WILL YOU SEE MY PAIN?

EXAMINING THE ROLE OF ATTENTION AND MOTIVATION ON RACIAL BIAS IN PAIN PERCEPTION

by

Alexis Drain

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Psychological and Brain Sciences.

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ABSTRACT

Racial bias in pain care is a prevalent issue within the US, with Black patients being undertreated for their pain. Previous research finds that visual perception plays a role in this bias, suggesting a novel route for potentially reducing this bias. In this work, we will test whether 1) directing visual attention to diagnostic regions of the face (Exps. 1-4) and 2) motivating individuation can reduce racial bias in pain perception (Exps. 5-8). To understand the role attention plays in pain recognition, and the bias therein, we first measured participants' attention to different regions of the face in the context of pain (Exp. 1). We then implicitly and explicitly directed participants' attention to specific face regions during a pain task (Exps. 2-4). We predicted that directing participants' attention to pain-diagnostic regions of the face would result higher pain judgments for Black faces, thus reducing the racial gap. To understand the role individuation (or lack of) plays in pain recognition, participants made judgments regarding or learned unique information about targets (e.g., their names) to promote individuation prior to assessing pain and recommending pain relief (Exps. 5-6). In subsequent experiments, we provided participants with information about racial biases in social perception, both broadly and within the context of pain, to motivate them to individuate Black targets (Exps. 7-8). We predicted that promoting the individuation of Black faces would result in participants seeing their pain, and in turn, that recognizing pain on Black faces would promote higher recommendations of pain reliever. Together, this work provides insight into how attentional and motivational processes may be leveraged to reduce racial bias in pain care.

Chapter 1

INTRODUCTION

Black Americans have long been mistreated and undertreated 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; Washington, 2006). The neglect of Black Americans is part of the foundation of this country and is still being perpetuated today. To better understand the impact that a lack of pain care has on Black Americans, we turn our attention to the perceivers of their pain. In this introduction, we will explore the history behind the disparities in pain treatment for Black and White Americans, followed by reviewing the psychology literature on the racial bias in pain care and treatment. We will then focus on the relationship between configural face processing and social categories, configural face processing and attention, and how those relationships factor into racial bias in pain perception.

The Structure of Medical Racism

Historically, Black people have been regarded as subhuman making them perfect for medical exploitation. It was standard practice to experiment on enslaved Black people, as they were powerless and there was no regard for the harm done to them. Enslavers would "rent out" enslaved Black people to physicians allowing physicians to act out their medical curiosities (Washington, 2006). Physicians had a financial incentive for the continuation of slavery and treating enslaved people. Treatment of slaves was a primary source of income for southern physicians. Also, experimentation on enslaved Black people was highly profitable. Upon concluding their experiments, physicians could gain both fame and fortune. One notable figure is J Marion Sims, known as the father of modern gynecology (Holland, 2018; Washington, 2006). He is recognized for medical tools and surgical techniques that helped advance reproductive medicine. He became president of medical organizations and societies, and to this day, there are statues in his honor celebrating his "achievements." His fame stems from his exploitation of enslaved Black women. He would test out new instruments and techniques on these women, with no anesthesia, and very little recovery time in between surgeries. When these physicians were criticized for their experimentation on enslaved people, their solution was not to stop the harm, but to mask it. They stopped being as explicit about the race of those they experimented on by either not mentioning race all together or by mentioning only social cues that alluded to race when reporting on their "findings" (Washington, 2006). Marion Sims went as far as to provide illustrations of White women as his patients, instead of the enslaved *Black* women he actually tortured.

The medical neglect of Black people was deliberate and devastating. From 1862 to 1868, an outbreak of smallpox in the south afflicted Black people who were newly freed, dislocated, and now experiencing extreme poverty (Downs, 2012). Smallpox was believed to primarily affect Black people, making it a low priority for government and medical officials. The federal government ignored pleas for more doctors, more supplies, and more vaccines. They provided no guidance or policy for doctors to follow to deal with the growing outbreak; they were on their own. Some doctors ignored the outbreak, some were responsible for the spread of smallpox in their area, while others attempted to help with the limited resources they had at their disposal. The government accepted the massive deaths of Black people and believed that smallpox was a vehicle for the extinction of the new freedpeople (Downs, 2012).

This could be contrasted with the 1865-1866 outbreak of smallpox in the north, primarily in New York City, and the cholera outbreak in 1866. Because *this* smallpox outbreak could not be attributed to Black people, officials were invested in discovering its origins and mode of transmission (Downs, 2012). It was understood that smallpox was not race specific, despite this fact being ignored by the federal government. Poor housing conditions seemed to be a key factor in the spread of the virus; therefore, officials warned against overcrowding. Health officials required that a case be reported within 24 hours of its discovery, and the authorities and citizens worked together to stop its spread. In the case of a potential cholera outbreak in 1866, the federal government took preemptive measures to prevent its spread. So much so that cholera was first reported in the summer and subsided that November (Downs, 2012). Even a year later, the government and health officials were still on alert and warning the public about the possibility of cholera's return. The doctors, resources, and policy guidance that were not provided to deal with smallpox in the south were miraculously available to deal with cholera. The US was able to get control of the spread of cholera while the rest of the world struggled (Downs, 2012). Cholera came and went, and smallpox continued to spread in the south. It wasn’t until more White people started to get sick that officials began to take the spread of smallpox seriously.

The impact of slavery medicine was widespread and long lasting. Physicians at that time fabricated many diseases that were supposedly unique to Black people (Washington, 2006). They also reported that some illnesses were shared among White and Black people but impacted the races differently; one being syphilis. The disease was supposedly less damaging to Black people and only attacked the muscles. The belief that the disease was different for Black people and that medical interventions needed to be specific for each race justified the Tuskegee Study of Syphilis in the Untreated Negro Male as a way of tracking the progression of the illness (Jones, 1993; Washington, 2006). They also created myths about how Black people were biologically different for White people and less evolved. Black people were both beastly and forever childlike. This was used to justify enslavement (Downs, 2012; Washington, 2006). Black people were also able to withstand ailments like heatstroke because their dark skin and tropical origins made them particularly equipped to withstand labor in the harsh southern climate (Washington, 2006). This of course ignores the fact that there were countless reports of enslaved people being impacted by exertion from working in the sun. Black people were depicted as being able to endure more pain than White people (Trawalter & Hoffman, 2015; Washington, 2006). This justified extremely painful surgeries with no kind of pain reliever or anesthesia (Washington, 2006). Though they knew this to not be true, as physicians would report *in writing* about the pain enslaved Black people would endure during experimentation. In the case of

Marion Sims, many of his early assistants left because they could no longer bear "the bone-chilling shrieks of the women" (Washington, 2006). He would later provide his White patients with anesthesia for their surgeries, of course. These false narratives have 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 underdiagnose and undertreat the pain of Black Americans across various contexts (Anderson et al., 2002; Anderson, Green, & Payne, 2009; Burgess et al., 2014; Goyal et al., 2021; Mossey, 2011; Ringwalt, Roberts, Gugelmann, & Skinner, 2015). For example, a recent meta-analysis of 13 experiments 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. When Black individuals do receive pain medication, it tends to be at lower doses compared to their White counterparts. 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). Moreover, despite overlap between the experience of pain and empathy for the pain of others, empathic neural responses are diminished for the pain of racial out-group members (Azevedo et al., 2013; Chiao & Mathur, 2010). Beyond these factors, some work links reduced care for racial minorities' pain to implicit racial bias (Green et al., 2007; Sabin & Greenwald, 2012). However, when considered in full, the evidence for links between implicit bias and treatment is mixed at best (Hagiwara et al., 2021).

Recent research has also shown that these biases in pain care and pain attribution are both mirrored by and associated with gaps in the visual perception of pain. 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, perceivers also prescribe less pain reliever to Black faces, and critically, these biases in pain perception and treatment are positively associated with one another (Mende-Siedlecki et al., 2019). A recent meta-analysis across 40 experiments on racial bias in pain perception robustly confirms these effects (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 ambiguous or nonprototypic) structure (Drain et al., in prep). In considering the impact that both race and gender has on pain perception, perceivers saw pain less readily on Black man faces, but prescribed less treatment to Black women (Goharzad et al., in prep). Overall, White men's pain was seen more readily and given the most treatment. When compared to the racial bias for other emotions (e.g., happiness, anger, sadness, and fear), racial bias in pain perception was more robust, while being weakly correlated with the under perceiving of negative emotions on Black faces (Mende-Siedlecki et al., 2021). Notably, this bias appears even within rapid presentation conditions (e.g., seeing a face for 33ms), particularly when pain expressions are ambiguous, and when burdened with cognitive load (Mende-Siedlecki et al., 2022). The persistence of racial bias under these conditions would support investigating this phenomenon at the perceptual level. As such, the present work describes two programs of research examining the influence of attentional and motivational means for the racial bias in pain perception as initial steps to promoting equity in pain treatment.

Disruptions in Configural Face Processing

What perceptual mechanisms might underlie these differences in thresholds for pain on Black versus White faces? Face perception can be characterized by configural and featural processing working in parallel (Piepers & Robbins, 2012). 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). Featural processing is necessary for configural processing as establishing the existence (and to a lesser extent, details) of individual features is needed to then understand the relationship between different facial features. Both play a role in processing a face in terms of identity and emotion recognition (Calder, Young, Keane, & Dean, 2000). A problem arises when an individual processes a face at the featural level alone; these consequences are covered in greater detail below.

To understand face and emotion recognition, researchers have historically conducted experiments testing the limits of configural and featural processing through various paradigms. One such paradigm is the composite task, in which two halves of different faces are aligned or slightly misaligned while participants do a recognition task (Calder et al., 2000; Michel et al. 2006). Participants are typically asked to identify one half of the face while ignoring the other. When the two face parts are aligned, this task is difficult. The aligned face parts are processed holistically, creating a new face (and identity) from the two different halves (Piepers & Robbins, 2012; Rossion & Boremanse, 2008). A person now struggles to see the two face parts as separable which is necessary for the task. The facial features are processed interdependently. This is not the case when the face parts are misaligned. When misaligned, participants can focus on the featural components to identify the attended face part. The same challenge occurs when participants are asked to identify an expression on one part of a face that is aligned with another face part expressing a different expression, even when the two face parts are from the same identity (Calder et al., 2000).

Another common approach employed by researchers to assess and disrupt configural face processing is face inversion. Here, researchers have participants do a recognition task while a face is upside down typically to compare their accuracy to when a face is right side up (Freire, Lee, & Symons, 2000; Yin, 1969). Inverting a face disrupts the encoding of configural (or relational) information on a face, thus creating challenges in distinguishing faces from each other and remembering faces after a delay (Freire, Lee, & Symons, 2000). Featural information is less impacted though. One potential explanation for the effect of face inversion is the lack of experience of viewing faces in this particular orientation. Rossion and Boremanse (2008) suggest that when a face is oriented beyond 90 degrees, it is no longer within the realm of typical experience, resulting in an impairment in fully processing that face. In the initial investigation of racial bias in pain perception, previous work used a face inversion approach to determine if this bias stems from similar disruptions in configural face processing (Mende-Siedlecki et al., 2019). 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.

So, why might this have occurred? Configural processing is a more complex and substantive process than featural processing (Piepers & Robbins, 2012). For that reason, configural processing may be selectively deployed. Under certain conditions, shallower featural processing is “enough.” A target’s social categories can determine which of these processes is emphasized. If a target is less valued, that target may be processed less configurally. For example, viewing same-race faces engages configural processing, while viewing other-race faces engages more featural processing (Rhodes et al., 1989), and in turn, configural processing of other-race faces is comparatively effortful (Tüttenberg & Wiese, 2021). Moreover, a large, related body of work that demonstrates that social categories, such as race, can impede a person’s ability to accurately recognize others’ emotions. In a large meta-analysis, Elfenbein and Ambady (2002) show that in fact there are intergroup differences in emotion recognition. Notably, for experiments within a country, majority members were more likely to have an ingroup advantage than their outgroup counterparts. This accuracy difference may be the result of differences in configural face processing; people are more likely to engage in configural processing of ingroup faces, while outgroup faces are processed featurally (Young & Hugenberg, 2010). In addition, 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). An individual would typically place more value with an ingroup member than an outgroup member; however, this is not a race-exclusive finding. Other salient social cues can also impact the deployment of face processing. Individuals are better able to recognize individuals they believe are of a high status (Ratcliff et al., 2011) or even something as arbitrary as sharing a university affiliation (Hugenberg & Corneille, 2009)—all unrelated to race. This suggests that the effort put into face processing is contingent on the *value* placed on the people in front of us. It would be no surprise then that in the context of race, individuals struggle more to recall Black faces, decipher emotions on Black face, or empathize with Black faces.

The consequences of intergroup differences in individuation on emotion recognition

Much of the research on biases in face and emotion recognition have focused on racial bias. For example, numerous models in this literature 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, these accounts do not take into consideration the non-racial biases that have similar impacts on face processing. For example, a difference in perceptual expertise would not account for own group biases produced from artificial groups (Hehman et al., 2010; Young & Hugemberg, 2010). More recent work has attempted to integrate these perspectives together with other social cognitive perspectives on own group biases. One such model is the

Categorization-Individuation Model (CIM; Hugenberg, Wilson, See, & Young, 2013; 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., 2013) suggests that this tendency to cluster outgroup members categorically and to individuate ingroup members has direct consequences for face perception and memory. The CIM posits that own group biases are contingent of perceivers' motivation to individuate and experience individuating ingroup and outgroup members. Within the context of race, it is plausible that an individual would have more exposure to ingroup members leading to more experience individuating them, while having a lack of experience with outgroup members. This experience differential would result in a racial bias in recognition; however, gender biases cannot be accounted for in the same way (Man & Hills, 2017). An individual is likely to have similar exposure to different genders (at least within the gender binary), thus equally experienced in individuating men and women's faces. In addition, biases that stem from more superficial group distinctions cannot be explained based on a lack of individuation experience (Shriver et al., 2008; Shriver & Hugenberg, 2010). Outgroup members in this case would be no different from ingroup members in terms of physical characteristics (e.g., race, age, gender). Instead, an individual's *motivation* to individuate would contribute to whether or not they individuate ingroup members but not outgroup members. It is important to note that the degree in which individuation motivation and experience contribute to an own group bias will determine how stable the bias is and the means for reducing said bias.

Individuation experience *and* motivation are both factors influencing racial bias in face and emotion recognition. Literature on the CRE often reference a lack of interracial contact as a factor (Hancock & Rhodes, 2008; Walker & Hewstone, 2006). While individuation experience can play a large role, the impact of individuation motivation cannot be understated. Previous research demonstrates that motivating or triggering individuation likely facilitates configural (versus featural) processing of other-race faces (Hugenberg et al., 2010; Young et al., 2012). Indeed, increasing a perceiver's motivation to individuate (e.g., instructing participants to focus on features that distinguished individual faces from each other; Hugenberg et al., 2007) can reduce 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., 2012).

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 identifiers have also been demonstrated to reduce implicit racial bias more generally (Lebrecht et al., 2009).

Contact alone is not enough to get rid of the CRE. When asked to individuate one racial outgroup while performing another non-individuating task with another racial outgroup, White participants showed improvement over time within a perceptual discrimination task for the individuated outgroup (McGugin et al., 2011). Yet, participants had equal experience with both groups. Similarly, when trained to identify members of one group with names and another group by their racial category, White participants recognized the individuated (i.e., named) group members better (Tanaka & Pierce, 2009). Individuation motivation coupled with experience can override racial biases in recognition. 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 experiments 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 consequences of intergroup differences in visual attention on emotion recognition

As introduced above, configural face processing plays a critical role in deciphering social information. Configural processing supports our ability to remember people (Maurer et al., 2002), decipher emotions (Bombari et al. 2013; Young & Hugenberg, 2010), and decode gender (Cassidy et al., 2022; Cloutier et al., 2008). Previous research suggests that attending to the eye region is necessary for configural face processing (Cassidy et al., 2022; Young et al., 2014). Attending to the eyes (versus other feature) facilitates face recognition and can minimize the face-inversion effect (Hills, Ross, & Lewis, 2011). Though undermining this perceptual process is linked with dehumanization (Fincher & Tetlock, 2016; Hugenberg et al., 2016)—those who are dehumanized typically are processed less configurally. Related, non-Black perceivers attend more to the eyes of White faces than Black faces (Cassidy et al., 2019; Kawakami et al., 2014).

It is worth noting that attention to the eyes can be redirected to Black individuals if perceivers are motivated to do so, thus reducing intergroup related biases (Kawakami et al., 2014). Though Hills & Pake (2013) suggest that disparities in face recognition in fact result from not attending to features that are diagnostic to specific races. When cued to fixate on the race-specific features (e.g., the bridge of the nose for White faces and the middle of the nose for Black faces), there was a reduction in recognition biases as a function of racial group membership. Applying this same principle to emotion recognition, it is possible that cueing White perceivers to regions that are more informative for extracting the emotional experience of Black individuals would reduce recognition differences.

Indeed, as alluded to above, perceiver culture and race do exert an influence on emotion processing. Cross-cultural studies suggest that patterns of visual attention during emotion processing can vary based on the perceiver's culture separate from the culture or face of the target. When attempting to identify an unknown emotion, West European perceivers distribute their gaze evenly across faces, while East Asian perceivers consistently fixate on the eyes (Jack et al., 2009; see also Stanley, Zhang, Fung, & Isaacowitz, 2013; Kelly et al., 2011). Thus, differences in patterns of visual attention across the face might support racial bias in pain perception in multiple ways. White perceivers might be attending less readily to (more or less) universally pain-diagnostic signals on Black (versus White) faces, or because White perceivers' typical gaze patterns are less attuned to features that are diagnostic for pain on Black faces, in particular.

