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The Impact of Racial Group Status on Neural Activity, Belongingness, and Distress during Social Exclusion

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The Impact of Racial Group Status on Neural Activity, Belongingness, and Distress during Social Exclusion

A thesis submitted in partial fulfillment of the requirement for the degree of Bachelor of Science in Neuroscience from The College of William and Mary

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Abstract

Social exclusion, whereby individuals are made to feel isolated by others, has been frequently demonstrated to be detrimental to human social needs and can negatively impact mental and physical health because human beings are intrinsically social (Goodwin et al., 2010). Past research has shown that human motivational, psychological, and affective responses to ostracism indicate increased levels of social pain, the emotional pain we experience when our social needs are violated (Kawamoto et. al, 2013). The current study aimed to assess the impact of social exclusion on neural activity, feelings of belonging, and self-reported distress, while also determining whether these responses would be moderated by ingroup/outgroup racial status. Results revealed that manipulation of racial ingroup vs. outgroup status was not associated with differences in P3 amplitude during social exclusion, contrary to previous research. However, self-reported levels of distress were greater after exclusion by the ingroup compared to the outgroup and were predicted by feelings of belonging and social anxiety.

The Impact of Racial Group Status on Neural Activity, Belongingness, and Distress during Social Exclusion

The desire to belong is a fundamental part of who we are as human beings, reinforcing our innate biological drive for social interaction, likely fueled by an evolutionary impetus to build and sustain relationships in an effort to survive and reproduce (Baumeister & Leary, 1995). Research has suggested that, due to the intrinsic social nature of human beings, social exclusion can undermine human social needs and prove detrimental to mental health (Goodwin, Williams & Carter-Sowell, 2010). Social exclusion, in this sense, can be defined as an act of discrimination that induces feelings of isolation and unimportance in an individual (Kawamoto, Nittono & Ura, 2013). Thus, it can be said that the value of person-to-person interaction remains critically indispensable to us and a lack of it confers negative emotional and psychological effects.

To that end, it has also been suggested that one prominent result of being excluded is the onset of social pain, the emotional pain experienced during exclusionary situations. Goodwin and colleagues (2010) suggest that, in violating social needs, the aversive experience of social exclusion impinges on one's self-worth and leads to "an overt, immediate, and robustly painful yet minimally moderated response" (Goodwin et al., 2010, p. 612). Social pain involves a violation of social needs and is akin to actual pain. In fact, some of the same areas of the brain that are active during the experience of physical pain are active during the experience of social pain as well (Eisenberger, Lieberman & Williams, 2003). Neuroimaging techniques have shown that exclusion causes increased activity in the dorsal anterior cingulate gyrus (dACC), responsible for the intense emotional unpleasantness accompanying pain (Nishiyama et al., 2015). Furthermore, there is a correlation between activity in this area of the brain and relative amounts of self-reported distress (Sleegers, Proulx & van Beest, 2017). Additionally, studies of individuals suffering from chronic pain have found that hurt feelings augment the physical pain experienced (MacDonald & Leary, 2005). This is all evidence that points to a shared overlap between the neural systems involved in social pain and physical pain. Specifically, these findings support the theory of social-physical pain overlap, based on the idea that “humans evolved to become more social and adapted physiological systems to monitor responses to social cues” (Sleegers et al., 2017). Altogether, this suggests that physical and emotional pain systems can be thought of as deeply intertwined.

