frontiers | Research Topics

The emotional antecedents and consequences of social rejection

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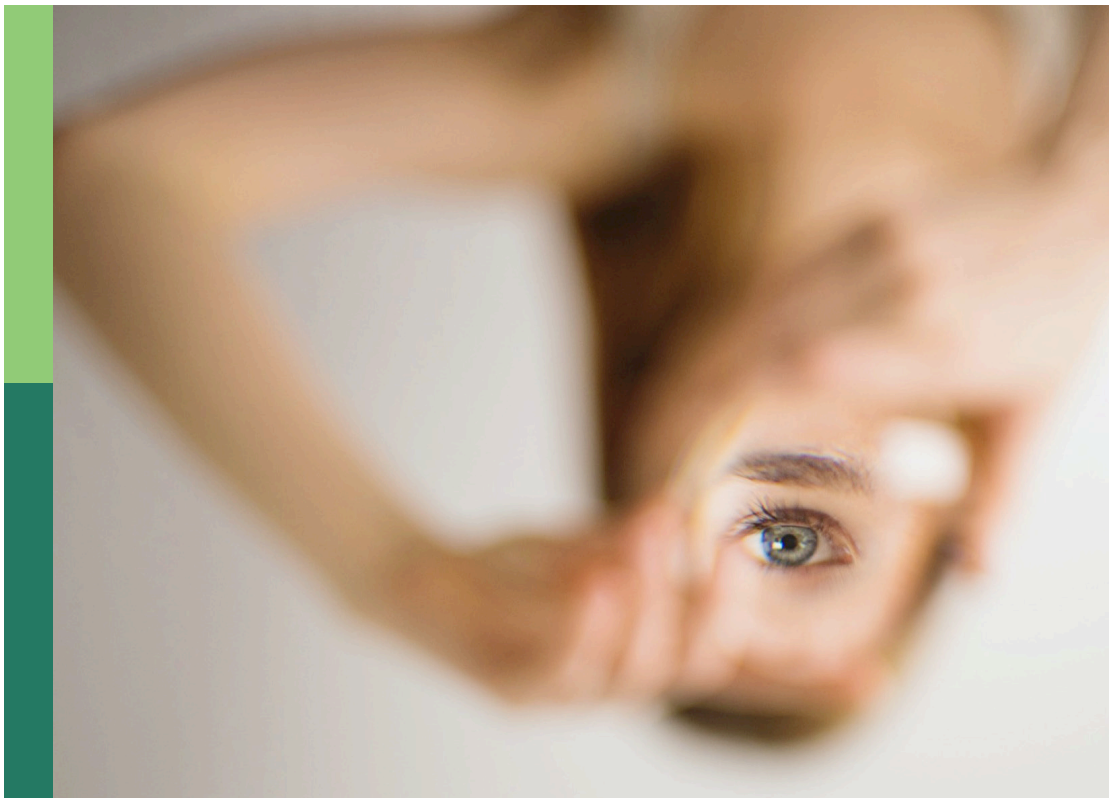
Published in
Frontiers in Psychology



ISSN 1664-8714
ISBN 978-2-8325-3636-0
DOI 10.3389/978-2-8325-3636-0

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The emotional antecedents and consequences of social rejection

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Citation

Pond, R., Terrizzi, J., Kamble, S. V., eds. (2023). *The emotional antecedents and consequences of social rejection*. Lausanne: Frontiers Media SA.
doi: 10.3389/978-2-8325-3636-0

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frontiers | Frontiers in Psychology

TYPE Editorial
PUBLISHED 21 September 2023
DOI 10.3389/fpsyg.2023.1279894

OPEN ACCESS

EDITED AND REVIEWED BY
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George Mason University, United States

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RECEIVED 18 August 2023
ACCEPTED 05 September 2023
PUBLISHED 21 September 2023

CITATION
Pond RS Jr, Terrizzi JA Jr and Kamble SV (2023) Editorial: The emotional antecedents and consequences of social rejection. *Front. Psychol.* 14:1279894. doi: 10.3389/fpsyg.2023.1279894

Editorial: The emotional antecedents and consequences of social rejection

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KEYWORDS

social rejection, social exclusion, social pain, ostracism, stigma, emotion

Editorial on the Research Topic
The emotional antecedents and consequences of social rejection

Introduction

Social scientists have long argued that the need to belong is a central feature of human psychology and a cross-cultural human universal (Baumeister and Leary, 1995). Not only does social connection provide us with numerous survival benefits (e.g., aid in building shelter, providing defense, etc.), but we also tend to suffer from a host of harmful psychological and physiological consequences when our need to belong is thwarted (see DeWall and Bushman, 2011, for a review). As a result, social rejection is an aversive experience that can be strategically employed to inflict harm and punishment.

Social rejection experiences have both emotional antecedents and consequences. That is, strong emotional experiences (e.g., anger, disgust, etc.) within actors may provoke them to engage in social rejection behaviors, whereas targets of rejection may suffer various emotional consequences (e.g., anger, sadness, emotional numbness, etc.). Thus, the role that emotion plays in social rejection is not simple; it is multifaceted (see Figure 1). Negative emotions can provoke social rejection and, reciprocally, the rejection experience can evoke negative emotions in those who are rejected. Positive emotions, however, may act as a buffer or shield that insulates us from the deleterious consequences of rejection.

The goal of the present Research Topic was to provide an opportunity for contributors to present a current overview of the recent theoretical and methodological advances in the areas of belongingness, social rejection, stigma, and emotion in order to shed light on the multifaceted relationship between emotional experience and social rejection. In addition, we hoped to generate discussion about implications for future work in the area, as well as practical applications, and to identify critical gaps left to be explored.

As a result of the work of 22 authors and 21 reviewers, nine manuscripts were published in this Research Topic of *Frontiers in Psychology* (*The emotional antecedents and consequences of social rejection*; participating sections included: *Personality and social psychology, emotion science,* and *evolutionary psychology*) between May 11, 2022 and June 16, 2023. These manuscripts varied in form and methodological approach, including psychophysiological assessments (Park et al.; Yin and Lee), experience-sampling techniques (Wang and Li), self-report methods (Park and Joshanloo; Pfundmair and Mahr), behavioral

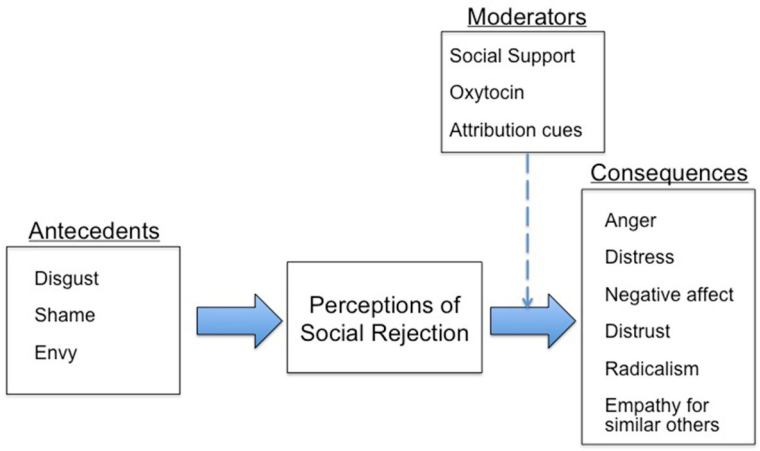

FIGURE 1
Examples of emotional antecedents, consequences, and moderators identified in the present collection of manuscripts.

experiments (Dvir and Nagar; Knausenberger et al.; Yaakobi) and a mini-review (Terrizzi et al.). The basic themes of the contributions fall into three categories: 1. Emotional antecedents to social rejection, 2. Emotional consequences of social rejection, and 3. Emotional buffers or resiliency factors to the consequences of rejection. These themes are discussed further below.

Emotional antecedents

Two papers within the Research Topic focused more directly on the antecedents of rejection. First, Terrizzi et al. summarized evidence that suggests that disgust and shame (i.e., a self-directed form of disgust) are both key antecedents to the rejection experience, due to their roles in promoting stigmatization among actors and self-isolation among targets, respectively. In addition, Wang and Li used experience-sampling techniques to identify envy toward a target as another key antecedent to social rejection.

Emotional consequences

A number of papers within the Research Topic emphasized the emotional consequences of rejection, using a variety of different methods for inducing rejection. For instance, Dvir and Nagar explored sexual objectification as a partial form of ostracism (i.e., when one's body is the focus of another's attention as opposed to one's internal thoughts and feelings). They showed that sexual objectification tended to reduce the incidence of victim-blaming among women, because it increased empathy for other victims of objectification. These effects, however, appeared to be attenuated for women who experienced a form of ostracism that was unrelated to sexual objectification. Knausenberger et al. demonstrated that *phubbing* (i.e., a momentary act of ostracism that occurs when actors divert their attention to their phone instead of their conversation partner) yields negative consequences for mood and trust, similar to more explicit forms of ostracism (e.g., rejection by a group). Likewise, using methods from electroencephalography (EEG), Yin and Lee showed that loneliness primes negatively impacted mood and increased hypervigilance to threat. Further, changes in event-related potentials (ERPs) due to the loneliness primes were negatively associated with prosociality. Finally, Pfundmair and Mahr revealed that feelings of social exclusion as a function of COVID-19 containment policies were associated with increased radicalism, partly as a means of re-establishing feelings of control.

Emotional buffers

Three papers within the Research Topic addressed factors that may buffer or reduce the emotional distress of social rejection. Park and Joshanloo observed, among a South Korean sample, that perceived social support shielded participants from the negative impact that ethnic discrimination (a form of social rejection) has on mood and wellbeing. Park et al. explored reactions to out-group acceptance and rejection among ethnic/racial minoritized participants. They found that the administration of intranasal oxytocin amplified favorable responses (in terms of cardiovascular reactivity, cooperative behavior, and partner perceptions) among Black participants who received positive feedback from White partners. However, intranasal oxytocin also tended to amplify angry reactions to negative feedback from White partners. Finally, Yaakobi explored the mitigating effects of attributional cues during ostracism recovery. Specifically, participants who were able to make unstable and external attributions (e.g., being left out because of "bad luck") showed less distress post-ostracism compared to participants who made stable and internal attributions (e.g., "it's because of my personality").

Concluding remarks

Our hope in presenting this special topic for *Frontiers in Psychology* was to shed light on the multifaceted nature of the relationship between emotional experience and social rejection.

The present collection of papers demonstrated the fundamental connection between our emotional and social lives. Further, they each highlighted new directions for future research, particularly in regards to resiliency factors that may protect against belongingness threats. We would like to thank all the authors and reviewers who contributed to the success of this project.

Author contributions

RP: Writing—original draft. JT: Writing—review and editing. SK: Writing—review and editing.

Acknowledgments

We would like to thank all the authors and reviewers who contributed to the success of this project.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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ORIGINAL RESEARCH
published: 11 May 2022
doi: 10.3389/fpsyg.2022.899564

Recovery From Ostracism Distress: The Role of Attribution

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Ostracism is known to cause psychological distress. Thus, defining the factors that can lead to recovery or diminish these negative effects is crucial. Three experiments examined whether suggesting the possible causes of ostracism to victims could decrease or eliminate their ostracism distress. They also examined whether death-anxiety mediated the association between the suggested possible cause for being ostracized and recovery. Participants ($N = 656$) were randomly assigned to six experimental and control groups and were either ostracized or included in a game of Cyberball. Two control conditions were used: participants who were ostracized but received no explanation and participants who were included. Immediately after the ostracism experience, participants in the experimental groups were presented with one of four causes for being ostracized, using locus of control (internal, external) and stability (stable, unstable), the two causal dimensions of Weiner's attribution theory. After a short delay they were administered a mood or needs-satisfaction questionnaire. The results highlight the interaction between locus of control and stability, and underscore the relative importance of different attributions in alleviating self-reported ostracism distress. Specifically, both external and unstable attributions decreased distress, and an unstable attribution led to complete recovery in some participants. Thus, recovery from ostracism may be accelerated when the victim receives an explanation for ostracism that attributes the incident to unstable, external causes soon after the incident. Death-anxiety fully mediated the association between locus of control attribution and mood, but for on needs-satisfaction or the stability of the attribution.

Keywords: social exclusion, ostracism, attribution, intervention, death anxiety

OPEN ACCESS

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Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *18 March 2022*
Accepted: *21 April 2022*
Published: *11 May 2022*

Citation:
Yaakobi E (2022) Recovery From Ostracism Distress: The Role of Attribution. Front. Psychol. 13:899564. doi: 10.3389/fpsyg.2022.899564

INTRODUCTION

Ostracism effects are widespread in the workplace, school, family, the military, religious groups, and organizations (e.g., Williams, 2007; Sommer and Yoon, 2013; Chung and Kim, 2017; Zhang et al., 2017; Wesselmann et al., 2018). Numerous studies indicate that ostracism occurs in the virtual realm as well [e.g., Donate et al., 2017; see meta-analysis by Hartgerink et al. (2015)].

The experience of ostracism has negative effects on both immediate (reflexive) and delayed (reflective) physiological, cognitive, affective, motivational, and behavioral outcomes, offline and online (e.g., Williams, 2009; Kouchaki and Wareham, 2015; Buelow and Wirth, 2017). For example, ostracized individuals' subsequent behavior was reported to include greater risk-taking (e.g., Buelow and Wirth, 2017), aggression (Liu et al., 2018), dishonesty (Kouchaki and

Wareham, 2015), racist attitudes (Bernstein et al., 2014), and less prosocial behavior (Twenge et al., 2007). Given these negative effects, it is crucial to better understand how to alleviate the distress underlying these outcomes.