Are specific features considered diagnostic for certain emotions? Indeed, visual features of the face provide useful information for perceivers when attempting to recognize different emotions, such that when processing emotions, perceivers attend to different regions of the face depending on the emotion in question. For example, people fixate longer on the mouth when looking for happiness and the eyes for anger (Bombari et al., 2013). People have a bias toward the top half of the face when recognizing fear or sadness, while being biased towards the bottom half of the face when recognizing disgust (Calder et al., 2000). This would suggest that different facial features provide useful information for different emotions. Moreover, while different features may be more relevant for specific emotions, emotions are primarily processed configurally (e.g., Calder et al., 2000)—suggesting that although identity and emotion processing are typically considered as being distinct from one another (e.g., Bruce & Young, 1986), disruptions in configural processing would hinder emotion recognition as well.

What, then, might be most diagnostic for recognizing pain? Though not always thought of as an emotion in and of itself, pain is robustly distinguished from other facial expressions (Simon et al., 2008). Moreover, expressions of pain are evaluated as being more arousing and more unpleasant than other emotional expressions. More generally, pain is processed rapidly in the visual system (Craig et al., 2010; Vervoort et al., 2013; Yamada & Decety, 2009) and show biases in early attention to pain (versus neutral expressions; Priebe, Messingschlager, & Lautenbacher, 2015). These findings are perhaps not surprising, as this expression is important for communicating both potential for harm to the perceiver and the potential need to help or aid the individual expressing pain (Williams, 2002). Experientially, pain has an affective (feelings of unpleasantness) and a sensory (location, intensity) component that translates to how it is expressed. Ultimately, while there is no singular prototypical expression of pain, the furrowing of the eyebrows, the narrowing or closing of the eyes, the wrinkling of the nose, and raising of the upper lip are common featural changes that accompany pain (Kunz, Meixner, &

Lautenbacher, 2019; Prkachin & Craig, 1995). The affective component of pain is encoded through changes in the eyebrows, nose, and upper lip, while the sensory component is encoded through the narrowing of the eyes (Kunz et al., 2012). Despite this distinction, people rely heavily on the lowering of the eyebrows and nose wrinkling/upper lip raising when deciphering pian (the affective component; Blais et al., 2019; Roy et al., 2015). More generally, low spatial frequency information (which supports configural processing) dominates the processing of painful facial expressions (Wang & Eccleston, 2017).

Taken together, previous work demonstrates the importance of attention to the eyes for basic face processing (including configural processing) and the importance of the mouth and eye regions for pain recognition, in particular. As such, we sought to test whether manipulating attention to these specific features would reduce racial bias in pain perception.

The Present Research

In this work, we tested whether 1) directing visual attention to diagnostic regions of the face and 2) motivating individuation can reduce racial bias in pain perception.

Previous research indicates that individuals struggle to recognize emotions on outgroup faces. We investigated this error by measuring and cueing participants' attention to diagnostic features (specifically, the mouth and eyes), both implicitly and explicitly, which could improve participants' recognition of pain on Black faces across four experiments. In Experiment 1, we measured differences in attention to face regions in the context of pain as a function of race. Specifically, we employed a probe paradigm and used differences in participants' reaction time and accuracy to probes that appeared in the eye or mouth regions of Black and White faces as implicit measures of attention. In Experiment 2, we implicitly directed attention to three different regions of the face (eyes, mouth, and periphery; blocked throughout the task in a randomized order) during a pain rating task by instructing participants to find probes that appeared probabilistically in one of those three regions of the face. The result of this experiment provided initial insights into how attending to certain facial regions could increase or reduce racial biases. In Experiment 3, we took a less subtle approach and explicitly directed participants' attention to either the eye or mouth regions with visual cues during the pain judgment task. In Experiment 4, participants saw only portions of the face (e.g., only the eyes or the mouth) when assessing pain. By limiting participants' view to only diagnostic features, we predicted that bias in pain judgements would be reduced compared to a full view of the face.

Previous research would indicate that individuation (or lack of) would result in differential attention to another's face as a function of their group membership, which would impact emotion recognition. Across four experiments, we tested whether enhancing individuation could reduce the racial bias in pain perception. In Experiment 5, participants considered individuating information (e.g., name), categorical information (e.g., race or ethnicity), or no additional information about targets prior to making pain assessments. We predicted that unique information like a name would promote individuation towards Black faces and reduce bias in pain judgments. In

Experiment 6, we simultaneously manipulated individuation and familiarity. Participants either learned individuating information (e.g., their name) or just saw targets' faces prior to making pain assessments involving both old and new faces. This allowed us to investigate the roles that individuation experience and motivation play in racial bias of pain perception. In Experiment 7, we took a more direct approach to motivating individuation. Specifically, prior to the standard pain rating task, some participants were randomly assigned to learn about the Cross Race Effect and were instructed to pay close attention to the facial features of other-race faces. In Experiment 8, we tailored the instructions specifically to the context of racial bias in pain perception. We predicted that being informed about racial bias broadly, and more specifically in the context of pain, as well as being instructed to individuate the faces by focusing on features and details of the expression would reduce racial bias in pain perception.

Chapter 2

CAN MODULATING VISUAL ATTENTION REDUCE RACIAL BIAS IN PAIN PERCEPTION?

Across four experiments, we explored the perceptual mechanisms supporting racial bias in pain care, with a specific focus on whether directed attention may be used as an approach to mitigate this bias. Racial biases in emotion recognition are linked to disruptions in configural processing, and redirecting participants' attention to diagnostic regions of the face can reduce these deficits. The present experiments applied this principle to the context of disparities in pain care, to determine if there were differences in how participants attended to a target's pain as a function of race and test whether directing participant's attention to different regions of the face would alter their pain assessments. In Experiment 1, we measured where on a face participants naturally attend within the context of pain using a probe task. In Experiment 2, we implicitly manipulated where participants attended to in an attempt to direct participants' attention to pain diagnostic regions of the face. In Experiment 3, we were more explicit with our manipulation. Participants were asked if a face was in pain while being directed to specific face regions using arrows. In Experiment 4, participants had to make pain judgments while only seeing the eyes or the mouth, with no additional face information. We predicted that participants would see pain less readily on Black (versus White) faces (Experiments 1-4). However, we predicted that bias in pain perception would vary based on condition—specifically, while bias would persist in control and periphery conditions, bias would be reduced when directed to pain diagnostic regions of the face (Experiments 3-4).

Experiment 1: Measuring Attention to Pain-Diagnostic Regions

Previous research indicates that both the eye and mouth regions provide useful information for assessing pain (Blais et al., 2019; Roy et al., 2015). To better understand the relationship between pain perception and visual attention to specific regions of the face, we first measured participants' natural attention to different face regions to assess whether attention would differentially impact pain perception as a function of race. We used reaction time and accuracy to dot probes to determine 1) which facial features participants attend to most, 2) whether attention varies by race, and 3) how race-based differences in attention impact bias in pain judgments.

Consistent with previous lab findings, we predicted that participants would judge pain more intensely on White face than Black faces (Lin et al., under review). We also predicted that participants would identify probes in the eye and mouth regions sooner and more accurately than probes in the periphery. In addition, we predicted that participants would attend to different features as a function of race (e.g., reacting faster to probes in the eye region for White faces and in the mouth region of Black faces), and further, that racial differences in attention would be correlated with racial differences in pain recognition.

Method

Participants

102 participants were recruited from the University of Delaware psychology subject pool[1]. We excluded participants from analysis who a) performed below 70%

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[1] We were unable to recruit the intended 130 participants before this submission. We anticipated that this amount would yield at least 100 participants passing our exclusion criteria, thus affording us 80% statistical power to detect an interaction with an effect size of $f = .128$ (for the 2×3 race-by-region interaction, both within-subject factors). Therefore, discussion about the findings in Experiment 1

accuracy in probe color judgments, or b) gave the same rating on 90% of trials or greater in the pain task. Given our previous work demonstrating that racial bias in pain perception generalizes across perceiver race, we did not restrict our analyses based on race or ethnicity in Experiment 1 or the following experiments.

Ultimately, 90 participants passes the exclusion criteria (50 women, 29 men, 2 non-binary, 9 did not disclose; M_{age} = 18.90, SD_{age} = 1.05; 69 Non-Hispanic/Latinx, 12 Hispanic, 9 did not disclose; 62 White/Caucasian, 5 African American, 3 East Asian, 3 Middle Eastern/North African, 3 South Asian, 14 who prefer to self-describe or did not disclose).

The sample size and exclusion criteria, procedures, analyses, and predictions of Experiment 1 were pre-registered on OSF (https://osf.io/rxq7d).

Stimuli

Participants saw 40 targets (20 Black males, 20 White males) that were created using FaceGen. We selected five pain expressions from the digitally rendered subset of the Delaware Pain Database (Mende-Siedlecki et al., 2020). Each target was depicted making a randomly-assigned painful expression at five levels of intensity (0% [or neutral], 30%, 50%, 70%, and 100% painful). Each expression was rendered on four different targets at all five intensities. Expressions were randomly assigned to target base heads. We created both Black and White versions of each target's base head; presentation of these different versions were counterbalanced across four versions of the task. In other words, no participant saw both Black and White versions

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should be considered with that in mind. We do plan to resume recruiting participants in Fall 2023 until we reach our goal and reanalyze the data.

of the same base head. However, the different Black and White versions of each base head were always making the same expressions. Thus, expression intensity and target head structure were completely equated within participants.

On some trials, participants saw probes appearing in one of three face locations—the eye region, the mouth region, or the facial periphery. These probes were represented by dots varying in location (80 placed in the eye region, 80 placed in the mouth region, 24 placed in the periphery) and color (92 green, 92 blue; evenly distributed across location). To ensure that the locations of the dots were equated across conditions, we first set a fixation cross that was equidistant from the middle of the eyes and the middle of the mouth. We then created two concentric circles that encompassed the majority of the eye and mouth regions. The space between these circles represents the range in which the dot probes can appear (see Figure 1). Dot probe stimuli were created in Microsoft PowerPoint; probe placement was determined manually with a sample face and the circles in Figure 1 onscreen as a guide. (The spacing and positioning of the eyes, mouth, and nose in FaceGen is strongly consistent across the set of faces used in this experiment.) We aimed to distribute placement of dots evenly across each face region (e.g., left versus right eye; left, center, and right portions of the mouth). Non-diagnostic dot probes were also placed within the guide circles—specifically within an area of the cheek that was equidistant from the corners of the eyes and mouth.

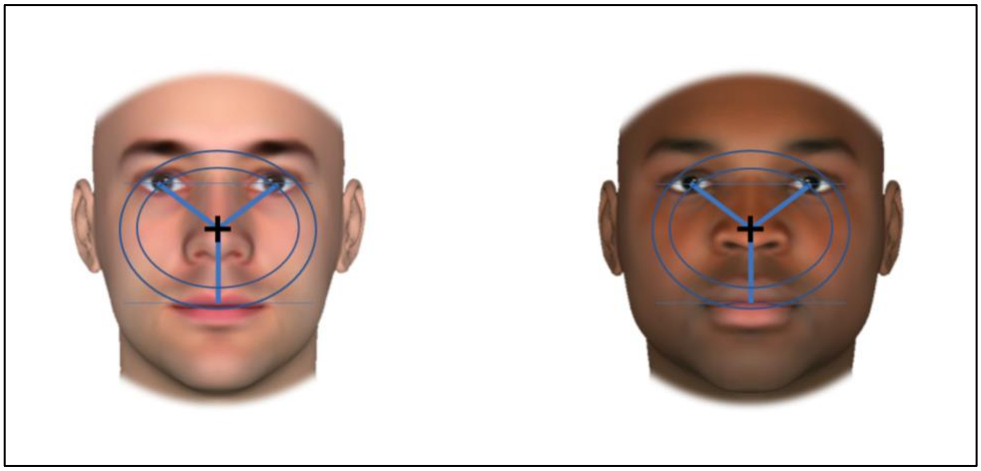

Figure 1 We attempted to ensure that dot probes appearing in the eye, mouth, and periphery regions were equidistant from the fixation cross that preceded each face stimulus, and further, that these probes were evenly distributed across each region within the space of the two circles.

Procedure

Participants completed all aspects of this experiment in-lab. Participants were informed that they would have to make two types of judgments during a computerized task while viewing a series of faces. During some trials, participants were asked to rate whether or not the face they saw looked like it was in pain. (Pain ratings were made by pressing the 1 [Yes] and 0 [No] keys.) On other trials, they were asked to rapidly indicate if they saw a blue or green dot (e.g., probe stimulus) on the face by pressing a key corresponding to the color of the probe as quickly as possible. (Probe responses were made by pressing the 2 or 9 keys, which were marked with colored tape on the keyboard. Mapping of color to key was counterbalanced across four versions of the task.)

Each trial began with a fixation cross appearing for 750ms, followed by the face appearing for 1000ms. From there, the procedures diverged depending on whether the participant was completing a pain trial or a probe trial. On pain trials, the face presented was either a Black or White target displaying 0%, 30%, 50%, 70%, or 100% painful expressions. The face was followed by a Fourier-scrambled mask image appearing for 500ms, after which participants were asked "Was the face you just saw in pain or not?" On probe trials, the face presented was either a Black or White target displaying an ambiguous (50%) or intense (100%) painful expression. 250ms after presentation of the face, a blue or green probe appeared somewhere on the face and participants had 1250ms to indicate the color of the probe. A mask image then appeared, and participants were told to press the space bar to continue. All faces were presented in a randomized order with regards to target race, pain intensity, and probe location. Pain and probe trials were randomly intermixed.

Next, participants completed a demographic survey including a measure of intergroup contact (adapted from Cloutier et al., 2014) and were then debriefed.

Analyses

Color Accuracy and Reaction Time to Probes

We assessed participants' accuracy and average reaction time (RT) on probe responses as a function of target race, separately. We submitted these values to two separate 2 × 3 repeated measures ANOVAs assessing the interaction between target race and probe condition. For these analyses we collapsed across expression intensity [e.g., 50% vs. 100%].

Accuracy in identifying the color of probes and RT served as indicators of what aspects of the face participants were attending to when observing faces in pain. If a participant was faster to respond to probes (or more accurate in identifying the color of probes) in the eye region, compared to the mouth region or periphery, we could conclude that participant was attending comparatively more to the eye region. Our goal was to determine (via RT and accuracy) what features participants were attending to more often on average, whether this varies based on race, and how this relates to bias in pain judgments.

Overall, we predicted participants would be faster to respond to probes (and more accurate in identifying the color of probes) in the eye and mouth regions compared to probes in non-pain-diagnostic regions of the face. Critically, we also predicted that participants would respond faster to probes (and be more accurate in color identification) in the eye region of White (versus Black) targets. We also predicted that participants would respond faster to probes (and be more accurate in color identification) in the mouth region of Black (versus White) targets.

Pain Judgments

All "Yes" and "No" judgments were first recoded to 1s and 0s, respectively, allowing us to calculate average pain judgments within each cell of the design. Higher numbers within a given cell indicated that stimuli within that cell were more likely to be judged as looking like they were in pain. These judgments were then submitted to a 2×5 repeated measures ANOVA assessing the interaction between target race and expression intensity on pain perception.

Overall, we predicted that participants would rate expressions on White faces as looking more like pain, versus Black faces. We also predicted that there would be more "Yes" responses for faces making more intense pain expressions. Moreover, we predicted that racial bias in pain judgments would be magnified for the most ambiguous faces and would decrease as expressions became more clearly neutral or painful.

Finally, we assessed the correlational relationships between biases in pain judgment and differences in attention to specific regions as a function of target race. In particular, we tested whether participants who were more likely to judge expressions as looking like pain on White (versus Black) faces also show evidence of a) greater attention to the eye region on White (versus Black) faces and b) greater attention to the mouth region on White (versus Black) faces, as indexed by faster RT (and great accuracy) to probes in those regions. We also used multiple linear regression to better understand the relationship between biases in attending to the eyes and the mouth regions with bias in pain judgements.

Results

Main effects of target race and probe location on accuracy and reaction time

In terms of accuracy of responding to probes, we did not observe a statistically significant main effect of target race ($F(1,89) = 0.212$, $p = .647$, $\eta_p^2 = .002$) or probe location ($F(1.27,113.46$[2]$) = 3.458$, $p = .055$, $\eta_p^2 = .037$).

In terms of reaction time to responding to probes, we also did not observe a statistically significant main effect of target race ($F(1,89) = 0.40$, $p = .842$, $\eta_p^2 < .01$) or probe location ($F(1.26,111.75^*) = 1.785$, $p = .183$, $\eta_p^2 = .02$).

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[2] Degrees of freedom were adjusted using Greenhouse-Geisser correction since the sphericity assumption was not met. Any future corrections are indicated with a "*".

Interactions between target race and probe location on accuracy and reaction time

We did not observe a statistically significant two-way interaction between target race and probe location (F(1.28,114.03*) = 1.715, p = .193, η_p^2 = .019) on accuracy.

We also did not observe a statistically significant two-way interaction between target race and probe location (F(1.28,113.57*) = 0.398, p = .579, η_p^2 = .004) on reaction time.