Social exclusion, and reactionary social pain by extension, has also been shown to be moderated by ingroup-outgroup status to an extent. By nature, people are wired to affiliate and align themselves with others who are similar to them in some way, but also maintain a tendency to stray away from those who are not (Brewer, 1991). An ingroup refers to a social grouping that an individual identifies as being a part of on a psychological level (due to some perceived degree of similarity or likeness when compared with oneself), while an outgroup is one in which the opposite reigns true. Social categorization has been shown to lead to biased perceptions of one’s outgroup. According to Brewer’s Optimal Distinctiveness Theory (1991), one has a proclivity to naturally favor their own ingroup above the outgroup. In essence, solidarity is fostered by attachment to others similar to oneself. Thus, by nature of this, a default and subconscious bias towards the outgroup can surface and stem from simply liking and affiliating with one’s own ingroup. However, this attachment to the ingroup gives rise to a new obstacle for members: while social inclusion leads to positive outcomes for individuals (due to increased levels of perceived similarity), social exclusion tends to hurt more coming from ingroup members than when it comes from outgroup members (Sacco, Bernstein, Young & Hugenberg, 2014). Indeed, "ostracism by ingroup members may be interpreted as evidence of dissimilarity between the self and group, which may sharpen the negative experience of social exclusion" (Sacco et al., 2014, p. 131). If exclusion occurs within the ingroup, this may result in contracted degrees of perceived belongingness to the ingroup and greater interpersonal distress.

Regardless of the source of the ostracism, however, it would appear that the pain of being stigmatized is lessened by the solidarity conferred by identifying with others who are cast out (Schmitt, Spears & Branscombe, 2002). Thus, a collective sense of identity is forged from perceived exclusion of the individual, giving one a place among others in the same position. And as a result, a resilience is fostered. In this regard, the formation of a new ingroup takes place to diminish the weight of the psychological/emotional blow inflicted by the ostracism itself.

The aim of the current study was to extend previous lines of research by examining how social exclusion by ingroup and outgroup members affects neural and emotional responses. To accomplish this, we recruited 29 participants (16 African-American and 13 Caucasian) who engaged in a social exclusion computer task while their brain responses were monitored. Electroencephalography (EEG) was used to record brain activity, as it serves as an ideal, non-invasive measure of electrophysiological activity that allows for a rather acute temporal track of authentic and timely cognitive processes affiliated with social behavior, such as responses to perceived exclusion. Event-related potentials (ERPs) are depictions of brain activity determined after averaging over multiple presentations of stimuli. In this sense, they are thought to be representative of cognitive processes that occur in action. Previous research looking at ERP fluctuation in response to ostracism demonstrated that relative levels of distress caused by social exclusion were correlated with frontal slow wave activity (580-900 ms post-stimulus) and the activity became more positive in subjects experiencing less distress and more negative in those contending with greater distress (Crowley et al., 2009). Further, a separate study concluded that exclusion was tightly associated with the amplitude of a specific, positive ERP component, the P3 (300-800 ms post-stimulus). In using a computer-based social exclusion task, this group of researchers was able to segment and define the functionality of P3 activity in the context of exclusion. It was found that P3a activity (in more frontal/anterior regions of the brain) is linked to the affective processing of exclusion, while P3b amplitude (in the parietal lobe) is related to its perceived intensity. This is consistent with similar research studies that have revealed strong, positive correlations of subjective social pain (and increased negative affect) with heightened P3b amplitude—this is expressed as higher attentional salience in response to exclusionary cues (Kawamoto et al., 2013) Taken together, these results suggest a regional, time-sensitive allocation of brain resources in response to perceived exclusion and subsequent shifts in social behavior.

By means of this study, we aim to gain more concrete answers to our core scientific questions:

1) How does the impact of social exclusion affect neural activity?

2) Is this impact moderated by ingroup/outgroup status, particularly in the context of race?

3) Does ingroup/outgroup status affect individuals' level of belongingness and negative emotional responses following exclusion?

Based on previous work, we hypothesized that:

1) Social pain, evoked by social exclusion, will lead to increased P3 activity typically correlated with negative mood, and heightened attentional allocation to exclusionary cues (Weschke & Niedeggen, 2015).

2) Social exclusion will yield different neural processing when it comes from a racial ingroup/outgroup member, possibly pointing to different innate sensitivities/responses to social pain.

3) Social exclusion will yield different levels of social belongingness and distress based on whether they are rejected by ingroup compared to outgroup members.

