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ORIGINAL RESEARCH

Social Rejection but Not Ostracism Increases Cognitive Effort Avoidance

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Purpose: Social exclusion has been found to have a significant impact on cognitive control processing. However, the existing research on this topic has yielded inconsistent findings, possibly due to variations in the type of exclusion and individuals' cognitive effort. Two studies were conducted to explore the influence of social rejection and ostracism on cognitive effort avoidance.

Participants and Methods: Study 1 involved forty-six adults who were randomly divided into a rejection group and a control group using a get-acquainted paradigm. The demand selection task (DST) was used to measure cognitive effort avoidance. In Study 2, forty-eight adults were recruited, Cyberball and DST paradigms were used to evoke ostracism and test cognitive effort avoidance, respectively.

Results: The results of study 1 showed that individuals who were socially rejected by their partners exhibited impaired response accuracy of cognitive control and increased cognitive effort avoidance. This indicates that social rejection has a negative impact on cognitive control processing and that individuals may be more likely to avoid cognitive effort when experiencing social rejection. The results of study 2 showed that ostracism had an impact on both response speed and accuracy, but it did not significantly affect cognitive effort avoidance. This indicates that social rejection affects cognitive control processing differently than ostracism, and individuals are more likely to avoid cognitive effort when experiencing social rejection.

Conclusion: These findings suggest that social rejection and ostracism have different effects on cognitive effort, which may contribute to the inconsistent cognitive performance during social exclusion. Future research may explore the underlying mechanisms that lead to these differences and examine how individuals can mitigate the negative effects of social exclusion on cognitive control processing.

Keywords: social rejection, ostracism, demand selection task, cognitive control, cognitive effort

Introduction

As social animals, humans have a natural inclination to maintain positive and stable relationships with others.[1] However, social exclusion, which refers to the experience of being kept apart from others physically or emotionally, can sever social connections and cause a range of physical and psychological pain. It is considered one of the most agonizing experiences humans endure, which can reduce self-regulation ability and increase impulsivity and risk-taking behaviors.[2,3] This may be due to the fact that social exclusion affects fundamental cognitive processes, such as cognitive control.[4,5] The experience of social exclusion derives from two reasons, rejection and ostracism, which leads to different allocation of mental resources during cognitive processes (cognitive effort) and thus have various effect on cognitive control.[6,7] However, research on how ostracism and rejection affect cognitive effort and modulate cognitive control is still lacking.

Several studies have explored the modulatory effects of social exclusion on cognitive processes. According to cognitive deconstruction theory, social exclusion leads to a state of cognitive disintegration, including unresponsiveness and emotional numbness.[8] Recent studies suggested that acute stress resulting from social exclusion causes individuals to shift from flexible, effortful behaviors to more primitive, rigid, but less cognitively demanding forms of control.[9–11] Negative emotions induced by social stress are believed to recruit a large amount of cognitive resources, leaving insufficient resources for cognitive control.[12–14] However, cognitive control capacity can be improved by timely and

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appropriate rewards that reduce negative emotions related to exclusion.[15–17] These findings emphasized that social exclusion directly alters cognitive control processing and has significant implications for human behavior and social functioning.[18,19]

Notably, recent studies on cognitive effort have highlighted that cognitive performance is not solely determined by cognitive control but is also influenced by cognitive effort selection.[20–22] That is, people either expend cognitive effort to pursue valuable outcomes or they do not because the expected benefits are too low, and cognitive effort fundamentally involves the regulation of cognitive control during the pursuit of goals. Several recent studies have shown that poor performance in cognitive control task is not a consequence of impaired cognitive processing but rather a tendency to avoid cognitive effort.[23–25] Several other studies have also shown that stress or punishment can weaken individuals' motivation of cognitive effort.[26–28] A recent psychosocial stress research found that acute stress decreased individuals' preference for higher demanding behavior, whereas cognitive control performance remained intact.[9] Expected value of control (EVC) model suggested that higher cognitive control requires more cognitive effort costs, but these costs are balanced by the expected benefits of cognitive control.[21,22,29] That is, when the expected benefits are higher, individuals are more likely to choose cognitive effort and enhance cognitive control. This might explain why social exclusion leads to different behavioral outcomes and might be related to individuals' expected value assessment of cognitive control.

