Need Threat Can Motivate Performance After Ostracism

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Article

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Abstract

Ostracism threatens fundamental needs of belonging, self-esteem, control, and meaningful existence, which should motivate participants to respond to this threat. However, research has yet to examine the role of need threat in producing motivation after ostracism. In the current work, participants completed a "cognitive ability" (antisaccade) task following Cyberball-induced ostracism or inclusion. In two experiments, it was found that when ostracized, participants do not see antisaccade performance as a means of responding to the concerns produced by need threat; they respond only to the social threat, leading to worse performance than included participants (Experiments 1 and 2). However, when participants see an avenue of response (the Cyberball players can compare antisaccade performances), ostracized participants outperform included participants (Experiment 2). Moreover, this effect was mediated by the need for belonging, suggesting that ostracized participants were motivated to elevate their inclusionary status by demonstrating their worth on the cognitive ability task.

Keywords

ostracism, social exclusion, motivation, evaluation, mere effort

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Ostracism—being ignored and excluded—is a frequent and powerful aversive social experience. While it maintains the strength of the group or individuals employing it, ostracism has the unique capability of threatening at least four fundamental needs: belonging, self-esteem, control, and meaningful existence (Williams, 2009). Receiving no acknowledgment, response, or involvement from others, the ostracized individual loses his or her sense of belonging. Self-esteem plummets because self-esteem is at least partly determined by one's social inclusionary status (Leary, Haupt, Strausser, & Chokel, 1998; Leary, Tambor, Terdal, & Downs, 1995) and because initial reactions involve internalizing and self-deprecating explanations (Williams, 2007). Control is stripped away because of the nonresponsiveness of others no matter what the individual does to provoke attention and inclusion. Finally, existential needs are threatened because the ostracism experience evokes the feeling of invisibility, nonexistence, and unworthiness (Case & Williams, 2004). Ostracism threatens these needs quickly and strongly—so much so that being excluded from receiving the ball in Cyberball, a 2-min triadic online game of ball toss, results in negative affect and reduced need satisfaction (Van Beest & Williams, 2006; Williams, Cheung, & Choi, 2000; Zadro, Williams, & Richardson, 2004) and even activates a pain detection region of the brain, the dorsal anterior cingulate cortex (Eisenberg, Lieberman, & Williams, 2003).

Thus, previous work has demonstrated that the experience of ostracism threatens fundamental needs (Williams, 2009). In addition, researchers have argued that the experience of need threat motivates one to act to ameliorate these effects. For example, Leary (1999) has proposed that information suggesting that an individual is not valued and accepted by other people motivates behaviors that will increase relational evaluation. Williams (2009) has argued that when fundamental needs (belonging, self-esteem, control, and meaningful existence) are threatened, individuals are motivated to fortify these needs. However, research has yet to directly test the impact of threats to fundamental needs on motivation following the experience of ostracism. In the current research, we examined the effect of ostracism on subsequent task performance, using a paradigm suggested by Harkins and his colleagues' research on motivational responses to other social threats (Harkins, 2006; Jamieson & Harkins, 2007; McFall, Jamieson, & Harkins, 2007).

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The motivation-based mere effort account is an explanation for how social threats affect task performance. This model was suggested by Harkins's (2006) analysis of the effect of evaluation on performance and argues that evaluation motivates participants to want to perform well, which potentiates whatever response is prepotent, or most likely to be produced, on a given task. If the prepotent response is correct, the potential for evaluation facilitates performance. If the prepotent response is incorrect, and participants do not know, or lack the knowledge or time required for correction, performance is debilitated. However, if participants are able to recognize that their prepotent tendencies are incorrect and are given the opportunity to correct, performance will be facilitated.

Jamieson and Harkins (2007) argued that another social threat, stereotype threat, operates like evaluation threat, bringing into play the same process that Harkins and his colleagues (Harkins, 2006; McFall et al., 2009) implicate in the evaluation–performance relationship. The mere effort account of stereotype threat shares the notion that stereotype threat energizes prepotent or dominant responses with the arousal/drive explanations proposed by O'Brien and Crandall (2003) and Ben-Zeev, Fein, and Inzlicht (2005). For example, O'Brien and Crandall argued that the arousal produced by stereotype threat "is non-specific and serves to energize behavior in a nondirective way. For this reason, arousal enhances the emission of dominant responses" (p. 783). However, as is also the case for the arousal/drive explanations for social facilitation (e.g., Cottrell, 1972), these other accounts do not incorporate the correction process proposed by Harkins and his colleagues (Harkins, 2006; McFall et al., 2009).

Harkins and his colleagues have used the antisaccade task (see Figure 1) to test this account of the effects of evaluation (McFall et al., 2009) and stereotype threat on task performance (Jamieson & Harkins, 2007). The antisaccade task is an inhibition task that requires participants to respond to a target, but before the target appears, a cue is presented on the opposite side of the display. Participants are explicitly instructed to not look at this cue but rather to look to the opposite side of the display where the target will appear. However, participants have a reflexive-like prepotent tendency to orient attention toward the cue. This tendency must be inhibited or corrected to optimize performance.

When combined with eye tracking, the antisaccade task is ideal for studying the processes that culminate in terminal performance because one is able to isolate the contribution of specific processes. More specifically, by measuring the incidence of reflexive saccades, correct and corrective saccade latencies (see Figure 2), and reaction time adjusted for when participants' eyes arrive at the target location, one can gain insight into the mechanism(s) that produce(s) differences in the terminal performance measures, accuracy of target identification and overall reaction time (see Jamieson & Harkins, 2007, Experiment 3, for additional detail).

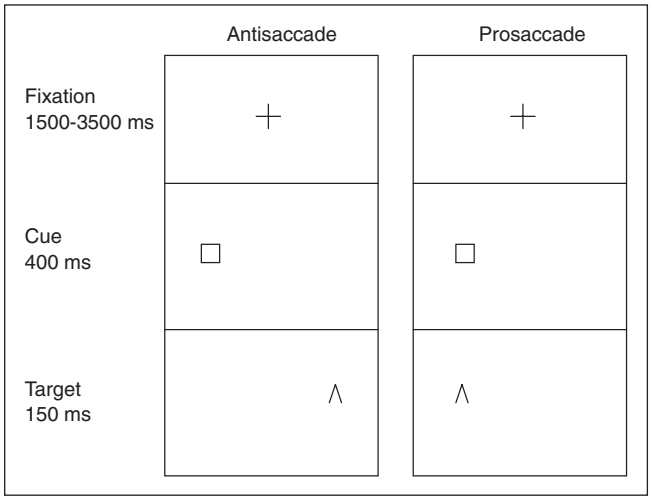

Figure 1. Sequence of events for the antisaccade and prosaccade tasks

Each frame represents what was displayed on the monitor for the period of time shown to the left of the figure. The target appeared in one of three orientations: pointing up (shown), to the right, or to the left. Targets and cues were presented as white figures on a black screen 11.5° from the center of the screen.