More specifically, we anticipate that neural processing of exclusion and self-reported feelings of distress will be larger and that feelings of social belongingness would be lower in response to ingroup exclusion than outgroup exclusion, falling in line with previous research. To test these hypotheses, we used an exclusionary research paradigm known as "Cyberball". In this program, participants are placed in front of a computer screen and play a game of catch with two computer players, who pass a ball equally and then unequally between themselves and the subject, replacing a perceived sense of integration and belonging with a sudden onset of ostracism. Additionally, we also manipulated racial ingroup/outgroup status. EEG activity was recorded during the exclusion task and self-reported belongingness and distress were recorded by participants following the task. Together, we hope to use our findings to help establish a more perceptible link between social pain, exclusion, and race, all while stressing the importance of social interaction in everyday life.

Method

Participants

Twenty-nine undergraduate students (4 White males, 9 White females, 5 Black males, 11 Black females) at the College of William and Mary participated to partially satisfy a course requirement. The mean age was 18.8 (*SD* = 1.4). Participants were recruited based on race using an online mass testing poll. For their participation, they were given partial course credit for their introductory Psychology class. All procedures implemented were approved by the College's Protection of Human Subjects Committee, and written informed consent was obtained from each participant.

Materials

Cyberball Paradigm. Ostracism was induced using a computer task known as "Cyberball", in which the participant plays a virtual game of "catch" with two computer players (Sleegers et al., 2017). As depicted in Figure 1, in this particular manipulation of Cyberball, participants are told that the two other players are in separate rooms with the laboratory suite, playing with them in real-time. Additionally, in regards to the task itself, two conditions were used, one with Caucasian computer players and one with African American ones. Participants were assigned to either a condition with players that were their own race (e.g., Caucasian participants with Caucasian computer players) or players that were not their own race (e.g., Caucasian participants with African-American computer players). The race of the computer players was defined based on stereotypical names (ABC News, 2006). These names were attached to male and female faceless silhouettes. This was done to cement the impression that participants were playing with two members of racial groups that were the same as or different from their own.

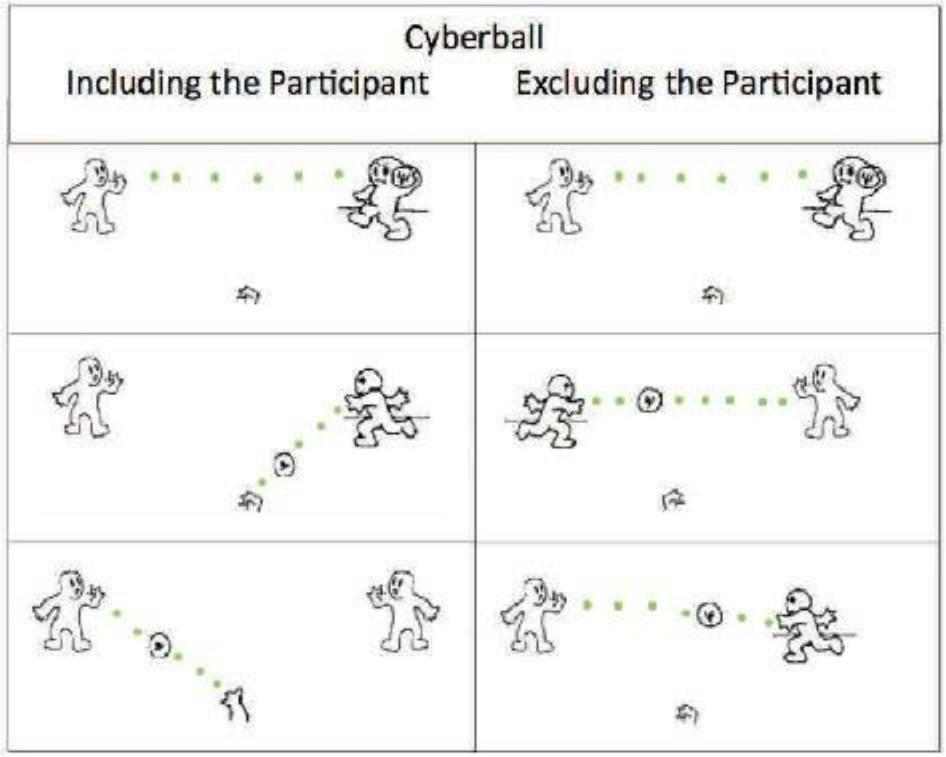

Figure 1. Depiction of the Cyberball paradigm with inclusion and exclusion trials.