In fact, socially excluded individuals would try to relieve the social pain through various methods, many of which appear to be quite contradictory. In the model of social monitoring system, socially excluded individuals would motivate to attend more carefully to social cues to gain belongingness in the subsequent social interactions. In this case, individuals are willing to apply more cognitive effort to regain acceptance.[12] Williams proposed that the responses to social exclusion are generally categorized into fight-flight-freeze (negative outcomes) and tend-and-befriend (positive outcomes).[1] These contradictory responses to social exclusion could be related to cognitive effort motivation, an idea that is compelling but has not been directly verified.[30] It might be because it is difficult to distinguish whether the effect of social exclusion on individuals is a cognitive control of processing or a resource allocation of cognitive effort. For instance, Baumeister et al found that excluded people showed a decrease cognitive performance in complex cognitive tasks such as effortful logic and reasoning but has no effect on simple information processing.[2,31] It suggested that people would reduce cognitive effort when the expectation of re-establishing social bonds was low. However, Riva et al found that social exclusion increases participants do something effortful in uncomfortable conditions as requested by the experimenter.[32] They suggested that acute social exclusion makes people more effort to highlight their own value when the expectation of re-establishing social bonds was high. These inconsistent findings may be due to the different social exclusion paradigms adopted. The types of social exclusion often involve rejection or ostracism. Social rejection was defined as being explicitly told one is not wanted and ostracism was primarily characterized by being ignored.[1,33,34]

Previous research has found a correlation between the performance of excluded individuals on cognitive tasks and resource allocation for cognitive effort, as well as the type of social exclusion experienced.[31,35–37] In this study, we aimed to directly test whether social exclusion reduces motivation for high cognitive demanding behaviors by manipulating social rejection and ostracism using a get-acquainted paradigm and Cyberball game, respectively. Subsequently, subjects' cognitive effort selection tendencies were then measured using the demand-selection task (DST), a paradigm developed by Kool and colleagues.[38,39] In the DST, participants had to choose between two cognitive demand options, with the high cognitive demand option having a higher probability of switching between two simple tasks. Previous DST studies have shown that participants tend to choose the low cognitive demand option, indicating a general preference for avoiding cognitive effort in humans. However, this preference is not solely determined by task requirements but is also influenced by moderating factors such as affective state, personality traits, and reward expectations. For example, studies have found that ostracized females may exert more cognitive effort to enhance social connections, while rejection may temporarily decrease the cognitive effort required for self-regulation.[40–42]

More importantly, previous research has found that acute social rejection induces anger-related emotion and leads to a failure of self-control, whereas ostracism induces anxiety-related emotion and leads to a threatened need to belong. They are consistent with the cognitive deconstruction theory and according to the different emotion and cognitive effects of rejection and ostracism, the types of social exclusion may affect cognitive effort avoidance, leading to differences in the effects on cognitive control. However, no research to date has investigated the influence of social exclusion on

cognitive effort. Hence, we hypothesized that social rejection would lead to more cognitive effort avoidance compared to ostracism, by reducing the perceived benefit of cognitive effort. Socially rejected individuals would be unwilling to exert further cognitive effort for cognitive control and would show stronger cognitive effort avoidance in comparison to the control group.

In study 1, we first tested whether social rejection is more likely to increase cognitive effort avoidance to high cognitive demand task than that to low cognitive demand. Considering that there are two types of social exclusion, we tested whether the findings from study 1 would be replicated under ostracism circumstances in study 2.

