not observe strong evidence for an interaction between target race and individuation on pain perception. The difference in racial bias for pain perception between participants in the Control and Individuation conditions was only marginally significant (meta-analytic estimate = -0.009, z = -1.705, p = .088, CI [-0.020, 0.001]). Assessing the effects within condition, the difference in thresholds was smaller with participants assigned to the Individuation

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[9] Since it represented an active manipulation (e.g., beyond a neutral control) we did not include data from participants in Study 1's Categorization condition in these meta-analyses.

conditions (meta-analytic estimate = 0.026, z = 1.619, p = .106, CI [-0.006, 0.058]) compared to the Control conditions (meta-analytic estimate = 0.037, z = 1.904, p = .057, CI [-0.001, 0.075]), though the 95% confidence interval surrounding both effects contained zero.

We did, however, observe a significant interaction between target race and condition on treatment recommendations; participants in the Individuation conditions demonstrated less of a racial bias in treatment, compared to participants in the Control conditions (meta-analytic estimate = -0.331, z = -2.119, p = .034, CI [-0.637, -0.025]). The difference in thresholds was once again smaller with participants assigned to the Individuation conditions (meta-analytic estimate = 0.461, z = 1.018, p = .309, CI [-0.427, 1.349]) compared to the Control conditions (meta-analytic estimate = 0.514, z = 1.822, p = .068, CI [-0.039, 1.067]), though the 95% confidence interval surrounding both effects still contained zero.

Chapter 6

General Discussion

Previous research suggests that individuation has the potential to reduce the cross-race effect (Hugenberg et al., 2007; McGugin et al. 2010), potentially by enhancing high-level processing of other-race faces (e.g., Bukach et al., 2012; Hancock & Rhodes, 2010). Given that disruptions in configural processing are also implicated in racial bias in pain perception (Mende-Siedlecki et al., 2019), we hypothesized that manipulating individuation (via a naming manipulation or motivating instructions) would reduce the racial bias observed in pain perception and pain treatment recommendations. However, across three studies, we observed that providing individuating information (Study 1) or motivating participants to individuate (Studies 2 and 3) did not consistently reduce race-based differences in visual thresholds for painful expressions. That said, meta-analysis suggested that there was a reduction in racial bias in treatment recommendations for participants in Individuation (versus Control) conditions. Thus, when considered in the aggregate, individuation had *some* beneficial effect in terms of reducing racial bias in pain outcomes—at least within treatment. That said, the small magnitude of these effects and their study-to-study variability suggest that individuation, at least in the ways it was manipulated here, may not be an effective means for scalably improving emotion recognition on other-race faces, or by extension, for reducing racial bias in pain care. If anything, the results of Study 3 suggest that focusing such interventions on pain in particular may have the strongest impact.

The successful use of individuation in previous studies (e.g., to reduce the cross-race effect in face memory) would suggest that individuation *should have* reduced bias in pain perception. With that in mind, why were our results so mixed? One possibility is an ineffective manipulation of individuation. That said, Study 1's manipulation is taken from previous work testing the effects of individuation on recognition memory for faces (e.g., McGugin et al., 2011; Schwartz & Yovel, 2016), as well as complex non-face objects (e.g., Gauthier et al., 1998; Wong et al., 2009). We also directly adapted the individuation-motivating instructions from Hugenberg and colleagues (2007) for Studies 2 and 3, following a more social psychology approach toward individuation. Notably, the results of these two studies demonstrate that the exact wording of these instructions does influence overall pain perception. In Study 2, we did not observe an overall difference in pain perception thresholds between the Individuation and Control conditions. However, in Study 3, participants in the Individuation condition saw pain more readily and prescribed more treatment for pain, compared to the Control condition. This likely reflects the fact that participants in Study 3 saw instructions that were tailored to be specifically about pain perception (and bias therein), rather than the cross-race effect. Unfortunately, the effect on overall pain thresholds did not translate to a reduction in racial bias in pain perception, specifically. One possible implication of this finding is that for individuation to have a beneficial effect on bias, it needs to be targeted, not deployed indiscriminately.