The task requires participants to press one of two keys on the keyboard to toss the ball to the player of their choosing. Said computer players would then proceed to pass the ball back to the participant or to one another. For the first several trials, the ball is passed fairly and evenly amongst the three players. This was the inclusion block. Following a lengthy period of this fair play, an exclusion block ensues. The computer players, upon receiving the ball, would proceed to pass the ball solely between one another, seemingly ignoring the participant. This is intended to incite a feeling of ostracism in participants. The blocks, when combined, total to be 108 rounds of ball tossing.

Questionnaires

Need Threat Scale. The Need Threat Scale (Williams, Cheung & Choi, 2000) is a 20-item questionnaire specific to the Cyberball paradigm, aimed at assessing the degree to which participants felt they experienced a threat to or violation of their social needs during the game. It also assesses perceived levels of belonging amongst other players during the game's duration. This is achieved using a 7-point scale, ranging from "Do Not Agree" on one end, to "Agree" on the other and asking participants about the extent to which they agree with statements like "I felt like an outsider during the game". Higher scores indicate greater feelings of belonging.

Need Threat Questionnaire. Also tailored to the Cyberball paradigm, the Need Threat Questionnaire (van Beest & Williams, 2006) is a brief, 3-item self-report inventory that gauges participants' perceived levels of belonging and control during gameplay. Using a 9-point scale (ranging from "not at all" on the low end to "very much" on the higher end), participants rate the extent to which they feel certain statements are true to them. Examples of these statements include questions like "How much do you feel like you belonged to the group?" and "To what extent do you think the other participants value you as a person?". Higher scores indicate greater feelings of belonging.

PANAS. The Positive and Negative Affect Schedule (PANAS) is a 20-item questionnaire that assesses different emotions and feelings. Participants are tasked with assigning a point value, on a scale from 1 to 5, to the degree to which they feel they are experiencing a listed emotion at the present moment. The responses respectively include "very slightly or not at all", "a little", "moderately", "quite a bit", and "extremely" (Watson, Clark & Tellegen, 1988). The emotion of interest in the current study was "distressed."

SPAI-23. Participants were given an abridged version of the Social Phobia and Anxiety Inventory (SPAI-23; Roberson-Nay, Strong, Nay, Beidel & Turner, 2007), which gauges the frequency of anxiety onset that participants state they experience using a 5-point response scale, indicating "never", "very infrequent", "sometimes", "very frequent", or "always". The questionnaire has 16 statements centered on social phobia and 7 statements centered on agoraphobia. Participants were tasked with responding to statements such as “I feel anxious before entering a social situation”.

MEIM. The Multigroup Ethnic Identity Measure (MEIM; Roberts, Phinney, Masse & Roberts, 1999) assesses psychological well-being relative to the salience of one’s ethnicity and their self-perception. This measure lists 12 statements meant to gauge the extent of one’s racial identification or attachment to their racial group. It implements a 4-point scale of agreement and disagreement, with the following as possible answers (“strongly agree”, “agree”, “disagree”, “strongly disagree”) and respective score values (4, 3, 2, 1). Examples of presented statements include “I feel good about my cultural or ethnic background” and “I am happy that I am a member of the group I belong to”.

Procedure

Upon entry into the lab, participants were led into a Faraday chamber and were asked to complete an informed consent form. Because this task involved leading the participants to believe they are competing against other students to get authentic responses, participants were told that two other players were in separate rooms, playing with them in real-time. The other rooms were adjacent to the room that the participant was in. In addition, the set-up of these other rooms was identical to the participant’s and was also equipped with similar equipment.

To ensure that participants thought they were playing with other students, the signs that indicated that the rooms were in use were illuminated. The experimenter informed the participant that they were waiting for two other participants to join the game before they could start the task. The experimenter then exited the participant’s room and, after several minutes, proceeded to open the doors of the other rooms and speak to ostensible participants. Following this, the participant was given instructions about the game and was told the other participants are ready and they would get started.