Study 1

In this study, we explored how social rejection affect cognitive effort. A modified get-acquainted paradigm and demand-selection task were used to induce social rejection and test cognitive effort avoidance, respectively.[31,38,43]

Methods

Participants

Participants were recruited through the online social platform. With both age and sex controlled for balance, forty-six right-handed students (22 females, 23.3 ± 2.2 years) were recruited for the current study and divided randomly into two groups: rejection group (23 participants, 11 females, 23.5± 2.6 years) and control group (23 participants, 11 females; mean age = 22.1; SD = 2.4). All participants were right-handed, had normal or corrected-to-normal vision and reported no history of neurological or psychiatric disorders. Informed consent was obtained from all participants and the study protocol was approved by the Ethics Committee of Anhui Normal University, China. In addition, two experimenters (1 male and 1 female) were recruited as confederates in the current study. The two experimenters were stranger to all the participants in our experiment.

Rejection Design and Procedure

To induce the feeling of social rejection, a modified get-acquainted paradigm was used in the present study. In this paradigm, rejection was manipulated between a participant and a confederate(experimenter), using the get-acquainted discussion followed by a cooperative task. Then, the experimenter told the participant that his/her partner did not want to cooperate with them due to the low performance during the task. All the tasks were programmed using E-prime 2.0 (Psychology Software Tools, Pittsburgh, PA). All the instruments were transformed into Chinese versions in the present study. The detailed procedure is described below.

In the first session, the participant was told to cooperate on a task with another same-sex confederate. Before the task, both participant and confederate had to answer ten interview questions orally, including daily lives, hobbies, favorite movies, etc., and then were required to evaluate each other in the purpose of getting acquainted better. Then the participant and confederate seated at their own computers separately, completing a two-person task switching through the computer network, which is modified based on the classical task switching. Both the participant and confederate viewed same stimuli on two monitor screens and asked to response as accurately and quickly as possible. To make sure participants believe the confederate was a real participant, we manipulated that once the confederate responded more quickly, the stimuli would disappear without participant's response.

In task switching, the stimulus was a single-digit number (1–4, 6–9) coloring red or yellow. If the digit number was red, participants were required to judge whether the number is larger or smaller than 5. If the digit number was yellow, participants were required to judge whether the number is even or odd. In this task, participants had to respond to a series of pair-trials (AABBABAB), including switch (AB or BA) and non-switch (AA or BB) condition. Each trial involved the following sequence of events: (a) presentation of a fixation sign for 800 ms; (b) presentation of target stimuli, which remained visible until 2500 ms had elapsed or a response occurred; (c) a trial interval of 1000 ms. Participants were instructed to respond with the digit number.

In the second session, we performed a rejection manipulation by a modified get-acquainted paradigm. When experiment was in process for about 5 minutes, for the rejection group, the confederate would interrupt the task and told experimenter that he/she reject to continue playing with the participant. When the experimenter asked the