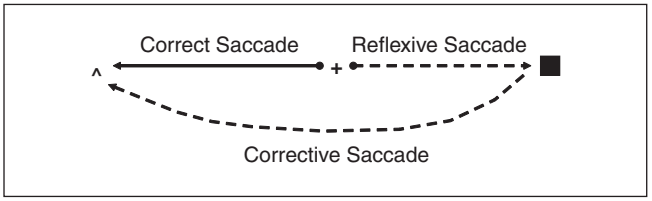

Figure 2. Response maps for different types of saccadic eye movements on antisaccade trials

Solid line represents trials on which participants first make a correct saccade toward the target. Broken line represents trials on which participants first make an incorrect reflexive saccade to the cue and then generate a corrective saccade back toward the target.

As shown in Figure 2, reflexive saccades are incorrect, but prepotent, eye movements toward the cue. These eye movements must then be corrected for the participant to see the target. Corrective saccades are the volitional eye movements launched to the target following an incorrect, reflexive saccade toward the cue. On those trials in which a participant does not generate a reflexive saccade (i.e., inhibits the prepotent tendency to look at the cue), he or she need only look toward the target. Correct saccades are the volitional eye movements that are generated from the central fixation point to the target. Both correct and corrective saccades are volitional, meaning that they are endogenously generated; the more motivated one is to see the target, the faster one can generate these eye movements (see Jamieson & Harkins, 2007).

In a step paradigm, an antisaccade trial begins with cue onset on either the left or right side of the display immediately

following fixation offset. After a fixed period, the cue is removed, and the target then appears on the opposite side of the display. Overall reaction time is measured from target onset. However, in some cases (e.g., when the participant orients attention toward the cue), the participant's eyes arrive at the target site after target onset. Of course, a response cannot be made until the eyes have arrived at the target site. To take this into account, for each person on each of the trials on which this occurred, the time lost is subtracted from the overall reaction time for that trial. For example, if on a given trial, the participant's eyes arrived at the target location 50 ms after the target appeared, these 50 ms are subtracted from the overall reaction time on that trial. These adjusted reaction times directly reflect the participant's level of motivation to press the response key as quickly as possible.

The mere effort account suggests that the experience of threat arouses the individual and potentiates prepotent responses. Thus, participants subject to social threat (i.e., stereotype or evaluation threat) are expected to generate more reflexive saccades than controls on antisaccade trials. However, because of the motivation resulting from the desire to perform well and the fact that looking toward the cue is an obviously incorrect response, threatened participants should launch correct and corrective (i.e., volitional) saccades faster than controls in an effort to fixate the target as quickly as possible. Moreover, the motivation to perform well should lead threatened participants to try to respond as quickly as possible. As a result, the experience of social threat and the resulting motivation to perform well should increase the incidence of reflexive saccades but decrease volitional saccade latency and adjusted reaction time. Jamieson and Harkins (2007, Experiment 3) and McFall et al. (2009; Experiment 4) found support for each of these predictions, which taken together, led to faster overall terminal reaction times with no cost in accuracy for participants subject to threat as compared to no-threat participants.

Experiment 1

When one anticipates the potential for evaluation, there is the possibility that one's performance will not measure up. When one is subject to stereotype threat, there is not only the possibility that one will fail to measure up as an individual but also the possibility of confirming the negative stereotype concerning one's group. In each of these cases, the effects of threat and motivation to do well cannot be separated. For instance, there is no stereotype threat without concern about one's performance confirming the stereotype, just as there is no concern about being evaluated negatively if performance is anonymous.

Unlike the potential for evaluation and stereotype threat, ostracism represents a social threat that may or may not lead to the motivation to perform well. For example, participants could be ostracized while playing Cyberball with "students from other universities" and then asked to perform the antisaccade task. Under these circumstances, participants may not believe that performance on the antisaccade task represents a means of responding to the concerns produced by their experience of need threat. That is, they could suffer the effects of the social threat (threatened needs) but have no reason to be motivated to perform well. If this were the case, we would find that threat resulting from the experience of ostracism would potentiate the prepotent response, looking the wrong way at the cue. However, unlike the potential for evaluation and stereotype threat, ostracism would have no effect on the measures of volitional behavior (saccade launch times and adjusted reaction times).

On the other hand, ostracized participants could believe that performing well on the antisaccade task, which was framed as a test of cognitive ability, would be a means of demonstrating their self-worth. If this were the case, we would find the same pattern of findings as that produced by the potential for evaluation and stereotype threat: increased incidence of reflexive saccades, faster volitional saccades, and faster adjusted reaction time. Of course, there are also other possible outcomes, which would be reflected in different patterns of performance on the antisaccade task. For example, participants could feel anxiety concerning the ostracism experience or performance on the task, and this anxiety could act like a secondary task, occupying central executive processing resources (e.g., Roberts, Hagar, & Heron, 1994). If this were the case, we would find increased incidence of reflexive saccades, slower volitional saccades, and no effect on adjusted reaction time. These possibilities were tested in Experiment 1.

Method

Participants and design. Thirty-three Northeastern University undergraduates (17 male, 16 female) participated in an experiment "examining the effect of mental visualization on cognitive processing ability." To engage mental visualization processes, participants were instructed to play an online ball-tossing game called Cyberball (Williams & Jarvis, 2006) with two "players from other universities" (actually the computer) and to visualize playing ball toss with the other players. Participants could throw to whomever they wished, and they believed the other "players" could do so as well. Ostracized participants received two throws at the beginning of the game, after which the other "players" stopped throwing to the participant. In the inclusion condition, participants received the ball for approximately one third of the total tosses. After the task was explained, the experimenter left the room. The program terminated after 20 throws and the participant retrieved the experimenter.

Tasks and apparatus. Upon completion of the Cyberball game, participants completed two eye-movement tasks, the antisaccade and prosaccade tasks, after having been told that

performance on these tasks indexed their cognitive ability. On the antisaccade task (see Figure 1), each trial began with the presentation of a fixation cross, subtending 1º of visual angle, in the center of the screen for a randomly determined interval ranging from 1,500 to 3,500 ms. The cue, a white square subtending 0.5º of visual angle, was then presented 11º to either the left or the right of the fixation cross for 400 ms. When the cue was extinguished, the target, an arrow also subtending 0.5º of visual angle, appeared on the opposite side of the screen, 11º from the center. The target was presented in one of three orientations: pointing up (as shown in Figure 1), to the left, or to the right. The target was displayed for 150 ms, after which a mask, another white square subtending 0.5º of visual angle, appeared in its place. The mask remained until the participant responded. If no response was made, it was removed after 1,500 ms, and the next trial began after a 1,750-ms intertrial interval. For antisaccade trials, participants were instructed to look at the central fixation cross until the cue was presented, at which point they were told to look away from the cue and indicate the orientation of the target located on the opposite side of the screen as quickly and accurately as possible by pressing the corresponding arrow key on a keyboard. Cue side (left or right) and arrow direction (up, left, right) were randomized across trials.

As shown in Figure 1, prosaccade trials were nearly identical to antisaccade trials except that the target was presented on the same side of the screen as the cue. Participants must, and were instructed to, look toward the cue to identify the orientation of the target. The prepotent tendency to look toward the peripherally flashed cue is correct on prosaccade trials. Thus, prosaccade trials are structurally similar to antisaccade trials but do not require the inhibition or correction responses or both.