Once the participant was seated in the room, two experimenters proceeded with electrode cap attachment. All protocols involving safe and sanitary concerns were taken during both experiments to ensure participant and experimenter safety. Before administration, participants were given detailed information about the electrodes and the equipment; specifically, they were told that the electrodes are harmless and that no electricity would pass through them. Additionally, they were shown all the materials and told the exact purpose of each instrument. All instruments and the electrodes and electrode cap were thoroughly cleaned and disinfected between uses to avoid contamination. All other materials (e.g., electrode collars, q-tips, tape) were discarded after each experimental session. Participants were assured that they would not be harmed in any way during the experiment, and were told that all materials had been disinfected after the previous participant. EEG data were recorded using a standard actiCAP electrode cap with 32 electrodes and a BrainAmp DC amplifier (BrainVision LLC, Morrisville, NC), with a 10 Hz low-pass filter and a 250 Hz high-pass filter.

After electrode attachment, participants were told to begin the computer task (~30 minutes), while EEG data was monitored in the next room. Upon completion of the task, the experimenter removed the electrode cap from the participants, and the participants completed an online survey containing the above scales. Participants also provided demographic information as well as a manipulation check. Following this, participants were debriefed and released.

Electrophysiological Analysis

Following data collection, the EEG data was analyzed using BrainVision Analyzer software (BrainVision LLC, Morrisville, NC). Eye movement artifacts in the data were corrected, using either ocular correction or ocular ICA correction based on how noisy the continuous data were (Gratton, Coles, & Donchin, 1983). All EEG data were filtered at low pass .01 Hz and at high pass 30 Hz. Segmentation 200 ms prior to stimulus onset and 1000 ms post-stimulus onset was performed. After baseline correction over the pre-stimulus interval, segmented data were averaged for each participant in each of the conditions.

Each ERP was quantified through visual inspection of the grand average waveforms. Following quantification, a repeated measures ANOVA was conducted including all of the electrodes and conditions. The typical electrodes used for each ERP, as well as the electrodes with the highest amplitudes, were examined. The P3 component was quantified through visual inspection of the grand average waveforms. The P3 component was quantified as the largest amplitude peak at electrode Pz between 300-600ms post-stimulus.

Results

Data were excluded for participants who had excessive EEG artifacts (n = 4). Additionally, one participant's data failed to be recorded due to experimenter error.

Psychophysiological Results

To examine whether neural responses to exclusion trials differed as a function of group, a between-subjects one-way analysis of variance (ANOVA) was conducted with P3 amplitude to exclusion trials in the unfair block as the dependent variable and Group (Ingroup, Outgroup) as the independent variable. Results indicated that there was not a significant effect, $F(1, 21) = 0.11$, $p = .741$, $\eta_p^2 = .005$.

To investigate whether the P3 amplitude to the exclusion trials differed as a function of participant race and confederates' race, a between-subjects analysis of variance (ANOVA) was conducted with P3 amplitude to exclusion trials in the unfair block as the dependent variable and

Participant Race (Black, White) and Confederates' race (Black, White) as the independent variables. As shown in Figure 2, results indicated that there was not a significant main effect of Participant Race, $F(1, 19) = 0.24$, $p = .632$, $\eta_p^2 = .012$. However, there was a marginally significant effect of Confederates' race, $F(1, 19) = 3.08$, $p = .096$, $\eta_p^2 = .139$, such that Black confederates yielded greater processing ($M = 4.63$, $SE = 0.77$) than White confederates ($M = 2.75$, $SE = 0.75$. There was no interaction, $F(1, 19) = 0.87$, $p = .771$, $\eta_p^2 = .005$.