One of the coping mechanisms that can alleviate distress is to attribute the cause of ostracism to specific factors. Snoek (1962) argued that attribution is one of the key cognitive processes that occur in the reflective stage. More recently, Williams (2009) has suggested that attributions could alleviate the effects of ostracism. Goodwin et al. (2010) examined whether attributing ostracism to racial prejudice mediated recovery. They indicated that Whites attributed ostracism to racism when the other players were Black; by contrast, Blacks attributed ostracism to racism when the other players were White or Black. Within a few minutes after attribution, the participants reported feeling less distress, but attributing ostracism to racial prejudice impeded their recovery. However, these authors did not characterize the types of attribution used by the ostracism victims. Tuscherer et al. (2016) found that the perceived fairness of being ostracized moderated victims' ostracism response, but they did not systematically vary fair and unfair attributions. Bernstein et al. (2018) examined people's responses to others' exclusion experiences and found that internal attributions decreased the desire for affiliation to a greater extent than external or ambiguous attributions. They also found that empathy toward the target mediated this association. However, people's responses to others' exclusion experiences cannot be deduced from the effects of attribution on the ostracized victims. Moreover, Bernstein et al. only examined the locus of causality, but did not examine other attribution factors. Recently, Yaakobi (2022) have found that attachment orientation mediates the relationship between locus of attribution and ostracism distress. Yaakobi (2021) found that both locus of control (henceforth: locus) and stability attribution are associated with immediate ostracism distress. However, neither of these studies examined the temporal effects of the interaction of locus and stability on recovery after a short delay or the possible mediation processes underlying these effects. Thus, to date, there has been no empirical examination of the role of different types of attribution in alleviating or eliminating victims' ostracism distress, specifically in the reflective stage following the ostracism event or its underlying mechanism.

The three experiments reported below were designed to fill this gap by examining how recovery might be affected by an intervention in which ostracism victims receive explicit cues that prompt specific types of attributions for the ostracism incident. These were examined in the reflective stage *after* victims had the opportunity to dwell on their ostracism experience and its possible causes, which often includes a search for attribution as a coping mechanism. The possible mediation of death anxiety on these effects was also examined. These experiments thus respond to the call for more research "to determine the recovery rate as a function of the attributed ostracism motive" (Williams, 2009, p. 296; Park et al., 2017). Weiner's well-established attribution theory (1972, 1985) served as the foundation for developing the principles of the attribution intervention.

Attribution Theory

Attributions are defined as causal explanations people construct to interpret their world and adapt to their surroundings. They are crucial when individuals find themselves in new, important, as well as negative situations (Weiner, 1985). According to the attributional theory of motivation (Weiner, 1972, 1985), all perceived attributions of success and failure have three causal dimensions: locus (external vs. internal), stability (unstable vs. stable), and controllability (controllable vs. uncontrollable). Here the focus was on locus and stability. This is because in Williams' (2009) need-threat model, sense of control is considered to be one of the basic needs. Including controllability could thus lead to methodological biases which would be even more problematic when examined in parallel with manipulating locus and stability.

Internal attribution refers to the belief that an event was caused by internal factors such as a person's intelligence, whereas external attribution refers to the belief that an event was caused by external factors such as luck. Stable attribution refers to belief that the cause of an event cannot change over time (e.g., personality) while unstable attribution relates to causes that can change over time (e.g., effort). The four possible combinations of internal–external and stable–unstable causes yield four types of attributions that people formulate to explain their own actions and those of others.

For example, a victim of ostracism may attribute the incident to a lack of effort on her part in a game, which corresponds to an internal, unstable (temporary) attribution. Alternatively, the victim may feel that she was ostracized because of task difficulty, which assigns attribution to an external, stable factor. A victim who believes that she was ostracized because she was simply unlucky is making an external, unstable attribution. A victim who believes that she was ostracized because people do not like her personality is making an internal, stable attribution. In this study, it was hypothesized that some forms of attribution could alleviate or even eliminate the effects of ostracism on needs-satisfaction and mood to an extent comparable to participants who were not ostracized. More generally, the aim was to explore how victims' cognitive interpretations of the causes of ostracism were associated with the dynamics of their resultant emotions, thus shedding light on the possible underlying links between attributions and ostracism distress.

Mediating Role of Death-Anxiety

Numerous studies have shown that the feeling of being included in social networks is a core individual need (Case and Williams, 2004). Terror Management Theory (TMT, Greenberg et al., 1997; see meta-analysis in Burke et al., 2010) has been posited to be linked to ostracism in that death anxiety may prompt similar effects to those elicited by ostracism (Case and Williams, 2004), since the ostracism experience is perceived as the negation of other's existence. Individuals need to be recognized as sentient humans to be shielded against a sense of angst and purposelessness (Greenberg et al., 1997; Solomon et al., 2004). The key tenet of TMT is that individuals who feel they can

contribute in a meaningful way to the world are protected from thoughts of death. When people feel they are being valued in their culture, they feel that their legacy will make an impact beyond their death and that their achievements will be remembered (Greenberg et al., 1997; Solomon et al., 2004). By extension, individuals who are rejected by their culture are more likely to feel that they are not of value and may thus experience greater death anxiety (Becker, 1971). Thus, when this need is not met, it may threaten existentialistic concerns. Case and Williams (2004) suggested that similar to other mortality salience inductions, ostracism may trigger defenses based on individual's cultural worldview. Previous studies have revealed that death-anxiety mediates ostracism distress (Yaakobi, 2018, 2019). Since cuing possible external and unstable attributions for ostracism may impact ostracism distress, death-anxiety could mediate this association.

Overview of the Present Experiments

The three experiments presented here were designed to examine whether attributions of an ostracism experience to an external/internal stable/unstable cause could alleviate or perhaps eliminate ostracism distress in a factorial design based on Weiner's (1972) causal dimensions of attribution. People who attribute negative events to internal, stable, and global causes (characterized as a maladaptive attribution style) are thought to be more susceptible to depressive reactions than people who attribute such events to contrasting causes (i.e., external, unstable; Mezulis et al., 2004). Empirical findings indicate that in achievement-related failure, a maladaptive attributional style was associated with depressive reactions (Metalsky et al., 1987) and with low aspirations and achievement (Peterson, 1990).

The decision to examine attribution effects in the reflective stage was motivated by Williams' (2009) argument that immediate reactions to ostracism are resistant to moderation. By contrast, numerous studies have shown that people's background and understanding of the context can enhance coping responses in the later reflective stage (e.g., Zadro et al., 2006; Wirth and Williams, 2009). Thus, it is reasonable to expect attribution to have a greater effect on alleviating distress in the reflective stage than immediately after the ostracism experience. This is because ostracized individuals are hypothesized to better implement attribution processes after they are given an opportunity to cognitively consider what prompted the ostracism and apply coping strategies, based on the robust notion that people need time to cognitively analyze new information (Zadro et al., 2006). Examining the four attributions served to identify the relative role of different attribution types in enhancing recovery from an ostracism episode. The findings may also constitute a foundation for the development of a useful intervention that enhances recovery after experiencing ostracism.

Experiment 1 examined whether exposure to one of the four types of attributions immediately after the ostracism event would moderate the effects of ostracism on victims' mood. In Williams' (2009) temporal need-threat theory of ostracism, ostracism also affects victims' fundamental needs-satisfaction, and in particular their needs for a sense of belonging, self-esteem, control, and meaningful experience. Therefore, Experiment 2 examined the effects of victims' exposure to the four types of attributions examined in Experiment 1 on needs-satisfaction. The use of two independent experiments and two study populations was aimed to enhance the generalizability and external validity of the results. The independent use of two well-known measures of ostracism distress was also designed to enhance the construct validity of the results and better eliminate biases such as the halo effect. This led to five hypotheses:

Hypothesis 1: Unstable attributions should reduce distress to a greater extent than stable attributions and when no explanation for ostracism is provided.

Hypothesis 2: External attributions should reduce distress to a greater extent than internal attributions and when no explanation for ostracism is provided.

Hypothesis 3: Participants provided with an external and unstable attribution should experience less distress when ostracized than when no attribution is provided. Conversely, when participants are given an internal and stable attribution, they should experience more distress than in all the other attributions, as well as the ostracism with no-attribution condition, and being included.

Hypothesis 4a-b: a. External-stable and b. internal-unstable attributions should reduce distress compared to internal attributions and when no explanation for ostracism is provided.

Hypothesis 5: The accessibility of death-related thoughts will mediate the relationship between attribution cue for the ostracism experience and distress.

The data in all experiments were included and no outliers were found. Assumptions regarding normality and homogeneity of variance were met in all the statistical analyses.

EXPERIMENT 1

Experiment 1 was conducted to examine whether the type of attribution provided immediately after the ostracism experience (in the reflective stage) would moderate ostracism distress and whether certain types of attribution lead to complete recovery.

Method

Participants and Design

An *a priori* power analysis to estimate the sample size was conducted (using G*Power 3.1; Faul et al., 2009). With an $\alpha = 0.05$ and power = 0.80%, the projected sample size needed to detect a moderate–high effect size ($f = 0.30$) was approximately $N = 149$ for a between-group comparison (ANOVA). The actual sample size was larger than the calculated number of $N = 149$. Sample size was determined before any data analysis. All the participants who participated in the experiment were included in the analyses.

One hundred and ninety undergraduate business administration students (32% men; 90% unmarried), ranging

in age from 19 to 42 (mdn = 24) volunteered to take part in the study. All the participants were recruited from an Israeli academic institution. No monetary compensation was provided. Participants were randomly assigned to one of six groups: four study groups based on a 2 (locus: internal, external) × 2 (stability: stable, unstable) between-subject design, and two control groups (an inclusion group and an ostracism with no-attribution group).

Materials and Procedure

The procedure was based on the multiple studies using the Cyberball game (e.g., Williams et al., 2000; Williams and Jarvis, 2006).

Cyberball Experience Manipulation

Participants were seated at a computer in separate cubicles. All instructions were presented on the screen. Participants were told that they were participating in a study about the relationships between mental visualization and task performance, and that these would be tested by means of a three-player internet ball-toss game called Cyberball. In this game, players engage in an animated ball-toss game. Depicted on the screen are two other ostensible players (represented by Cyber icons). The participant is represented as an animated hand at the bottom of the screen. Here, the participants were asked to use this game to engage in mental visualization. (They were encouraged to visualize the other players' appearance and identity, the location of the game, and so on.) In total, there were 30 throws in each game. The Cyberball experience was manipulated by the number of ball tosses to the participant. In the five ostracism conditions, the participant received two tosses at the beginning of the game and then never received another toss. In the inclusion condition, the participant received one-third of the tosses (i.e., all players received an equal number of tosses).

Immediately after the participants in the four attribution groups completed the game, they were cued with one of the four types of attribution by a research assistant. For participants in the external-unstable attribution condition, the research assistant said, "Hey, I saw you did not get the ball very often, right?," and after the participant concurred, she said to the participants "you did not have any luck today, did you?" For participants in the external-stable attribution condition, the research assistant said, "Hey, I saw you did not get the ball very often, right?," and after the participant concurred, she stated, "This often happens on tasks like ball-toss games." For participants in the internal-stable attribution condition, the research assistant said, "Hey, I saw you did not get the ball very often, right?," and after the participant concurred, she stated, "This often happens depending on players' personality." For participants in the internal-unstable attribution condition, the research assistant said, "Hey, I saw you did not get the ball very often, right?," and after the participant concurred, she stated that this might have happened because "I saw that you were not making much of an effort during the game." Prior to the main experiments, 30 undergraduate students took part in a pilot study to test several cover stories for the four attribution types used in the current experiments. Twelve scenarios were presented (3 for each attribution type). Participants were asked to rate each scenario on two scales (stable–unstable and internal–external) from 1 to 5, which were the same scales used in the manipulation in the experiments themselves. The scenarios with the best statistical fit to each attribution type were selected for use in the main experiments[1]. To overcome order effects, the scenarios presented to participants were counterbalanced. In addition to this pilot, a manipulation check after the experiment was conducted which fully validated that the cover stories used in the two experiments corresponded to each attribution construct.

Two control groups were used: 1) An inclusion condition was used to examine whether attribution could lead to complete recovery and 2) an ostracism condition with no explanation was used to assess whether attribution would lead to greater distress than when an explanation was provided (e.g., internal-stable). In order to make all conditions similar except for the attribution manipulation, in the "ostracism with no explanation condition" the research assistant was instructed to say: "Hey, I saw you did not get the ball very often, right?," and after the participant concurred, instead of providing one of the four possible causes, she asked participants to wait in another room as in all the other conditions. In the inclusion condition, the research assistant was instructed to say "Hey, I saw you got the ball often, right?," and after the participant concurred, she also asked these participants to wait in a separate room. This procedure was used to minimize possible alternative explanations for the results other than the attribution manipulation. During this time, the research assistant ostensibly went to retrieve the questionnaire sheets and returned 10 min later. Participants were asked to wait a few minutes for the research assistant to come back, and not use their phones.

Dependent Variables

Participants completed anonymous self-reports on their emotional state based on the van Beest and Williams's (2006) mood index, which contains four items assessing negative emotions (e.g., sad, hurt) and four assessing positive emotions (e.g., happy, elated; $\alpha = 0.91$; see **Appendix A** for the complete scale). A 5-point scale was used. Positive emotions were reverse-scored; thus, a higher score on these items implied more distress.