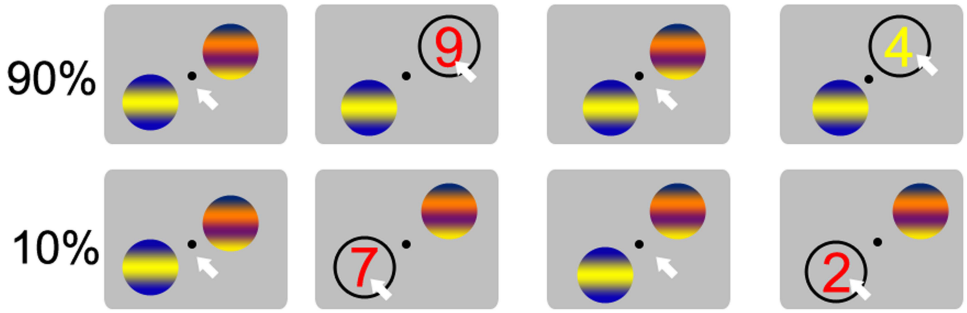

Figure 1 The demand-selection task: Participants were instructed to hover the mouse cursor (white arrow) on one image and choose one of two pattern cues. The cue reveals a random number (range = 1–4 and 6–9) presented in either yellow or red. They had to judge the number's parity (red: whether the number is odd or even) or magnitude (yellow: whether the number is odd or even) by pressing the left or right mouse button. In each block, one of the cues corresponds to a task switching probability of 90% (high demand), while the other cue corresponds to a task switching probability of 10% (low demand).
Notes: Adapted from Bogdanov M, Nitschke JP, LoParco S, Bartz JA, Otto AR. Acute Psychosocial Stress Increases Cognitive-Effort Avoidance. *Psychol Sci*. 2021;32(9):1463–1475. Creative Commons.[9]

confederate some questions, for example, "What's wrong? Why do you want to exit this game?" The confederate answered like "I just don't want to cooperate with this guy". Then the experimenter tried to persuade the confederate to complete the task; however, the confederate refused to cooperate and request for cooperating with other people at another time. In contrast, for the control group, the participant was told that his/her confederate could not continue playing with them because of emergency. Finally, the participants for both rejection and control groups were told that they had to complete the task by themselves.

In the third session, participants had to complete the next demand-selection task (DST) alone. As shown in Figure 1, the DST refers to the design of Bogdanov et al;[9] participants were presented with two distinct visual cues that contained a tagged image. Participants were instructed to hover the mouse cursor on one image and select a cue, which would reveal a random single-digit number (1–4 and 6–9) presented in either red or yellow. They had to judge the number's parity (red) or magnitude (yellow) by pressing the left or right mouse button. Unbeknownst to participants, in each block, one of the cues corresponds to a task switching probability of 90% (high demand), while the other cue corresponds to a task switching probability of 10% (low demand). In high demand condition, participants had to recruit more cognitive resources to the more probably to switch task according to different colors compared to low demand condition. After responding to the target, all stimuli disappeared, and no performance-related feedback (reward or punishment) presented on the screen. In total, the whole DST contained 300 trials and lasted approximately 20 min.

Self-Reported Assessment

After the DST paradigm, each participant was instructed to report how they felt during the whole task and then completed two questionnaires including (PANAS) to measure both positive and negative affect,[44] and Need-Threat Scale for an indication of social rejection distress (NTS).[45]

Statistical Analysis

In accordance with previous studies, the self-reported assessment and low-demand choice rates were analyzed using an independent samples *t*-test. In order to test the difference in cognitive effort avoidance between the rejection and control group, repeated-measures analysis of variance (ANOVA) was performed separately for the reaction time (RT) and percentage errors, with trial type (switch vs repeat) and demand (low vs high) as within-subject factors and group (rejection vs control) as a between-subjects factor.

Results and Discussion

The self-reported assessment data confirmed that the get-acquainted paradigm successfully induced social rejection. Independent samples *t*-test (rejection vs control) for NTS and PANAS showed that NTS scores were significantly higher in rejection group than that in control group [t (46) = 4.14, $p < 0.05$].

Table 1 Behavior Results of DST in Study 1

	Rejection	Control	*p*
Low-demand choice rates	65.23 ± 17.26%	57.22 ± 15.32%	<0.05
Repeat trials RT	1009 ± 143 ms	1023 ± 118 ms	>0.05
Switch trials RT	1239 ± 182 ms	1248 ± 231 ms	>0.05
Percentage errors	5.2 ± 1.55%	2.7 ± 1.16%	<0.01