Participants completed six practice trials before each saccade task and then completed 72 antisaccade or prosaccade trials. Task order was counterbalanced across participants. As is common in antisaccade research (e.g., Roberts et al., 1994; Stuyven, Van der Goten, Vandierendonck, Claeys, & Crevits, 2000), participants did not receive feedback after each trial.

Eye movements were recorded using an infrared oculometer, while head position was stabilized with a chin rest. The oculometer measured eye position by projecting an infrared light into the eye at an intensity limited to 3×10^{-4} W/cm^2 and calculating the angular disparity between pupil reflectance and maximum corneal reflectance. The oculometer permitted eye position to be tracked with a resolution of 0.1°, which is ideal for measuring small eye movements such as saccades (Bach, Bouis, & Fischer, 1983). To ensure that the oculometer remained calibrated for luminance and spatial accuracy, a calibration test was presented every 20 trials.

Data preparation. Filters were employed before data analysis to ensure that eye movements recorded by the eye tracker represented responses to the stimuli. Before each trial, participants were required to fixate on a center fixation cross. If in the 200 ms preceding cue onset eye position did not vary by more than 2.82º (50 pixels), that trial was considered as having a valid baseline. If gaze strayed more than 2.82º from the center of the center, that trial was considered as having a bad baseline and was excluded. A total of 3.92% of the total number of trials across tasks and conditions were excluded due to bad baselines.

Trials on which participants initiated saccades 80 ms or less after cue onset were considered anticipatory (e.g., Crevits & Vandierendonck, 2005; Ford, Goltz, Brown, & Everling, 2005) and were excluded. Additionally, saccades beginning at 1,000 ms or more after the presentation of the cue were excluded from the data analyses because these eye movements could not have been initiated in response to either the cue or the target. These criteria resulted in the exclusion of another 7.37% of the trials. Thus, a total of 11.29% of trials were excluded from the analyses because of bad baselines and threshold violations. The percentage of excluded trials did not differ by condition, $p > .40$. In addition, previous antisaccade research using similar eye-tracking measures has excluded approximately the same percentage of trials (e.g., Jamieson & Harkins, 2007; Kane, Bleckley, Conway, & Engle, 2001; McFall et al., 2009; Unsworth, Schrock, & Engle, 2004).

Questionnaire measures. After the saccade tasks, participants filled out ostracism and need-threat measures. The ostracism manipulation check items asked the extent to which they were ignored and excluded on 5-point scales, and asked participants to estimate the percentage of throws they received during the Cyberball interaction. The full need-threat scale is presented in the appendix and was adapted from previous research (Williams, 2009, Table 6.1). Scales separately assessed needs for belonging, self-esteem, meaningful existence, and control. However, ample research demonstrates that Cyberball-induced ostracism threatens each of these needs, resulting in less belonging, lower self-esteem, less control, and a sense of meaninglessness and invisibility (Carter-Sowell, Chen, & Williams, 2008; Eisenberger et al., 2003; Lakin, Chartrand, & Arkin, 2008; Williams et al., 2000; Zadro et al., 2004). Therefore, we expected the need-threat measures to be highly correlated with each other and anticipated creating a need-threat composite, which is consistent with previous research in this area (see Williams, 2009). Additional questionnaire items asked participants to indicate how difficult the saccade tasks were, how anxious they were during performance, and the extent to which the experimenter could evaluate their performance, all on 11-point scales.

Results

Data were analyzed with independent samples *t* tests (ostracism vs. included) unless otherwise noted.[1]

Table 1. Experiment 1: Individual Need-Threat Means and Standard Deviations as a Function of the Ostracism Condition

	Need-threat measures							
	Belonging		Control		Self-esteem		Meaningful existence	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Ostracism	2.16_a	1.01	2.03_a	0.95	2.33_a	1.03	2.88_a	1.21
Include	3.88_b	1.14	3.23_b	1.19	3.51_b	1.07	4.12_b	1.06

Lower scores index less need satisfaction (i.e., more need threat). Different subscripts within a column indicate that means differ at $p < .01$.

Ostracism. We first examined whether the Cyberball manipulation was successful in inducing the experience of ostracism. Ostracized participants felt more ignored (M = 4.25, SD = 1.06) than included participants (M = 1.53, SD = 1.01), $t(31) = 7.54$, $p < .001$, $d = 1.39$. Ostracized participants also indicated they were excluded more (M = 4.38, SD = 1.15) than controls (M = 1.53, SD = 1.07), $t(31) = 7.38$, $p < .001$, $d = 1.38$, and reported that they received the ball on a smaller percentage of trials (M = 6.69%, SD = 4.74%) than included participants (M = 31.18%, SD = 6.65%), $t(31) = 12.23$, $p < .001$, $d = 1.78$. Thus, the ostracism manipulation was successful.

Need threat. As shown in Table 1, ostracism had a reliable effect on each individual need-threat measure, and significant correlations existed between all need-threat measures (see Table 2). As is commonly done in the ostracism literature (see Williams, 2009), we then averaged the four needs for each participant to form a composite measure of need threat (Cronbach's $\alpha = .78$). Analysis of the composite measure indicated that ostracized participants exhibited less need satisfaction (M = 2.35, SD = .37) than participants included in the Cyberball game (M = 3.69, SD = .39), $t(31) = 7.91$, $p < .001$, $d = 2.82$. Consistent with research in this area (see Williams, 2009), the experience of ostracism threatened fundamental needs.

Ancillary measures. We also examined the effect of ostracism on self-reports of difficulty, anxiety, and evaluation potential. Ostracism had no impact on ratings of saccade task difficulty, self-reported anxiety during performance, or the extent to which the experimenter could evaluate performance, ps > .25.

Performance. Performance data were analyzed in 2 (ostracism: ostracism vs. include) × 2 (task: antisaccade vs. prosaccade) ANOVAs with ostracism as a between-subjects factor and task as a within-subjects factor. Pairwise contrasts (Kirk, 1995) were used to decompose interactions.

Accuracy. This analysis produced a Task × Ostracism interaction, $F(1, 31) = 4.37$, $p = .045$, $d = .75$. On antisaccade trials, ostracized participants responded less accurately (M = 94.22%, SD = 5.21%) than included participants (M = 96.61%, SD = 3.13%), $F(1, 31) = 5.99$, $p = .02$, $d = .88$, whereas accuracy rates of ostracism and included participants did not differ on prosaccade trials ($M_{ostracism}$ = 99.29%, SD = 1.14%; $M_{include}$ = 98.79%, SD = 1.36%), $F < 1$. The main effect for task, $F(1, 31) = 27.55$, $p < .001$, $d = 1.89$, should be interpreted in the context of the interaction.

Table 2. Experiment 1: Correlation Matrix for the Individual Need-Threat Measures

	Control	Self-esteem	Meaningful existence
Belonging	.47**	.43**	.58**
Control		.68**	.49**
Self-esteem			.62**

**$p < .01$.

Terminal reaction time. As in previous research (Jamieson & Harkins, 2007), only reaction times for correct responses were submitted to analysis because we wanted to ensure that our reaction-time measures represented responses to the target. In any event, including the incorrect trials had no impact on any of the analyses.