As a check for the Cyberball manipulation, participants were asked to recall the percentage of ball tosses that they received in the game (0–100). To assess feelings of being ignored, participants responded to one item on a scale from

[1]The other scenarios that were examined in the pilot study in addition to those chose were: External – unstable attribution condition – "the computer was not working very well today" (Minternal = 3.83, SDinternal = 0.98; Mstable = 4.01, SDstable = 0.88) and "the program was not the final one that was uploaded" (Minternal = 3.92, SDinternal = 0.99; Mstable = 3.81, SDstable = 0.79); External – stable attribution condition – "This often happens during experiments in the lab" (Minternal = 3.14, SDinternal = 0.88; Mstable = 2.21, SDstable = 0.68) and "this often happens when three people are playing together" (Minternal = 3.30, SDinternal = 1.09; Mstable = 2.11, SDstable = 0.92); Internal – stable attribution condition – "This often happens when players differ in ability" (Minternal = 2.01, SDinternal = 0.86; Mstable = 2.17, SDstable = 0.82); and "this often happens when the player is not liked" (Minternal = 1.97, SDinternal = 0.85; Mstable = 2.22, SDstable = 0.77); Internal – unstable attribution condition – "I saw that you were not concentrating" (Minternal = 2.31, SDinternal = 1.00; Mstable = 4.02, SDstable = 0.90) and "This often happens when players do not practice" (Minternal = 2.19, SDinternal = 0.99; Mstable = 3.98, SDstable = 0.76).

1 (*not at all*) to 5 (*very much so*). Exclusion was measured by one item on a scale from 1 (*not at all*) to 5 (*very much so*). These three items have been used extensively by Williams et al. in studies on ostracism (e.g., van Beest and Williams, 2006; Yaakobi and Williams, 2016a,b) and were translated into Hebrew independently by two native speakers of English and then back-translated to English according to the customary procedure for translation verification (Brislin, 1970).

As a check for the attribution manipulation, and the extent to which participants perceived the cover stories as correctly corresponding to the attribution constructs they were intended for, after completing the mood questionnaire the participants were asked to assess the research assistant's explanation as to why they had not received the ball on two scales measuring locus from 1 (*internal*) to 5 (*external*) and stability from 1 (*stable*) to 5 (*unstable*). At the top of the questionnaire, the scales were explained to participants in parentheses (e.g., "internal = assigns the cause of the observed behavior to the person's internal characteristics whereas external attribution assigns the cause of behavior to external factors"; "stable = assigns the cause to factors that are likely to happen again over time whereas unstable means that the factors can change").

Demographics

Participants were also asked to complete a brief socio-demographic sheet indicating their gender, age and marital status. Marital status was included based on research showing that couplehood can contribute to mitigating the experience of ostracism (Yaakobi, 2018) and that marital status moderates the mediation effect of death anxiety on ostracism distress.

At the conclusion of the experiment, the participants were fully debriefed and were informed that they had played against preprogrammed computer players.

Results and Discussion

Manipulation Checks

Cyberball Manipulation Check

To examine the Cyberball manipulation, a multivariate analysis of variance (MANOVA) for the dependent variables (percent throws received, feeling ignored/excluded) was conducted. As expected, the analysis yielded a significant effect for the Cyberball experience [Wilks' lambda $F(15, 489) = 10.82$, $p < 0.001$, $\eta p^2 = 0.232$]. Ostracized participants reported that they received the ball on a smaller percentage of the tosses ($M = 11.60\%$, $SD = 13.12\%$) than the included participants ($M = 34.40\%$, $SD = 12.15\%$), $F(1, 183) = 116.40$, $p < 0.001$, $\eta p^2 = 0.389$; they also felt more ignored ($M = 3.70$, $SD = 1.20$) than the included participants ($M = 1.98$, $SD = 1.23$), $F(1, 183) = 73.88$, $p < 0.001$, $\eta p^2 = 0.288$) and more excluded ($M = 3.67$, $SD = 1.25$) than the included participants ($M = 1.80$, $SD = 1.23$), $F(1, 183) = 83.15$, $p < 0.001$, $\eta p^2 = 0.312$. These findings confirmed that the Cyberball manipulation was successful.

Attribution Manipulation Check

To examine the attribution manipulation, a multivariate analysis of variance (MANOVA) for the dependent variables (classification of perceived cause of being ostracized: internal/external; stable/unstable) was conducted. As expected, the analysis yielded a significant effect for the attribution manipulation [Wilks' lambda for locus $F(3, 109) = 74.65$, $p < 0.001$, $\eta p^2 = 0.681$; Wilks' lambda for stability $F(3, 109) = 79.12$, $p < 0.001$, $\eta p^2 = 0.693$]. A Bonferroni *post hoc* analysis confirmed that the attribution manipulation was successful: Each group was significantly different (all $ps < 0.001$) from the other two groups having the opposite dimension, but were not significantly different from the other groups on the same dimension (all $ps > 0.1$; e.g., the internal-stable group reported effects that were significantly different from either internal-unstable or external-unstable groups on the stability dimension, but showed no significant difference from the internal-unstable group). Participants who were cued with an internal-stable cause for being ostracized evaluated the cause as more internal ($M = 1.67$, $SD = 0.78$) and stable ($M = 2.00$, $SD = 0.85$). Participants who were cued with an internal-unstable cause for being ostracized evaluated the cause as more internal ($M = 1.96$, $SD = 0.77$) and unstable ($M = 4.13$, $SD = 0.76$). Participants who were cued with an external-stable cause for being ostracized evaluated the cause as more external ($M = 4.11$, $SD = 0.74$) and stable ($M = 1.96$, $SD = 0.74$). Participants who were cued with an external-unstable cause for being ostracized evaluated the cause as more external ($M = 4.11$, $SD = 0.71$) and unstable ($M = 4.26$, $SD = 0.68$). (For full statistics on the Bonferroni *post-hoc* test, see **Table 1**.) As shown in **Table 1**, the results indicated that each condition successfully manipulated the dimension of interest.

Additional analyses were conducted to check the attribution manipulation. To determine whether locus was successfully manipulated, a 2 (Locus: internal vs. external) × 2 (Stability: stable vs. unstable) was conducted. The results indicated that only locus was significant [$F(1, 105) = 203.34$, $p < 0.001$; $\eta p^2 = 0.668$; $Minternal = 1.82$, $SD = 0.77$; $Mexternal = 4.10$, $SD = 0.72$], but not stability [$F(1, 105) = 0.91$, $p = 0.343$; $\eta p^2 = 0.009$; $Mstable = 3.37$, $SD = 1.34$; $Munstable = 3.39$, $SD = 1.27$] or the interaction between locus and stability [$F(1, 105) = 0.53$, $p = 0.471$; $\eta p^2 = 0.005$; $Minternal*stable = 1.64$, $SD = 0.81$; $Minternal*unstable = 1.91$, $SD = 0.75$; $Mexternal*stable = 4.07$, $SD = 0.73$; $Mexternal*unstable = 4.11$, $SD = 0.71$]. To determine whether stability was successfully manipulated, a 2 (Locus: internal vs. external) × 2 (Stability: stable vs. unstable) was conducted. The results indicated that only stability was significant [$F(1, 105) = 190.72$, $p < 0.001$; $\eta p^2 = 0.654$] ($Mstable = 1.97$, $SD = 0.75$; $Munstable = 4.19$, $SD = 0.70$), but not locus [$F(1, 105) = 0.58$, $p = 0.447$; $\eta p^2 = 0.006$; $Minternal = 3.36$, $SD = 1.30$; $Mexternal = 3.40$, $SD = 1.30$] or the interaction between stability and locus [$F(1, 105) = 0.038$, $p = 0.845$; $\eta p^2 < 0.001$; $Minternal*stable = 1.91$, $SD = 0.83$; $Minternal*unstable = 4.09$, $SD = 0.75$; $Mexternal*stable = 2.00$, $SD = 0.73$; $Mexternal*unstable = 4.24$, $SD = 0.68$]. Thus, the attribution manipulation was successful.

Mood

The means and standard deviations for the mood index are presented in **Table 2**.

To examine whether the cued attribution type moderated ostracism distress, two analyses were conducted on mood. A 2 (locus: internal, external) × 2 (stability: stable, unstable) analysis

TABLE 1 | Values of *p* and 95% confidence interval values for the analysis of the manipulation check indices (internality–externality; stable–unstable) as a function of attribution manipulation (Experiment 1).

Dependent variable			*p*	95% LCI	95% UCI
Manipulation check Internal–external	internal-stable	internal-unstable	N. S.	−0.994	0.414
		external-stable	< 0.001	−3.123	−1.758
		external-unstable	< 0.001	−3.083	−1.801
	internal-unstable	internal-stable	N. S.	−0.414	0.994
		external-stable	< 0.001	−2.707	−1.594
		external-unstable	< 0.001	−2.657	−1.647
	external-stable	internal-stable	< 0.001	1.758	3.123
		internal-unstable	< 0.001	1.594	2.707
		external-unstable	N. S.	−0.475	0.472
	external-unstable	internal-stable	< 0.001	1.801	3.083
		internal-unstable	< 0.001	1.647	2.657
		external-stable	N. S.	−0.472	0.475
Manipulation check Stable–unstable	internal-stable	internal-unstable	< 0.001	−2.833	−1.428
		external-stable	N. S.	−0.645	0.716
		external-unstable	< 0.001	−2.900	−1.622
	internal-unstable	internal-stable	< 0.001	1.428	2.833
		external-stable	< 0.001	1.611	2.721
		external-unstable	N. S.	−0.634	0.373
	external-stable	internal-stable	N. S.	−0.716	0.645
		internal-unstable	< 0.001	−2.721	−1.611
		external-unstable	< 0.001	−2.769	−1.824
	external-unstable	internal-stable	< 0.001	1.622	2.900
		internal-unstable	N. S.	−0.373	0.634
		external-stable	< 0.001	1.824	2.769

Time = N. S. – nonsignificant (p > 0.1).

of variance was conducted on mood. A one-way ANOVA for the six groups (internal-stable, internal-unstable, external-stable, external-unstable, included, no explanation) was conducted. The use of the 2 × 2 ANOVA served to capture both the main and interaction effects of the attribution manipulation. The one-way ANOVA captured the attribution effects in comparison with the inclusion and ostracism with no explanation control groups. The two-way ANOVA revealed a significant main effect for the locus manipulation on mood [$F(1, 105) = 13.88$, $p > 0.001$, $\eta p^2 = 0.117$] and a significant effect for the stability manipulation on mood [$F(1, 105) = 7.58$, $p = 0.007$, $\eta p^2 = 0.067$]. In addition, a significant interaction effect was found for the locus × stability manipulation [$F(1, 105) = 11.51$, $p = 0.001$, $\eta p^2 = 0.099$] on the mood measure. The one-way ANOVA also revealed a significant effect $F(1, 184) = 9.13$, $p < 0.001$. For a graphic presentation of the results, see **Figure 1**.

Ostracism With No Explanation vs. Inclusion

As expected, ostracized participants who were given no explanation for being ostracized showed a higher level of distress than the included participants ($p < 0.001$).

Stable vs. Unstable Attribution

A Bonferroni *post hoc* test revealed that ostracized participants who were cued with unstable attributions reported significantly less distress than participants who were cued with stable attributions ($p = 0.038$) and significantly less distress than participants who were given no explanation for being ostracized ($p = 0.030$). The mood of participants who were cued with unstable attributions was similar to the mood of the included participants ($p = 0.097$), which is comparable to complete recovery. Participants who were cued with stable attributions reported a similar level of distress as ostracized participants who were given no explanation for being ostracized ($p > 0.10$), but reported a significantly higher level of distress than that of included participants ($p < 0.001$).

Thus overall, *an unstable attribution not only alleviated ostracism distress, which fully supported H1, but led to complete recovery. A stable attribution led to a similar level of perceived distress as for participants who did not receive any explanation for the cause of ostracism.*

Internal vs. External Attribution

A Bonferroni *post hoc* test revealed that ostracized participants who were cued with external attributions reported significantly less distress than participants who were cued with internal attributions ($p = 0.002$) and significantly less distress than participants who were given no explanation for being ostracized ($p = 0.006$). Participants in the external attribution conditions reported a mood level similar to the included participants ($p = 0.338$), which is comparable to complete recovery. Participants who were cued with internal attributions reported a level of distress comparable to that of ostracized participants who were given no explanation for being ostracized ($p > 0.10$), but reported a significantly higher level of distress than included participants ($p < 0.001$).

Thus overall, *external attributions not only alleviated ostracism distress, fully supporting H2, but led to complete recovery when measured shortly after the cued attribution of ostracism. Internal attributions led to a similar level of perceived*

TABLE 2 | Means and Standard Deviations for the distress (mood) index as a function of the Cyberball experience for each of the four types of attribution and controls (Experiment 1).

		Ostracized (no explanation)		Locus						Included	
				Internal		External		Total			
		M	SD	M	SD	M	SD	M	SD	M	SD
Controls		3.08	0.68							2.10	0.96
Stability	Unstable			2.53	0.91	2.47	0.92	2.49	0.91		
	Stable			3.70	0.98	2.35	0.74	2.75	1.02		
	Total			2.93	1.08	2.42	0.86	2.59	0.96		

A higher score indicates higher distress. The sample sizes were as follows: (Internal-stable = 32 participants, internal-unstable = 31 participants, external-stable = 31 participants, external-unstable 32 participants, ostracized no explanation = 31 participants, included = 33). The participants were randomly assigned to the experimental and control groups; and no significant differences were found for age of gender between groups.