One notable issue that emerged concerns the high number of participants failing our manipulation checks. Both Studies 2 and 3 used manipulation check questions to determine if participants read and comprehended our instructions. These items ultimately removed 641 participants in total—86 participants from Study 2 and 555 participants from Study 3. When comparing participants who failed the manipulation check questions versus those who passed, we see that in Study 2, there was no difference in racial bias in pain perception ($F(1,199) = 1.41$, $p = .237$, $\eta_p^2 = .01$) or treatment recommendations ($F(1,199) = 1.31$, $p = .253$, $\eta_p^2 = .01$). Similarly, in Study 3, participants who were in the individuation condition and got both manipulation check questions wrong did not differ in their responses from those who passed in regards to pain perception ($F(1,685 = 0.21$, $p = .649$, $\eta_p^2 < .01$) and treatment recommendations ($F(1,685) = 3.40$, $p = .066$, $\eta_p^2 = .01$). However, when looking specifically at participants in the individuation condition who answered the first manipulation check question right compared to those who answered incorrectly, there was a reduction in racial bias in pain perception ($F(1,685 = 8.90$, $p = .003$, $\eta_p^2 = .01$) and treatment recommendations ($F(1,685) = 9.61$, $p = .002$, $\eta_p^2 = .01$). This would suggest that for whatever reason these participants answered the manipulation check questions wrong (e.g., they didn't read the instructions carefully, forgot what they read, didn't believe what they read, or the questions were too difficult), they were less motivated to individuate than participants who passed these checks. More importantly, those who got the questions right *were* (at least comparatively) impacted by the instructions in the intended way.

Between this observation and the overall effect of individuation on pain perception thresholds and treatment, it seems unlikely that the manipulation was wholly ineffective. However, despite the instructions "working," their impact was rather minimal. Because of this, motivating or manipulating individuation as the present experiments attempted to do may be ill-suited to reducing racial bias in pain perception consistently or meaningfully in a nonexperimental setting. Future explorations of the impact of individuation can have in this domain should take a more direct approach.

For example, employing a pre- and post-manipulation assessment of perceptual bias would allow us to better understand *how much* individuation can alter a person's perception. Taking Study 3 as an example, we see that participants in the Individuation condition had lower perceptual thresholds for seeing pain, compared to those in the Control condition. Typically, we would assume that participants in the Control condition can serve as a proxy for what participants' ratings would be prior to an individuation manipulation. However, even with sufficient power and random assignment to condition, we cannot know for certain whether this is true. Using a within-subjects design with both pre- and post-manipulation assessment would allow more confident conclusions about the effects of individuation.

Previous work demonstrates disruptions in configural face processing support bias in perceiving pain on Black faces (Mende-Siedlecki et al., 2019). While individuation was not able to consistently improve recognition of Black pain in the present work, it is worth exploring what other factors may be impacting configural face processing. It is possible that prior to processing configural information in a Black face, a perceiver has already determined that it is of little or no value to process their mental or emotional state. If a perceiver judges Black individuals (and therefore, Black faces) as being less important or valuable than White individuals, that could fuel differences in how that perceiver sees painful expressions on Black and White faces. Indeed, work by Cassidy and colleagues demonstrates that differences in humanization of Black (versus White) faces are associated with differential engagement of configural face processing (Cassidy et al., 2017), and further, that sensitivity to complex emotional displays and facial humanization share a common root in configural face processing (Cassidy, Wiley, Sim, & Hugenberg, 2021).

Moreover, it is also possible that target race leads to differences in attention (e.g., gaze patterns, fixation location, and duration) that have downstream impacts on face processing. If a perceiver is not focusing on important facial features that may be associated with configural processing (e.g., eyes; Young, Slepian, Wilson, & Hugenberg, 2014; Hills, Cooper, & Pake, 2013a) or that are diagnostic of pain (e.g., eyes and mouth; Kunz, Meixner, & Lautenbacher, 2019), their ability to recognize pain would be hindered. Indeed, White perceivers' differential attention to key regions may underlie divergent thresholds for pain perception. Assessing attentional differences in perceivers as they evaluate pain on Black and White faces would be able to speak to this possibility. Furthermore, research suggests that other-race face and emotion recognition can improve by training a person to attend to "diagnostic" regions of the face (e.g., Hills & Pake, 2013; Hills, Cooper, & Pake, 2013b). Potentially, similar approaches could be adapted to reduce racial bias in pain perception. Finally, a core assumption of the present work was that the cross-race effect and racial bias in pain perception share a common underlying mechanism. While disrupted configural processing has been linked to both phenomena in separate experiments (e.g., Cassidy et al., 2017; Mende-Siedlecki et al., 2019), our work has yet to directly test the association *between* these effects. Future work should examine the extent to which insensitivity to pain and identity on Black (versus White) faces are associated with one another.