As shown in Table 1, for the demand choice in DST, rejection group [M = 65.23%, SD = 17.26%] showed significantly low-demand choice rates in DST, when compared with the control group (M = 57.22%, SD = 15.32%), [t (46) = −2.85, $p < 0.05$, $d = 0.75$]. For RT, the ANOVA revealed a significant main effect of trial type [F (1, 45) = 38.91, $p < 0.01$, $\eta^2 = 0.51$], with longer RTs for switch trials [M = 1260 ms, SD = 231 ms] than that for repeat trials [M = 1012 ms, SD = 126 ms]. For the percentage errors, the ANOVA showed a significant main effect of trial type [F (1, 45) = 33.20, $p < 0.001$, $\eta^2 = 0.48$], with higher percentage errors in switch trials [M = 4.6%, SD = 1.26] than repeat trials [M = 2.1%, SD = 0.95%]; and a significant main effect of group [F (1, 45) = 21.22, $p < 0.01$, $\eta^2 = 0.36$], with higher percentage errors for rejection group [M = 5.2%, SD = 1.55%] than for control group [M = 2.7%, SD = 1.16%]. Besides, neither other main effects nor interactions reached significance, all $ps > 0.05$.

Considering the self-reported assessment data, the get-acquainted paradigm successfully induced social rejection. Replicating previous findings, self-reported assessment results presented multiple consequences of social rejection, including increased participants' negative affect and feelings of need-threat, decreased positive affect. More importantly, as expected, the results of this first study showed that rejection group were more likely to choose low-demand option, which support the hypothesis that social rejection increases cognitive effort avoidance.

Study 2

The aim of this study was to further investigate how another type of social exclusion (ostracism) affect cognitive effort avoidance. Here, the Cyberball game and DST paradigm were used to induce ostracism and test cognitive effort avoidance, respectively. We hypothesized that ostracism would also increase cognitive effort avoidance.

Methods

Participants

Participants were recruited through the online social platform. With both age and sex controlled for balance, forty-eight right-handed students (24 females; 24.2 ± 3.2 years) were recruited for study 2 and divided randomly into two groups: ostracism group (24 participants, 12 females; 24.5 ± 3.6 years) and control group (24 participants, 12 females; 24.1 ± 2.6 years). All participants were right-handed, had normal or corrected-to-normal vision and reported no history of neurological or psychiatric disorders. Informed consent was obtained from all participants and the study protocol was approved by the Ethics Committee of Anhui Normal University, China.

Ostracism Design and Procedure

As shown in Figure 2, the Cyberball game was developed by Williams and used to manipulate ostracism. In the present study, the instrument was transformed in Chinese version. Before the task, participants were instructed that they would play an online virtual ball-tossing game with two other participants. In Cyberball game, participants saw an animated ball-tossing game and two other players were also in the upper corners of the screen accompanied by their names. Both ostracism and control group started with an inclusion condition by having each player receive the ball equally often. After 10 ball tosses, the ostracism group received the ball only once at the beginning, and then got ostracized and never receiving the ball for the last time of the game. However, the control group received an equal amount of the ball tosses throughout the game. The Cyberball games consisted of a total of 60 ball tosses and lasted approximately 5 min in both