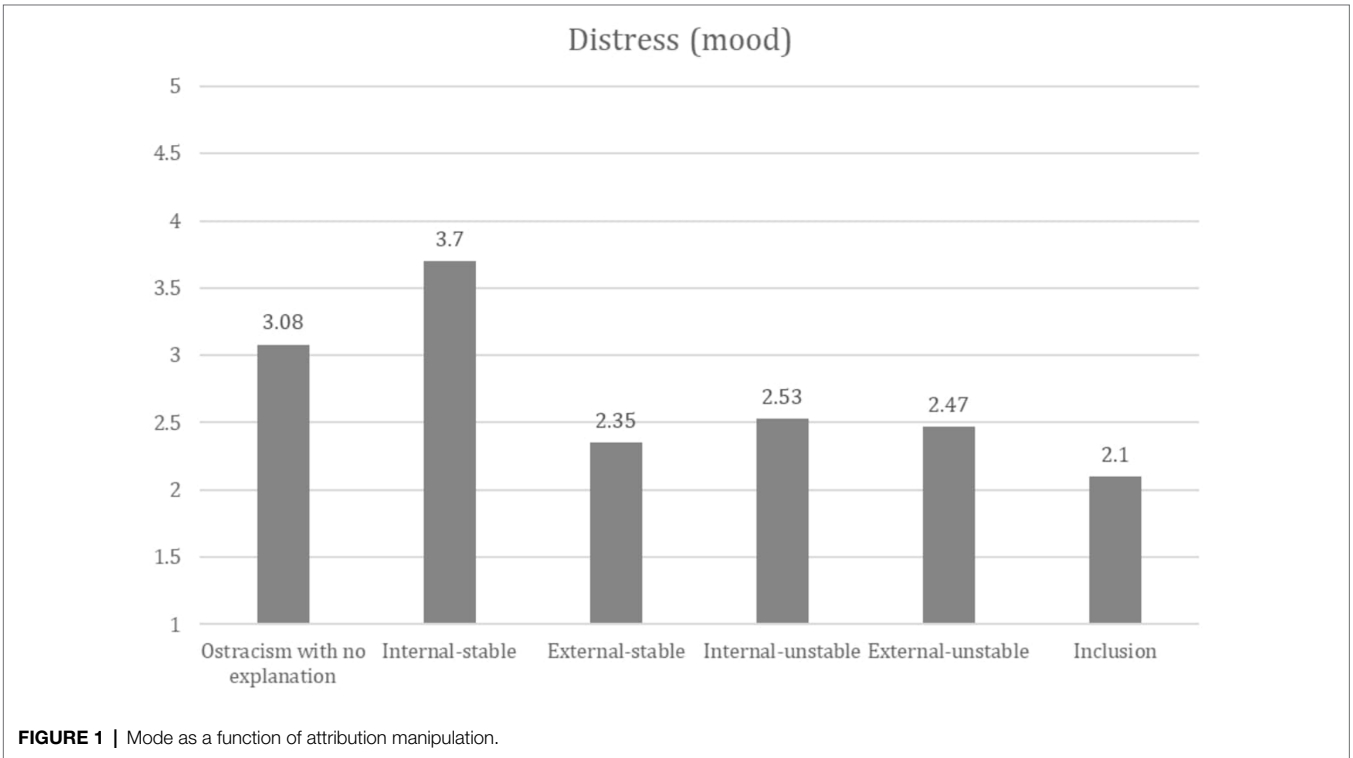

FIGURE 1 | Mode as a function of attribution manipulation.

distress as when not receiving any explanation for the cause of ostracism.

Locus × Stability Attribution

A Bonferroni *post hoc* analysis of the interaction between locus × stability revealed that participants who thought they did not receive the ball for external-unstable reasons reported lower distress than ostracized participants who thought they did not receive the ball for internal-stable reasons ($p < 0.001$) and marginally lower distress than participants who received no explanation ($p = 0.073$), but their reported level of distress was not significantly different from the distress reported by the included participants ($p = 0.586$).

Moreover, participants who thought they did not receive the ball for external-stable reasons reported lower distress than ostracized participants who received no explanation for being ostracized ($p = 0.037$) and lower distress than participants who thought they had not received the ball for internal-stable reasons ($p < 0.001$); their reported level of distress was not significantly different from the distress reported by included participants ($p > 0.10$).

In addition, participants who thought they did not receive the ball for internal-stable reasons reported similar distress as ostracized participants who received no explanation for being ostracized ($p = 0.867$), but significantly higher distress than the included participants ($p < 0.001$) and participants in all the

other attribution groups (all p's < 0.005), thus supporting the second part of H3 regarding all other attributions cued, and reported similar (but not lower distress) than ostracized participants who received no explanation for being ostracized.

In addition, participants who thought they did not receive the ball for internal-unstable reasons reported lower distress than ostracized participants who thought they did not receive the ball for internal-stable reasons ($p = 0.005$), but did not differ in their level of distress from participants who received no explanation for being ostracized ($p > 0.10$). Thus, although not hypothesized, an internal-unstable attribution did not lead to less distress than when participants were not provided with an explanation for being ostracized. They, however, reported less distress than participants cued to the internal-stable attribution.

Thus, *external-stable attributions decreased ostracism distress and led to complete recovery*. *External-unstable attributions led to same level of distress as included participants*. Thus, H3 was partially supported, and H4a was fully supported, and revealed that although not hypothesized, external-stable attributions eliminated distress altogether. H4b was partially supported.[2]

Overall, these findings confirmed that causal attributions for ostracism provided immediately after the ostracism episode moderated the effects of ostracism distress on a mood questionnaire administered soon after the experience. Specifically, the results indicated that *cuing external, unstable, external-stable, or external-unstable causes as explanations for ostracism led to similar mood levels as when included. Providing external or unstable causes for ostracism led to less distress than providing internal causes or not providing any cues as to the cause of ostracism*. As hypothesized, *internal-stable attributions led to higher distress than all the other* attributions, but these participants did not differ from ostracized participants who received no explanation for being ostracized. Finally, the findings also point to the differential role of attribute types in alleviating distress after an ostracism episode. However, as Williams (2009) reported in numerous studies (e.g., see meta-analyses of Hartgerink et al., 2015), ostracism also threatens fundamental needs. Experiment 2 was conducted to determine whether cuing different attributions would yield similar results for needs-satisfaction as for mood.

EXPERIMENT 2

Experiment 2 was conducted to increase the generalizability of the results of Experiment 1 with respect to external and construct validity. Experiment 2 examined whether the different types of attribution cued as possible explanations for ostracism would also affect participants' fundamental needs-satisfaction (Williams, 2009) in the post-ostracism reflective stage. Similar to the procedure in Experiment 1, Experiment 2 examined whether specific attributions would lead to greater needs-satisfaction than when no explanation for the cause of ostracism was given, or would lead to a level of needs-satisfaction similar to the needs-satisfaction of included participants.

Method

Participants and Design

To determine the sample size for Experiment 2, the same procedure as in Experiment 1 was used. The actual sample size was larger than the calculated number of N = 149. Sample size was determined before any data analysis. As in Experiment 1, all the participants were included in the analyses. One hundred and ninety-four undergraduate business administration students (40% men, 70% unmarried), ranging in age from 20 to 43 (mdn = 25) volunteered to take part in the study. All participants were recruited from an Israeli academic institution. No monetary compensation was provided. Participants were randomly assigned to six groups: four groups in a 2 (locus: internal, external) × 2 (stability: stable, unstable) between-subject design, and two control groups (an inclusion group and a no-attribution group). Three participants whose stated attribution did not correspond to their assigned group on the attribution check were dropped from the analyses.

Materials and Procedure

The general outline for the procedure, the experimental manipulation, and the measures were identical to those used in Experiment 1. The only difference was that fundamental needs-satisfaction was used as the dependent variable instead of the mood measure. After the research assistant returned to the room where the participants were waiting, the participants provided anonymous self-reports on their current levels of satisfaction of their needs for belonging (e.g., "I felt I belonged to the group" (reversed); I felt rejected), self-esteem (e.g., "I felt good about myself" (reversed) "I felt liked" (reversed)), meaningful existence (e.g., "I felt important" (reversed), "I felt invisible," and control) (e.g., "I felt powerful" (reversed), "I felt I had control over the course of the game"(reversed)), on the 5-point Need Satisfaction Scale developed by van Beest and Williams (2006) ($\alpha = 0.95$; see **Appendix B** for the complete scale). Finally, we confirmed that participants had understood the key elements of the experiment.

Results and Discussion

Manipulation Checks

Cyberball Manipulation Check

To examine the Cyberball manipulation, a multivariate analysis of variance (MANOVA) for the dependent variables (percent throws received, feeling ignored/excluded) was conducted. As expected, the analysis yielded a significant effect for the Cyberball experience [Wilks' lambda $F(15, 486) = 74.65$, $p < 0.001$, $\eta p^2 = 0.262$]. Ostracized participants reported that they received the ball on a smaller percentage of tosses ($M = 9.60\%$, $SD = 10.65\%$) than the included participants ($M = 34.30\%$, $SD = 12.53\%$), $F(1, 182) = 180.32$, $p < 0.001$, $\eta p^2 = 0.498$; they also felt more ignored ($M = 3.70$, $SD = 1.16$) than the included participants ($M = 1.92$, $SD = 1.20$),

[2]*It could be claimed that differences would be found between negative and positive emotions and that after an ostracism experience negative emotions would increase while positive emotions would remain unchanged. To control for this possibility, the same analyses were conducted separately for the positive and negative emotion scores. No differences were found, so that only the combined measure is reported.*

TABLE 3 | Values of *p* and 95% confidence interval values for the analysis of the manipulation check indices (internality–externality; stable–unstable) as a function of attribution manipulation (Experiment 2).

Dependent variable			*p*	95% LCI	95% UCI
Manipulation check Internal–external	internal-stable	internal-unstable	N. S.	−0.517	1.243
		external-stable	<0.001	−2.783	−1.097
		external-unstable	<0.001	−2.676	−1.070
	internal-unstable	internal-stable	N. S.	−1.243	0.517
		external-stable	<0.001	−2.989	−1.618
		external-unstable	<0.001	−2.872	−1.601
	external-stable	internal-stable	<0.001	1.097	2.783
		internal-unstable	<0.001	1.618	2.989
		external-unstable	N. S.	−0.516	0.650
	external-unstable	internal-stable	<0.001	1.070	2.676
		internal-unstable	<0.001	1.601	2.872
		external-stable	N. S.	−0.650	0.516
Manipulation check Stable–unstable	internal-stable	internal-unstable	<0.001	−3.526	−1.579
		external-stable	N. S.	−1.152	0.712
		external-unstable	<0.001	−3.496	−1.720
	internal-unstable	internal-stable	<0.001	1.579	3.526
		external-stable	<0.001	1.574	3.091
		external-unstable	N. S.	−0.759	0.648
	external-stable	internal-stable	N. S.	−0.712	1.152
		internal-unstable	<0.001	−3.091	−1.574
		external-unstable	<0.001	−3.033	−1.743
	external-unstable	internal-stable	<0.001	1.720	3.496
		internal-unstable	N. S.	−0.648	0.759
		external-stable	<0.001	1.743	3.033

Time = N. S. – nonsignificant (p > 0.1).

$F(1, 182) = 84.93$, $p < 0.001$, $\eta p^2 = 0.318$, and felt more excluded ($M = 3.66$, $SD = 1.18$) than the included participants ($M = 1.81$, $SD = 1.19$). Thus, the Cyberball manipulation was successful.

Attribution Manipulation Check

To examine the attribution manipulation, a multivariate analysis of variance (MANOVA) for the dependent variables (attribution type: internal/external; stable/unstable) was performed. As in Experiment 1, this analysis served to examine both factors simultaneously to ensure that only the factor of interest was affected. As expected, the analysis yielded a significant effect for the attribution manipulation [Wilks' lambda for locus $F(3, 91) = 43.72$, $p < 0.001$, $\eta p^2 = 0.601$; Wilkes' lambda for stability $F(3, 91) = 50.04$, $p < 0.001$, $\eta p^2 = 0.633$]. A Bonferroni *post hoc* analysis confirmed that the attribution manipulation was successful since each group was significantly different (all *p*'s < 0.001) from the other two groups representing the opposite dimension, but was not significantly different from the other group on the same dimension (all *p*'s > 0.1; e.g., internal-stable was significantly different from both internal-unstable and external-unstable on the stability dimension, but was not significantly different from the internal-unstable group on the locus dimension). Participants who were cued with an internal-stable cause for being ostracized evaluated the cause as more internal ($M = 2.10$, $SD = 0.99$) and stable ($M = 1.50$, $SD = 0.71$). Participants who were cued with an internal-unstable cause for being ostracized evaluated the cause as more internal ($M = 1.74$, $SD = 0.56$) and unstable ($M = 4.05$, $SD = 0.85$). Participants who were cued with an external-stable cause for being ostracized evaluated the cause as more external ($M = 4.04$, $SD = 1.02$) and stable ($M = 1.72$, $SD = 0.74$). Participants who were cued with an external-unstable cause for being ostracized evaluated the cause as more external ($M = 3.97$, $SD = 0.76$) and unstable ($M = 4.10$, $SD = 1.10$; for full statistics of the Bonferroni *post hoc* test see **Table 3**). As shown in **Table 3**, each condition was successfully manipulated on the dimension of interest.

As in Experiment 1, additional analyses were conducted to check the attribution manipulation. To determine whether locus was successfully manipulated, a 2 (Locus: internal vs. external) × 2 (Stability: stable vs. unstable) ANOVA was conducted to evaluate locus. The results indicated that only locus was significant [$F(1, 106) = 96.13$, $p < 0.001$; $\eta p^2 = 0.488$; $Minternal = 1.86$, $SD = 0.76$; $Mexternal = 4.00$, $SD = 0.87$], but not stability [$F(1, 106) = 1.10$, $p = 0.297$; $\eta p^2 = 0.011$] ($Mstable = 3.50$, $SD = 1.34$; $Munstable = 3.20$, $SD = 1.28$) or the interaction between locus and stability [$F(1, 106) = 0.51$, $p = 0.478$; $\eta p^2 = 0.005$] ($Minternal*stable = 2.11$, $SD = 1.05$; $Minternal*unstable = 1.74$, $SD = 0.56$; $Mexternal*stable = 4.04$, $SD = 1.02$; $Mexternal*unstable = 3.97$, $SD = 0.77$). Thus, only the manipulation of locus was significant.