Participants responded more quickly on prosaccade trials (M = 453.53 ms, SD = 62.22 ms) than on antisaccade trials (M = 515.93 ms, SD = 112.37 ms), $F(1, 31) = 14.00$, $p < .001$, $d = 1.34$. No other effects were reliable, ps > .20.

Eye movement. As expected, on the prosaccade task participants made reflexive saccades toward the target or cue on 99% of valid trials. Because of this lack of volitional orienting on the prosaccade task, only eye movements from antisaccade trials were analyzed. Response maps for each type of eye movement are shown in Figure 2.

Reflexive saccades. Ostracized participants produced more reflexive saccades (M = 46.14%, SD = 22.98%) than controls (M = 30.46%, SD = 18.87%), $t(31) = 2.15$, $p = .039$, $d = .77$. Thus, ostracized participants were at a disadvantage at the outset of antisaccade trials because of their higher incidence of incorrect saccades. This finding is consistent with the notion that ostracism threatened participants, potentiating the prepotent response.

Volitional saccades. Latency to generate the two types of volitional, or endogenously generated, saccades (i.e., correct and corrective saccades; see Figure 2) was analyzed in a 2 (ostracism: ostracism vs. inclusion) × 2 (saccade type: correct vs. corrective) ANOVA with ostracism as a between-subjects factor and saccade type as a within-subjects factor.

Ostracism had no impact on volitional saccade latencies, $p > .20$, suggesting that the experience of ostracism did not motivate participants in Experiment 1.

Adjusted reaction time. As with terminal reaction times, only correct trials were subjected to analysis. Adjusted reaction time takes into account when participants' eyes fixate the target. If their eyes arrived before the target appeared, no adjustment was necessary. However, in those cases in which the saccade reached the target after its presentation, we subtracted from terminal reaction time the amount of time by which it came after. This procedure was followed for each trial for each participant, and the resulting adjusted reaction times were averaged for each participant. Ostracism did not affect participants' adjusted reaction time, $p > .20$. Again, this finding indicates that the ostracized participants were not more motivated to perform well on the antisaccade task than included participants.

Discussion

Consistent with the argument that the experience of ostracism represents a threat that potentiates prepotent responses, we found that ostracized participants produced more reflexive saccades than included participants. Other social threats (i.e., evaluation threat and stereotype threat) have also produced this effect (Jamieson & Harkins, 2007; McFall et al., 2009). However, those threats also affected motivated behavior (volitional saccade latency and adjusted reaction time), but this was not the case in Experiment 1. Because ostracized participants made more incorrect reflexive saccades but were not motivated to correct this response, they were slower to fixate the target than included participants. As a result, ostracized participants were less accurate in their identifications of target orientation than included participants.

Thus, the experience of need threat could have motivated ostracized participants to demonstrate their self-worth on the saccade tasks in Experiment 1, but it did not, as shown by the fact that there are no differences in volitional saccade latencies and adjusted reaction time. Moreover, this pattern of results was likely not due to ostracized participants experiencing processing deficits as a result of anxiety, because ostracism had no impact on self-reports of anxiety, nor did ostracism slow volitional saccade latencies, which is a consequence of decreasing executive processing capacity (e.g., Roberts et al., 1994).

The pattern of results observed in Experiment 1 is consistent with the notion that ostracism represents a social threat that potentiates prepotent responses, but because performance on the antisaccade task does not address the concerns aroused by need threat, ostracized participants are not motivated to perform well. In the next experiment, we sought to link the experience of ostracism and performance on the antisaccade task in such a way that performance on the task would provide a means of addressing the concerns produced by need threat.

Experiment 2

In Experiment 2, participants were either told that the people who had just ostracized them were also performing the "cognitive ability" (i.e., saccade) tasks and the triad of participants would be able to compare their performances (evaluation) or that individual scores would remain anonymous (no evaluation). Under no evaluation, there is no link between the experience of ostracism and the performance situation; thus, we predicted the same pattern of findings as in Experiment 1: Ostracism presents a threat that will potentiate the prepotent response (looking the wrong direction toward the cue), but there will be no effect on the motivation measures, leading to worse performance.

In contrast, the evaluation condition directly links the experience of ostracism with the performance situation. That is, in the evaluation condition, the ostracized participants can respond to the concerns produced by need threat by performing well on the antisaccade task, thereby demonstrating their self-worth, which is a means to improve one's inclusionary status (Baumeister & Leary, 1995). Thus, ostracized participants in the evaluation condition were expected to make more reflexive saccades than evaluated controls but were predicted to be motivated to correct these responses. As a result, they should launch volitional saccades more quickly, as well as press the response key faster once their eyes arrive at the target site than controls, leading to better overall performance.

Method

Participants and design. Sixty-eight Northeastern University undergraduates (27 male, 41 female) were randomly assigned to one of the four conditions from the 2 (ostracism: ostracism vs. included) × 2 (evaluation: evaluation vs. no evaluation) design.

Tasks, materials, and manipulations. Tasks, materials, and manipulations were nearly identical to those reported in Experiment 1 with the exception that Experiment 2 introduced an evaluation manipulation. In the evaluation condition, the experimenter explained that the triad of Cyberball "players" would be able to compare their performances on the cognitive ability task. Thus, participants believed that they would see the other players' scores and that these other players would be able to assess their score. Evaluation participants were also led to believe the experimenter would not have access to anyone's score. In the no-evaluation condition, participants were told that scores would be pooled so that no one would be able to evaluate their individual performance.

The ostracism manipulation checks and the need-threat measures were identical to those reported in Experiment 1. An additional questionnaire assessed the effectiveness of the evaluation manipulation. Participants were asked: "To what extent will you be able to compare your performance on this [the saccade] task to the performance of the other Cyberball

Table 3. Experiment 2: Individual Need-Threat Means and Standard Deviations as a Function of the Ostracism Condition

	Need-threat measures							
	Belonging		Control		Self-esteem		Meaningful existence	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Ostracism	2.25_a	0.97	1.97_a	0.91	2.72_a	0.81	2.65_a	1.02
Include	4.08_b	0.89	3.01_b	0.92	3.64_b	0.88	4.12_b	0.96

Lower scores index less need satisfaction (i.e., more need threat). Different subscripts within each column indicate that means differ at $p < .01$.

players?" and "To what extent will the other Cyberball players be able to compare their performance on this task to yours?" both on 11-point scales. Participants were also asked to rate the extent to which the experimenter could evaluate performance on an 11-point scale.

Results

Unless otherwise noted, data were analyzed in 2 (ostracism: ostracism vs. include) × 2 (evaluation: evaluation vs. no evaluation) ANOVAs with both ostracism and evaluation as between-subjects factors. Pairwise contrasts (Kirk, 1995) were used to test predictions in the context of the overall analyses.

Ostracism. Ostracized participants felt more ignored (M = 4.27, SD = 1.02) than included participants (M = 1.76, SD = .92), $F(1, 64) = 109.89$, $p < .001$, $d = 2.62$, and felt they were excluded more (M = 4.32, SD = .88) than included participants (M = 1.88, SD = .95), $F(1, 64) = 199.55$, $p < .001$, d = 2.73. Ostracized participants also reported receiving the ball on fewer trials (M = 4.98%, SD = 3.70%) than included participants (M = 31.65%, SD = 8.46%), $F(1, 64) = 286.31$, $p <$ .001, d = 4.23. These findings indicated that, again, the Cyberball ostracism manipulation was successful.