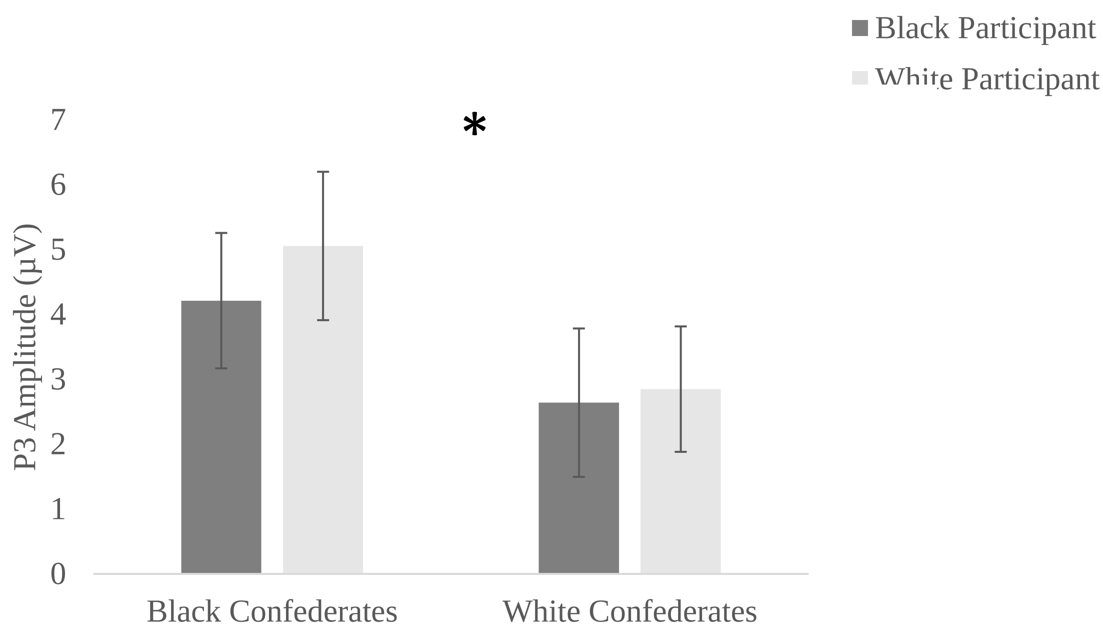

Figure 2. P3 Amplitude as a function of confederate race and participant race. Error bars represented standard error. The asterisk denotes a marginally significant effect of confederate race.

Self-Report Measures

To investigate whether the self-report variables differed as a function of participant race and confederates' race, a between-subjects ANOVA was conducted with survey responses to exclusion trials in the unfair block as the dependent variable and Participant Race (Black, White) and Confederates' race (Black, White) as the independent variables. See Table 1 for descriptive statistics.

	All conditions	Black-Black	Black-White	White-Black	White-White
Distressed	1.48 (0.81)	1.00 (.00)	1.33 (.58)	1.00 (.00)	2.29 (.95)
Need Threat Scale	4.81 (0.90)	4.95 (1.37)	4.07 (.72)	5.07 (.56)	4.86 (.46)
Need Threat Questionnaire	5.43 (1.30)	5.22 (1.67)	4.56 (.69)	5.87 (1.54)	5.67 (.94)
SPAI	2.04 (0.32)	1.83 (.31)	2.23 (.33)	2.08 (.31)	2.10 (.32)
MEIM	1.92 (0.57)	1.33 (.40)	2.11 (.29)	2.22 (.40)	2.14 (.56)

Table 1. Descriptive statistics for self-report variables. Numbers represent means, numbers in parentheses represent standard deviations. For each column, the first word represents the condition of participant race and the second represents the condition of confederates' race.

Need Threat Scale. Data collected in response to the 20-item scale was partially reverse-coded (effectively flipping all scale values for appropriate questions) and then averaged in SPSS. There were no main effects nor was there an interaction.

Need Threat Questionnaire. Data collected in response to the three items from the survey was aggregated and averaged in SPSS. There were no main effects nor was there an interaction.

PANAS. We examined the "distressed" emotion and found that there was a significant effect of confederates' race such that White confederates (M = 1.81, SE = 0.21) yielded more distress than Black confederates (M = 1.00, SE = 0.20), $F(1, 16) = 7.71$, $p = .013$, $\eta_p^2 = .325$. There were no other significant effects.