Main effects of target race and expression intensity on pain judgments

We observed statistically significant main effects of target race (F(1,89) = 9.789, p = .002, η_p^2 = .099) and pain intensity (F(2.44,217.46*) = 1061.984, p < .001, η_p^2 = .923; see Figure 2) on pain judgments. Specifically, participants were less likely to judge expressions on Black faces as looking like pain (M = .395, SD = .098), compared to expressions on White faces (M = .417, SD = .089). Moreover, targets' pain intensity expression tracked linearly with participants' judgments ($M_{0\%}$ = .023, $SD_{0\%}$ = .064; $M_{30\%}$ = .074, $SD_{30\%}$ = .106; $M_{50\%}$ = .271, $SD_{50\%}$ = .183; $M_{70\%}$ = .725, $SD_{70\%}$ = .188; $M_{100\%}$ = .937, $SD_{100\%}$ = .103).

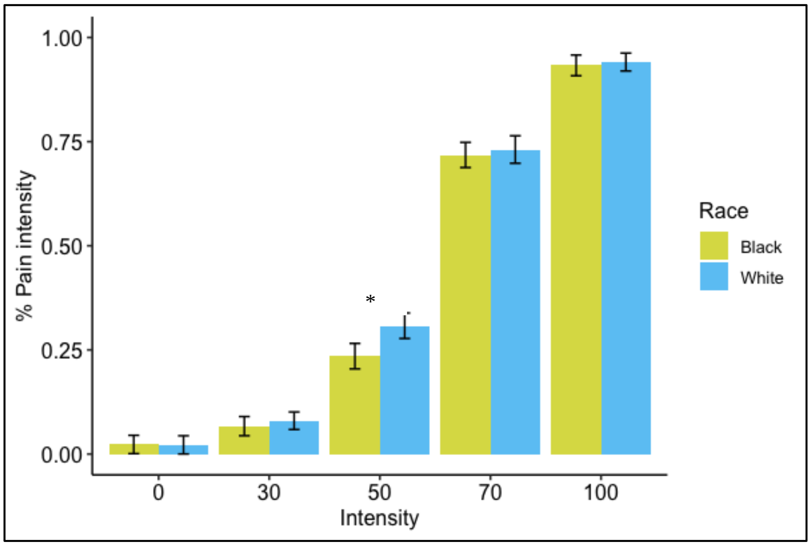

Figure 2 Participants in Experiment 1 rated White pain faces as expressing more pain when pain intensity was ambiguous (50%). Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Interactions between target race and expression intensity

We observed a statistically significant two-way interaction between target race and pain intensity ($F(2.89,256.78^*) = 8.146$, $p < .001$, $\eta_p^2 = .084$). This bias was largest and only statistically significant for the 50% pain intensity expressions ($t(89) = -4.399$, $p < .001$, $d = -.464$; $M_{Black} = .235$, $SD_{Black} = .202$; $M_{White} = .308$, $SD_{White} = .196$). There was no significant difference in pain judgments for Black and White targets within the 0% ($t(89) = 0.043$, $p = .966$, $d = .005$; $M_{Black} = .023$, $SD_{Black} = .073$; $M_{White} = .022$, $SD_{White} = .062$), 30% ($t(89) = -1.372$, $p = .173$, $d = -.145$; $M_{Black} = .067$, $SD_{Black} = .122$; $M_{White} = .080$, $SD_{White} = .107$), 70% ($t(89) = -0.885$, $p = .379$, $d = -.093$; $M_{Black} = .718$, $SD_{Black} = .197$; $M_{White} = .731$, $SD_{White} = .205$), and 100% pain intensities ($t(89) = -1.191$, $p = .237$, $d = -.126$; $M_{Black} = .933$, $SD_{Black} = .120$; $M_{White} = .941$, $SD_{White} = .093$).

Relationships between bias in attention and bias in perception

Correlations

Our secondary hypothesis was that biased attention (accuracy and response time) to pain faces would be associated with biased perception of painful expressions. First, we assessed the zero-order correlation between biased accuracy (White accuracy – Black accuracy) for identifying probes in the eye region and the mouth region with bias in pain perception. We assessed this relationship both across all pain intensities (White pain judgments – Black pain judgments) and specifically within the 50% pain intensity expressions (e.g., where bias in judgments was present). We also assessed the zero-order correlation between biased response time (Black RT – White RT) in the eye region and the mouth region with bias in pain perception.

With regards to the eye region, there was no significant relationship between biased accuracy and biased pain perception either overall ($r(88) = -.008$, $p = .942$) or within the 50% intensity expressions specifically ($r(88) = -.008$, $p = .940$). Similarly, there was no significant relationship between biased reaction time to eye region probes and biased pain perception overall ($r(88) = -.063$, $p = .556$) or within the 50% intensity expressions ($r(88) = .080$, $p = .456$).

With regards to the mouth region, there was no significant relationship between biased accuracy and biased pain perception either overall ($r(88) = .115$, $p = .279$) or within the 50% intensity expressions specifically ($r(88) = .061$, $p = .565$). Yet again, there was no significant relationship between biased reaction time to mouth region probes and biased pain perception overall ($r(88) = .136$, $p = .201$). However, when it comes to bias at 50% intensities specifically, we did observe a significant relationship between biased reaction time and pain perception ($r(88) = .247$, $p = .019$).

Multiple linear regressions

While the majority of the zero-order relationships detailed above were non-significant, we continued with our preregistered analyses pitting biases in eye and mouth attention against each other as predictors of racial bias in pain judgments. First we used multiple linear regression to compare racial bias in accuracy in the eye and mouth regions as predictors of racial bias in pain judgements. The overall regression was not statistically significant ($R^2 = .013$, $F(2,87) = 0.588$, $p = .558$). Moreover, neither racial bias in accurately identifying probes in the eye region ($\beta = -0.006$, $p = .960$), nor racial bias in accurately identifying probes in the mouth region predicted racial bias in pain judgments ($\beta = 0.163$, $p = .282$).

Next, we considered accuracy bias in the eye and mouth regions as a predictor of bias in pain judgments specifically within the 50% intensity pain expressions. Once again, the overall regression was not statistically significant ($R^2 = .004$, $F(2,87) = 0.167$, $p = .847$). Neither racial bias in accuracy in the eye region ($\beta = -0.020$, $p = .950$), nor racial bias in accuracy in the mouth region predicted racial bias in pain judgments ($\beta = 0.210$, $p = .568$).

Next, we moved onto our reaction time measures. We used multiple linear regression to compare racial bias in reaction time to probes in the eye and mouth regions as predictors of racial bias in pain judgements. The overall regression was not statistically significant ($R^2 = .035$, $F(2,87) = 1.595$, $p = .209$). Neither racial bias in reaction times to probes in the eye region ($\beta = -0.252$, $p = .221$), nor racial bias in reaction times to probes in the mouth region predicted racial bias in pain judgments ($\beta = 0.128$, $p = .096$).

Finally, we considered racial bias in reaction to probes in the eye and mouth regions as predictors of pain judgments specifically within the 50% intensity pain expressions. The overall regression was not statistically significant ($R^2 = .062$, $F(2,87) = 2.854$, $p = .063$). Once again, racial bias in reaction times to probes in the eye region did not predict racial bias in pain judgments ($\beta = -0.110$, $p = .823$). That said, racial bias in reaction times to probes in the mouth region still positively predicted racial bias in pain judgments when accounting for the reaction time bias in the eye region ($\beta = 0.412$, $p = .026$).

Discussion

In Experiment 1, we set out to discover how participants attended to different facial features when viewing faces in pain and whether that varied by target race. Participants equally attended to all regions of the face and did not vary that attention based on the race of the face. This experiment did replicate our core findings observed in previous work (Lin et al., under review). Participants judged White faces to be in more pain than Black faces. This bias was magnified by expression ambiguity—the gap in pain judgments between Black and White targets were observed *exclusively* within the 50% expression intensity. Generally, we did not find a relationship between bias in attention and bias in pain perception, except when it comes to bias in reaction time in response to probes in the mouth region and bias in pain judgment at 50%. In this case, as participants responded quicker to probes on White faces, they also judged pain to be higher on White faces. This relationship held when controlling for reaction time bias in the eye region. That said, given the potential weakness of our primary manipulation and the numerous non-significant relationships observed, we do not wish to overinterpret this result.

Our design may have contributed to not finding a difference in attending to different faces regions as a function of race. Presentation of targets was not blocked by race. It is possible that because Black and White targets were intermixed, participants were unable to employ a race-specific method of attending to a face, thus using a single method for viewing faces. It is also possible that because the main task was to attend to the probes, participants varied their attention strategically to find the probes rather than attending to specific regions of the face that they would naturally attend to for assessing pain. As such, we focused on manipulating attention in Experiment 2.

Experiment 2: Implicitly Directing Attention to Pain-Diagnostic Regions

To build on the findings in Experiment 1, we developed an implicit manipulation of attention. Since we sought to compare between attention directed to diagnostic regions versus non-diagnostic regions, we took a cue from prior work that compared how facilitating typical scan paths (focused heavily on the mouth and nose) versus atypical scan paths (focused on the periphery) influenced emotion perception in both neurotypical individuals and schizophrenia patients (Spilka et al., 2019).

Specifically, in a blocked design, participants were instructed to click on probe stimuli that occasionally appeared on either the eyes, the mouth, or in the periphery of the face. Thus, without explicitly indicating that participants should attend to these regions, their focus was differentially distributed across the three blocks. We did not make explicit predictions about which of the three face region conditions racial bias would be largest or smallest within, or how pain judgments would vary overall across these conditions overall.

Method

Participants

142 participants were recruited from the University of Delaware psychology subject pool. Based on prior work using a similar base paradigm (e.g., Experiment 1A; Mende-Siedlecki, Goharzad, Tuerxuntuoheti, Reyes, Lin, & Drain, 2022), we anticipated that this amount would yield at least 100 participants passing our exclusion criteria, thus affording us 80% statistical power to detect an interaction with an effect size of $f = .128$ (for the 2×3 race-by-region interaction, both within-subjects factors).

Participants completed the task remotely; the main task was hosted via Pavlovia, while the post-task surveys were administered through Qualtrics. We excluded participants who a) completed the main task but not the post-task surveys, b) said that they'd been interrupted multiple times while completing the task, c) said that they'd been watching, listening to, or working on something else while completing the task, or d) gave the same response on 90% of trials or more.

Ultimately, 111 participants passed the exclusion criteria (75 women, 35 men, 1 non-binary; $M_{age} = 18.84$, $SD_{age} = 0.82$; 101 Non-Hispanic/Latinx, 10 Hispanic/Latinx; 89 White/Caucasian, 8 African American, 7 East Asian, 2 South Asian, 1 Middle Eastern/North African, 1 Pacific Islander, and 3 who preferred to self-describe).

Stimuli

Participants saw 24 photographic stimuli (12 Black males, 12 White males) taken from the DPD (Mende-Siedlecki et al., 2020). Each target was presented at the same five levels of pain expression intensity as in Experiment 1.

We assessed whether the selected stimuli varied on any key social, emotional, or demographic dimensions based on norming data collected previously (Mende-Siedlecki et al., 2021). Importantly, the selected stimuli did not differ across race in terms of subjective evaluations of the intensity (M_{Black} = 4.50, M_{White} = 4.60, p = .581), specificity (M_{Black} = 1.57, M_{White} = 1.64, p = .754) or believability (M_{Black} = 5.60, M_{White} = 5.34, p = .273) of their painful expressions, or the latent pain content of their neutral expressions (M_{Black} = 1.83, M_{White} = 1.93, p = .396).

Furthermore, the selected stimuli did not vary in terms of subjective evaluations of the strength (M_{Black} = 4.27, M_{White} = 4.01, p = .206), dominance (M_{Black} = 3.99, M_{White} = 3.76, p = .266), trustworthiness (M_{Black} = 3.38, M_{White} = 3.18, p = .297), or perceived status (high status: M_{Black} = 2.79, M_{White} = 3.02, p = .218; low status: M_{Black} = 3.45, M_{White} = 3.21, p = .235) of their neutral images.

Moreover, these stimuli were also submitted to OpenFace (Baltrusaitis et al., 2018) to assess the number of pain-related action units activated in the selected the neutral and painful expressions. Critically, based on this algorithmic assessment, neither the 100% pain expressions or latent pain content in the neutral expressions varied based on target race (M_{Black} = 4.00, M_{White} = 4.08, p = .860; M_{Black} = 0.50, M_{White} = 0.67, p = .581).

Procedure

In this experiment, we used an implicit manipulation of attention. Participants were told that while their primary task was to rate whether or not each face they saw looked like it was in pain, occasionally, a blue cross (e.g., “probe” stimulus) would appear superimposed over one of the faces. Next, they were told to click on the probe as quickly as possible. We systematically manipulated the location of these probes over three different blocks. In one block, they appeared in the eye region (e.g., either on one eye or between the eyes), in one block they appeared in the mouth region (e.g., either on the lips, philtrum, or teeth), and in one block ("control" condition) they appeared in the periphery of the face (e.g., either on the upper forehead or outer cheeks).

Each face appeared three times, once in each block. A random subset of the faces were selected to appear additionally as the probe stimuli. Faces were presented in a randomized order within blocks, and blocks were presented in a randomized order as well. Probe trials were randomly intermixed between the rating trials and occurred on 24 out of 144 trials.

Analysis

Individual judgments were then submitted to a 2 × 3 × 5 repeated measures ANOVA assessing the interaction between target race, face region, and expression intensity on pain perception.

We preregistered the procedures and predictions of Experiment 2 on OSF (https://osf.io/eu7tx). However, in general, we predicted that participants would rate pain as more intense when expressed by White versus Black targets, and further, as in previous work (Mende-Siedlecki et al., 2022), we expected that the effect of target race would interact with expression intensity. Specifically, we expected that this bias would be largest for the most ambiguous (e.g., 50% pain) expressions. Our primary goal, however, was to assess whether racial bias in pain perception might be influenced by implicitly directing attention to key regions of the face. As prior work supports multiple possible hypotheses regarding the effects of face region (and its interaction with race), we were agnostic as to how bias would vary across the three face region conditions. As such, we tested competing hypotheses regarding the effects of manipulating attention to different face regions. To the extent that a given region (e.g., the eyes or mouth) is diagnostic for pain, implicitly increasing attention to that region should enhance pain judgments overall and reduce racial bias in pain judgments. Ultimately, we reasoned that Experiment 2 would provide a basis for more confident predictions in subsequent experiments.

Results

Main effects of target race, expression intensity, and face region on pain judgments

We observed statistically significant main effects for both target race ($F(1,110) = 10.508$, $p = .002$, $\eta_p^2 = .087$) and expression intensity ($F(2.02,222.52^*) = 797.359$, $p < .001$, $\eta_p^2 = .879$), but the effect of face region was not significant ($F(1.87,205.74^*) = 0.219$, $p = .789$, $\eta_p^2 = .002$; see Figure 3). As predicted, participants were more likely to judge White faces ($M = .510$, $SD = .135$) as being in pain than Black faces ($M = .488$, $SD = .140$). Participants' pain judgments scaled linearly with the intensity of morphs ($M_{0\%} = .083$, $SD_{0\%} = .108$; $M_{30\%} = .240$, $SD_{30\%} = .159$; $M_{50\%} = .562$, $SD_{50\%} = .224$; $M_{70\%} = .763$, $SD_{70\%} = .190$; $M_{100\%} = .848$, $SD_{100\%} = .160$). Once again, no significant differences were observed as a function of face region ($M_{\text{control}} = .502$, $SD_{\text{control}} = .141$; $M_{\text{eyes}} = .500$, $SD_{\text{eyes}} = .142$; $M_{\text{mouth}} = .495$, $SD_{\text{mouth}} = .161$).

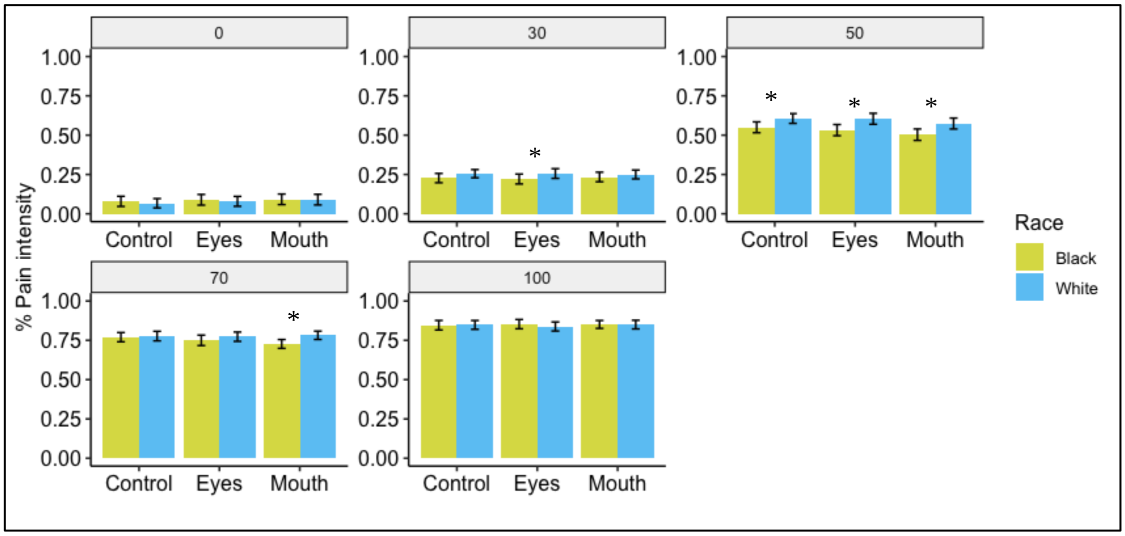

Figure 3 Participants in Experiment 2 rated White faces as expressing more pain; however, there was no effect of face region on pain assessments. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Interactions between target race, expression intensity, and face region

With regards to our main focus, we did not observe a significant two-way interaction between target race and face region ($F(2,220) = 0.880$, $p = .416$, $\eta_p^2 = .008$). In the hopes of better understanding the effect of our manipulation, we examined the effect of target race within each face region condition. Participants rated pain as being less intense on Black versus White faces across all three conditions. Interestingly, the general patterns of means suggest that this bias was largest when participants' attention was implicitly drawn to the mouth region ($t(110) = -3.242$, $p = .002$, $d = -.308$; $M_{Black} = .482$, $SD_{Black} = .170$; $M_{White} = .509$, $SD_{White} = .165$), in comparison to the eyes condition ($t(110) = -2.483$, $p = .015$, $d = -.236$; $M_{Black} = .489$, $SD_{Black} = .152$; $M_{White} = .510$, $SD_{White} = .146$) or the control condition ($t(110) = -1.942$, $p = .055$, $d = -.184$; $M_{Black} = .494$, $SD_{Black} = .148$; $M_{White} = .510$, $SD_{White} = .147$).