To determine whether stability was successfully manipulated, a 2 (Locus: internal vs. external) × 2 (Stability: stable vs. unstable) ANOVA was conducted to evaluate stability. The results revealed that only stability was significant [$F(1, 105) = 122.20$, $p < 0.001$; $\eta p^2 = 0.533$; $Mstable = 1.63$, $SD = 0.71$; $Munstable = 4.08$, $SD = 0.99$], but not locus [$F(1, 105) = 0.95$, $p = 0.331$; $\eta p^2 = 0.009$] ($Minternal = 3.18$, $SD = 1.49$; $Mexternal = 3.26$, $SD = 1.48$) or the interaction between stability and locus [$F(1, 105) = 0.63$, $p = 0.431$; $\eta p^2 = 0.006$; $Minternal*stable = 1.33$, $SD = 0.50$; $Minternal*unstable = 4.05$,

SD = 0.85; *Mexternal*stable* = 1.74, *SD* = 0.75; *Mexternal *unstable* = 4.10, *SD* = 1.06]. Thus, only the manipulation of stability was significant. Overall, the results revealed that the attribution manipulation was successful.

Needs-Satisfaction

The means and standard deviations for the needs-satisfaction index are presented in **Table 4**.

To examine whether the attributed cause of the ostracism episode moderated distress, two analyses were performed on needs satisfaction. A 2 (locus: internal, external) × 2 (stability: stable, unstable) analysis of variance was conducted on needs-satisfaction for attributions and an additional one-way ANOVA was performed for the six study conditions (internal-stable, internal-unstable, external-stable, external-unstable, included, and no-attribution). The two-way ANOVA revealed a significant main effect on needs-satisfaction for the locus manipulation [$F(1, 102) = 8.95$, $p > 0.001$, $\eta p^2 = 0.079$] and a significant effect for the stability manipulation [$F(1, 102) = 17.64$, $p < 0.001$, $\eta p^2 = 0.092$]. In addition, a significant interaction effect on the needs-satisfaction measure was found for the locus × stability manipulation [$F(1, 102) = 12.01$, $p = 0.001$, $\eta p^2 = 0.065$]. The one-way ANOVA also revealed a significant effect $F(1, 179) = 11.88$, $p < 0.001$. For a graphic presentation of the results, see **Figure 2**.

Stable vs. Unstable Attribution

A Bonferroni *post hoc* test revealed that the ostracized participants cued with unstable causes reported significantly lower distress than participants who were cued with stable causes ($p = 0.017$) and participants who were provided no explanation for being ostracized ($p = 0.004$). Moreover, participants who were cued with unstable causes showed similar distress as participants in the included condition ($p = 0.156$), thus presenting complete recovery for needs-satisfaction as was the case for mood in Experiment 1. However, participants cued with stable causes reported a similar level of distress as ostracized participants who were given no explanation ($p > 0.10$), but a significantly higher level of distress than included participants ($p < 0.001$).

Thus, similar to Experiment 1, H1 was fully supported, revealing that unstable attributions proved to be a sufficient intervention to alleviate distress. Unstable attribution not only alleviated ostracism distress, but led to complete recovery after a short delay as in Experiment 1. A stable attribution led to a similar level of perceived distress as when not receiving any explanation for the cause of ostracism.

Internal vs. External Attribution

A Bonferroni *post hoc* test revealed that ostracized participants who were provided with an external attribution reported significantly less distress (greater needs-satisfaction) than participants whose ostracism was attributed to an internal cause ($p = 0.022$) and participants who were given no explanation ($p = 0.006$). Moreover, as in Experiment 1, participants who were cued with an external attribution showed similar distress levels as included participants on the needs-satisfaction scale ($p = 0.084$), and thus evidenced complete recovery. As in Experiment 1, participants who were cued with internal causes reported similar distress as the ostracized participants who were given no explanation ($p > 0.10$), but significantly higher distress than the included participants ($p < 0.001$). As expected, ostracized participants who were given no explanation reported higher distress than included participants ($p < 0.001$).

External attributions alleviated ostracism distress, thus fully supporting H2 and also led to complete recovery for needs-satisfaction, as was the case for mood. Internal attribution led to similar levels of perceived distress as when not receiving any explanation for the cause of ostracism, as found in Experiment 1.

Locus × Stability Attribution

A Bonferroni *post hoc* analysis of the interaction between locus and stability revealed that participants cued with an external-unstable cause reported less distress than ostracized participants who received no explanation ($p = 0.016$) or those cued to an internal-stable attribution ($p < 0.001$) and their reported level of distress did not differ significantly from included participants ($p > 0.10$).

TABLE 4 | Means and Standard Deviations for the distress (needs satisfaction) index as a function of the Cyberball experience for each of the four types of attribution and controls (Experiment 2).

	Ostracized (no explanation)			Locus						Included	
				Internal		External		Total			
		M	SD	M	SD	M	SD	M	SD	M	SD
Controls		3.34	0.61							2.41	0.89
Stability	Unstable			2.78	0.68	2.71	0.89	2.74	0.82		
	Stable			4.12	0.54	2.84	0.64	3.22	0.85		
	Total			3.26	0.90	2.76	0.80	2.84	0.89		

A higher score indicates higher distress. The sample sizes were as follows (Internal-stable = 33 participants, internal-unstable = 31 participants, external-stable = 32 participants, external-unstable 32 participants, ostracized no explanation = 34 participants, included = 33). The participants were randomly assigned to the experimental and control groups; and no significant differences were found for age of gender between groups.

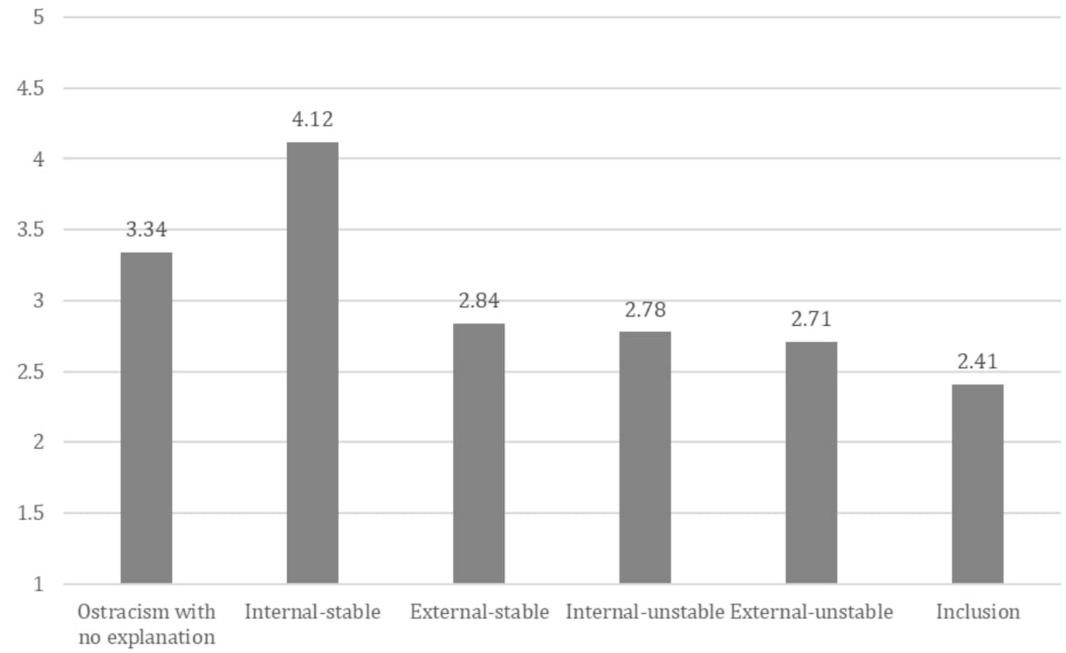

FIGURE 2 | Needs satisfaction as a function of attribution manipulation.

Thus, cuing an internal-unstable attribution reduced ostracism distress, supporting the first part of H3.

Participants cued with an external-stable cause reported lower distress than ostracized participants cued to an internal-stable cause ($p < 0.001$) and reported similar distress as included participants ($p > 0.10$), but surprisingly did not differ from the ostracized participants who received no explanation ($p = 0.283$). Thus, H4a was partially supported. Their reported distress was similar to the ostracized participants cued to an external-unstable cause ($p > 0.10$).

In addition, participants cued to an internal-unstable cause reported similar distress as ostracized participants who received no explanation ($p = 0.218$) and did not differ in their distress from the included participants ($p > 0.10$). Thus, the internal-unstable attribution did not reduce ostracism distress, contrary to what was predicted in H4b.

Finally, participants cued with an internal-stable cause reported higher distress than ostracized participants cued to an internal-unstable cause ($p < 0.001$), but did not differ from ostracized participants who received no explanation ($p = 0.073$), but reported higher distress than included participants ($p < 0.001$). They also reported higher distress than ostracized participants cued to an internal-unstable cause ($p < 0.001$), ostracized participants cued to an external-stable cause ($p < 0.001$), and ostracized participants cued to an external-unstable cause ($p < 0.001$).

Thus, internal-stable attribution led to similar distress as when not receiving any explanation for the cause of ostracism and higher distress than all other types of attribution.

Overall, these findings confirmed that attributions moderated the effects of ostracism on needs-satisfaction. Cuing unstable, external, and external-unstable causes of ostracism reduced ostracism distress and led to complete recovery with respect to needs-satisfaction reported after a short delay, thus supporting H1, H2, and H3. In addition, internal-stable attributions of ostracism led to the greatest distress, similar to when participants received no explanation for being ostracized. Finally, H4a regarding the moderating role of external-stable attribution effects was only supported for mood and partially supported for needs-satisfaction. H4b predicting the moderating role of internal-unstable attribution effects was not supported.

EXPERIMENT 3

Experiment 3 was conducted to examine the possible mediating role of death-anxiety on the association between cuing a cause for attribution and ostracism distress.

Method

Participants and Design

To determine the sample size for Experiment 3, the same procedure as in Experiments 1 and 2 was used. The actual sample size was larger than the calculated number of $N = 149$. Sample size was determined before any data analysis. Two hundred and seventy-two undergraduate business administration students (35% men), ranging in age from 19 to 51 (mdn = 24) volunteered to take part in the study. All participants were

recruited from an Israeli academic institution. No monetary compensation was provided. Participants were randomly assigned to six groups: four groups in a 2 (locus: internal, external) × 2 (stability: stable, unstable) between-subject design, and two control groups (an inclusion group and a no-attribution group). After a delay and before completing the distress measures (needs satisfaction and mood), the accessibility of death-related thoughts scale was completed by participants.

Materials and Procedure

The general outline for the procedure, the experimental manipulation, and the measures were identical to those used in Experiments 1 and 2.

The accessibility of death-related thoughts was assessed by a Hebrew version of the word completion task originally devised in English by Greenberg et al. (1994) and successfully used in Hebrew by Mikulincer and Florian (2000) on an Israeli sample. In this study, the task consisted of 20 Hebrew word fragments that participants were asked to complete with the first word that came to mind by filling in one missing letter. Eight of the twenty Hebrew fragments could be completed to form either neutral or death-related Hebrew words. For example, participants saw the Hebrew fragment _VEL and could complete it with the Hebrew word HVEL ("cord") or with the death-related EVEL ("mourning"). The possible death-related words were the Hebrew words for death, mourning, cadaver, grave, killing, dying, grief, and skeleton. The dependent measure was the number of death-related Hebrew words (0–8) completed by each participant.

Results and Discussion

To examine the mediational role of death anxiety, the PROCESS macro (Hayes, 2013) Model 4 was used to calculate two sets of regressions. The first set of regressions examined the association between the predictors and mediator variables. The second set of regressions examined the links from the mediators to the outcomes. To test the significance of the indirect effects of attribution on ostracism distress through death-related thoughts, the bootstrapping approach was used and calculated the 95% CI for the indirect effects on 5,000 resamples (Hayes, 2013).

Table 5 presents the regression results for simple mediation of accessibility of death-related words on the association between attribution on either mood or needs-satisfaction (Experiment 3).

External attribution was negatively associated with the accessibility of death-related thoughts, as indicated by the significant unstandardized regression coefficient. There was a negative relationship between accessibility of death-related thought and mood, when controlling for attribution. External attribution had an indirect effect on mood: this indirect effect was positive, as hypothesized. The formal two-tailed significance test (assuming a normal distribution) indicated that the indirect effect was significant. Bootstrap results showed that the bootstrapped 95% CI around the indirect effect did not include zero. Thus, Hypothesis 5 was fully supported for external attribution on mood through accessibility of death-related thoughts. In contrast, there was no mediation of death-related thoughts for external attribution on needs satisfaction or for unstable attribution on either mood or needs-satisfaction (see **Table 5**).

GENERAL DISCUSSION

These three experiments are the first to provide empirical evidence for an effective intervention to eliminate ostracism distress by cuing possible attributions for being ostracized in the reflective stage. The findings underscore the differential effect of different types of attribution described in Weiner's influential taxonomy on mood and needs-satisfaction, two factors that are known to be related to ostracism distress. Specifically, attributing an ostracism episode to an unstable or external cause led to complete recovery from ostracism distress for mood and needs-satisfaction. Not surprisingly, on all measures, cuing ostracized participants with internal-stable attributions led to the highest distress. However, their level of distress was similar to participants who were not provided with a cause for being ostracized and not lower than when not given any explanation. Thus, people may experience psychological effects from being ostracized that lead to the same level of distress as when "blaming" their personality for being ostracized. Neurological findings suggest that the detection of ostracism activates the same region as physical pain (Eisenberger et al., 2003; Eisenberger, 2013). Hence, being ostracized could activate an immediate internal-state explanation. This is consistent with the fundamental attribution error of attributing behavior to internal causes (Ross, 1977).

The results also showed that a combination of locus and stability moderated distress as a function of the specific distress measure. Cuing with an external-unstable attribution was the most effective for needs-satisfaction, whereas external-stable cuing was the most effective for mood. Note that the research assistant talked as much to the control group participants who received no cues as to participants in the attribution conditions. This served to minimize possible alternative explanations for the results other than the attribution manipulation and avoided potential confounds for the effects. Finally, the results revealed that death anxiety mediated the effects of cuing external attribution for ostracism on mood reduction after ostracism.