Evaluation. The evaluation manipulation was also successful. Evaluation participants reported that they could evaluate the other players' performance to a greater extent (M = 8.71, SD = 2.30) than no-evaluation participants (M = 3.23, SD = 2.62), $F(1, 64) = 81.47$, $p < .001$, $d = 2.26$. Evaluation participants also reported that the other players could evaluate their performance more (M = 8.59, SD = 2.40) than controls (M = 3.18, SD = 2.47), $F(1, 64) = 82.08$, $p < .001$, $d = 2.26$. Neither ostracism nor evaluation condition affected ratings of the potential for experimenter evaluation, ps > .30, which were low overall (M = 3.23). In sum, these findings suggest that the evaluation manipulation was successful.

Need threat. As shown in Table 3, the experience of ostracism threatened each individual fundamental need. Because significant correlations existed between need-threat measures (see Table 4), the four needs were again averaged to form a need-threat composite (Cronbach's α = .80). As in Experiment 1, ostracized participants exhibited less need satisfaction (M = 2.39, SD = .62) than controls (M = 3.71, SD = .65), $F(1, 64) = 72.25$, $p < .001$, $d = 2.13$. The evaluation manipulation had no impact on any of the individual need-threat measures or on the need-threat composite, ps > .30. These data indicate that ostracism threatened fundamental needs.

Table 4. Experiment 2: Correlation Matrix for the Individual Need-Threat Measures

	Control	Self-esteem	Meaningful existence
Belonging	.42**	.32**	.69**
Control		.61**	.52**
Self-esteem			.46**

**$p < .01$.

Performance. Performance data were analyzed in 2 (ostracism: ostracism vs. include) × 2 (evaluation: evaluation vs. no evaluation) × 2 (task: antisaccade vs. prosaccade) ANOVAs with ostracism and evaluation as between-subjects factors and task as a within-subjects factor.

Accuracy. We observed an Ostracism × Evaluation × Task interaction, $F(1, 64) = 4.58$, $p = .036$, $d = .54$ (see Figure 3). As in Experiment 1, when not subject to evaluation, ostracized participants performed more poorly (M = 92.24%, SD = 7.58%) than included participants (M = 96.52%, SD = 2.70%) on antisaccade trials, $F(1, 64) = 15.95$, $p < .001$, $d = 1.00$. However, under evaluation, ostracized and included participants did not differ in accuracy, $F < 1$. No differences emerged on prosaccade trials. The main effect for task, $F(1, 64) = 44.52$, $p < .001$, $d = 1.67$; the Ostracism × Task interaction, $F(1, 64) = 5.03$, $p = .028$, $d = .56$; and the Evaluation × Task interaction, $F(1, 64) = 9.63$, $p = .003$, $d = .78$, must be interpreted in the context of the three-way interaction.

Terminal reaction time. This analysis produced a marginal Ostracism × Evaluation × Task interaction, $F(1, 64) = 3.74$, $p = .058$, $d = .48$ (see Table 5). When not subject to evaluation, ostracized and included participants did not differ, $F < 1$. However, when performance could be evaluated, ostracized participants responded more quickly (M = 431.11 ms, SD = 66.61 ms) than controls (M = 489.19 ms, SD = 96.59 ms) on antisaccade trials, $F(1, 64) = 15.73$, $p < .001$, $d = .99$. Here,

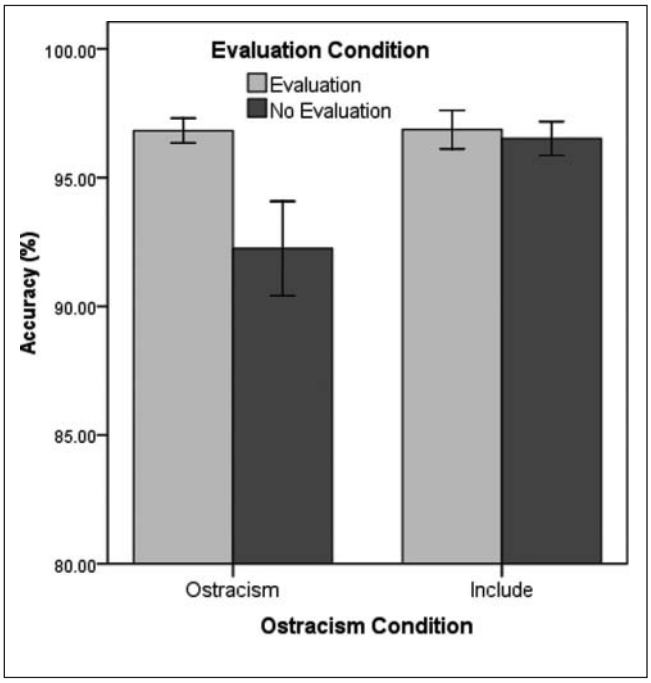

Figure 3. Antisaccade accuracy rates for correctly identifying the target in Experiment 2 as a function of ostracism and evaluation conditions
Error bars = +/– standard error of the mean.

Table 5. Experiment 2: Terminal Reaction Time on Antisaccade and Prosaccade Trials as a Function of Ostracism and Evaluation Conditions

	Terminal reaction time (ms)			
	Antisaccade		Prosaccade	
Condition	*M*	*SD*	*M*	*SD*
Ostracism/no evaluation	524.92	59.50	465.25	54.70
Ostracism/evaluation	431.11	66.61	420.36	91.98
Included/no evaluation	517.28	46.04	471.54	63.94
Included/evaluation	489.19	96.59	435.79	69.25

when ostracized participants were able to respond to need threat by demonstrating their self-worth, they outperformed the included participants. On prosaccade trials, which do not require inhibition, ostracism did not interact with evaluation condition.

The main effects for evaluation, $F(1, 64) = 10.74$, $p = .002$, $d = .82$, and task, $F(1, 64) = 33.52$, $p < .001$, $d = 1.45$, must be interpreted in the context of the interaction.

Reflexive saccades. Ostracized participants generated significantly more reflexive saccades ($M = 47.35\%$, $SD = 21.77\%$) than included participants ($M = 30.60\%$, $SD = 24.07\%$), $F(1, 64) = 9.96$, $p = .002$, $d = .79$, which indicates that the experience of ostracism potentiated the prepotent response, regardless of evaluation potential.

Table 6. Experiment 2: Latency to Launch Correct and Corrective Saccades (See Figure 2) as a Function of Ostracism and Evaluation Conditions

	Volitional Saccade Latency (ms)			
	Correct saccades		Corrective saccades	
Condition	*M*	*SD*	*M*	*SD*
Ostracism/no evaluation	371.19	50.28	461.03	52.33
Ostracism/evaluation	287.75	70.41	368.90	76.26
Included/no evaluation	369.82	59.27	459.47	41.23
Included/evaluation	338.00	60.76	427.01	69.39

Volitional saccades. Volitional saccade latency was analyzed in a 2 (ostracism: ostracism vs. no ostracism) × 2 (evaluation: evaluation vs. no evaluation) × 2 (volitional saccade type: correct vs. corrective) ANOVA, with ostracism and evaluation as between-subjects factors and saccade type as a within-subjects factor.