However, we did observe a significant two-way interaction between target race and pain intensity (F(3.26,358.53*) = 11.632, p < .001, η_p^2 = .096). Our prediction that racial bias in pain judgments would scale with stimulus ambiguity was largely supported. This bias was largest for the 50% pain intensity expressions (t(110) = -4.738, p < .001, d = -.450; M_{Black} = .529, SD_{Black} = .245; M_{White} = .595, SD_{White} = .227), smaller within the 70% (t(110) = -2.957, p = .004, d = -.281; M_{Black} = .749, SD_{Black} = .203; M_{White} = .778, SD_{White} = .191) and 30% pain intensity expressions (t(110) = -2.308, p = .023, d = -.219; M_{Black} = .227, SD_{Black} = .169; M_{White} = .254, SD_{White} = .171), and not statistically significant within the 0% (t(110) 1.292, p = .200, d = .123; M_{Black} = .087, SD_{Black} = .117; M_{White} = .079, SD_{White} = .110) and 100% pain intensity expressions (t(110) = 0.516, p = .607, d = .049; M_{Black} = .850, SD_{Black} = .171; M_{White} = .845, SD_{White} = .163).

We did not observe a three-way interaction between target race, pain intensity, and face region (F(7,769.94*) = 1.130, p < .340, η_p^2 = .010)[3].

Discussion

Experiment 2 replicated our core findings observed in Experiment 1 and prior work (Mende-Siedlecki et al., 2019; 2021; 2022). Perceivers judged pain as being more intense on White faces versus Black faces. Moreover, this bias was magnified by expression ambiguity—the largest gap in pain judgments between Black and White targets were observed within the 50% pain intensity expressions. That being said, we observed null effects for both of our novel predictions: the main effect of face region

[3] The two-way interaction between intensity and region in Experiments 2-4 is not presented in the main text as it was not our main focus. These analyses are available in Appendix A.

and the interaction between target race and face region. In other words, we did not observe differences in pain judgments as a function of the facial region that participants were implicitly cued to attend to, nor did this implicit manipulation of attention vary as a function of target race. Two design issues may have potentially contributed to these null effects.

First, while adapted from prior work that attempted to represent atypical scan paths while attending to a single face (Spilka et al., 2019), it's possible that our periphery condition (in which participants' attention was meant to be implicitly directed towards the cheeks and foreheads of our targets) unintentionally distributed attention across the whole face. Second, and perhaps more importantly, our implicit manipulation of attention was likely too subtle. Probe appearances were intermittent, attention to these probes was not incentivized, and accuracy was not assessed. Given the results of Experiments 1 and 2, Experiment 3 employed a more concerted manipulation of visual attention.

Experiment 3: Explicitly Directing Attention to Pain-Diagnostic Regions

To build on the findings of Experiment 2, we developed a paradigm in which attention could be more explicitly directed to various regions of a target face. Specifically, arrows pointing to either the eye or mouth region appeared on screen shortly before the face and remained on screen for the duration of the face presentation. Moreover, to reduce ambiguity and to offer a better means of baseline comparison, we replaced the periphery condition with a control condition in which no arrows appeared with the target faces.

In addition, Experiment 3 was run in person (reducing potential exclusions due to distraction or interruption) and preregistered. While the findings of Experiment 1 and 2 hampered our ability to make strong predictions regarding the main effect of face region or its interaction with target race, we anticipated that racial bias in pain perception might be larger when attention was explicitly directed to the mouth versus the eyes.

Method

Participants

135 participants were recruited from the University of Delaware psychology subject pool. We sought to recruit enough participants to yield at least 100 participants passing our exclusion criteria.

We preregistered our sample and exclusion criteria, in addition to our procedure, stimuli, and analysis plan (https://osf.io/aj7fv). Since this task was run in person, our list of task-specific exclusion criteria was somewhat simplified. We excluded participants from analyses if a) they gave the same response on 90% of trials or more or b) when asked whether or not they maintained their compliance with the attention manipulations throughout the entire task, they stated that they never paid attention to the arrow cues or flagged in their attention to these cues as the task went on.

Ultimately, 112 participants passed the exclusion criteria (93 women, 17 men, 2 non-binary; M_{age} = 18.68, SD_{age}= 1.12; 97 Non-Hispanic/Latinx, 15 Hispanic/Latinx; 90 White/Caucasian, 9 African American, 2 East Asian, 4 South Asian, 2 Middle Eastern/North African, 1 Pacific Islander, 1 American Indian or Alaska Native, and 3 who preferred to self-describe).

Stimuli

Participants saw the same 24 targets (12 Black males, 12 white males) presented at the same five levels of pain expression intensity as in Experiment 2. Critically, while Experiment 2 used a relatively implicit manipulation of attention, in Experiment 3, we were more direct. Specifically, in certain blocks of stimuli, we presented arrows at the sides of each stimulus pointing inwardly towards either the eyes or the mouth. (No arrows appeared in control blocks.) These arrows were placed on a stimulus-specific basis, such that their points lined up precisely with the corners of either the eyes or the mouth. Within a given target's morphs, arrow position varied from morph to morph, as these features "moved" within the face. Stimuli were presented in blocks that were dedicated to a particular region of the face (eyes, mouth, or control).

Procedure

Participants completed a modified version of Experiment 1A in Mende-Siedlecki et al. (2022). Participants were told that in each block, they would be cued to look at a particular area of the faces appearing on screen. Each trial began with a 500ms fixation cross. Then, two arrows appeared on either side of the screen (pointing inwards; 800ms). Next, a face appeared within the arrows. Participants were told to fix their attention on the area of the face indicated by the arrows. After an additional 800ms elapsed, the face was replaced with a Fourier-scrambled mask image and participants indicated with a binary response (Yes or No) whether the morph was in pain or not. The mask remained on screen until participants registered their response. Participants saw an equal number of faces during each block. Each morph appeared three times, once in each block. Faces were presented in a randomized order within blocks, and blocks were presented in a randomized order as well.

Following the task, participants reported on their compliance with our attention instructions and completed demographic survey including a measure of intergroup contact (adapted from Cloutier et al., 2014). Following the completion of the intergroup contact measure, participants were debriefed. Several other exploratory individual difference measures were available for these participants, having been previously collected in a testing battery within the subject pool, specifically a) the Modern Racism Scale (McConahay, 1986), b) the Symbolic Racism Scale (Henry & Sears, 2002), c) the EMS/IMS scales (Plant & Devine, 1998), d) the "Ascent" scale of blatant dehumanization (Kteily et al., 2015), e) feeling thermometer of various social groups (including Black and White Americans), and f) a measure of Social Dominance Orientation (Pratto et al., 1994).

Analyses

Individual judgments were processed in an identical manner to Experiment 2 and submitted to a 2 × 3 × 5 repeated measures ANOVA (target race × face region × expression intensity).

Overall, we predicted a main effect of target race on pain judgments—specifically, we expected that participants would be more likely to rate expressions on White faces (versus Black faces) as looking like pain (as seen in Experiments 1 and 2 and our previous work; Mende-Siedlecki et al., 2022). We also predicted a main effect of pain intensity on pain judgments (e.g., more "Yes" responses as for the morphs containing a higher percentage of the pain expression). Testing the main effect of face region allowed us to gain a better understanding of which regions are most informative for the detection of pain. For example, if the eye region is more informative than the mouth region, pain judgments should be higher when participants are directed to look at the eyes versus the mouth. That said, in light of the results of Experiment 2, we still could not make a conclusive prediction regarding the direction of the main effect of face region.

With regards to the interaction between race and face region, our preregistration stated that if a given region was more informative for pain judgments overall, then directing attention towards that region should reduce racial bias in pain judgments. Moreover, while we recognized that several patterns of results were still possible and were cautious against overinterpreting the results of Experiment 2, the raw differences in means observed in that data suggested that bias was somewhat larger in the mouth condition versus the eye condition, even when attention was only subtly manipulated. As such, in our preregistration, we put our greatest confidence in the likelihood that bias in pain judgments would be larger in the mouth condition (compared to the eye or control conditions).

Lastly, with regards to the interaction between race and intensity, we once again predicted that racial bias in pain judgments would be magnified for the most ambiguous faces (e.g., the 50% morphs) and would decrease as expressions become more clearly neutral or painful.

Results

Main effects of target race, expression intensity, and face region on pain judgments

We observed statistically significant main effects of target race ($F(1,111) = 75.129$, $p < .001$, $\eta_p^2 = .404$), pain intensity ($F(2.24,249.07^*) = 1615.689$, $p < .001$,

η_p^2 = .936), and face region (F(1.78,197.33*) = 95.129, $p < .001$, η_p^2 = .462; see Figure 4) on pain judgments. Specifically, participants were less likely to judge expressions on Black faces as looking like pain (M = .486, SD = .086), compared to expressions on White faces (M = .530, SD = .081). Moreover, targets' pain intensity expression tracked linearly with participants' judgments ($M_{0\%}$ = .057, $SD_{0\%}$ = .099; $M_{30\%}$ = .203, $SD_{30\%}$ = .120; $M_{50\%}$ = .599, $SD_{50\%}$ = .141; $M_{70\%}$ = .803, $SD_{70\%}$ = .109; $M_{100\%}$ = .876, $SD_{100\%}$ = .107). Most notably, pain judgments were higher when participants' attention was explicitly directed to the eyes (M = .558, SD = .092), compared to either the control condition (M = .532, SD = .092; t(111) = -3.426, p < .001, d = -.324) or the mouth condition (M = .433, SD = .110; t(111) = 12.616, p < .001, d = 1.192). Pain judgments were also significantly higher in the control condition compared to the mouth condition (t(111) = 9.177, p < .001, d = .867).

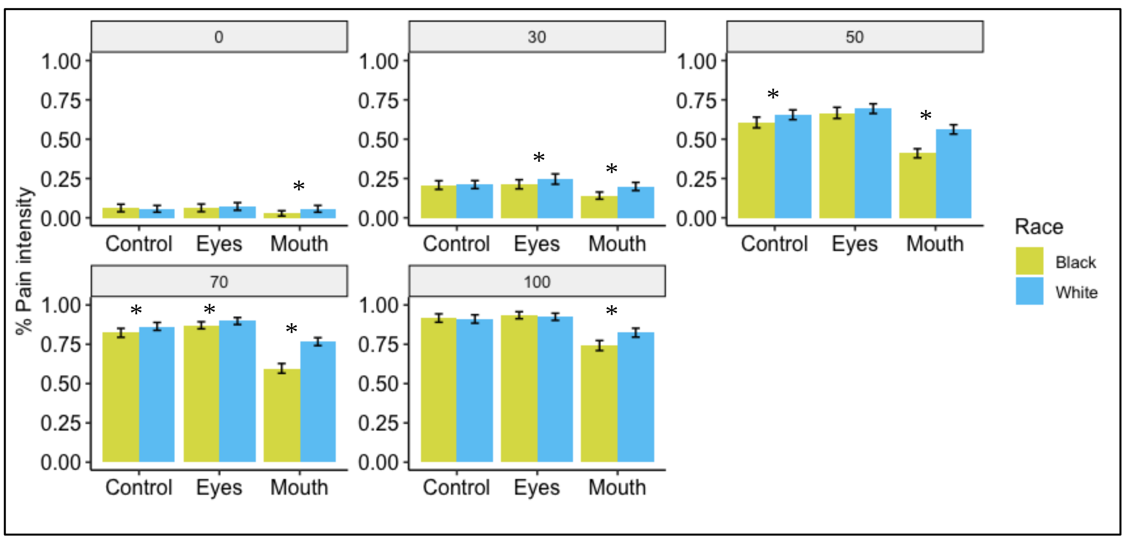

Figure 4 Participants in Experiment 3 rated pain higher when explicitly directed to the eyes. Racial bias was largest when participants were directed to the mouth region. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Interactions between target race, expression intensity, and face region

We also observed a statistically significant two-way interaction between target race and face region ($F(2,222) = 52.051$, $p < .001$, $\eta_p^2 = .319$). Specifically, while participants rated pain as being less intense on Black (versus White) faces across face region conditions, the effect of race was significantly larger within the mouth condition ($t(111) = -13.295$, $p < .001$, $d = -1.256$; $M_{Black} = .384$, $SD_{Black} = .122$; $M_{White} = .482$, $SD_{White} = .110$), compared to both the eyes condition ($t(111) = -2.683$, $p = .008$, $d = -.254$; $M_{Black} = .550$, $SD_{Black} = .101$; $M_{White} = .567$, $SD_{White} = .096$) and the control condition ($t(111) = -1.997$, $p = .048$, $d = -.189$; $M_{Black} = .523$, $SD_{Black} = .107$; $M_{White} = .540$, $SD_{White} = .096$). Thus, our prediction was supported: when attention was explicitly directed to a comparatively less informative region (e.g., the mouth), racial bias in pain judgments was greater in magnitude.

Moreover, as predicted, we observed a statistically significant two-way interaction between target race and pain intensity ($F(3.51,389.44^*) = 17.979$, $p < .001$, $\eta_p^2 = .139$). This bias was largest for the 70% ($t(111) = -8.761$, $p < .001$, $d = -.828$; $M_{Black} = .764$, $SD_{Black} = .125$; $M_{White} = .843$, $SD_{White} = .114$) and 50% pain intensity expressions ($t(111) = -6.985$, $p < .001$, $d = -.660$; $M_{Black} = .561$, $SD_{Black} = .157$; $M_{White} = .637$, $SD_{White} = .149$), smaller within the 30% pain intensity expressions ($t(111) = -3.688$, $p < .001$, $d = -.348$; $M_{Black} = .188$, $SD_{Black} = .124$; $M_{White} = .219$, $SD_{White} = .131$), and smaller still within the 100% ($t(111) = -3.118$, $p = .002$, $d = -.295$; $M_{Black} = .865$, $SD_{Black} = .116$; $M_{White} = .887$, $SD_{White} = .111$) and 0% pain intensity expressions ($t(111) = -1.977$, $p = .051$, $d = -.187$; $M_{Black} = .051$, $SD_{Black} = .097$; $M_{White} = .062$, $SD_{White} = .109$).

Finally, we also observed a three way interaction between target race, pain intensity and face region ($F(6.61,733.56^*) = 6.092$, $p < .001$, $\eta_p^2 = .052$). To unpack this interaction, we assessed the two-way interaction between target race and face region at each level of expression intensity.

This two-way interaction was significant at every intensity level: 0% (F(2,222) = 4.485, p = .012, η_p^2 = .039), 30% (F(2,222) = 3.987, p = .020, η_p^2 = .035), 50% (F(2,222) = 17.672, p < .001, η_p^2 = .137), 70% (F(1.77,196.35*) = 41.742, p < .001, η_p^2 = .273), and 100% (F(1.75,193.83*) = 24.192, p < .001, η_p^2 = .179). Within each intensity, racial bias in pain judgments was largest in the mouth condition (0%: t(111) = -3.207, p = .002, d = -.303; 30%: t(111) = -4.660, p < .001, d = -.440; 50%: t(111) = -9.732, p < .001, d = -.920; 70%: t(111) = -11.351, p < .001, d = -1.073; 100%: t(111) = -6.149, p < .001, d = -.581). Bias in the eye condition was only significant at the 30% and 70% intensity levels (0%: t(111) = -1.156, p = .250, d = -.109; 30%: t(111) = -2.313, p = .023, d = -.219; 50%: t(111) = -1.558, p = .122, d = -.147; 70%: t(111) = -2.44, p = .016, d = -.230; 100%: t(111) = 1.221, p = .225, d = .115), while bias in the control condition was only significant at the 50% and 70% intensity levels (0%: t(111) = 0.596, p = .552, d = .056; 30%: t(111) = -0.192, p = .848, d = -.018; 50%: t(111) = -2.766, p = .007, d = -.261; 70%: t(111) = -2.910, p = .004, d = -.275; 100%: t(111) = 0.533, p = .595, d = .050).

Discussion

In Experiment 3, attention to the eye region enhanced pain judgments overall (compared to a non-directed control condition), while attention to the mouth region diminished pain judgments. Moreover, participants' tendency to underrate pain on Black faces was significantly larger when participants were directed to focus on the mouth region versus the eye region. This latter finding accorded with our preregistered predictions. Moreover, as predicted, participants rated pain as less intense on Black targets overall, and this bias was largest within the most ambiguous expressions of pain.