Taken together, the evidence for the efficacy of using individuation as a means for reducing racial bias in pain outcomes was mixed and stronger within the context of treatment than perception. On the one hand, it is encouraging that these effects were strongest for hypothetical treatment recommendations—particularly in Study 3 when the instructions were tailored specifically for pain. This is, after all, the best analogue in this work for real-world disparities in pain care. Moreover, the results of Study 3. That being said, projecting from the small effects observed in this tightly controlled experimental context to real-world clinical settings, these results suggest that interventions aimed at reducing biases in pain perception and care should focus on alternative means. For example, as outlined above, explicitly manipulating visual attention to pain-diagnostic regions may be a more effective way of reducing this bias in perception. Future research should explore this avenue of inquiry.

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Appendix A

IRB/HUMAN SUBJECTS APPROVAL

Institutional Review Board
210H Hullihen Hall
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Phone: 302-831-2137
Fax: 302-831-2828

DATE:	October 25, 2019
TO:	Peter Mende-Siedlecki, PhD
FROM:	University of Delaware IRB
STUDY TITLE:	[958105-11] Leveraging perceptual and psychological mechanisms to understand racial bias in pain care [Social and Emotional Evaluation of Faces]
SUBMISSION TYPE:	Continuing Review/Progress Report
ACTION:	APPROVED
APPROVAL DATE:	October 25, 2019
EXPIRATION DATE:	October 20, 2020
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *(4,7)*

Thank you for your Continuing Review/Progress Report submission to the University of Delaware Institutional Review Board (UD IRB). The UD IRB has reviewed and APPROVED the proposed research and submitted documents via Expedited Review in compliance with the pertinent federal regulations.

As the Principal Investigator for this study, you are responsible for and agree that:

- All research must be conducted in accordance with the protocol and all other study forms as approved in this submission. Any revisions to the approved study procedures or documents must be reviewed and approved by the IRB prior to their implementation. Please use the UD amendment form to request the review of any changes to approved study procedures or documents.
- Informed consent is a process that must allow prospective participants sufficient opportunity to discuss and consider whether to participate. IRB-approved and stamped consent documents must be used when enrolling participants and a written copy shall be given to the person signing the informed consent form.
- Unanticipated problems, serious adverse events involving risk to participants, and all non-compliance issues must be reported to this office in a timely fashion according with the UD requirements for reportable events. All sponsor reporting requirements must also be followed.

Oversight of this study by the UD IRB REQUIRES the submission of a CONTINUING REVIEW seeking the renewal of this IRB approval, which will expire on October 20, 2020. A continuing review/progress report form and up-to-date copies of the protocol form and all other approved study materials must be submitted to the UD IRB at least 45 days prior to the expiration date to allow for the required IRB review of that report.

If you have any questions, please contact the UD IRB Office at (302) 831-2137 or via email at hsrb-research@udel.edu. Please include the study title and reference number in all correspondence with this office.

Institutional Review Board
210H Hullihen Hall
Newark, DE 19716
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Fax: 302-831-2828

DATE:	November 11, 2020
TO:	Peter Mende-Siedlecki, PhD
FROM:	University of Delaware IRB
STUDY TITLE:	[958105-13] Leveraging perceptual and psychological mechanisms to understand racial bias in pain care [Social and Emotional Evaluation of Faces]
SUBMISSION TYPE:	Continuing Review/Progress Report
ACTION:	APPROVED
APPROVAL DATE:	November 11, 2020
EXPIRATION DATE:	October 20, 2021
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *(4,7)*

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Fax: 302-831-2828

DATE:	October 21, 2021
TO:	Peter Mende-Siedlecki, PhD
FROM:	University of Delaware IRB
STUDY TITLE:	[958105-15] Leveraging perceptual and psychological mechanisms to understand racial bias in pain care [Social and Emotional Evaluation of Faces]
SUBMISSION TYPE:	Continuing Review/Progress Report
ACTION:	APPROVED
APPROVAL DATE:	October 21, 2021
EXPIRATION DATE:	October 20, 2022
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *(4,7)*

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