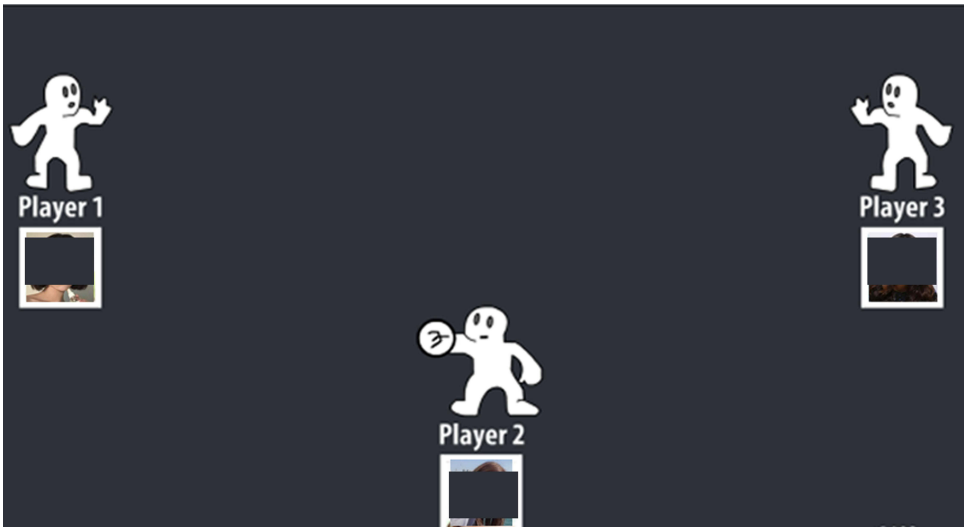

Figure 2 Cyberball game display: Participants are displayed as photographs at the bottom of the screen and the two other players as photographs in the upper corners of the screen.

ostracism and control group. After finishing the Cyberball game, participants had to complete the DST, which was the same as in study 1.

Self-Reported Assessment

Same as in study 1, after the DST paradigm, each participant was instructed to report how they felt during the whole task, then completed PANAS and NTS.

Statistical Analysis

Same as in study 1, the self-reported assessment and low-demand choice rates were analyzed using an independent samples *t*-test. To test the difference in cognitive effort avoidance between the ostracism and control group, repeated-measures analysis of variance (ANOVA) was performed separately for the reaction time (RT) and percentage errors, with trial type (switch vs repeat) and demand (low vs high) as within-subject factors and group (ostracism vs control) as a between-subjects factor.

Results and Discussion

The self-reported NTS and PANAS results confirmed that ostracism manipulation was effective. Independent samples *t*-test for NTS showed a higher score [t (47) = 7.73, $p < 0.001$, $d = 1.50$] for the ostracism group ($M = 34.67$, $SD = 8.23$) than for the control group ($M = 23.43$, $SD = 7.12$). Additionally, the PANAS results showed that the negative affect scores were significantly higher in ostracism group than that in control group [t (47) = 5.24, $p < 0.05$, $d = 1.13$].

As shown in Table 2, for the low-demand choice rates in DST, the results showed no significant difference [t (47) = −1.66, $p = 0.11$, $d = 0.35$] between the ostracism ($M = 54.42\%$, $SD = 12.24\%$) and control group ($M = 56.82\%$, $SD = 12.52\%$). For the

Table 2 Behavior Results of DST in Study 2

	Ostracism	Control	*p*
Low-demand choice rates	54.42 ± 12.24%	56.82 ± 12.52%	>0.05
Repeat trials RT	1012 ± 198 ms	1142 ± 158 ms	<0.05
Switch trials RT	1255 ± 232 ms	1395 ± 241 ms	<0.05
Percentage errors	4.2 ± 1.42%	2.1 ± 0.54%	<0.01

RT, the ANOVA revealed a significant main effect of trial type [F (1, 47) = 35.21, $p < 0.01$, $\eta^2 = 0.48$], with longer RTs for switch trials (M = 1360 ms, SD = 216 ms) than for repeat trials (M = 1102 ms, SD = 156 ms); and a significant main effect of group [F (1, 47) = 25.18, p < 0.01, $\eta^2 = 0.45$], with faster responses for the ostracism group (M = 1145 ms, SD = 182 ms) than for the control group (M = 1257 ms, SD = 173 ms). For the percentage errors, the ANOVA showed a significant main effect of trial type [F (1, 47) = 28.18, $p < 0.001$, $\eta^2 = 0.49$], with more percentage errors in switch trials (M = 4.3%, SD = 1.12%) than repeat trials (M = 2.4%, SD = 0.95%); and a significant main effect of group [F (1, 47) = 25.32, $p < 0.01$, $\eta^2 = 0.39$], with higher percentage errors for ostracism group (M = 4.2%, SD = 1.42%) than for control group (M = 2.1%, SD = 0.54%). Besides, neither other main effects nor interactions reached significance, all $ps > 0.05$.