The current experiments make theoretical and practical contributions. The results contribute to work on ostracism by identifying the ways in which attributions can moderate ostracism effects. These experiments respond to Williams' (2009) call for "more research to determine the recovery rate as a function of the attributed ostracism motive" (p. 296), and other researchers' similar recommendations (e.g., Park et al., 2017). The current findings enable a better understanding of the relative importance and effectiveness of four different attributions in alleviating and eliminating distress. They enhance both literature and practice by outlining possible principles for an intervention that can reduce the extensive negative effects of ostracism. They suggest that a targeted intervention based on a cognitive interpretation (e.g., through attribution processes) administered immediately after the ostracism episode can alleviate distress which for specific attributions results in complete recovery after a short delay. Numerous ostracism studies have pointed to the effects of situational and individual moderators in the reflective stage. This may imply that ostracism victims' disposition, background, and grasp of context can orient their coping

TABLE 5 | Regression results for simple mediation of ADW on the association between attribution and mood (Experiment 3).

	Locus						Stability					
Variable	***β***	***SE***	***t***	***p***	***LLCI***	***ULCI***	***β***	***SE***	***t***	***p***	***LLCI***	***ULCI***
Direct and total effects												
Distress regressed on Attribution:	0.02	0.04	0.61	0.545	−0.052	0.099	0.02	0.06	0.36	0.720	−0.090	0.130
ADW regressed on attribution:	−0.12	0.06	−2.04	0.043	−0.230	−0.004	−0.01	0.09	−0.02	0.987	−0.169	0.166
Distress regressed on ADW, controlling for attribution:	−0.11	0.04	−2.76	0.006	−0.190	−0.032	−0.14	0.05	−2.59	0.011	−0.248	−0.033
Distress regressed on attribution, controlling for ADW:	0.02	0.04	0.61	0.545	−0.052	0.099	0.02	0.06	0.359	0.720	−0.090	0.130
	β	***SE***	***LLCI***	***ULCI***	***β***	***SE***				***LLCI***	***ULCI***	
Indirect effects and significance using normal distribution												
Bootstrap results for indirect effects												
Effect	*0.01*	*0.01*	*0.001*	*0.034*	*0.01*	*0.01*				*−0.027*	*0.025*	
Distress regressed on Attribution:	0.07	0.04	1.82	0.070	−0.006	0.144	0.08	0.05	1.52	0.131	−0.024	0.196
ADW regressed on attribution:	−0.10	0.06	−1.65	0.100	−0.207	0.018	0.02	0.08	0.21	0.836	−0.146	0.180
Distress regressed on ADW, controlling for attribution:	0.10	0.04	2.52	0.012	0.022	0.181	0.06	0.05	1.17	0.243	−0.043	−0.167
Distress regressed on attribution, controlling for ADW:	0.07	0.04	1.82	0.070	−0.006	0.144	0.08	0.05	1.52	0.131	−0.024	0.186
	β	***SE***	***LLCI***	***ULCI***	***β***	***SE***				***LLCI***	***ULCI***	
Indirect effects and significance using normal distribution												
Bootstrap results for indirect effects												
Effect	−0.01	0.01	−0.028	0.002	0.01	0.01				−0.013	0.016	

Standardized regression coefficients are reported. Bootstrap sample size = 5,000. AWD – accessibility of death-related words. LL, lower limit; CI, confidence interval; UL, upper limit.

responses and impact the speed of their recovery (Zadro et al., 2006). The current findings are consistent with these claims but also reveal that attribution processes can reduce distress resulting from ostracism. These may point to new research directions related to these moderation effects and the mechanisms involved in mitigating the deleterious effects of ostracism.

Although attribution may be perceived as a stable personality variable, the findings here suggest that an external intervention can alter the accessibility of explanations for being ostracized by highlighting other possible attributions. Thus, these results also contribute to attribution theory in that attribution can be manipulated. However, future research should examine the effects of shifts in attribution at more distant time points from the ostracism experience. If recovery appears in the reflective stage, only a few minutes after the ostracism experience, it may lead to recovery in the long run. Future research should examine this empirically as well as whether the other attributions that were found to lower, but not completely eliminate levels of distress can nevertheless contribute to recovery in the longer run.

The results make practical contributions as well by shedding light on ways in which victims can be helped to recover from the negative consequences of ostracism. Providing an explanation that shifts the responsibility for the episode to an external factor or to temporary (unstable) circumstances may be one way to restore victims' well-being. Psychologists, consultants, managers, parents, and teachers can draw on the mechanisms reported here to facilitate and accelerate recovery from ostracism. Future studies should extrapolate the findings to such practices as attributional retraining therapy (Hamm et al., 2014). As in CBT therapy, one of the treatment mechanisms consists of providing clients with tools such as viewing a (negative) experience from different perspectives. The current findings may suggest that the negative experience of ostracism can be mitigated by suggestions of different attributions. Therapists working with victims of ostracism could possibly suggest considering other possible causes for being ostracized, and external/unstable attributions in particular. Previous findings have indicated that individuals' dominant attribution styles moderate the relationship between daily hassles and anxiety and depression symptoms (Wang, 2021). Note that hopelessness theory, one of the main cognitive models of depression describes the relationship between the onset and maintenance of depression and a dysfunctional and rigid attributional style (Abramson et al., 1989). Heggeness et al. (2020) argued that negative attributional biases can lead to the excessive misperception that stressors are insurmountable. They report greater negative outcomes when a controllable stressor is misconstrued as persistent (i.e., stable) and when the cause is attributed to the self (i.e., internal). Hence, more depressive individuals may have higher risk of interpreting ostracism as arising from internal-stable factors, thus making this group more vulnerable to victimhood.

The discounting principle (Kelly, 1972) refers to the cognitive process of reducing a belief in one potential cause of behavior (e.g., "I did not get the ball because others did not like me") by substituting another viable cause (e.g., "There was an internet problem and therefore the other players may have not seen me"). Thus, providing specific types of attributions for an ostracism episode could augment victims' well-being by rectifying possible self-blame. If there is an external and/or unstable cause for ostracism, it is important to highlight it.

To implement more systematic coping and recovery, victims of ostracism need both the motivation and the ability to do so (e.g., the ELM model, Petty and Cacioppo, 1986). Future studies could extend these ostracism results to pathologies and examine whether major depressive individuals who suffer from less motivation, for example, can muster the extra effort to recover from ostracism distress through changes in attribution. In cases of learned helplessness, attribution processes may be less effective. This should be examined in future research.

Finally, research has found that psychological flexibility moderates ostracism distress and that techniques to enhance individuals' psychological flexibility can help them cope with ostracism (Waldeck et al., 2017). These authors reported that the relationship between perceived ostracism and distress only appeared when psychological flexibility was low but not high. Thus, people who are more prone to adopting methods that hamper psychological flexibility when coping with stressors may be more likely to experience distress. In contrast, high psychologically flexible individuals may cope better and recover more quickly from ostracism. Given the increasing interest in possible ostracism moderators, future research should also concentrate on developing a holistic model for coping with ostracism.

Limitations and Future Work

The current experiments have limitations that deserve mention. One limitation relates to self-reported measures. Although the scales used here are extremely common and are the most widely used measures assessing the impact of ostracism in ostracism research (e.g., Garczynski and Brown, 2014; for meta-analyses see Hartgerink et al., 2015), participants may have underreported their negative mood and unsatisfied needs. For example, Garczynski and Brown (2014) found that temporal framing, or phrasing ostracism self-reported measures shaped individuals' responses. They argued that "differences based on tense are the result of biased self-reports (due to social desirability concerns or implicit theories of change over time), rather than representing actual recovery from exclusion" (p. 40). They noted that greater distress will be reported when asking participants to report their feelings in the past than in the present. While it is possible that people may try to create an impression by falsely answering self-reports, the use of a between-subject design and a mental visualization cover story make it less likely that participants knew what sort of relative impression to make. They were unaware of the other conditions and could not know whether they were reporting scores that were more or less comparable to other conditions. Moreover, the current paper focuses solely on the reflective stage, during which the participant can appraise the experience of being ostracized, such as its cause (Williams, 2007). In the experiments, all the participants were asked to relate to their current feelings (see **Appendices A**, **B**). However, as also suggested by Garczynski

and Brown (2014) future studies should assess distress using physiological measures such as levels of cortisol or blood pressure while participants report their feelings. To examine the tense effects, future research could also manipulate self-presentation beliefs and participants' concerns about emotional intensity across time, or counterbalance the tenses of the measures (see details in Garczynski and Brown, 2014). Nonetheless, future research should use implicit or psychological measures to examine the effects of attribution on ostracism distress and also examine the mitigating effects of attribution on actual post-ostracism behavior. It would also be important to examine whether being ostracized by someone the participant knows exacerbates the distress of ostracism and decreases the effects of attribution found here. The examination should also be extended to include the more recent expansion of Weiner's attribution theory to eight possible types of attribution.

Another limitation relates to the fact the current studies used an experimental design with a brief (but externally valid) manipulation of ostracism (see the meta-analysis of nearly 120 Cyberball studies by Hartgerink et al., 2015). As such, the generalizability of the findings can be challenged. However, the participants were heterogeneous in terms of their gender and age. Future research should test the moderating role of attribution on ostracism effects on a broader spectrum of populations while using other manipulations (or indices) of ostracism. It would be interesting to examine whether attribution interventions are also effective when ostracism occurs with people who are more emotionally close to individuals, such as their peers and romantic partners. Moreover, in the current research the intervention was administered immediately after the ostracism experience. Future research should also examine whether attributional interventions that are administered after a longer delay have similar or different effects than those found here.

In Weiner's (1985) attribution theory, controllability was defined as another attribution factor. As reported by Warburton et al. (2006), ostracized individuals can become aggressive to establish control. Thus, the importance of a sense of control over ostracism affects recovery. In the current study, only locus and stability were analyzed.

Since previous findings have indicated that death anxiety mediates the association between ostracism experience and distress (e.g., Yaakobi, 2018, 2019), future research should examine whether death anxiety moderates attribution effects using an experimental design.

Finally, it would be of value to examine whether the moderating effects found in the current study in the reflective stage are sustained in what Williams (2009) calls the resignation stage, and if not, when this moderating effect dissipates. According to Williams' (2009) temporal need-threat model, the third (resignation) stage only characterizes individuals who are chronically exposed to ostracism. Their resources are depleted, which leads to internalized feelings of alienation, depression, helplessness, and worthlessness. If the effects of attribution help mitigate ostracism distress immediately after the experience, it would be useful to examine whether some attribution types can lead to complete recovery in the reflexive stage. Examining concurrently the effects of attribution in the reflexive and reflective stages could serve to determine whether the attributions could have produced immediate relief, and would make it possible to directly examine changes in needs and negative affect over time.

Conclusion

These three experiments provide empirical evidence for the role of attribution in moderating ostracism distress in the reflective stage. They also suggest which attribution types are the most effective in achieving relief and mitigating the negative effects of ostracism. They also pave the way for future empirical research on ways to better alleviate and recover from ostracism-related distress. Finally, death anxiety mediated the association between cuing an external attribution for ostracism on mood.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ono Academic College review board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

EY contributed to conception and design of the study, organized the database, performed the statistical analysis, wrote the first draft of the manuscript, and wrote sections of the manuscript.

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Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX A: MOOD SCALE

For each question, please circle the number to the right that best represents the feelings you are experiencing RIGHT NOW.	Not at all				Extremely
Good	1	2	3	4	5
Bad	1	2	3	4	5
Friendly	1	2	3	4	5
Unfriendly	1	2	3	4	5
Angry	1	2	3	4	5
Pleasant	1	2	3	4	5
Happy	1	2	3	4	5
Sad	1	2	3	4	5

APPENDIX B: NEEDS SATISFACTION SCALE

For each question, please circle the number to the right that best represents the feelings you are experiencing RIGHT NOW.	Not at all				Extremely
Belonging					
I felt "disconnected" (R)	1	2	3	4	5
I felt rejected (R)	1	2	3	4	5
I felt like an outsider (R)	1	2	3	4	5
I felt I belonged to the group	1	2	3	4	5
I felt the other players interacted with me a lot	1	2	3	4	5
Self esteem					
I felt good about myself	1	2	3	4	5
My self-esteem was high	1	2	3	4	5
I felt liked	1	2	3	4	5
I felt insecure (R)	1	2	3	4	5
I felt satisfied	1	2	3	4	5
Meaningful existence					
I felt invisible (R)	1	2	3	4	5
I felt meaningless (R)	1	2	3	4	5
I felt nonexistent (R)	1	2	3	4	5
I felt important	1	2	3	4	5
I felt useful	1	2	3	4	5
Control					
I felt powerful	1	2	3	4	5
I felt I had control over the course of the game	1	2	3	4	5
I felt I had the ability to significantly alter events	1	2	3	4	5
I felt I was unable to influence the action of others (R)	1	2	3	4	5
I felt the other players decided everything (R)	1	2	3	4	5

frontiers | Frontiers in Psychology

ORIGINAL RESEARCH
published: 01 July 2022
doi: 10.3389/fpsyg.2022.883901

Feeling Ostracized by Others' Smartphone Use: The Effect of Phubbing on Fundamental Needs, Mood, and Trust

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OPEN ACCESS

Edited by:
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Reviewed by:
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Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *25 February 2022*
Accepted: *07 June 2022*
Published: *01 July 2022*

Citation:
Knausenberger J, Giesen-Leuchter A and Echterhoff G (2022) Feeling Ostracized by Others' Smartphone Use: The Effect of Phubbing on Fundamental Needs, Mood, and Trust. Front. Psychol. 13:883901. doi: 10.3389/fpsyg.2022.883901

With phubbing (i.e., "The act of snubbing someone. . . by looking at your phone instead of paying attention") being a widespread phenomenon, a sound understanding of its emotional reverberations and consequences for interpersonal relationships is required. To the extent that phubbing is perceived as a momentary act of ostracism, it should influence both emotional and behavioral reactions. To address this issue empirically, we investigated effects of phubbing on variables previously shown to be affected by ostracism. Specifically, we examined in two studies how being phubbed affects participants' mood, satisfaction of fundamental needs, feelings of being ostracized (Study 1 and 2) and trust (Study 2). In Study 1, participants remembered a situation in which they were either phubbed, phubbed someone else or experienced an attentive conversation. In Study 2 different phubbing behaviors were manipulated during an ongoing conversation. Results from both studies suggest that phubbing triggers negative mood and feelings of ostracism, and threatens fundamental needs. Study 2 revealed that these effects were stronger when phubbing occurred three times (vs. once). Study 2 further demonstrated behavioral consequences of phubbing, namely that trust in a trust game was reduced when participants were phubbed three times (vs. once). We discuss conceptual and practical implications of smartphone use for emotion regulation and interpersonal relations.