Of course, participants were merely instructed to look at one region or the other. While we excluded participants who explicitly reported that they did not comply with these instructions, participants were ultimately not prohibited from looking at other parts of the face. Since we cannot say for certain whether participants truly restricted their attention solely to one region or the other, it remains possible that directing attention to the eyes promoted more efficient processing of faces as a whole (versus the mouth condition). Experiment 4 sought to address this open question by presenting participants with only the eyes or the mouth in these respective conditions (e.g., similar to Friesen et al., 2019).

Experiment 4: Restricting Visual Attention to Pain-Diagnostic Regions

To ensure that participants were restricting their visual attention to certain regions, we vignetted our stimuli in Experiment 4 to depict only the eyes or the mouth of a face. By comparing to our full-face control condition, we can now address whether limiting the "signal" that participants are considering influences racial bias in pain judgments (or indeed, overall judgments collapsing across target race).

Moreover, in a departure from Experiments 2 and 3, we used computer-generated (e.g., FaceGen) stimuli that allowed us to completely equate pain intensity and head structure across target race. Our prior meta-analytic work demonstrates that racial bias in pain perception does not vary in magnitude across photographic versus computer-generated stimuli (Lin et al., under review). Ultimately, any reduction in ecological validity that comes with using these stimuli is offset by an enhancement in internal validity.

As with Experiment 3, we preregistered Experiment 4 and collected this data in person. Given the findings of Experiment 3, we more confidently predicted that attention to the eye region would enhance pain judgments overall and reduce racial bias therein, compared to attention to the mouth region.

Method

Participants

140 participants were recruited from the University of Delaware psychology subject pool. We sought to recruit at least 100 participants to achieve adequate statistical power, and in this case simply kept running the experiment until the semester ended.

We once again preregistered our sample and exclusion criteria, in addition to our procedure, stimuli, and analysis plan (https://osf.io/w9tyk). Since the task in Experiment 4 was conducted in-lab and did not depend on participants' compliance with specific instructions (e.g., attending to the arrows in Experiment 3), we only excluded participants from analyses if they gave the same response on 90% of trials or greater. Ultimately, 138 participants passed the exclusion criteria (88 women, 49 men, 1 non-binary; M_{age} = 19.04, SD_{age}= 2.14; 123 Non-Hispanic/Latinx, 14 Hispanic/Latinx, 1who preferred to did not disclose; 106 White/Caucasian, 12 African American, 7 East Asian, 2 Middle Eastern/North African, and 11 who preferred to self-describe).

Stimuli

For Experiment 4, we used computer-generated FaceGen stimuli. Specifically, we selected 5 pain expressions from the digitally rendered subset of the DPD (Mende-

Siedlecki et al., 2020), which we previously developed by manipulating FaceGen sliders linked to specific facial action units, expressions, and phonemes. Based on norming data when the DPD was first developed, these five expressions were rated as looking more like pain on average than any emotion (M = 4.93 out of 7; all comparison emotion Ms < 3.26, all comparison ps < .0017).

Participants saw 30 targets (15 Black males, 15 White males), each depicted making painful expressions at five levels of intensity (0% (or neutral), 30%, 50%, 70%, and 100% painful). Each expression was rendered on three different targets at all five intensities. Expressions were randomly assigned to target base heads. Critically, we made both Black and White versions of each target base head, both of which were presented to and rated by each participant. Thus, expression intensity and target head structure were completely equated within participants.

To create the stimuli for our eye and mouth conditions, we applied oval shaped vignettes of exactly the same height and width to the eye and mouth regions in Photoshop. These vignettes cropped out all other content from the face. The eye region vignettes included both eyes, the eyebrows, and the bridge of the nose. The mouth region vignettes included the mouth, philtrum, mentolabial sulcus and upper chin, and some of the mid-cheek region. The full-face control images were more subtly vignetted in Photoshop (as in our prior work [Mende-Siedlecki et al., 2021] and other work [e.g., Freeman et al., 2014]) to minimize their "bald" appearance.

Procedure

Participants completed a modified version of the task in Experiment 3. While the general structure and trial timing was the same, participants were now told that in each block, they would see different portions of a particular area of the faces appearing on screen. Sometimes they would see full faces without any alteration, other times they would see only the eye regions, and still other times they would see only the mouth regions. (Our instructions did not refer directly to "eye" or "mouth regions" directly; this information was conveyed visually by displaying example stimuli.)

On each trial, a face appeared (either a full face or vignetted eye or mouth region). Participants were told to fix their attention on the area of the face that was presented. After 800ms, the image was replaced with a Fourier-scrambled mask image and participants indicated with a binary response (Yes or No) whether the morph was in pain or not. As in the previous experiments, each morph of each target appeared three times (e.g., once per block), and both face order within block and overall block order was randomized. Following the task, participants once again completed a demographic survey including a measure of intergroup contact (Cloutier et al., 2014). (The same individual difference measures from Experiment 3 were once again collected prior to participation in a subject-pool-wide survey battery.)

Analyses

Individual judgments were processed in an identical manner to Experiments 2 and 3, and then submitted to a 2 × 3 × 5 repeated measures ANOVA (target race × face region × expression intensity).

We once again predicted main effects of target race and intensity on pain judgments, as well as an interaction between these two factors (e.g., with racial bias in judgments magnified within the more ambiguous morphs). Based on the patterns observed in Experiment 3, we predicted a main effect of face regions, such that pain judgments would be highest in the eye region condition, followed by the control condition, followed by the mouth condition. Further, we predicted an interaction between target race and face region—specifically, greater bias when participants attend to the mouth region versus the eye region. Finally, we noted that we expected this interaction between target race and face region would be most pronounced at the 50% intensity level.

Results

Main effects of target race, expression intensity, and face region on pain judgments

We did not observe a statistically significant main effect of target race ($F(1,137) = 0.179$, $p = .673$, $\eta_p^2 = .001$; see Figure 5). We did, however, observe a statistically significant main effect of pain intensity ($F(2.5,342.11^*) = 1817.493$, $p < .001$, $\eta_p^2 = .930$), face region ($F(1.89,259.33^*) = 38.024$, $p < .001$, $\eta_p^2 = .217$) on pain judgments. Both of these effects fell in line with our preregistered predictions.

Participants' judgments of pain expressions at different intensities also tracked linearly with participants pain judgments ($M_{0\%} = .054$, $SD_{0\%} = .058$; $M_{30\%} = .151$, $SD_{30\%} = .121$; $M_{50\%} = .399$, $SD_{50\%} = .183$; $M_{70\%} = .720$, $SD_{70\%} = .166$; $M_{100\%} = .893$, $SD_{100\%} = .094$). Finally, participants' pain judgments were highest when participants evaluated the control faces ($M = .473$, $SD = .099$), compared to both the eye region ($M = .434$, $SD = .110$; $t(137) = 6.157$, $p < .001$, $d = .524$) or the mouth region alone ($M = .424$, $SD = .112$; $t(137) = 7.903$, $p < .001$, $d = .673$). However, pain judgments were not statistically significant between the eye condition and mouth condition ($t(137) = 1.876$, $p = .063$, $d = .160$).

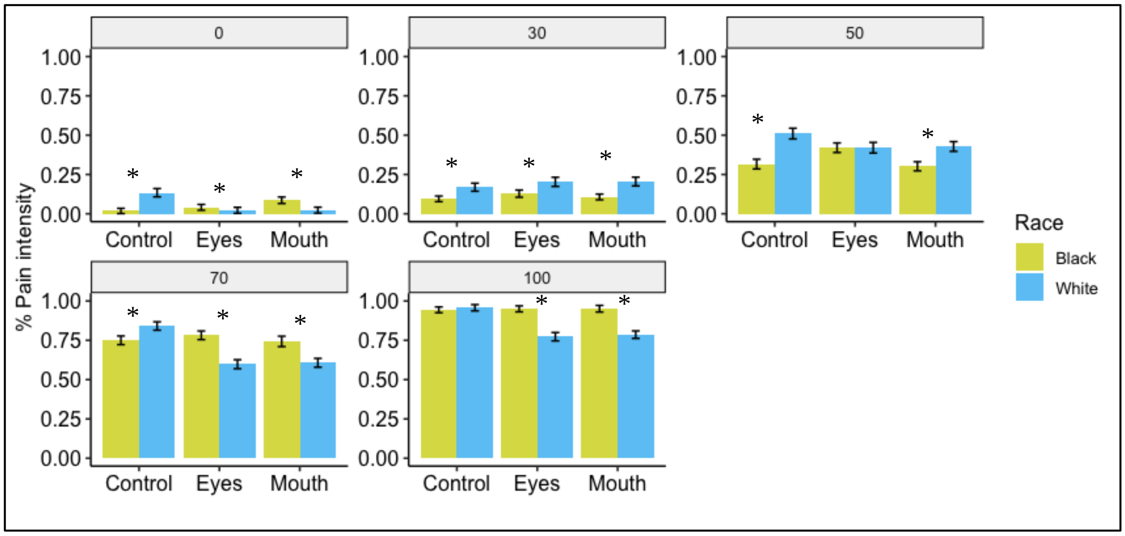

Figure 5 When unconstrained (control condition), participants in Experiment 4 rated White faces as expressing more pain. Limiting attention to specific features resulted in lower pain ratings for White faces. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Interactions between target race, expression intensity, and face region

We also observed a statistically significant two-way interaction between target race and face region (F(1.68,230.09*) = 61.169, $p < .001$, $\eta_p^2 = .309$). While we observed a racial bias in pain judgments in the predicted direction in the control condition (t(137) = -9.815, $p < .001$, d = -.835, M_{Black} = .425, SD_{Black} = .107, M_{White} = .522, SD_{White} = .123), this bias was reversed in the eyes (t(137) = 5.192, $p < .001$, d = 0.442, M_{Black} = .464, SD_{Black} = .108, M_{White} = .403, SD_{White} = .148) and mouth conditions (t(137) = 2.451, p = .016, d = .209, M_{Black} = .438, SD_{Black} = .113, M_{White} = .410, SD_{White} = .145). Surprisingly the customary pro-White bias was high largest in the control condition when participants saw the whole face, though in the eye *and* mouth conditions, participants rated Black pain higher.

Moreover, we observed a statistically significant two-way interaction between target race and pain intensity (F(3.53,483.04*) = 127.632, p < .001, η_p^2 = .482). Our prediction that racial bias in pain judgments would vary as a function of stimulus ambiguity was supported. Participants showed the strongest tendency to underrate pain on Black (versus White) faces within 50% expression intensity (t(137) = -8.211, p < .001, d = -.699; M_{Black} = .346, SD_{Black} = .195; M_{White} = .453, SD_{White} = .202). This bias was also statistically significant within the 30% (t(137) = -8.128, p < .001, d = -.692; M_{Black} = .110, SD_{Black} = .109; M_{White} = .192, SD_{White} = .157), and statistically significant at a smaller extent at 0% pain intensity (t(137) = -2.837, p = .005, d = -.242; M_{Black} = .048, SD_{Black} = .056; M_{White} = .060, SD_{White} = .068). Participants underrated *White* faces within 70% (t(137) = 6.259, p < .001, d = .533; M_{Black} = .758, SD_{Black} = .189; M_{White} = .682, SD_{White} = .173), and 100% pain intensities (t(137) = 12.691, p < .001, d = 1.080; M_{Black} = .948, SD_{Black} = .082; M_{White} = .838, SD_{White} = .128).

The effects above are qualified by a statistically significant three-way interaction between target race, expression intensity, and face region (F(5.98,819.09*) = 20.763, p < .001, η_p^2 = .132). Once again, to break this interaction down, we assessed the two-way interaction between target race and face region at each level of expression intensity.

This two-way interaction was significant at the 0% (F(1.52,207.73*) = 72.477, p < .001, η_p^2 = .346), 50% (F(1.73,237.67*) = 20.295, p < .001, η_p^2 = .129), 70% (F(1.79,244.84*) = 61.566, p < .001, η_p^2 = .310), and 100% intensity levels (F(1.82,248.7*) = 68.817, p < .001, η_p^2 = .334). However, at the 30% intensity level, this two-way interaction was not significant (F(1.74,238*) = 0.743, p = .459, η_p^2 =

.005). Within each intensity, there was a pro-White bias in pain judgments in the control condition (0%: $t(137) = -9.138$, $p < .001$, d = -.418; 50%: $t(137) = -8.950$, $p < .001$, $d = -.762$; 70%: $t(137) = -5.196$, $p < .001$, $d = -.442$), with an exception at 100% ($t(137) = -1.387$, $p = .168$, $d = -.118$). There was a pro-White bias in the mouth condition at 50% expression intensity ($t(137) = -5.746$, $p < .001$, $d = -.489$); however, there was a pro-Black bias at 0% ($t(137) = 7.339$, $p < .001$, $d = -.500$), 70% ($t(137) = 6.228$, $p < .001$, $d = .530$), and 100% intensities ($t(137) = 10.721$, $p < .001$, $d = .913$). There was a pro-Black bias in the eye condition at 0% ($t(137) = 2.510$, $p = .013$, $d = -.368$), 70% ($t(137) = 9.580$, $p < .001$, $d = .815$) and 100% expression intensities ($t(137) = 11.456$, $p < .001$, $d = .975$); however, there was a null effect at 50% intensity ($t(137) = -0.021$, $p = .983$, $d = -.002$), meaning participants did not see a difference in pain as a function of race when viewing only the eyes when pain was ambiguous.

Discussion

While we predicted that attention to the most diagnostic region would reduce racial bias in pain judgments, Experiment 4 demonstrated that limiting attention to only the eyes or the mouth regions diminished pain judgments compared to viewing the whole face—though the largest bias in pain judgments was when participants' view was no restricted. In fact, participants rated Black pain higher when viewing only the eyes or mouth, compared to White pain. Participants also rated White pain lowest overall when viewing the eyes only. While restricting information increased assessments of Black pain, this same restriction impaired assessments for White pain.

One important difference between Experiments 3 and 4 is that in the latter, participants could not glean pain experience from other aspects of the face. It is possible that our manipulation in Experiment 3 encouraged more efficient face processing when direct to attend to eyes. Conversely, all participants in Experiment 4 could evaluate was the given region presented on screen; they had no additional information to contextualize (or in the case of Black faces distract from) what they saw in these regions. Without that context, signal from diagnostic features like the eyes could be rendered more ambiguous, thus impairing recognition of pain for White faces. These results suggest that race is a factor used when processing a face, to the detriment of Black people.

Chapter 3

DOES ENHANCING INDIVIDUATION REDUCE RACIAL BIAS IN PAIN PERCEPTION?

Across four experiments, we explored the perceptual mechanisms supporting racial bias in pain care, with a specific focus on whether individuation motivation 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 reduce these deficits. Researchers have demonstrated that individuation motivation can reduce the CRE and its consequences. The present experiments applied these principles to the context of disparities in pain care and tested whether enhancing individuation of Black faces would reduce race-based gaps in pain perception. In Experiment 5, 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 Experiment 6, participants were asked to learn and remember individuating information (i.e., a target's name) prior to making pain evaluations. Moreover, we independently manipulated familiarity: some targets in the pain perception task had been encountered previously, while others were novel. Moving forward, in Experiments 7 and 8, 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 (Experiment 5) and control conditions of these experiments

(Experiments 6-8), bias in perceiving and treating pain on Black versus White faces would be comparatively reduced in the individuation conditions.

Experiment 5: Testing the Influence of Individuating Information on Racial Bias in Pain Perception

The Categorization-Individuation Model suggests that individuals tend to think of outgroup members in terms of group, or categorical, distinctions, which result in own group biases (Hugenberg et al., 2013); however, they tend to think of ingroup members in terms of individual, or unique, qualities. This would suggest that prompting individuals to think of outgroup members (in this case Black targets) in terms of their individual nature, they would receive similar benefits that ingroup members have (i.e., seeing pain more readily). On the other hand, emphasizing their otherness could increase this disparity. Inspired by Tanaka and Pierce (2009), we predicted that instructing participants to consider unique identifiers (e.g., names) should promote individuation of those faces, enhancing face processing; however, if participants are instructed to consider only categorical information (e.g., race), this should reduce individuation and potentially further disrupt face processing. In Experiment 5, 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 tasks.

Method

Participants

We recruited 411 participants through Amazon's Mechanical Turk (137 in Categorization, 141 in Control, 133 in Individuation; 213 women, 195 men, 2 non-binary, 1 did not disclose; M_{age} = 36.06, SD_{age} = 11.47; 309 White/Caucasian, 40 African American, 29 Asian, 23 Hispanic, 5 Native American, 5 who preferred to self-describe). 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 experiments on racial bias in pain perception (e.g., Mende-Siedlecki et al., 2019). Our sample size was determined somewhat heuristically; we aimed for at least 100 participants per condition.

Stimuli

Participants saw 16 photographic stimuli (8 Black males, 8 White males) taken from the DPD (Mende-Siedlecki et al., 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[4].

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[5].

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[4] 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 $t(14) = 1.78$, $p = .096$, $M_{Black} = 4.32$, $M_{White} = 4.03$).

[5] 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.,

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 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.

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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 Experiment 1 in Mende-Siedlecki et al., 2020.

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 experiment. 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 racial 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[6]. In the Individuation condition, at 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

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[6] 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.

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 experiment, 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 experiment to experiment. Thus, while we report details on the measures included below (and in Experiments 6-8), 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[7]. 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).

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[7] Unlike Experiments 1-4, the values used for pain judgments indicate participants' thresholds for recognizing pain—i.e., when participants first saw pain on White and Black faces, on average, such that a higher number indicates participants needed *more* pain to be expressed in order to be classified as pain.