This analysis produced an Ostracism × Evaluation interaction, $F(1, 64) = 4.38$, $p = .040$, $d = .52$. Consistent with Experiment 1, ostracism did not impact volitional saccade latencies in the absence of evaluation, $F < 1$. However, evaluated, ostracized participants generated volitional eye movements significantly more quickly than did evaluated, included participants, $F(1, 64) = 17.47$, $p < .001$, $d = 1.04$. See Table 6 for all means and standard deviations.

Adjusted reaction time. This analysis yielded a marginal Ostracism × Evaluation interaction, $F(1, 64) = 3.62$, $p = .062$, $d = .48$ (see Figure 4). Consistent with Experiment 1, when there was no link between ostracism and task performance, ostracized and included participants did not differ in their adjusted reaction times, $F < 1$. However, when performance was subject to evaluation, ostracized participants exhibited faster adjusted reaction times ($M = 399.26$ ms, $SD = 47.21$ ms) than controls ($M = 444.53$ ms, $SD = 67.64$ ms), $F(1, 64) = 6.81$, $p = .011$, $d = .65$. The main effect for evaluation, $F(1, 64) = 13.07$, $p < .001$, $d = .90$, must be interpreted in the context of the interaction.

To summarize, the eye movement data show that under conditions of no evaluation, ostracized participants generated more reflexive saccades than controls and were not motivated to make up for this deficit. As a result, ostracized participants were unable to see the target on a greater percentage of trials and thus responded with lower accuracies compared to included participants. In the evaluation condition, ostracized participants started antisaccade trials at a disadvantage relative to included participants (more reflexive saccades). However, they more than made up for this deficit by launching volitional (correct and corrective) saccades and pressing the key more quickly than included participants, leading to performance facilitation.

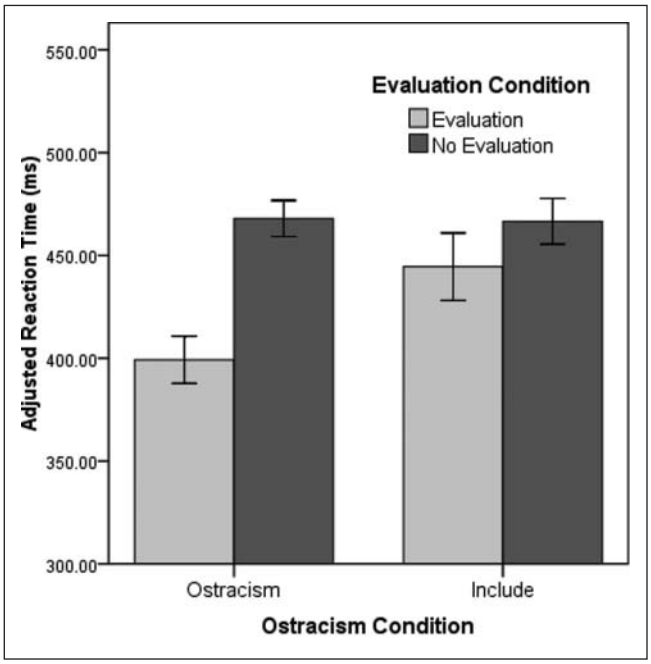

Figure 4. Adjusted reaction time in Experiment 2 as a function of ostracism and evaluation conditions
Error bars = +/– standard error of the mean.

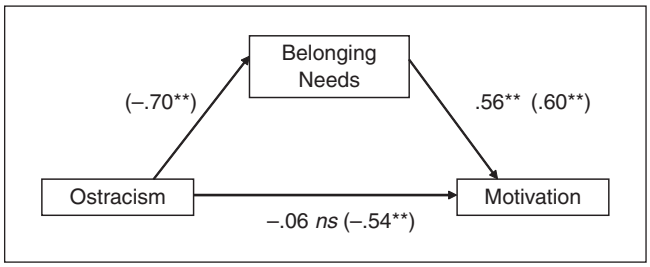

Figure 5. Need to belong as a mediator of motivation in the evaluation condition in Experiment 2
Coefficients in parentheses indicate zero-order correlations. Coefficients not in parentheses represent parameter estimates for a recursive path model including both predictors. Ostracism condition is dummy coded (1 = *ostracism*, 0 = *included*). Note that lower (i.e., faster) motivation composite scores indexed an increase in motivation, and lower scores on the belonging needs scale indexed less need satisfaction (i.e., more threat).
**$p < .01$.

Mediation. To test whether the experience of need threat produced the increase in motivation after ostracism in the evaluation condition, we conducted a mediation analysis (Kenny, Kashy, & Bolger, 1998) on the measures of participants' motivation. To conduct this test, we created a motivation composite composed of an average of volitional saccade latency and adjusted reaction time, which were significantly correlated with one another, $r = .48$, $p = .003$. We then examined the potential for each individual need threat and the need-threat composite to mediate the relationship between ostracism and motivation.

When each fundamental need (belonging, control, self-esteem, and meaningful existence) was analyzed separately, threatened belonging needs emerged as the only significant mediator of the effect of ostracism on motivation, Sobel $Z = 2.51$, $p = .012$ (see Figure 5).[2] The composite measure of need threat also mediated the effect of ostracism on motivation, Sobel $Z = 2.06$, $p = .039$. Thus, the mediation analysis is consistent with the argument that the ostracized participants were motivated in the evaluation condition because their fundamental needs, and more specifically their belonging needs, were threatened.

Discussion

As in Experiment 1, the experience of ostracism threatened participants' fundamental needs, and replicating the first experiment, the ostracized participants not subject to evaluation generated more reflexive saccades and were less accurate in identifying the target than included participants. However, the findings from Experiment 2 demonstrate that the effect of ostracism on performance differs as a function of whether performance can be evaluated by the triad of Cyberball players.

Consistent with predictions, in the evaluation condition, even though ostracized participants produced more reflexive saccades, they responded to target orientation more quickly than controls because they generated volitional eye movements more quickly and exhibited faster adjusted reaction times than the included participants. By linking performance on the antisaccade task to the experience of ostracism, the evaluation manipulation motivated threatened participants to try and perform as well as possible on the cognitive ability (i.e., saccade) task.

This argument is supported by the mediation analysis, which shows that under evaluation, ostracized participants were motivated to perform well because their fundamental needs, and, more specifically, their need to belong, was threatened. Thus, the greater the threat to belonging needs that ostracized participants experienced, the more motivated they were to perform well when evaluation by the triad was possible. This finding suggests that the ostracized participants were motivated to establish a social bond with the ostracizing others by demonstrating their worth on the cognitive ability tasks. This conclusion seems warranted given the fact that the only individuals with whom ostracized participants could forge a social bond in the evaluation condition were the other Cyberball "players" because they, alone, had access to the participants' scores. Alternatively, if ostracized participants were trying to take back control of the situation, one would expect threatened control needs to mediate the effect, but this was not the case. Likewise, ostracized participants were not motivated by threatened existential or self-esteem needs in Experiment 2.