Relationships between variables

A multiple regression analysis was conducted to examine the unique contributions of each of the need-threat inventories, self-reported social anxiety (SPAI-23), and group (ingroup, outgroup) to P3 amplitude. Results indicated that, as predicted, there was a negative relationship between P3 amplitude and sense of belonging such that more positive feelings of belonging related to the Cyberball task were associated with less neural processing in the P3 ERP component. However, these results did not reach statistical significance (p < .200).

The need threat inventories were each entered into separately into regression analyses to examine the effect of the distress, self-reported social anxiety, and group. There were no significant effects.

The PANAS variable "distressed" was also entered into a regression analysis to examine the effect of the need threat inventories, self-reported social anxiety, and group. Results indicated that there was a significant effect of group, $\beta = -.65$, $p = .010$, such that participants felt more distressed when excluded by their own ingroup compared to their outgroup. There was also a significant effect in response to the need threat scale, $\beta = -.97$, $p = .026$, and a significant effect incurred from the need threat questionnaire, $\beta = 1.03$, $p = .021$, with those feeling a lesser sense of belonging as more distressed. Finally, SPAI-23 was a significant and positive predictor, $\beta = 0.46$, $p = .050$, such that the more social anxiety participants reported, the more distressed they were after exclusion.

Multiple regression analyses were conducted to examine if P3 amplitude and "distressed" were affected by the interaction between ethnic identity and condition. Group (ingroup, outgroup) and MEIM were entered on the first step and the interaction term between them (with MEIM mean-centered) was entered on the second step. There were no significant results.

Discussion

The purpose of the current study was to identify if race affects reactions to social exclusion, and thus social pain by extension. Contrary to hypotheses, ingroup versus outgroup status did not affect P3 ERP amplitudes to instances of social exclusion. This is inconsistent with previous literature (Sacco et al., 2014; Schmitt et al., 2002) which suggests that ingroup versus outgroup status can serve as a modulator of the intensity of perceived reactions to exclusionary cues. In addition, the lack of an effect of participant race is also counter to past lines of research that have revealed that members of traditionally stigmatized groups generally experience increased sensitivity to rejection (Goodwin et al., 2010). Results did indicate, however, that the confederates' race marginally predicted P3 amplitude such that both White and Black participants showed greater processing to Black confederates compared to White confederates. This more or less aligns with similar studies evidencing an increased neural processing of Black confederates as a factor of socio-evaluative concern within a context potentially threatening to social needs (Ofan, Rubin & Amodio, 2013). Furthermore, participants who felt their social needs were less threatened showed a trend towards less neural processing in the P3 ERP component. This falls in line with a number of studies (Weschke & Niedeggen, 2015; Kawamoto et al., 2013) that have demonstrated a positive relationship between enhanced P3 component activity and things like increased negative affect, perceived ostracism intensity, and greater attention to exclusionary cues, and a shift from motivation to withdrawal.

The current study also revealed that levels of distress recorded from various self-report measures we implemented were found to vary as a function of the group membership of the confederates, feelings of belonging, and self-reported social anxiety. These findings all fall in line with our hypotheses, as corroborated by previous research suggesting that unconscious biases affiliated with ingroup membership can influence the intensity of perceived exclusion (Brewer, 1991; Sacco et al., 2014; Schmitt et al., 2002). Additionally, other works (Baumeister & Leary, 1995; Goodwin et al., 2010) have suggested that the nature of “belonging” as a core human social need qualifies its very need to be preserved, while its violation (i.e., by exclusionary circumstances) can prove hazardous to one’s well-being. Finally, as a level of distress is already inherently grounded in the nature of social anxiety, it should hardly be surprising that previous research has linked medial frontal brain activity at the theta frequency (~400-800ms) to the distress accompanied by expectancy violation, a hallmark of certain exclusionary situations like the Cyberball task (van Noordt et al., 2015). In essence, this brain activity can be thought of as a bio-marker for self-reported distress that is connected to ostracism. Taken together, these findings imply a multi-variate and potent relationship between social exclusion and a number of intrinsic socio-emotive factors.