According to the NTS and PANAS scores, the results suggested that the Cyberball game successfully induced need threat and negative emotion, confirming the effective of the ostracism manipulation. More importantly, contrary to expectation, the result of study 2 showed no significant difference between the ostracism and control group, which suggested that ostracism have no significant influence on cognitive effort avoidance.

General Discussion

To verify the difference in the effect of social rejection and ostracism on cognitive effort avoidance, two studies employed get-acquainted paradigm and Cyberball game, respectively, to compare the influences of rejection and ostracism on cognitive effort avoidance in the demand selection task. The results found that both get-acquainted and Cyberball paradigm were successful in eliciting need threat and negative emotion in exclusion group. As predicted, we found that social rejection engendered a stronger preference to select the low demand choice, which consist of less frequent task switches. However, this cognitive effort avoidance was not found in ostracism group. Importantly, we found that social rejection only decreases accuracy and has no significant effect on respond speed (study 1), while ostracism leads to a significant increase in both respond speed and the error rate (study 2). These interesting findings suggested that there might be various underlying mechanisms by different types of social exclusion. By comparing the two studies, we found that both social rejection and ostracism are widely observed to impair cognitive control, which is often attributed to the deconstruction of cognitive processing and leads to a cognitive effort avoidance.[8] However, the mechanisms underlying the influence of social exclusion on cognitive effort are currently inconsistent and incomplete. Although no study has directly explored how different type of social exclusion affect cognitive effort, previous studies seem to indicate that rejection-based and ostracism-based exclusion affect cognitive effort differently.[34,46] We will discuss them separately next.

The results of DST during social rejection found a significant low demand choice rate in rejection group than in the control group. It demonstrated that social rejection decreases individual's willingness to engage in cognitive effort when facing with various difficult level of cognitive tasks. This rejection-induced increase in cognitive effort avoidance was consistent with previous studies, proving that social rejection impairs self-control, which is typically thought of as an effortful process.[31,47,48] According to the cognitive deconstruction theory, social rejection leads individuals to enter a defensive state of cognitive deconstruction to avoid meaningful thought.[43] Especially in get-acquainted paradigm, participants are led to believe their partner reject to cooperate with them, and rejected participants engaged in decreasing of cognitive control. Even though the RTs of DST in study 1 showed no significant difference between rejection and control group, the accuracy results revealed that social rejection decreases cognitive performance. These findings seemed to consist with previous findings that social rejection results in reduced cognitive abilities.[5,31] They proposed that social exclusion impairs cognitive performance by causing deficits in controlled processing mental resources were recruited to suppress emotional distress. Based on previous studies and the current findings in DST, another potential explanation for the impaired cognitive performance of rejected individuals might be provided by the expected value of control model.[29] Rejected individuals had to suppress emotional distress, the allocation processing resources of cognitive control would be serviced for emotional processing, and the cost was higher than benefit during cognitive demand selection task.[12,48,49] To sum up, the rejection-based exclusion found that when experiencing social rejection, the positive affective would be decreased while the need for threat and negative affective would be increased, resulting in an increase in the cognitive effort avoidance and an impaired cognitive control.

For the results of DST during ostracism, we found that the accuracy, like social rejection, was decreased in ostracism group. However, the respond speed, unlike social rejection, was significantly faster in ostracism group than in control group for both switch and repeat conditions. Previous studies of social exclusion had shown a link between impulsive behavior and ostracism. The pattern of cognitive control linked to ostracism, ie, increased respond speed and decreased accuracy, could thus be based on an underlying decrease of cognitive effort. In addition, it was notable that low demand choice rate in DST did not show a difference between ostracism and control group. To be specific, the cognitive effort avoidance showed a different pattern during ostracism compared to social rejection, ostracized individuals had to allocate mental resource to sustain response preparation to cognitive control, especially for the conflict detection. It could be explained by sociometer theory, ostracized individuals tried to achieve a high-quality performance in DST, in order to increase the awareness of the relational value to adjust self-esteem. In summary, ostracism promoted individuals to seek relational value and self-esteem, resulting in an increase in response speed and decrease in accuracy, whereas the cognitive effort avoidance was not changed.