General Discussion

The ostracism manipulation was successful in both experiments. Finding threatened needs of belonging, self-esteem, meaningful existence, and control in response to being ostracized via Cyberball demonstrates just how sensitive individuals are to threats of exclusion from social groups. Even when there is no possibility of future interactions with the ostracizing individuals (as in Cyberball) and when the group one is being excluded from is illusory, participants are threatened by exclusion.

In Experiment 1, after the manipulation of ostracism, participants performed the antisaccade task while their eye movements were recorded. Because performance on the antisaccade task had no apparent relation to the experience of ostracism, need threat did not motivate participants to perform well. Instead, they responded only to the experience of threat, as evidenced by their increased tendency to launch reflexive saccades toward the cue, leading to lower accuracy than the included participants.

Previous work suggests a potential mechanism for this effect that could be tested in future research. When subjected to threat, individuals exhibit a pattern of physiological arousal that is characterized by the activation of one or both of the two primary stress systems: the HPA (hypothalamus, pituitary, adrenal) axis and the SAM (sympathetic adrenal medullary) axis. For example, in a meta-analysis of studies examining cortisol levels in response to acute stressors, Dickerson and Kemeny (2004) found that exposure to social-evaluative threat was associated with heightened levels of cortisol, which is released in response to HPA activation. Rohleder, Wolf, Maldonado, and Kirschbaum (2006) found that a psychosocial stressor increased levels of salivary alpha amylase (sAA), a protein found in saliva that has been used as a proxy for catecholamines (specifically, epinephrine and norepinephrine), which are released in greater concentrations when the SAM axis is activated. Blascovich and Mendes (in press) have summarized work in this area as showing that social threat, among other variables (e.g., effort and distress, striving for control, uncertainty, fear), is often associated with moderate to high levels of activity in the HPA and SAM axes.

Increases in arousal have long been argued to be associated with the potentiation of prepotent (dominant) responses (e.g., Ben-Zeev et al., 2005; Cottrell, 1972; O'Brien & Crandall, 2003; Zajonc, 1965). This potentiation would have been adaptive in our ancestral past because responses to threat would likely require "flight or fight" or some other relatively simple behavior that would be facilitated by such potentiation.

Experiment 2 then introduced an evaluation manipulation. In the evaluation condition the experience of ostracism was directly linked to saccade task performance by leading participants to believe that the triad would be able to compare performances. When performance was linked to evaluation, participants who were excluded from the game were more motivated to perform well than participants included in Cyberball. This motivation was reflected in faster volitional saccade latencies and faster adjusted reaction times, which resulted in faster terminal reaction times with no cost in accuracy.

Moreover, Experiment 2 demonstrated that the effect of ostracism on motivation in the evaluation condition was mediated by the need for belonging, suggesting that ostracized participants were motivated to affiliate with the group that just excluded them by demonstrating their worth on the cognitive ability task. This finding is consistent with Leary's (1999) sociometer theory in that performing well on the task could increase relational evaluation. It is also consistent with Williams's (2009) temporal need-threat model, which argues that participants strive to resolve or cope with threatened fundamental needs after the experience of ostracism.

Williams et al. (2000) also found that threatened belonging needs played a direct role in guiding behavior after ostracism. In their research, ostracized individuals were more likely to conform to group norms in an effort to satisfy their belonging needs. Other research has demonstrated that after being rejected, individuals strive to establish social bonds by assigning greater rewards to those with whom they will interact in the future (Maner, DeWall, Baumeister, & Schaller, 2007). However, Maner et al. (2007) argue that social exclusion leads participants to seek connection with strangers but not with those who have excluded them. Although we also argue that ostracized participants seek connection, our mediation findings suggest that our ostracized participants are attempting to connect with their rejecters when given the opportunity.

These seemingly discrepant conclusions may be the result of important differences in the methods. In Maner et al.'s (2007) research, unlike the current work, the rejected participants were not evaluated by their rejecters. Instead, the rejected participants provided ratings of the rejecters (Experimenter 4) or evaluated the creativity of and assigned rewards to the rejecters (Experimenter 5). Furthermore, in Experiment 5 of Maner et al.'s research (the study most relevant to the current research), the rejected participants not only evaluated the rejecters' creativity but also were put in a position of power ("manager") over the rejecters ("workers"). Assigning the rejected participants this powerful role gave them control over the judgment of and rewards assigned to the rejecters, which may have enabled the rejected participants to satisfy control needs. Research by Warburton, Williams, and Cairns (2006) shows that when control needs are satisfied following the experience of ostracism, ostracized individuals behave like included participants. Thus, by placing the rejected participants in a power position, potentially

satisfying control needs, Maner et al.'s rejected participants may have no longer suffered need threat, making it unnecessary for them to attempt to satisfy belonging needs by establishing a social bond with the rejecters.

In the current research, ostracized individuals' performance on the cognitive ability task had the potential to help establish a connection with the ostracizing others, something that was absent in Maner's work. In addition, the ostracized participants in the current research had no power over the ostracizers. This analysis suggests that participants are motivated to respond to the concerns produced by the ostracism and take advantage of the avenue(s) that are available to them. In Maner et al.'s (2007) work, the rejected participants could respond to need threat by exerting control but had no opportunity to connect with the rejecters. In the current work, ostracized participants had no opportunity for exerting control over the ostracizers but did believe that they could connect with them. Maner et al.'s work generally suggests that if people feel that they can establish a connection with a group, they will seek that option. Our results are consistent with this premise. Future work could systematically manipulate the avenues of response made available to the ostracized to test this analysis, as well as to determine whether there are systematic preferences for particular avenues of response when multiple possibilities are available.

In sum, this research contributes to our understanding of the processes involved in responses to ostracism. In Experiment 1, ostracized individuals suffered from need threat and performance debilitation when the performance situation was dissociated from the experience of ostracism. However, by linking performance to ostracism in Experiment 2, we provided an avenue that ostracized participants could use to fortify their threatened fundamental needs. Under these circumstances, ostracized participants could respond to the concerns produced by need threat by performing well, which is a means to improve one's inclusionary status (Baumeister & Leary, 1995).

Williams's (2009) temporal model of ostracism asserts an initial pain response followed by an appraisal process that directs need-fortifying responses. The results of the present studies are consistent with this model. Evaluation created a link between the performance situation and the experience of ostracism, and threats to belonging needs directly led to increases in motivation following ostracism. Therefore, the manner in which ostracized individuals construe the situation can have a profound effect on their behavior. As long as excluded individuals perceive an avenue through which they can fortify their threatened needs, they are likely to exploit it and exhibit motivated behavior. However, this research also indicates that if ostracized individuals do not perceive an avenue, they will suffer from threatened needs and can exhibit performance decrements.

Appendix

Assessment of Need Satisfaction Following Ostracism

For each question, participants were asked to circle the number that best represented their feelings experienced during the Cyberball game on 5-point scales (1 = *not at all*, 5 = *extremely*). (R) = reversed scored.