Results

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

We observed a significant main effect of target race on thresholds for pain perception ($F(1,408) = 324.817$, $p < .001$, $\eta_p^2 = .443$; see Figure 6). Specifically, participants had higher overall thresholds for seeing pain on Black faces ($M = 0.318$, $SD = 0.125$) than pain on White faces ($M = 0.246$, $SD = 0.130$), meaning more pain needed to be expressed on Black faces for it be recognized. We also found a significant main effect of condition on thresholds for pain perception ($F(2,408) = 9.501$, $p < .001$, $\eta_p^2 = .044$). Specifically, participants in the Individuation condition ($M = .245$, $SD = .113$) had lower thresholds for seeing pain overall compared to participants in the Categorization condition ($M = .296$, $SD = .119$; t(267.88[8]) = 3.602, $p < .001$, $d = .438$) and Control condition ($M = .303$, $SD = .122$; t(271.92*) = 4.024, $p < .001$, $d = .486$). Participants in the Control condition did not show significant differences from participants in the Categorization condition (t(276.00*) = -0.435, $p = .664$, $d = -.052$).

Critically, we did not, however, observe an interaction between condition and race ($F(2,408) = .489$, $p = .614$, $\eta_p^2 = .002$).

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[8] Degrees of freedom were adjusted using Bonferroni correction. Any future corrections were indicated with a "*".

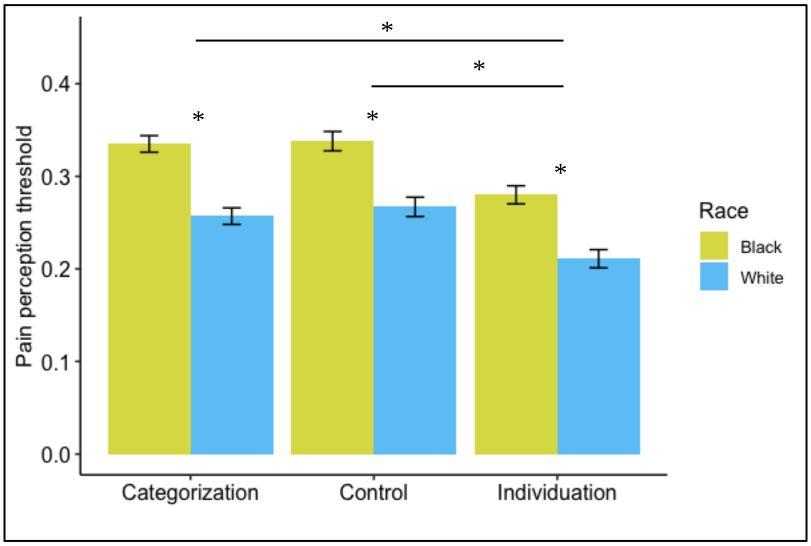

Figure 6 Participants in Experiment 5 had lower thresholds for perceiving pain in the Individuation condition, though racial bias was still present. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Effects of target race and individuation information on treatment recommendations

We observed a significant main effect of target race on treatment recommendations ($F(1,408) = 31.756$, $p < .001$, $\eta_p^2 = .072$; see Figure 7).Participants recommended less pain reliever to Black targets ($M = 10.91$, $SD = 4.734$) compared to White targets ($M = 11.89$, $SD = 4.697$). We did not, however, observe an effect of condition ($F(2,408) = 1.690$, $p = .186$, $\eta_p^2 < .01$) nor an interaction between target race and condition ($F(2,408) = 1.542$, $p = .215$, $\eta_p^2 < .01$) on treatment recommendations. Though the effect of condition was in the predicted direction with participants prescribing more pain reliever to targets in the Individuation condition ($M = 11.957$, $SD = 4.053$), followed by the Control ($M = 11.244$, $SD = 4.903$), and finally the Categorization condition ($M = 11.020$, $SD = 4.063$).

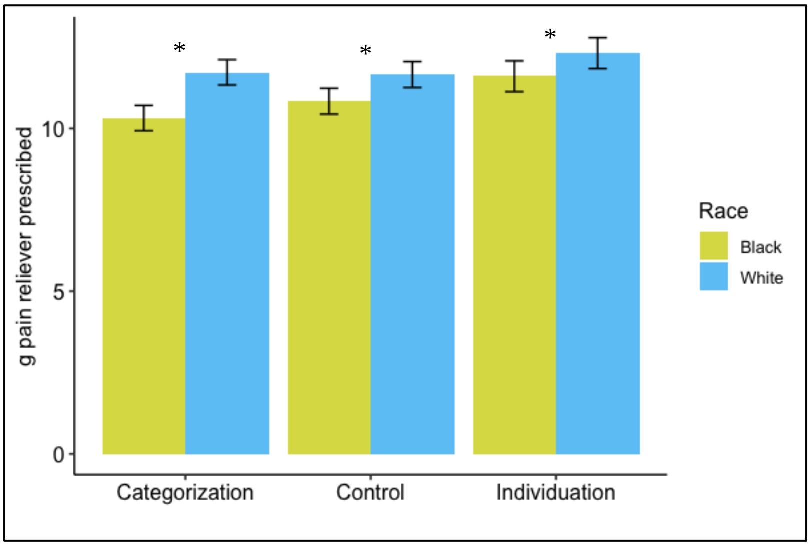

Figure 7 Participants in Experiment 5 prescribed more pain reliever to White faces in pain than Black faces in pain across conditions. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationship between racial 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 overall, collapsing across the three conditions: racial bias in pain perception was associated with racial bias in hypothetical treatment recommendations ($r(409) = .134$, $p < .001$). However, when considered individually, this relationship did not achieve statistical significance in the control condition ($r(139) = .164$, $p = .052$), the categorization condition ($r(135) = .099$, $p = .250$), or the individuation condition ($r(131) = .23$, $p = .160$).

Discussion

Experiment 5 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 recommendations, and more importantly, racial bias in treatment recommendations was still present across conditions. It may be the case that merely prompting participants to consider unique identifying information alone was not enough to induce individuation. Instead, participants may need to *learn* individuating information about familiar targets in order to perceive pain more readily.

Experiment 6: Testing the Influence of Familiarity and Individuating Information on Racial Bias in Pain Perception

Despite being prompted to individuate targets, participants in Experiment 5 still showed a bias in both pain perception and treatment recommendations. It is possible that prompting participants to provide unique information about targets did not effectively activate individuation to reduce this bias. Alternatively, another possible route to reducing racial biases in face processing and emotion recognition might be through contact, rather than individuation. Because a person may have more exposure to other ingroup members, they may be better able to recognize the emotions expressed by an ingroup member, compared to an outgroup member (e.g., Elfenbein & Ambady, 2002). While the effects of intergroup contact on social perception have been considered on a broad scale (e.g., in terms of lifetime experience with other-race individuals; Cloutier et al., 2017; Handley et al., 2021; Handley et al., 2023; Kubota et al., 2017), similar benefits may exist on the small scale. Related work has manipulated participants’ perceptual familiarity with individual target faces (e.g., Cloutier et al., 2014), which may have its own beneficial influence on enhance facial emotion processing (Abreu et al., 2023).

In Experiment 6, prior to completing a pain perception task, we provided participants with the name of targets and tested them twice to ensure that they remembered these unique identifiers, or simply showed participants target faces multiple times with no additional information. Having individuating information for familiar faces should promote face processing for targets overall. Moreover, we manipulated perceptual familiarity during the pain perception task. Half of the targets participants saw and rated had been previously encountered during the learning phase, while the other half were new faces. This allowed us to determine whether a) motivating individuation would reduce racial bias in pain perception and treatment compared to mere exposure and b) whether the effect of individuation is moderated by prior exposure (e.g., perceptual familiarity). We predicted that participants who only saw target faces would show the typical racial bias in pain perception and treatment recommendations, indicating that familiarity alone is not enough. However, participants with unique information about the targets would show less racial bias in both pain perception and treatment recommendations.

Method

Participants

265 participants were recruited from the University of Delaware psychology subject pool. We sought to recruit at least 264 participants (132 for either condition) anticipating that this amount would afford us 90% statistical power to detect an

interaction with an effect size of $f = .1005$ (for the 2 × 2 × 2 race-by-familiarity-by-individuation interaction)[9]. Participants completed the task remotely. We excluded participants who a) completed the main task but not the post-task surveys, b) said that they'd been interrupted multiple times while completing the task, c) said that they'd been watching, listening to, or working on something else while completing the task, and d) scored below 50% in name recall for those in the Naming condition.

Ultimately, 215 participants passed the exclusion criteria (111 in Face-only, 104 in Naming; 155 women, 58 men, and 2 non-binary; $M_{\text{age}} = 18.91$, $SD_{\text{age}} = 1.08$; 182 White/Caucasian, 10 African American, 7 East Asian, 4 South Asian, 3 Middle Eastern/North African, and 9 who preferred to self-describe).

The sample size and exclusion criteria, procedures, analyses, and predictions of Experiment 6 were pre-registered on OSF (https://osf.io/exy5w).

Stimuli

Participants saw 24 photographic stimuli (12 Black males, 12 White males) from the DPD (Mende-Siedlecki et al., 2020). For each face, 11 morphs were created using Morpheus PhotoMorpher Pro, from a 100% neutral expression to 100% painful expression.

Participants in the Naming condition saw faces paired with names (see Procedure). These names were the same ones used in Experiment 5, which had been previously rated by a set of MTurk participants ($M_{\text{age}} = 36.33$, $SD_{\text{age}} = 11.20$; 79 women, 82 men, 1 non-binary; 72.22% White) in terms of how stereotypically Black

[9] The power calculation was performed using G*Power. The effect size of $f = .1005$ is based on the magnitude of the interaction between target race and individuation condition in Experiment 8, which was conducted before Experiment 6. For clarity of narrative, we chose to use the current ordering.

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 either the Naming or Face-only condition. First, participants did a learning task. In the Naming condition, participants were shown 6 Black and 6 White faces in succession. Each face was paired with a unique name and was presented for four seconds. After seeing all 12 faces, participants’ memory for the face/name pairings was assessed. They were shown the 12 previously-seen faces and asked to pick the correct name that corresponds with the face from three options. If they were incorrect, the correct name was given. Participants did this twice. Participants in the Face-only condition only saw a series of 6 Black and 6 White faces. After seeing the faces once, they were told they would see each face two more times. Thus, participants in each condition saw the series of faces a total of three times, equating perceptual experience across the individuation (e.g., Naming) and control (e.g., Face-only) conditions.

Next, all participants completed a pain rating task in which they rated the amount of pain a face was presenting on a 7-point scale from 1 (Definitely not in pain) to 7 (Definitely in pain). They rated a total of 24 faces (12 old, 12 new; 12 Black, 12 White). Participants saw all faces expressing all 11 morphs of pain contained within their own block of trials. Following the pain ratings, participants then did a treatment recommendation task adapted from the one used in Experiment 5. Participants were informed that the targets they'd seen were rehabilitating after orthopedic surgery and were then asked to recommend how much Tylenol-like pain reliever they would prescribe to each target on a 0-4000 mg scale. Finally, participants completed a demographic survey including a measure of intergroup contact (adapted from Cloutier et al., 2014) and then were debriefed.

Analysis

Name recollection accuracy was calculated separately within each target race as a percentage. Accuracy was then submitted to a pair-wise *t*-test assessing the impact of race on name recollection. We predicted participants would be more accurate in remembering the names of White targets than Black targets.

Pain ratings were calculated separately within each race × familiarity cell as the point-of-subjective equality for recognizing pain. Pain ratings were linearly transformed to a scale from 0 to 1 (0 = not in pain, 1 = in pain), and separately fitted with a cumulative normal function to calculate the PSE in each cell of the design. The PSE represents the point at which a target would be equally likely to be judged as being in pain or not being in pain[10]. Lower numbers within a given cell indicated that stimuli within that cell were more likely to be judged as looking like they were in pain. Pain ratings were then submitted to a 2 × 2 × 2 repeated measures ANOVA assessing the interaction between target race, familiarity, and individuation condition on pain perception. Treatment recommendations were submitted to the same 2 × 2 × 2 repeated measures ANOVA.

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[10] This analytic approach was adapted from Looser & Wheatley, 2010 and Hackel et al., 2014, and was previously used in Mende-Siedlecki et al., 2019; 2021; 2022.

Overall, we predicted a main effect of target race on pain ratings—specifically, participants would have a higher threshold for perceiving pain on Black faces than White faces and recommend less pain reliever to Black targets. We also predicted a main effect of individuation condition such that participants in the Face-only condition would have higher thresholds overall than participants in the Naming (e.g., individuation) condition which would also translate to participants in the face-only condition recommending less treatment to targets overall. We also predicted that participants would have higher thresholds for seeing pain on new faces than old faces they learned previously. Participants would also prescribe more to old targets than new ones.

For participants in the Naming condition, we predicted an interaction between race and familiarity: there would be no racial bias in pain ratings and treatment for old targets, suggesting they successfully individuated those faces; however, there would be a racial bias for new faces, which they had not individuated. For participants in the Faces-only condition, we predicted that racial bias in pain ratings and treatment recommendations would still be present for old faces, though smaller than the gap found among new faces.

Results

Effects of target race on name recollection accuracy

There is a significant effect of target race on name recollection accuracy ($t(103) = -2.295$, $p = .024$, $d = -.225$), specifically participants are more accurate in remembering the names of White targets ($M = .815$, $SD = .149$) than Black targets ($M = .775$, $SD = .159$).

Effects of target race, familiarity, and individuation condition on thresholds for pain perception

We observed a significant main effect of target race on thresholds for pain perception (F(1,213) = 35.196, p < .001, η_p^2 = .142; see Figure 8). Participants had higher thresholds for seeing pain on Black targets (M = .478, SD = .162) than on White targets (M = .456, SD = .150). We did not, however, observe an effect of familiarity (F(1,213) = 0.728, p = .395, η_p^2 = .003) or condition (F(1,213) = 0.922, p = .338, η_p^2 = .004). Further, the interaction between target race and condition (F(1,213) = 2.045, p = .154, η_p^2 = .01), target race and familiarity (F(1,213) = 0.312, p = .577, η_p^2 = .001), and condition and familiarity (F(1,213) = 1.212, p = .272, η_p^2 = .006) were not significant. Finally, we did not observe a significant three-way interaction between target race, familiarity, and condition (F(1,213) = 0.004, p = .948, η_p^2 < .01).

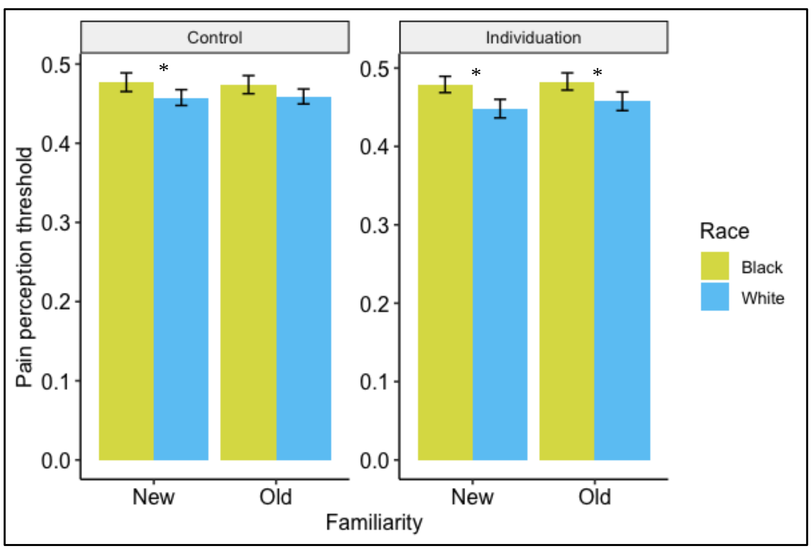

Figure 8 Collapsing across familiarity and individuation, participants in Experiment 6 had a higher threshold for seeing pain on Black faces compared to White faces, meaning Black faces needed to express more pain before it was recognized. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Effects of target race and individuation instructions on treatment recommendations

We observed a significant main effect of target race on treatment recommendations ($F(1,213) = 89.479$, $p < .001$, $\eta_p^2 = .296$; see Figure 9). Participants recommended less pain reliever to Black targets ($M = 1642.270$, $SD = 713.331$) than White targets ($M = 1822.933$, $SD = 748.744$). However, we did not observe a significant main effect of condition ($F(1,213) = 0.992$, $p = .320$, $\eta_p^2 = .005$) nor familiarity ($F(1,213) = 0.006$, $p = .938$, $\eta_p^2 < .01$) on treatment. We also did not observe a significant interaction between target race and condition ($F(1,213) = 3.882$, $p = .050$, $\eta_p^2 = .018$), target race and familiarity ($F(1,213) = 0.135$, $p = .714$, $\eta_p^2 = .001$), or condition and familiarity ($F(1,213) = 0.349$, $p = .555$, $\eta_p^2 = .002$). Finally, we did not observe a significant three-way interaction between target race, condition, and familiarity ($F(1,213) = 0.274$, $p = .601$, $\eta_p^2 = .001$).