However, while previous studies (Goodwin et al., 2010; Schmitt et al., 2002) have indicated the potential for ethnic identity to shield minority self-esteem from distress after majority attack, this was not observed in the current study. This lack of an effect could have been due to other factors being more influential in the relationship between exclusion and distress such as belonging and social anxiety, which were significant predictors of distress in the current study. In addition, the relationship between ethnic identity and distress is most appropriate to assess in minority group participants which was difficult to ascertain in the current study due to small group size.

Self-reported social belonging specific to the game was not affected by condition, which suggests that this outcome variable did not depend on the group status of the confederates who excluded the participant. As belonging is a core social need tied to one's sense of self-esteem, control, and meaningful existence, all of which become relatively threatened in exclusionary situations (Weschke & Niedeggen, 2015), it makes sense that exclusion affected participants in all conditions equally. Loss of social inclusivity and connection is thought to induce bouts of potent distress tied to depreciations in mental and physical well-being (van Noordt, White, Wu, Mayes & Crowley, 2015).

Furthermore, all participants showed greater self-reported distress from rejection from White confederates compared to Black confederates. This can be attributed to a perception of White people as part of a larger majority that is effectively in control, as is the general case in American society. Additionally, it has been shown that in group environments "majority rule empowers parties that hold a majority position and oppose a numerical minority…with different preferences because majority rule enables them to marginalize or even exclude a minority" (Velden, Beersma & De Dreu, p. 259, 2007). Thus, in this case, the power of this majority influence rests in its ability to affect one's proclivity for social motivation and/or withdrawal in group settings. This influence would explain our findings, as it presupposes a uselessness or lack of effect stemming from affiliation with the minority.

A number of limitations were also found to be inherently bound to the study and its progression. For one, the study maintained a small sample size with an even smaller number of participants assigned to each of the four conditions. This created a lack of statistical power necessary for more concrete findings with both less variance and more room for error. Additionally, the very nature of the Cyberball paradigm allowed a number of participants to recognize some of the study's intentions prematurely. For example, the task abruptly changes from fair to unfair play halfway through the task. In addition, the number of exclusion trials is also relatively low in the Cyberball paradigm. ERP research that involves averaging neural responses across conditions typically suggests a larger number of trials per condition than the current study affords. This is the number of trials, however, that has been used in previous ERP research with this paradigm. Also, a lack of physical presence of confederate co-players in the lab space made it harder to lead subjects away from the true intent of the study. Furthermore, with regard to the participants themselves, we chose neurotypical, Black or White college-educated individuals who were between 18 and 21 years of age. However, there are definitely other pools available to choose from in terms of race, age, and gender that we did not explore, and these may have provided much different or even more conclusive evidence. Individual differences in subjects may also have imbued them with different innate sensitivities to ostracism based on age, race, gender, or personal experience. Additionally, some students may have already been familiar with EEG experiments if they had previously signed up for similar studies for course credit through the W&M Psychology Department. Taken together, all of this could have skewed our data to an extent.

This study offered a unique opportunity to explore the impact of race on responses to a situation involving social exclusion. However, it is fair to say that much more work is needed to correct, validate, and replicate its findings. Going forward, it may prove beneficial to pull from different social groups to gauge differential neural processing effects as a product of modifying ingroup vs. outgroup status. Because our pool of participants was so small and limited, it would only make sense to refine and expound upon the bases established in this experiment with a larger, more diverse group. Further, to improve paradigm efficacy and credibility, it may be wise to introduce physical co-players. These steps are among the various others which should be explored in the interest of landing more decisive results.

In summary, this work can be seen as a small, yet important attempt to assess the neural processing of racial ingroups and out-groups in exclusionary settings and the psychological effects of this exclusion. Furthermore, this study aimed to better understand some of the psychological phenomena underlying human interaction. While much research in social neuroscience has been centered on these aspects, more work must be conducted to better understand the unique connections of social exclusion and pain. Going hand-in-hand, social interaction and ostracism are not mutually exclusive, as both prove very influential in the context of mental and emotional health, in addition to the quality of daily life. And a better understanding of their impact as a function of human nature may confer any number of socio-emotive benefits, to people and to society at large.

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