Keywords: phubbing, ostracism, fundamental needs, mood, interpersonal relations, trust game

INTRODUCTION

In 2021, there were 8.1 billion mobile phone subscriptions worldwide (Ericsson, 2021). By now, 97% of US Americans own a mobile phone (Pew Research Center, 2021) and use it quite frequently. Specifically, a study among college students revealed that this demographic uses their mobile phone for about 9 h a day (Roberts et al., 2014). This usage has many positive effects on relationships with friends and family members because it provides an easy way to stay connected (Leung and Wei, 2000; Salehan and Negahban, 2013). However, smartphone use can also have negative effects on social relationships. Using one's mobile phone in the presence of others (i.e., phubbing, a portmanteau from the two words *phone* and *snubbing*; Klein, 2014; Stop Phubbing, n.d.) can make a bad impression on others and has been linked to reduced relationship quality (e.g.,

Roberts and David, 2016; Vanden Abeele et al., 2016; Beukeboom and Pollmann, 2021; Bröning and Wartberg, 2022).

Given the omnipresence of phubbing (Klein, 2014; Vanden Abeele et al., 2019), it is important to understand its harmful consequences. Therefore, we want to illuminate *how* phubbing can produce negative effects in interactions with physically present interaction partners. We argue that phubbing can be perceived as a momentary act of ostracism (i.e., ignoring and excluding others, Williams, 2007; also see Gonzales and Wu, 2016; Hales et al., 2018), thereby causing harm to the well-being of the co-present interaction partner (Williams, 2007). Phubbing represents a sudden diversion of attention away from the phubee, which conveys a lack of interest in the ongoing interaction with the phubee. We thus argue that phubbing can be perceived as ostracism because the phubber ignores the interaction partner (i.e., the phubbee, Chotpitayasunondh and Douglas, 2016) when using her or his mobile phone (Klein, 2014; Vanden Abeele et al., 2016; Stop Phubbing, n.d.). Moreover, the phubber potentially excludes the phubbee from an online interaction with another person who is addressed by the phubber. In these ways, phubbers are excluding and ignoring others, which matches the definitional criteria of ostracism.

Prior research has found ample evidence for negative consequences of ostracism for its targets (Williams, 2007). Specifically, ostracism induces social pain, threatens fundamental human needs, and causes negative mood. Thus, we hypothesize that phubbing causes negative mood and threatens fundamental human needs as well. Prior research has provided initial evidence for this assumption (Gonzales and Wu, 2016; Chotpitayasunondh and Douglas, 2018; Hales et al., 2018; Beukeboom and Pollmann, 2021; McDaniel and Wesselmann, 2021). The goal of our research was to replicate and extend this existing research (Study 1 and 2) in two important aspects. First, we extended previous research on consequences of phubbing by comparing the perspective of both phubbers and phubbees with a control condition (Study 1). With previous research on ostracism focusing mainly on targets of ostracism, a comparison of targets and sources of ostracism is highly needed (Zadro and Gonsalkorale, 2014). Exploring both perspectives of phubbing, that is, of both the phubbee and the phubber, enables a more comprehensive view of phubbing in its interactive context. Second, no research has yet investigated behavioral consequences of phubbing. Thus, we also explored whether the negative intrapersonal consequences of phubbing affect interpersonal behavior. Particularly, we predict that phubbing has similar effects on behavioral measures as ostracism (Study 2) and causes reduced behavioral trust shown toward phubbers.

Phubbing as Ostracism

When engaging in phubbing, the phubber ignores the phubbee for a relatively short period (Vanden Abeele et al., 2016), and thus excludes him or her from a potential digital interaction with another person (Klein, 2014). Of course, mobile phones can be used for reasons other than interacting with someone else. However, mobile phones are frequently used for texting and other social media activities (Klein, 2014). Thus, the phubbee is likely to assume that the phubber engages in a remote interaction, thereby causing the phubbee to experience feelings of exclusion.

Previous research on ostracism has demonstrated that ostracism causes negative mood and threatens fundamental human needs of belongingness, self-esteem, control, and meaningful existence (i.e., need threat; e.g., Williams, 2007), but the intensity of these consequences depends on the temporal distance to the ostracism experience. In his temporal need-threat model, Williams (2009) distinguishes between a reflexive and reflective response to ostracism. The reflexive response is an immediate aversive experience, which is usually not affected by other variables (Hartgerink et al., 2015). Also, even minor cues of ostracism induce this reflexive threat to one's needs and reduce positive mood (Spoor and Williams, 2007; Kerr and Levine, 2008; Giesen and Echterhoff, 2018). The reflexive response occurs because humans have an innate ostracism detection system that automatically detects all cues that might signal ostracism in the environment (Spoor and Williams, 2007; Kerr and Levine, 2008). When these cues are detected, the system alarms the individual by immediately causing negative mood and need threat. Since minor cues of ostracism are enough to activate the ostracism detection system, even short instances of being ignored and excluded, such as phubbing, should be enough to cause reflexive negative mood and need threat. Later, this reflexive response can be buffered by coping strategies and deliberate reflection on the experience (i.e., the reflective response). The initial reflexive response represents the immediate negativity of the experience, unaffected by coping mechanisms. Thus, in the present research we are interested in the effect of phubbing on reflexive need threats and mood. In a first exploration of this effect, Hales et al. (2018) demonstrated that remembering an instance of being phubbed causes feelings of ostracism, negative mood and need threat in phubbees.

Of course, the social pain response might be immediately buffered by the fact that the phubbers only ostracize the phubbees for a relatively short period of time. Specifically, they usually attend briefly to their mobile phone before re-focusing their attention on the real-life conversation, or they do so in between multiple phubbing episodes, where they divide their attention between their mobile phone and the concurrent conversation (Misra et al., 2016). Indeed, research on ostracism in which the ostracism experiences were followed by re-inclusion (Rudert et al., 2017) or in which people experienced partial ostracism (i.e., receiving one of two balls in an online ball-tossing game; Van Beest, 2016) caused less negative mood and lower need threat than did full-blown ostracism.

Most research on ostracism has investigated the consequences of being ostracized by a group (Williams et al., 2000; Williams and Jarvis, 2006; Wolf et al., 2014); only little research has manipulated ostracism by a single individual (e.g., Wirth et al., 2010). Arguably, being ostracized by one person might be less harmful than being ostracized by multiple individuals (Latané, 1981; DeWall et al., 2010). Still, the ostracism detection system should promptly react to the temporary ostracism by the phubber, causing at least some negative mood and need threat.

Given the high sensitivity of the ostracism detection system, prior research has demonstrated that ostracism is not merely painful for its direct targets but also for observers of ostracism

(Wesselmann et al., 2009; Giesen and Echterhoff, 2018) and even the perpetrators (Legate et al., 2013). In their research, Legate et al. have shown that perpetrators of ostracism experience a threat to their autonomy and belongingness needs as well as negative mood. Also, more phubbing behavior has been found to be associated with more negative mood (Guazzini et al., 2021). Therefore, we expect phubbers to experience some need threat and negative mood, too.

Because ostracizers are responsible for the pain inflicted by ostracizing, it comes as no surprise that ostracized individuals have lower trust in the perpetrators (Twenge et al., 2007; Hillebrandt et al., 2011). Indeed, in prior research, ostracized individuals reported lower trust in others (Twenge et al., 2007) and showed lower behavioral trust in the so-called trust game (Hillebrandt et al., 2011). In this economic game (Berg et al., 1995), trust is operationalized by the amount of money or points a person (i.e., the sender) sends to an interaction partner (i.e., the receiver). This amount is multiplied, and the receiver can decide how much they want to give back to the sender. Thus, by initially sending money or points to the receiver, the sender can increase the profit of both parties. However, they are dependent on the decision by the receiver: The receiver could decide to send no money or points back, leaving the sender at a loss. Therefore, depending on how much the sender trusts the receiver to send back a reasonable amount of money or points, they will decide how much money or points they will initially send the receiver. By this process, the amount of money or points represents the level of the sender's trust in the receiver. Importantly, ostracized individuals showed less behavioral trust toward the other player when that other player was their ostracizer (Hillebrandt et al., 2011). Thus, we expect that phubbed individuals, like ostracized individuals, demonstrate less behavioral trust toward their phubbers. Preliminary evidence for this assumption is provided by Przybylski and Weinstein (2013), who have shown that the mere presence of a smart phone reduces self-reported trust in the conversation partner. However, to our knowledge, no previous research has examined the consequences of phubbing on behavioral trust.

Consequences of Phubbing

Prior research on the consequences of phubbing has revealed negative intra- and interpersonal consequences. In our research we aim to replicate and extend these findings. We further want to contribute to a deeper understanding of the negative consequences of phubbing by additionally investigating behavioral reactions of the phubbee toward the phubber. Prior research has solely focused their insights on self-reports by their participants. For example, people who had conversations in which a mobile phone was present or was used reported to experience less empathic concern (Misra et al., 2016), less interpersonal trust (Cameron and Webster, 2011), and reduced relationship (Roberts and David, 2016; Bröning and Wartberg, 2022) and friendship satisfaction (Sun and Samp, 2021). Overall, phubbing is perceived as inappropriate by phubbees, and the perceived inappropriateness increases with the frequency in which the mobile phone is used during the conversation (Klein, 2014). Some studies have also found positive associations between reported phubbing experiences and negative mood (do Nascimento Teixeira and de Assis Freire, 2020; Fellesson and Salomonson, 2020). However, most studies were correlational. To our knowledge, there are only a few published articles that have experimentally investigated the effect of mobile phone presence or usage on interactions with others who are physically present (Przybylski and Weinstein, 2013; Gonzales and Wu, 2016; Vanden Abeele et al., 2016; Hales et al., 2018; McDaniel and Wesselmann, 2021). For example, Przybylski and Weinstein (2013) demonstrated that the mere presence of a smart phone vs. a notebook during a dyadic conversation caused a reduction in perceived closeness, connection and conversation quality in both conversation partners. In another study, Vanden Abeele et al. (2016) showed that when someone interacts with a mobile phone during a conversation with another person, the phubbee perceives the phubber as being less attentive and polite.

However, the negative consequences of phubbing are not limited to the formation of interpersonal impressions and conversational quality, but they also cover effects like those of ostracism (Gonzales and Wu, 2016; Chotpitayasunondh and Douglas, 2018; Hales et al., 2018; McDaniel and Wesselmann, 2021). In fact, Hales et al. demonstrated that participants, who merely remembered being phubbed (vs. an attentive conversation vs. control) experienced feelings of ostracism, need threat and negative mood. Also, Gonzales and Wu (2016) as well as McDaniel and Wesselmann (2021) found that a manipulated phubbing episode during a face-to-face conversation caused feelings of exclusion in the participants. Chotpitayasunondh and Douglas (2018) found that imagining being phubbed increased negative mood, and decreased positive mood and feelings of belongingness. We aimed to replicate that phubbing causes negative mood, feelings of ostracism, and need threat for phubbees. Additionally, we examined negative effects of phubbing for phubbers and investigated a behavioral response to phubbing, that is, behavioral trust.

Different Types of Phubbing

In the studies outlined above in which phubbing was manipulated in an ongoing interaction (Gonzales and Wu, 2016; Vanden Abeele et al., 2016), the study authors operationalized different key aspects of phubbing that can often be observed in the presence of others. Specifically, Vanden Abeele et al. manipulated the initiation type of the mobile phone interaction. In their first study, the confederate either used her or his mobile phone after the sound of a ringtone (i.e., reactive phubbing) or without the sound of a prior ringtone (i.e., proactive phubbing). Additionally, the authors altered the type of mobile phone interaction (reading a message in Study 1; writing a message in Study 2), as well as the frequency of mobile phone usage (i.e., 3x phubbing in Study 1; 1x phubbing in Study 2) across their experiments. Also, across their conditions, Gonzales and Wu implemented reactive and proactive mobile phone initiation as well as reading information and answering text messages. Furthermore, the mobile phone usage was announced by the confederate before they used it.

Even though these are all interesting aspects of phubbing, they were rarely manipulated separately in the same experiment. In fact, Vanden Abeele et al. (2016) only compared the

consequences of proactive vs. reactive phubbing directly within one experiment, showing that proactive phubbing has more negative consequences than reactive phubbing, presumably due to a stronger violation of social norms. Similarly, Gonzales and Wu (2016) merely compared reading vs. writing in their experiment. They found that compared to being phubbed by a person who is reading information, being phubbed by someone who is writing messages to another person did not affect need threat and mood of the participants. Thus, some interesting aspects of phubbing were combined within the same condition or were only varied *between* different experiments (e.g., frequency of phubbing). Thus, the specific influence of each individual aspect could not be identified. From our view, an experimental comparison of these different aspects of phubbing provides important insights into the circumstances under which phubbing negatively affects interpersonal relationships. Therefore, we manipulated different aspects of phubbing behavior within one experiment and investigated their effect on the phubbee's fundamental human needs, mood, and behavioral trust toward the phubber.