Belonging
I felt "disconnected" (R)
I felt rejected (R)
I felt like an outsider (R)
I felt I belonged to the group
I felt the other players interacted with me a lot

Self-esteem
I felt good about myself
My self-esteem was high
I felt liked
I felt insecure (R)
I felt satisfied

Meaningful existence
I felt invisible (R)
I felt meaningless (R)
I felt nonexistent (R)
I felt important
I felt useful

Control
I felt powerful
I felt I had control over the course of the game
I felt I had the ability to significantly alter events
I felt I was unable to influence the action of others (R)
I felt the other players decided everything (R)

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Notes

1. Neither gender nor the order of the saccade tasks produced any significant effects in any of the statistical analyses reported in either Experiment 1 or Experiment 2 of this research. Thus, these factors are not reported in Results sections.
2. The mediation test was also conducted using the individual measures of motivation: time to launch volitional (correct and corrective; see Figure 2) saccades and adjusted reaction time. Both the need-threat composite and belonging needs remained significant mediators of the effect of ostracism on the individual dependent measures of motivation (volitional saccade launch time and adjusted reaction time), Sobel Zs > 2.00, ps < .05. For ease of presentation, only the composite measure of motivation is reported in the Results. Furthermore, the mediation analyses were conducted only in the evaluation condition because ostracism had no impact on motivation when performance could not be evaluated in Experiments 1 and 2.

References

Bach, M., Bouis, D., & Fischer, B. (1983). An accurate and linear infrared oculometer. *Journal of Neuroscience Methods, 9*, 9-14.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117,* 497-529.

Ben-Zeev, T., Fein, S., & Inzlicht, M. (2005). Arousal and stereotype threat. *Journal of Experimental Social Psychology, 41*, 174-181.

Blascovich, J., & Mendes, W. B. (in press). Social psychology and embodiment. *Handbook of Social Psychology*.

Carter-Sowell, A. R., Chen, Z., & Williams, K. D. (2008). Ostracism increases social susceptibility. *Social Influence, 3*, 143-153.

Case, T. I., & Williams, K. D. (2004). Ostracism: A metaphor for death. In J. Greenberg, S. L. Koole, & T. Pyszczynski (Eds.), *Handbook of experimental existential psychology* (pp. 336-351). New York, NY: Guilford.

Cottrell, N. B. (1972). Social facilitation. In N. B. McClintock (Ed.), *Experimental social psychology* (pp. 185-236). New York, NY: Holt, Rinehart & Winston.

Crevits, L., & Vandierendonck, A. (2005). Gap reflex in reflexive and intentional prosaccades. *Neuropsychobiology, 51*, 39-44.

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*, 355-391.

Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science, 302,* 290-292.

Ford, K. A., Goltz, H. C., Brown, M. R. G., & Everling, S. (2005). Neural processes associated with antisaccade task performance investigated with event-related fMRI. *Journal of Neurophysiology, 94*, 429-440.

Harkins, S. (2006). Mere effort as the mediator of the evaluation-performance relationship. *Journal of Personality and Social Psychology, 91*, 436-455.

Jamieson, J. P., & Harkins, S. G. (2007). Mere effort and stereotype threat performance effects. *Journal of Personality and Social Psychology*, *93*, 544-564.

Kane, M. J., Bleckley, M. K., Conway, A. R. A., & Engle, R. W. (2001). A controlled-attention view of working memory capacity. *Journal of Experimental Psychology: General, 130*, 169-183.

Kenny, D. A., Kashy, D. A., & Bolger, N. (1998). Data analysis in social psychology. In D. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *Handbook of social psychology* (4th ed., Vol. 1, pp. 233-265). New York, NY: McGraw-Hill.

Kirk, R. (1995). *Experimental design*. Pacific Grove, CA: Brooks/Cole.

Lakin, J. L., Chartrand, T. L., & Arkin, R. M. (2008). I am too just like you: Nonconscious mimicry as an automatic behavioral response to social exclusion. *Psychological Science, 19*, 816-822.

Leary, M. R. (1999). Making sense of self-esteem. *Current Directions in Psychological Science, 8*, 32-35.

Leary, M. R., Haupt, A. L., Strausser, K. S., & Chokel, J. T. (1998). Calibrating the sociometer: The relationship between interpersonal appraisals and state self-esteem. *Journal of Personality and Social Psychology, 74,* 1290-1299.

Leary, M. R., Tambor, E. S., Terdal, S. K., & Downs, D. L. (1995). Self esteem as an interpersonal monitor: The sociometer hypothesis. *Journal of Personality and Social Psychology, 2,* 518-530.

Maner, J. K., DeWall, C. N., Baumeister, R. F., & Schaller, M. (2007). Does social exclusion motivate interpersonal reconnection? Resolving the "porcupine problem." *Journal of Personality and Social Psychology, 92*, 42-55.

McFall, S., Jamieson, J. P., & Harkins, S. (2009). Testing the generalizability of the mere effort account of the evaluation-performance relationship. *Journal of Personality and Social Psychology, 96*, 135-154.

O'Brien, L. T., & Crandall, C. S. (2003). Stereotype threat and arousal: Effects on women's math performance. *Personality and Social Psychology Bulletin, 29*, 782-789.

Roberts, R. J., Hagar, L. D., & Heron, C. (1994). Prefrontal cognitive processes: Working memory and inhibition in the antisaccade task. *Journal of Experimental Psychology: General, 123*, 374-393.

Rohleder, N., Wolf, J. M., Maldonado, E. M., & Kirschbaum, C. (2006). The psychosocial stress-induced increase in salivary alpha-amylase is independent of saliva flow rate. *Psychophysiology, 43*, 645-652.

Stuyven, E., Van der Goten, K., Vandierendonck, A., Claeys, K., & Crevits, L. (2000). The effect of cognitive load on saccadic eye movements. *Acta Psychologica, 104*, 69-85.

Unsworth, N., Schrock, J. C., & Engle, R. W. (2004). Working memory capacity and the antisaccade task: Individual differences in voluntary saccade control. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30*, 1302-1321.

Van Beest, I., & Williams, K. D. (2006). When inclusion costs and ostracism pays, ostracism still hurts. *Journal of Personality and Social Psychology, 91,* 918-928.

Warburton, W. A., Williams, K. D., & Cairns, D. R. (2006). When ostracism leads to aggression: The moderating effects of control deprivation. *Journal of Experimental Social Psychology, 42*, 213-220.

Williams, K. D. (2007). Ostracism. *Annual Review of Psychology, 58,* 425-452.

Williams, K. D. (2009). Ostracism: Effects of being ignored and excluded. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 41, pp. 279-314). New York, NY: Academic Press.

Williams, K. D., Cheung, C. K. T., & Choi, W. (2000). CyberOstracism: Effects of being ignored over the Internet. *Journal of Personality and Social Psychology, 79,* 748-762.

Williams, K. D., & Jarvis, B. (2006). Cyberball: A program for use in research on ostracism and interpersonal acceptance. *Behavior Research Methods, Instruments, and Computers, 38,* 174-180.

Zadro, L., Williams, K. D., & Richardson, R. (2004). How low can you go? Ostracism by a computer lowers belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology, 40,* 560-567.

Zajonc, R. (1965). Social facilitation. *Science*, *149*, 269-274.