Taken together, in the results of DST during social rejection and ostracism, there were two major findings. Firstly, being socially rejected by partners impairs response accuracy of cognitive control and leads to an increase of cognitive effort avoidance. Secondly, ostracism impacts both response speed and accuracy while having no significant effect on the cognitive effort avoidance. According to cognitive deconstruction theory, social rejection impairs meaningful thought, and subsequently leads to escape from self-awareness. This may explain why rejected individuals' tendency to avoid high demanding courses of cognitive control. However, sociometer theory suggested that self-esteem system evolved as a monitor of social acceptance, and excluded individuals would maintain cognitive effort to increase their values. Consequently, converging with previous theories, the present two studies provide us with a comprehensive understanding of how social exclusion influences cognitive effort. It offered a new direction to explain the interaction between social exclusion and cognitive ability, which was various in previous studies. As far as we know, it is the first study to investigate the influence of different types of social exclusion on cognitive control and cognitive effort. Combined with previous controversies, social rejection and ostracism have different effects on cognitive effort, which may be a potential factor leading to the inconsistency cognitive performance during social exclusion. Combined with previous controversial findings, social rejection and ostracism have different effects on cognitive effort, which may be an important factor leading to the inconsistency between different theories or models. It is necessary to consider the cognitive effort avoidance related to factors in promoting prosocial behaviors during social exclusion. For example, ostracized individuals' desire to regain acceptance may be tended to pay more cognitive effort, then we could enhance prosocial behavior by affirming their cognitive performance. However, socially rejected individuals tend to pay less cognitive effort, then we had to increase prosocial behavior by rewarding their cognitive performance.

Limitations and Future Directions

The current study still has limitations to some extent. Firstly, only self-reported assessment was used to confirm the manipulation of social exclusion, which could not distinguish well between the affective response to social rejection and ostracism. Further research needs to consider more indicators to distinguish between social rejection and ostracism. Secondly, task switching can only test one sub-component of cognitive control, which may show a different cognitive effort in other sub-component of cognitive control, such as inhibitory control and working memory. Further studies are encouraged to evaluate whether cognitive effort avoidance might be changed in other subdomains of cognitive control task during social exclusion. Thirdly, there are many paradigms of social exclusion, but we only use two paradigms to manipulate social rejection and ostracism, which cannot represent all types of social exclusion. Future studies are encouraged to use more ecological paradigms to explore the impact of social exclusion on cognitive effort avoidance.

Conclusion

In conclusion, this study provides evidence that social rejection is associated with an increase in cognitive effort avoidance and a decrease in response accuracy in the demand selection task, whereas ostracism is associated with impairments in response speed and accuracy in cognitive control without affecting cognitive effort avoidance. It provides new insights into the interaction between social exclusion and cognitive ability, which has been a topic of debate in

previous studies. Even though both social rejection and ostracism modulate cognitive control during task switching, they support cognitive deconstruction theory and social monitoring model, respectively. That is, social rejection leads to cognitive deconstruction, which would increase cognitive avoidance and result in worse task performance. However, ostracism promotes individuals to pay more attention to social information and actively seek cognitive efforts to regain social connection. By distinguishing between social rejection and ostracism, the study highlights the different effects of these two types of social exclusion on cognitive effort. The findings have implications for understanding how social exclusion impacts cognitive performance and may inform interventions aimed at reducing the negative effects of social exclusion on cognitive functioning.

Data Sharing Statement

The data that support the conclusions of this article will be made available by the first author, without undue reservation.

Ethics Approval and Informed Consent

The study complied with the Declaration of Helsinki and followed its ethical codes for individuals, samples and data collection involved in each research procedure. This study involving human participants was reviewed and approved by the Ethics Committee of Anhui Normal University, China. The participants provided their written informed consent to participate in this study.

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Disclosure

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