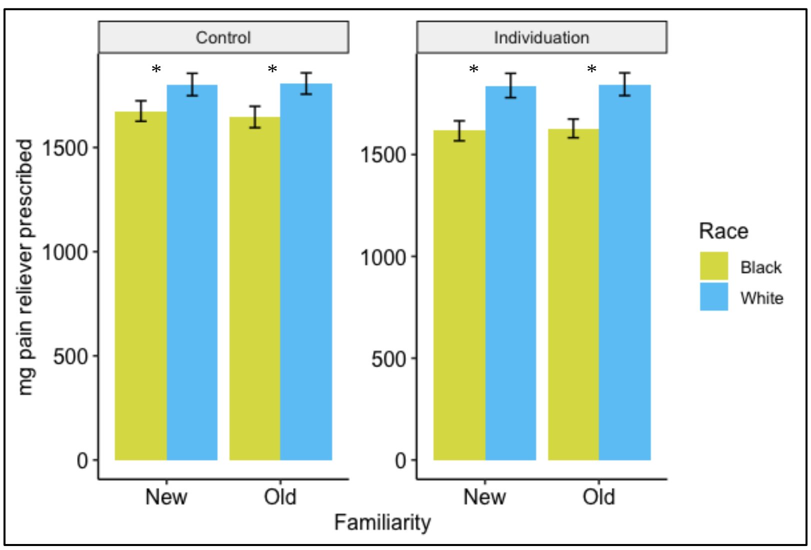

Figure 9 Participants in Experiment 6 prescribed more pain reliever to White faces; no difference was observed based on individuation condition or familiarity. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationships between bias in perception and bias in treatment

Overall, we did not observe a significant relationship between racial bias in pain perception and treatment ($r(213) = -.021$, $p = .764$), collapsing across the familiarity and individuation manipulations.

Discussion

In Experiment 5, participants were asked to consider the name of targets, and in Experiment 6, participants were tested on their recollection of target names. While participants were above chance in terms of their accuracy, they did recall the names of White targets more accurately than Black targets. This would suggest that they did *not* effectively individuate the named Black targets. This is reflected in the pain perception and treatment findings. Neither familiarity with nor individuation of Black targets reduced racial bias. Black targets, both old and new, needed to express higher levels of pain to be recognized and were recommended less pain reliever.

This iteration of individuation was unsuccessful in reducing racial bias. Instead, paralleling Experiments 3 and 4, we pivoted to a more active approach: informing participants of racial gaps in social perception and directly motivating them to individuate Black targets. This alternative may be a more effective means of reducing racial bias in pain perception and treatment.

Experiment 7: Testing the Influence of Individuation Instructions Tailored to the Cross-Race Effect

Previous work (Hugenberg, Miller, & Claypool, 2007) demonstrates that educating perceivers about the CRE and motivating them to individuate other-race faces effectively reducing 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 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

489 participants were recruited 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. Our sample size was determined somewhat heuristically; we aimed for at least 100 participants per condition. We excluded participants who failed the two manipulation check questions specific to the Individuation condition (see 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.

Ultimately, 355 participants passed the exclusion criteria (178 women, 174 men, 1 non-binary; M_{age} = 34.88, SD_{age} = 10.99; 254White/Caucasian, 39 African

American, 28 Asian, 22 Hispanic, 2 Native American, 1 Pacific Islander, 9 who preferred to self-describe).

Stimuli

Participants was 16 targets (8 Black males, 8 White males) 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 experiment 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. For each face/expression combination, we created 11 morphs also in FaceGen Modeller Pro, from a 100% neutral expression to 100% painful expression. 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 Experiment 5, 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[11]. Following these instructions, participants completed the *pain rating task* as in the Control condition of Experiment 5. Next, participants completed the *treatment recommendations task*; in this experiment, participants made treatment recommendations for *all* faces that appeared in the *pain rating task*. 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

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

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.

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)[12].

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[12] 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.

All post-task measures (including the manipulation check items in the Individuation condition) were self-paced. As in Experiment 6, 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).

Analyses

The analyses for Experiment 7 were similar to those in Experiment 5. We calculated participants' average pain perception thresholds for Black and White faces from the pain rating task. These judgments were then submitted to a 2 × 2 repeated measures ANOVA assessing the interaction between target race and individuation condition. Treatment recommendations were submitted to the same 2 × 2 repeated measures ANOVA.

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 Experiment 7, 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 observed a significant main effect of target race on thresholds for pain perception ($F(1,353) = 11.405$, $p < .001$, $\eta_p^2 = .031$; see Figure 10). Specifically, participants had higher thresholds for seeing pain on Black targets (*M* = 0.318, *SD* = 0.177) than pain on White targets (*M* = 0.305, *SD* = 0.197).

We did not, however, observe a main effect of instructions ($F(1,353) = 0.004$, $p = .947$, $\eta_p^2 < .01$), nor an interaction between target race and instructions condition ($F(1,353) = 0.128$, $p = .721$, $\eta_p^2 < .01$).

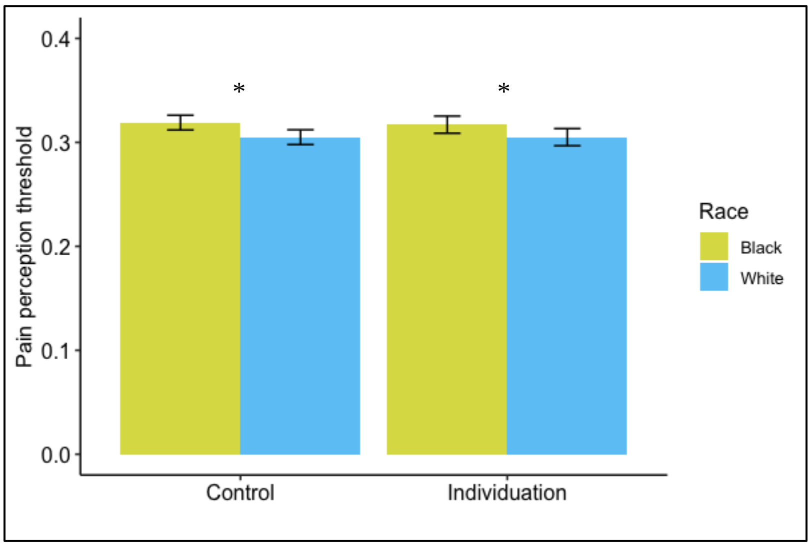

Figure 10 Participants in Experiment 7 had higher thresholds for perceiving pain on Black faces than White faces across conditions. There was no impact of individuation. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Effects of target race and individuation instructions on treatment recommendations

While we observed a significant main effect of target race on treatment recommendations ($F(1,353) = 74.623$, $p < .001$, $\eta_p^2 = .175$; see Figure 11), participants surprisingly recommended more pain reliever to Black targets (*M* = 10.195, *SD* = 4.537) than White targets (*M* = 9.223, *SD* = 4.714), contrary to the prevailing patterns observed in prior work (Lin et al., under review). We did not, however, observe main effect of condition ($F(1,353) = 0.058$, $p = .809$, $\eta_p^2 < .01$), nor an interaction between target race and condition ($F(1, 353) = 0.490$, $p = .485$, $\eta_p^2 < .01$).

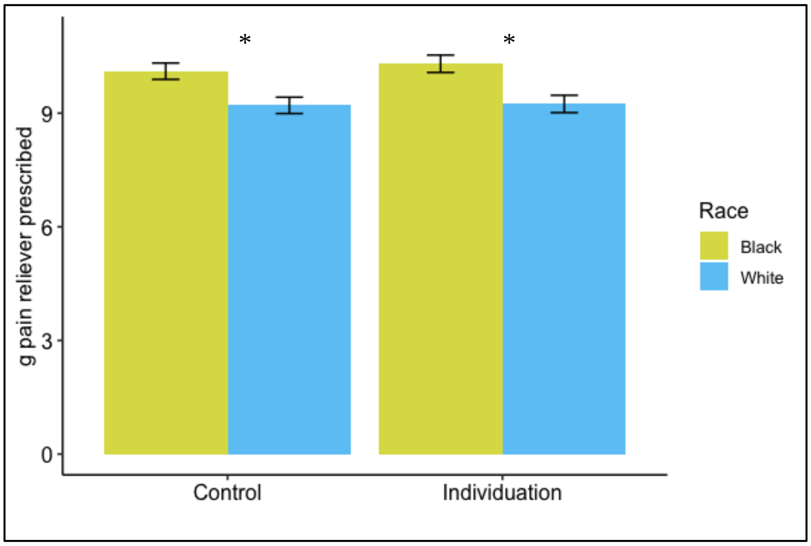

Figure 11 Participants in Experiment 7 prescribed more pain reliever to Black targets than White targets. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationships between bias in perception and bias in treatment

In line with Experiment 5 and our previously published work, there was a significant positive relationship between perceptual bias and treatment bias ($r(353) = .325$, $p < .001$). This relationship was maintained within both groups of participants. Biased pain perception was associated with biased treatment recommendations within participants in the Control condition ($r(197) = .261$, $p < .001$), as well as the Individuation condition ($r(154) = .408$, p < .001).

Discussion

Mirroring the findings in Experiments 5 and 6, racial bias in pain perception 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). We did find, however, that participants overall prescribed more pain reliever to Black targets than White targets. This is contrary to both previous findings (Lin et al., under review) and what is reported within pain care, broadly. 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.

Experiment 8: Testing the influence of Individuation Instructions Tailored to Pain

While Experiment 7 suggested that individuating instructions did not have an influence on racial bias in pain perception, it is possible that this occurred because our Experiment 7 manipulation was not specific to pain. 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

916 participants were recruited from 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. We sought to recruit 132 for each condition anticipating that this amount would afford us 90% statistical power to detect an interaction with an effect size of $f = .1005$ (for the 2×2 race-by-individuation interaction). In addition, we prescreened participants out who attempted to access our experiment via virtual private servers (VPNs) as a means of evading location restrictions (Dennis et al., 2020; Kennedy et al., 2020). We excluded participants who a) completed the main task but not the post-task surveys, b) said that they'd been interrupted multiple times while completing the task, c) said that they'd been watching, listening to, or working on something else while completing the task, or d) did not correctly answer the manipulation check questions if they were in the individuation condition.

Ultimately, 310 participants passed the exclusion criteria (167 Control, 143 Individuation; 145 women, 154 men, 7 non-binary, 4 preferred to self-describe or did not disclose; $M_{age} = 35.29$, $SD_{age} = 12.06$; 291 White/Caucasian, 2 African American, 12 Hispanic, 1 Native American, 4 preferred to self-describe).

Stimuli

Participants saw 12 targets (6 Black male, 6 White male) generated within FaceGen Modeller Pro (v3.18). We used the same approach as in Experiment 7 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_{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). For each face, we created 11 level morphs from a 100% neutral expression to 100% painful expression.

Procedure

The procedure was the same (e.g., in terms of tasks, task order, and trial timing) as Experiment 7 except for 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 experiment took place during the height of the COVID-19 pandemic, we also included the Fear of Coronavirus scale.

Analyses

Analyses for Experiment 8 were identical to the analyses conducted in Experiment 7.

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

We observed a significant main effect of individuation instructions on thresholds for pain perception (F(1,308) = 6.720, p = .010, η_p^2 = .021; see Figure 12). Specifically, participants who received the individuation instructions had lower thresholds for seeing pain across race (M = .203, SD = .117) compared to participants in the Control condition (M = .240, SD = .135). Surprisingly, we did not observe an effect of target race (F(1,308) = 0.001, p = .979, η_p^2 < .01) nor an interaction between target race and condition (F(1,308) = 0.22, p = .6.40, η_p^2 = .001).

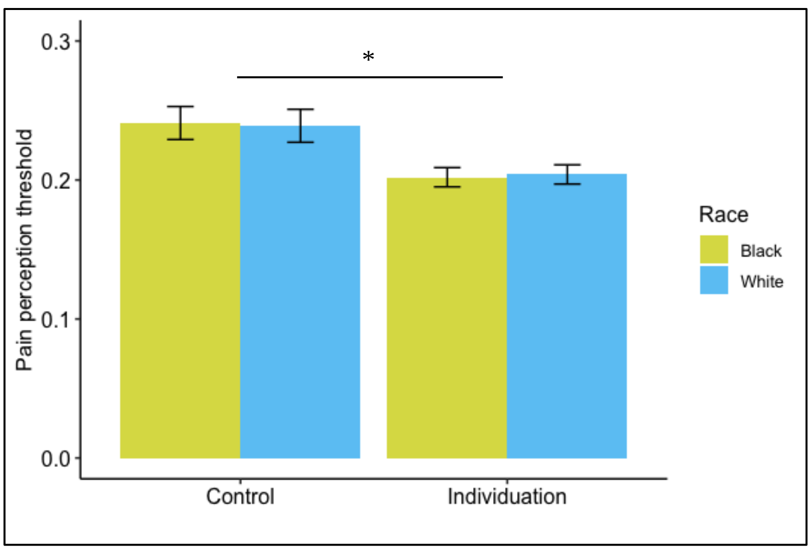

Figure 12 Participants in Experiment 8 had lower thresholds for perceiving pain after reading about racial bias in pain perception (Individuation condition). Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Effects of target race and individuation instructions on treatment recommendations

We observed a significant main effect of target race on treatment recommendations ($F(1,308) = 5.051$, $p = .025$, $\eta_p^2 = .016$; see Figure 13). Participants recommended *more* pain reliever to Black targets ($M = 12.291$, $SD = 4.649$) than White targets ($M = 12.076$, $SD = 4.570$). We also observed a significant effect of condition on treatment ($F(1,308) = 8.094$, $p = .005$, $\eta_p^2 = .026$). Specifically, participants in the Individuation condition recommended more pain reliever to targets overall ($M = 12.962$, $SD = 4.547$) than participants in the Control condition ($M = 11.516$, $SD = 4.387$).

These main effects were qualified by a significant interaction between target race and instructions condition ($F(1,308) = 8.229$, $p = .004$, $\eta_p^2 = .026$). Unpacking these results, for participants that received the Individuation instructions, there was a significant effect of target race on treatment recommendations ($t(166) = 4.445$, $p < .001$, $d = .372$), such that these participants prescribed more pain reliever to Black targets ($M = 13.234$, $SD = 4.634$) than to White targets ($M = 12.691$, $SD = 4.576$). However, there was no effect of target race on treatment recommendations for participants in the Control condition ($t(142) = -0.397$, $p = .692$, $d = -.031$). Taken together, these results suggest individuation did have an impact on racial bias in treatment recommendations—ultimately, it reversed the trend we typically observe.

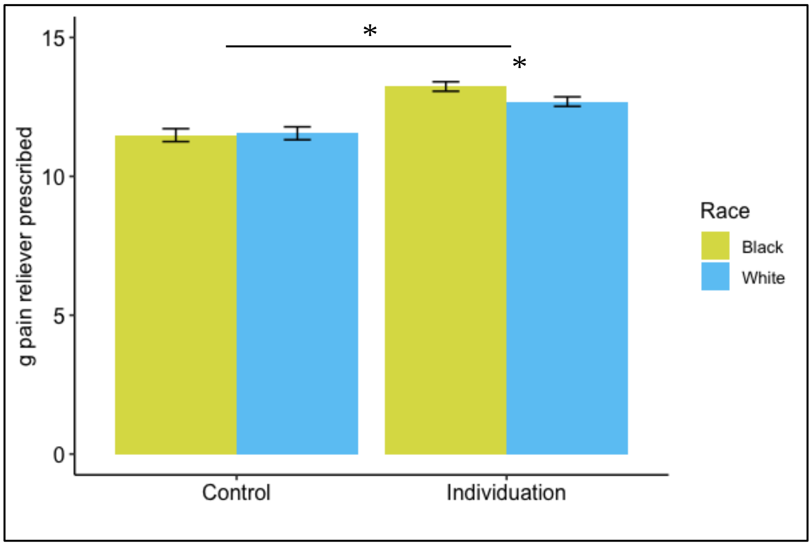

Figure 13 Participants in Experiment 8 who read the about racial bias in pain perception prescribed more pain reliever to Black faces. Error bars represent adjusted 95% within-subject confidence intervals (cf., Morey, 2008); * < .05.

Relationships between bias in perception and bias in treatment

There was a significant positive relationship between racial bias in pain perception and treatment ($r(308) = .472$, $p < .001$). 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 ($r(165) = .484$, $p < .001$) and the Individuation condition ($r(141) = .450$, $p < .001$).

Discussion

In Experiment 7, we did not observe an effect of individuation on pain perception; therefore, in Experiment 8, participants read more specific instructions that were directly tailored to the context of pain. Participants in the Individuation condition did perceived pain more readily, compared to participants in the Control condition. That said, we did not observe evidence of racial bias in pain perception 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 4

DISCUSSION

On the outset, our goal was to determine if directed attention to pain diagnostic regions of the face and motivating individuation could reduce racial bias in pain perception. Previous research suggests individuals attend to different regions of the face as a function of race and emotion (Hills & Pake, 2013; Kawakami et al., 2014). Directing a person's attention to diagnostic regions of the face can improve both face and emotion recognition (e.g., Friesen et al., 2019). In the context of pain, the eye region may be particularly important, as activation of muscle movements near the eyes are important for both expressing and detecting pain (Blais et al., 2019; Kunz et al., 2019; Roy et al., 2015) and attention to eye region is associated with configural face processing (Cassidy et al., 2022; Young et al., 2014). We hypothesized that participants would attend to different regions of the face as a function of race, and that directing (or limiting) their attention to specific regions would reduce racial bias in pain judgments.

We observed that participants judged White pain to be more intense than Black pain (Exps. 1-3). This bias was most apparent when pain expressions were most ambiguous. We did not find, however, that participants attended to different regions of the face as a function of race, as previous research would have suggested (more on why later). That said, in Experiment 3, we did find that participants rated pain highest when attention was directed to the eye region. In addition, the largest racial bias was observed when attention was directed to the mouth. Surprisingly, when participants were only given this diagnostic information, we see that their judgments were impaired (Exp. 4). Participants rated pain highest when they were given the entire face to assess. When given the limited information, participants rated Black pain higher than White pain. Participants judged Black pain higher when restricted to only viewing the eyes, and sometimes the mouth, than when seeing a full Black face. This was the opposite for assessing White pain; participants needed a full White face. From this, we can conclude that directing to the eyes does lead to higher ratings of pain; though for assessing White faces, perceivers used the eyes within the context of the full face. This would suggest that the eyes may be an important first, but not only, step while gathering the necessary information from the face (see Bombari et al., 2009). For assessing pain on Black faces, a full face seems to distract from recognition. Participants were better able to assess pain from *parts* of Black faces. It is possible that the reduction of physical cues to blackness allowed participants to see their pain more readily (see Friesen et al., 2019).

Our findings did not demonstrate a racial difference in assessing pain uncued. Previous research suggests that participants might have attended to the eye region when assessing an emotion on a White face than a Black face. That was not reflected in our findings. Participants did not differ in their accuracy or response time in identifying dot probes appearing on different regions of the face. It is possible that our paradigm was not constructed to allow participants to attend differently as a function of race. First, presentation of Black and White faces was intermixed; therefore, participants may have used the same gaze patterns as they did not know which face would appear at any given time. If that was the case, there would be no racial difference in accuracy or response time. Also, the probes appeared on different regions of the face at random. Participants could have prioritized finding the probes, which then would have been reflected in our gaze pattern, as there were more probe trials than pain trials. If that was the case, there would be no difference based on facial region for accuracy or response time.

That said we did find that directing participants attention to the eye region did influence their pain judgements, such that they rated pain higher (Exps. 3 & 4). Interestingly that was not always the case for directing attention to the mouth region (Exp. 3). While both the eyes and the mouth display diagnostic information indicative of pain (Blais et al., 2019; Roy et al., 2015), the eyes were most informative when assessing pain in another face. Previous research shows that attention to the eyes is necessary for configural face processing, which then facilitates emotion recognition. That would suggest that attending to the eyes would be more beneficial when assessing pain on faces—consistent with our findings. Direction to the eyes did result in higher pain ratings for Black faces, in particular. It is unclear the impact that attention to the mouth region had for assessing pain on Black faces. When directed to the mouth, within the context of the whole face, participants struggled to see pain, yet when seeing the mouth alone, participants rated pain second to the eyes in most cases. The mouth region of a Black face is racially diagnostic (Maddox & Chase, 2004). Hills and Pake's (2013) findings would suggest that cueing to racial diagnostic regions would improve recognition, though the individuation literature would suggest that cueing to categorical information would have the opposite effect (Tanaka & Pierce, 2009). Future explorations should continue to investigate how attention to different regions of the face differentially impact Black and White faces.

For example, including an eye-tracking component to an attention manipulation pain rating task would allow us to better understand how participants attend to pain faces as a function of race and specific features. Experiment 1 would suggest that people attend to features equally when assessing pain on Black and White face. With a control condition, we would be able to confirm if that is actually the case by recording participants' gaze patterns. Eye-tracking would also allow us to understand our findings in Experiments 3 and 4. We can discover if there is a specific gaze pattern used when assessing pain on White faces. Does that start with the eyes? What is the next feature attended to, and how crucial is that feature for recognition? And how does that differ when assessing pain on Black faces? What is the first feature that is attended to? Does redirecting that attention to specific features alter the next features attended to? Including an eye-tracking component would also provide how long a person attends to specific features. Previous research finds that people attend to the eyes longer on White faces than Black faces (Kawakami et al., 2014). A difference in time spent on any given feature may determine how much information a person was able to obtain before making pain assessments. The addition of an eye-tracking component would provide more information about how participants see pain faces.

Previous research suggests that individuation has the potential to reduce own group biases, like the cross-race effect (Hugenberg et al., 2007; McGugin et al. 2011), by enhancing high-level processing of other-group faces (e.g., Bukach et al., 2012; Hancock & Rhodes, 2008). 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 four experiments, we observed that providing individuating information (Experiments 5 and 6) or motivating participants to individuate (Experiments 7 and 8) did not consistently reduce race-based differences in visual thresholds for painful expressions. Only in Experiments 5 and 8 did we observe that participants saw pain more readily based on the individuation manipulation. In addition, in Experiment 8, participants who received individuation instructions did prescribe more to targets, particularly Black targets. This would suggest that means for individuation may be most effective if they are specific to the situation, in this case pain.

The successful use of individuation in previous work (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, Experiment 5 and 6's manipulation adapted from previous work testing the effects of familiarity and individuation on recognition memory for faces (e.g., McGugin et al., 2011; Schwartz & Yovel, 2016; Tanaka & Pierce, 2009; see also Cloutier et al., 2014), as well as complex non-face objects (e.g., Gauthier et al., 1998; Wong et al., 2009). Unlike these studies, repeated exposure and learning names of Black targets did not reduce racial bias in pain perception (Exp 6). Participants were more accurate in recalling White targets' names and had lower thresholds for seeing their pain. This would suggest that this form of individuation did not impact participants as anticipated. We also adapted the individuation-motivating instructions from Hugenberg and colleagues (2007) for Experiments 7 and 8. Notably, the results of these two experiments demonstrate that the exact wording of these instructions does influence overall pain perception. In Experiment 7, we did not observe a difference in pain perception thresholds between the Individuation and Control conditions. However, in Experiment 8, 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 Experiment 8 read instructions that were tailored to be specifically about pain perception (and bias therein), rather than the cross-race effect. Unfortunately, our findings do not allow us to determine if individuation instructions can reduce racial bias in 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 Experiments 7 and 8 used manipulation check questions to determine if participants read and comprehended our instructions. These items ultimately removed 720 participants in total—134 participants from Experiment 7 and 586 participants from Experiment 8. When comparing participants in the Individuation condition who failed the manipulation check questions versus those who passed, we see that in Experiment 7, there was neither an impact of response on pain perception ($F(1,288) = 2.157$, $p = .143$, $\eta_p^2 = .007$), nor treatment recommendations ($F(1,288) = 0.766$, $p = .382$, $\eta_p^2 = .003$). This might suggest that our manipulation did not work—or at the very least that our manipulation check was not sensitive enough. However, in Experiment 8, participants who were in the individuation condition and got both manipulation check questions right *did* respond differently than those who answered incorrectly in regards to pain perception (F(1,727 = 5.200, $p = .023$, $\eta_p^2 = .007$) and treatment recommendations ($F(1,727) = 7.883$, $p = .005$, $\eta_p^2 = .011$). Participants who answered correctly had lower pain thresholds ($M_{\text{right}} = .203$, $SD_{\text{right}} = .121$, $M_{\text{wrong}} = .235$, $SD_{\text{wrong}} = .160$) and recommended more treatment overall ($M_{\text{right}} = 13.0$, $SD_{\text{right}} = 4.61$, $M_{\text{wrong}} = 11.7$, $SD_{\text{wrong}} = 5.00$). This would suggest that for whatever reason that 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 Experiment 8 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, as tested here, was not able to consistently improve recognition of Black pain, 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 the mental or emotional state of a Black target. 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, Hugenberg and colleagues (2013) suggest that race is a rather stable group distinction which makes it more difficult to break from in order to allow for individuation and configural processing by extension.

Taken together, our findings suggest that racial bias in pain perception is persistent and difficult to reduce. Directing a person to the eyes did lead to higher ratings of pain for Black targets, and information about racial bias in pain perception did lead to participants seeing pain sooner overall. However, these attempts to reduce racial bias in pain perception have produced inconsistent results. Because of the small effects observed in these experiments, any future exploration should consider a multitude of factors, rather than perception alone, that contribute to pain disparities. The issue with pain recognition is beyond an individual's attention to one feature over another, their knowing a person's name or the existence of racial biases, or their lack of exposure or meaningful contact with Black people. Under different circumstances, Black emotions are quickly deciphered. While people recognized happiness sooner on White faces, negative emotions such as anger were recognized faster on Black faces

(Hugenberg, 2005; Hugenberg & Bodenhausen, 2003). Medical professionals have similar access to basic patient information, like names, across race. Moreover, discussions about racial bias in the medical field has been a topic of conversation for decades (Heckler, 1985), and especially recently (Elam-Evans, 2023; Krieg, 2019). Black patients admitted to minority-serving hospitals for a heart attack are at a higher risk of mortality 90 days after admittance than Black patients at other hospitals, despite physicians having more contact with Black patients in the former (Skinner et al., 2006). To improve pain care for Black Americans, we must do away with seeking simple solutions that do not capture the complexity of the problem. Work focused on the betterment of marginalized populations should reflect in its methods the magnitude of the issue.

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Appendix A

REGION X INTENSITY INTERACTIONS FOR EXPS. 2-4

Experiment 2

We also observed a significant two-way interaction between face region and pain intensity (F(6.39,702.37*) = 2.120, p < .045, η_p^2 = .019). We will compare pain judgments within each face region at each intensity. At 0% pain intensity, there is no significant difference in pain judgments between control and eyes (t(110) = -1.00, p = .320, d = -.095; $M_{control}$ = .073, $SD_{control}$ = .114; M_{eyes} = .084, SD_{eyes} = .112), control and mouth (t(110) = -1.856, p = .066, d = -.176; M_{mouth} = .091, SD_{mouth} = .157), and eyes and mouth (t(110) = -0.517, p = .606, d = -.049). Also at 30% pain intensity, there is no significant difference in pain judgments between control and eyes (t(110) = 0.133, p = .894, d = .013; $M_{control}$ = .241, $SD_{control}$ = .164; M_{eyes} = .239, SD_{eyes} = .183), control and mouth (t(110) = -0.112, p = .911, d = -.011; M_{mouth} = .242, SD_{mouth} = .198), and eyes and mouth (t(110) = -0.211, p = .833, d = -.020). At 50%, there is no significant difference in pain judgments between control and eyes (t(110) = 0.539, p = .591, d = .051; $M_{control}$ = .578, $SD_{control}$ = .240; M_{eyes} = .568, SD_{eyes} = .241) and eyes and mouth (t(110) = 1.502, p = .136, d = .143; M_{mouth} = .539, SD_{mouth} = .265); however pain judgments were significantly higher in the control condition compared to the eye condition (t(110) = 2.590, p = .011, d = .246). At 70% pain intensity, there is no significant difference in pain judgments between control and eyes (t(110) = 0.724, p = .471, d = .069; $M_{control}$ = .774, $SD_{control}$ = .208; M_{eyes} = .762, SD_{eyes} = .217), control and mouth (t(110) = 1.312, p = .192, d = .125; M_{mouth} = .755, SD_{mouth} = .213), and eyes and mouth (t(110) = 0.420, p = .675, d = .040). Finally at 100% pain intensity, there is no significant difference in pain judgments between control and eyes (t(110) = 0.133, p =

.894, d = .013; $M_{control}$ = .847, $SD_{control}$ = .185; M_{eyes} = .845, SD_{eyes} = .179), control and mouth (t(110) = -0.228, p = .820, d = -.022; M_{mouth} = .850, SD_{mouth} = .175), and eyes and mouth (t(110) = -0.371, p = .712, d = -.035).

Experiment 3

We observed a statistically significant two-way interaction between face region and pain intensity (F(5.54,615.12) = 24.350, p < .001, η_p^2 = .180). We will compare pain judgments within each face region at each intensity. At 0% pain intensity, there is no significant difference in pain judgments between control and eyes (t(111) = -1.061, p = .291, d = -.100; $M_{control}$ = .060, $SD_{control}$ = .115; M_{eyes} = .068, SD_{eyes} = .134), control and mouth (t(111) = 2.058, p = .042, d = .194; M_{mouth} = .042, SD_{mouth} = .079), and eyes and mouth (t(111) =2.729, p = .007, d = .258). At 30% pain intensity, there is no significant difference in pain judgments between control and eyes (t(111) = -1.361, p = .176, d = -.129; $M_{control}$ = .210, $SD_{control}$ = .141; M_{eyes} = .229, SD_{eyes} = .179), control and mouth (t(111) = 2.769, p = .007, d = .262; M_{mouth} = .170, SD_{mouth} = .129), and eyes and mouth (t(111) = 3.470, p < .001, d = .328). At 50% pain intensity, there is no significant difference in pain judgments between control and eyes (t(111) = -2.766, p = .007, d = -.261; $M_{control}$ = .631, $SD_{control}$ = .180; M_{eyes} = .680, SD_{eyes} = .190), control and mouth (t(111) = 7.569, p < .001, d = .715; M_{mouth} = .486, SD_{mouth} = .175), and eyes and mouth (t(111) = 10.153, p < .001, d = .959). At 70% pain intensity, there is no significant difference in pain judgments between control and eyes (t(111) = -3.406, p < .001, d = -.322; $M_{control}$ = .843, $SD_{control}$ = .148; M_{eyes} = .885, SD_{eyes} = .115), control and mouth (t(111) = 9.319, p < .001, d = .881; M_{mouth} = .682, SD_{mouth} = .164), and eyes and mouth (t(111) = 12.619, p < .001, d = 1.192). At 100% pain intensity, there is no significant difference in pain judgments between control and eyes (t(111) = -1.676, p

= .097, d = -.158; $M_{control}$ = .914, $SD_{control}$ = .121; M_{eyes} = .930, SD_{eyes} = .100), control and mouth (t(111) = 8.185, p < .001, d = .773; M_{mouth} = .783, SD_{mouth} = .172), and eyes and mouth (t(111) = 10.921, p < .001, d = 1.032).

Experiment 4

We observed a statistically significant two-way interaction between face region and pain intensity (F(6.7,918.43*) = 30.222, p < .001, η_p^2 = .181). We will compare pain judgments within each face region at each intensity. At 0% pain intensity, there was a significant difference in pain judgments between the control and eyes conditions (t(137) = 6.676, p < .001, d = .568; $M_{control}$ = .076, $SD_{control}$ = .087; M_{eyes} = .031, SD_{eyes} = .049), control and mouth (t(137) = 3.408, p < .001, d = .290; M_{mouth} = .055, SD_{mouth} = .075), and eyes and mouth (t(137) = -4.019, p < .001, d = -.342). At 30% pain intensity, there was a significant difference in pain judgments between the control and eyes conditions (t(137) = -1.361, p = .001, d = -.286; $M_{control}$ = .132, $SD_{control}$ = .119; M_{eyes} = .165, SD_{eyes} = .156) and the control and mouth conditions (t(137) = -2.527, p = .013, d = -.215; M_{mouth} = .156, SD_{mouth} = .136), but there was no significant difference between the eyes and mouth conditions (t(137) = 0.991, p = .323, d = .084). At 50% pain intensity, there is no significant difference in pain judgments between control and eyes (t(137) = -0.479, p = .633, d = -.041; $M_{control}$ = .413, $SD_{control}$ = .211; M_{eyes} = .420, SD_{eyes} = .208), but there is a significant difference between the control and mouth conditions (t(137) = 3.838, p < .001, d = .327; M_{mouth} = .365, SD_{mouth} = .195), and the eyes and mouth conditions (t(137) = 4.239, p < .001, d = .361). At 70% pain intensity, there is a significant difference in pain judgments between control and eyes (t(137) = 9.213, p < .001, d = .784; $M_{control}$ = .795, $SD_{control}$ = .175; M_{eyes} = .690, SD_{eyes} = .181), control and mouth (t(137) = 10.266, p < .001, d = .874; M_{mouth} = .675, SD_{mouth} = .197), and but there is not significant difference between the eyes and mouth conditions ($t(137) = 1.266$, $p = .208$, $d = .108$). At 100% pain intensity, there is a significant difference in pain judgments between control and eyes ($t(137) = 10.093$, $p < .001$, $d = .859$; $M_{control} = .951$, $SD_{control} = .081$; $M_{eyes} = .861$, $SD_{eyes} = .122$), control and mouth ($t(137) = 10.809$, $p < .001$, $d = .920$; $M_{mouth} = .868$, $SD_{mouth} = .117$), but not significantly different between the eyes and mouth conditions ($t(137) = -0.962$, $p = .338$, $d = -.082$).

Appendix B

IRB/HUMAN SUBJECT APPROVAL

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
Phone: 302-831-2137
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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- 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.

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Institutional Review Board
210H Hullihen Hall
Newark, DE 19716
Phone: 302-831-2137
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)*

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, 2022. 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
Phone: 302-831-2137
Fax: 302-831-2828

DATE:	October 28, 2022
TO:	Peter Mende-Siedlecki, PhD
FROM:	University of Delaware IRB
STUDY TITLE:	[958105-17] 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 28, 2022
EXPIRATION DATE:	October 20, 2023
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *(4,7)*

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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, 2023. 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.

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Institutional Review Board
210H Hullihen Hall
Newark, DE 19716
Phone: 302-831-2137
Fax: 302-831-2828

DATE:	November 28, 2022
TO:	Alexis Drain
FROM:	University of Delaware IRB
STUDY TITLE:	[1974068-1] Visual Attention and Pain Perception
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
EFFECTIVE DATE:	November 28, 2022
NEXT REPORT DUE:	November 27, 2023
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # *(4,7)*

Thank you for your New Project 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:

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- 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.

The UD IRB REQUIRES the submission of a PROGRESS REPORT DUE ON November 27, 2023. A continuing review/progress report form must be submitted to the UD IRB at least 45 days prior to the due date to allow for the 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