Goals of the Present Research

We conducted the present research to experimentally investigate the consequences of phubbing on the phubbee's well-being and behavioral responses toward the phubber. Prior research has demonstrated that phubbing causes feelings of being ostracized (Gonzales and Wu, 2016; Hales et al., 2018; McDaniel and Wesselmann, 2021) as well as negative mood and need threat in the phubbee (Hales et al., 2018). Our present research replicates and extends these prior studies by investigating the effect of phubbing on the reflexive satisfaction of fundamental human needs, mood, and feelings of ostracism (Studies 1 and 2). Specifically, we investigate for the first time how these negative intrapersonal consequences of phubbing translate into behavior and, therefore, we assessed behavioral trust (Berg et al., 1995) toward the phubber (Study 2).

In Study 1, participants were asked to remember a situation in which they were phubbed by another person, in which they have phubbed another person or in which they were having an attentive conversation. In Study 2, we manipulated phubbing in a face-to-face conversation between a confederate and participant and additionally varied the type (reactive vs. proactive, writing vs. reading) as well as the frequency (once vs. three times) of phubbing.

Building on prior ostracism research (Williams, 2007; Legate et al., 2013), we hypothesized that phubbing causes reflexive social pain in both the phubbee and the phubber, as indicated by negative mood, need threat, and feelings of ostracism. Because the ostracism detection system always alarms the individual when any cue of ostracism is detected (Spoor and Williams, 2007; Kerr and Levine, 2008), we expect phubbing to have a negative effect on need threat, mood and feelings of ostracism.

Specifically, we predict that the phubbee will show reduced trust toward the phubber. Concerning the different types of phubbing, we predict that reactive phubbing might be perceived as more acceptable than proactive phubbing because individuals might regard answering a received message as a social obligation and expect others to do so (Vanden Abeele et al., 2016). Reading a message might also have fewer negative consequences than typing an answer because the latter might require an even stronger focus on the mobile phone (Vanden Abeele et al., 2016). Finally, as pointed out by Klein (2014), the more often phubbing occurs, the more negative it might be. Thus, phubbing someone three times is predicted to have more negative effects than phubbing someone once.

STUDY 1

Given the similarities between phubbing and ostracism, we expect that phubbing causes the phubbee to experience a threat of their fundamental needs of belongingness, self-esteem, control, and meaningful existence, as well as negative mood and feelings of ostracism (also see Hales et al., 2018). In addition, since even perpetrators of ostracism experience negative consequences of their behavior (Legate et al., 2013), we also expect phubbers to experience reduced need satisfaction and negative mood. As pointed out by Giesen and Echterhoff (2018), the ostracism detection system might mainly warn the individual by inducing negative mood because of its high informational value (Schwarz and Clore, 1983, 1996). Therefore, we specifically expect that while phubbees and phubbers might not differ in the extent of their negative moods, phubbers might experience less need threat than phubbees. To test our prediction, we conducted an online experiment, in which participants were asked to either remember and describe a situation in which they have experienced phubbing, in which they have phubbed someone else, or in which they had an attentive conversation with another person.

Methods

Participants and Design

Data of this study are part of a larger exploratory online survey on phubbing behavior. To determine the required sample size, we calculated a power analysis with G*Power (Faul et al., 2009) based on the comparison between the Phubbee condition and the Attentive Conversation condition, with $d = 0.64$ (Hales et al., 2018), $1\text{-}\beta = 0.95$, and $\alpha = 0.05$. The analysis revealed a required sample size of $n = 108$ participants for these two conditions, resulting in a required sample size of $N = 162$ for all three conditions. To be able to detect a potentially smaller effect size for the Phubber condition, we recruited an additional 10% of participants (i.e., $N = 179$).In total, 182 participants answered this survey. Part of this survey involved having participants remember a situation in which they experienced being phubbed by another person (Phubbee condition), in which they had phubbed another person (Phubber condition), or in which they were having a conversation with an attentive other (Attentive Conversation condition). Participants were randomly assigned to these conditions. Five participants in the Attentive Conversation condition reported that the other person used their mobile phone during the conversation (i.e., has phubbed the participant). Thus, those five participants were excluded from further analyses. Another participant in the Attentive Conversation condition was

excluded from further analyses because she or he did not describe a conversation but instead described a different situation. Additionally, four participants in the Phubber condition were excluded since they described a situation in which they were the phubbee instead of the phubber. Finally, one participant was excluded from further analyses because they did not describe any situation at all. The remaining sample size consisted of $N = 170$ participants (144 female, 26 male) with a mean age of 29.26 years ($SD = 9.86$ years).

Procedure

Upon opening the link to the online survey, participants received information about the study and agreed to participate by clicking a corresponding button. They were informed that they could withdraw from participating at any time during the study by simply closing the browser window. Data from these participants were not included in our analyses. After having agreed to participate, the Phubbee, Phubber and Attentive Conversation conditions were manipulated modifying the essay manipulation of ostracism (Pfundmair et al., 2015). Thereafter, need satisfaction, feelings of being ostracized and mood were assessed. Participants in the Attentive Conversation condition were further asked whether their conversation partner had used her or his mobile phone during the conversation (response options: yes, no, I don't know). If they answered "yes," they were excluded from further analyses[1]. Afterward, potential moderators[2] and demographic data (i.e., gender, age, educational level, occupation) were assessed. At the end of the study, participants were debriefed and received the opportunity to participate in a lottery of online store vouchers as compensation for their participation (we raffled four vouchers worth 20 € and four vouchers worth 10 €).

Materials

Essay Manipulation

We adapted the essay manipulation by Pfundmair et al. (2015) to test the present hypotheses. Participants in the Phubbee condition were instructed to remember a past conversation in which they were phubbed by their conversation partner. They were asked to remember a situation in which only they and one other person were involved and to write a detailed description of this situation, to describe their feelings, thoughts, and behavior. Participants in the Phubber condition received the same instruction, except they were asked to remember a situation in which they had phubbed someone else. Participants in the Attentive Conversation condition were asked to remember a conversation with one other person in which this person gave them her or his full attention. Before these instructions, participants in the Phubbee and Phubber conditions received a definition of "phubbing" (i.e., "phubbing describes the behavior of a person who uses her or his mobile phone during a conversation instead of focusing her or his attention on her or his conversation partner").

Need Satisfaction

Need satisfaction was assessed by 20 items concerning the need to belong, need for self-esteem, need for control, and need for meaningful existence. For this purpose, we adapted the need-threat scale by Williams (2009) to fit the present context (e.g., "I felt like an outsider", $\alpha = 0.95$). Participants were asked to indicate on 5-point Likert scales (1 = *not at all*; 5 = *very*) how they felt while they were being phubbed.

Mood

To assess the mood of the participants during the conversation, they were asked to indicate to what extent they felt each of 28 emotional states on 5-point Likert scales (1 = *not at all*, 5 = *very*; e.g., angry, proud, nervous; Williams, 2009; PANAS, Krohne et al., 1996; $\alpha = 0.94$). Higher values indicate a more positive mood.

Feelings of Ostracism

Two items measured feelings of ostracism (e.g., "I was excluded"; Williams, 2009; $r_{SB} = 0.92$). Again, participants indicated how they felt during the conversation on 5-point Likert scales (1 = *not at all*; 5 = *very*).

Results

Needs

A one-factorial ANOVA with the conditions Phubbee, Phubber, and Attentive Conversation and need satisfaction as the dependent variable revealed a significant effect of the condition, $F(2, 167) = 86.90$, $p < 0.001$, $\eta_p^2 = 0.51$, 90% CI = [0.42;0.57]. Multiple comparisons, using the Bonferroni correction (Holm, 1979), revealed significant differences between all three conditions (see **Table 1** for inferential statistics). Confirming our hypotheses, participants in the Phubbee condition reported the least need satisfaction ($M = 2.48$, $SD = 0.69$), followed by participants in the Phubber condition ($M = 3.00$, $SD = 0.70$). Participants in the Attentive Conversation condition reported most need satisfaction ($M = 4.11$, $SD = 0.59$). Thus, phubbing was related to need threat in both phubbees and phubbers.

Mood

Another ANOVA was conducted to test the effect of our three conditions on mood. Again, there was a significant effect of the condition, $F(2, 167) = 46.98$, $p < 0.001$, $\eta_p^2 = 0.36$, 90%

[1]Before assessing the moderator variables, we asked open-ended questions on potential reasons for the phubbing, the content of the conversation, the behavioral response of the participant and the conversation partner. However, these questions are not considered in the present manuscript and are therefore not explained in detail.

[2]In total, we measured ten potential moderators: emotional closeness to the conversation partner, deepness of the conversation, degree of self-disclosure, duration of phubbing relative to the total duration of the conversation, frequency of phubbing, proactive vs. reactive phone use, announcement of the phone use, excusing the phone use, attachment anxiety (Thomson et al., 2012) and the need to belong (Hartung and Renner, 2014). To control for an inflation of the Type I error rate, the critical alpha level was adjusted by means of the Bonferroni correction (Holm, 1979; $\alpha = 0.05/10 = 0.005$). Considering this adjusted critical alpha level, none of the moderation analyses were significant (all Fs < 2.70; ps > 0.010). Therefore, we refrain from explaining these moderators in detail. In addition to the above-mentioned moderators, we further assessed as potential moderators the agreeableness (Rammstedt et al., 2013) and social norms of phubbing (Chotpitayasunondh and Douglas, 2016). However, given their low internal reliability (αs < 0.38), no further analyses were calculated with these variables.

TABLE 1 | Phubbing effects on reported need satisfaction: multiple comparisons between experimental conditions.

	Need satisfaction				
	Δ *M*	***SE***	***P***	***d***	**95% CI**
Phubbee vs. Phubber	−0.52	0.12	<0.001	0.76	[0.38; 1.13]
Phubbee vs. Attentive communication	−1.64	0.13	<0.001	2.56	[2.05; 3.07]
Phubber vs. Attentive communication	−1.12	0.13	<0.001	1.72	[1.30; 2.15]

n (Phubbee) = 54, n (Phubber) = 62, n (Attentive Conversation) = 54.

TABLE 2 | Phubbing effects on reported mood: multiple comparisons between experimental conditions.

	Mood				
	Δ *M*	***SE***	***p***	***d***	**95% *CI***
Phubbee vs. Phubber	−0.22	0.12	0.207	0.38	[0.007; 0.74]
Phubbee vs. Attentive communication	−1.11	0.12	<0.001	1.72	[1.27; 2.16]
Phubber vs. Attentive communication	−0.90	0.12	<0.001	1.55	[1.14; 1.97]

n (Phubbee) = 54, n (Phubber) = 62, n (Attentive Conversation) = 54.

TABLE 3 | Phubbing effects on reported feelings of being ignored and excluded multiple comparisons between experimental conditions.

	Feeling ignored and excluded				
	Δ *M*	***SE***	***P***	***d***	**95% CI**
Phubbee vs. Phubber	1.53	0.16	<0.001	1.53	[1.11; 1.94]
Phubbee vs. Attentive communication	2.44	0.16	<0.001	3.31	[2.73; 3.89]
Phubber vs. Attentive communication	0.90	0.16	<0.001	1.21	[0.827; 1.61]

n (Phubbee) = 54, n (Phubber) = 62, n (Attentive Conversation) = 54.

CI = [0.26; 0.44]. Multiple comparisons revealed that phubbees (M = 2.82, SD = 0.53) and phubbers (M = 3.04, SD = 0.61) did not significantly differ from each other in their mood (see **Table 2** for the inferential statistics). Those who wrote about an attentive conversation experienced significantly more positive mood (M = 3.93, SD = 0.75) than did participants in both other conditions. Again, these results show that phubbing has negative consequences for both phubbees and phubbers.

Feelings of Ostracism

The third ANOVA with feelings of being ignored and excluded also revealed a significant effect of our conditions, $F(2, 167) = 116.41$, $p < 0.001$, $\eta_p^2 = 0.58$, 90% CI = [0.50;0.64]. Multiple comparisons showed that all three conditions differed significantly from each other (see **Table 3** for the inferential statistics; Phubbee: M = 3.51, SD = 1.02; Phubber: M = 1.98, SD = 0.99; Attentive Conversation: M = 1.07, SD = 0.23). Thus, both phubbees and phubbers felt ostracized.

Mediation Analyses

In order to examine whether feelings of ostracism mediated the effect of condition on need satisfaction and mood, we conducted mediation analyses for the comparison between the phubbee condition and the attentive conversation condition as well as between the phubber condition and the attentive conversation condition with the R package mediation (Tingley et al., 2014).

Phubbee vs. Attentive Conversation

Feelings of ostracism mediated the effect of condition on need satisfaction, $ab = -1.35$, 95%-CI [−1.71; 1.01], $p < 0.001$, and on mood, $ab = -0.96$, 95%-CI [−1.36; −0.57], $p < 0.001$ (**Figure 1**).

Phubber vs. Attentive Conversation

There was a partial mediation via feelings of ostracism of the effect of condition on need satisfaction, $ab = -0.44$, 95%-CI [−0.64; −0.28], $p < 0.001$ and on mood, $ab = -0.24$, 95% CI [−0.41; −0.09], $p = 0.002$ (**Figure 2**).

Discussion

First of all, Study 1 replicated findings by Hales et al. (2018) and, thereby, provides further evidence for the assumption that phubbing can be perceived as ostracism. Participants who remembered a phubbing episode in which they were phubbed by another individual reported experiencing a threat to their fundamental needs, experienced negative mood and felt ostracized. Extending the findings by Hales et al. (2018), we also found that participants who remembered a situation in which they had phubbed someone else reported lower need satisfaction, more negative mood and greater feelings of ostracism compared to a control group. This is in line with research showing that ostracizers experience negative consequences of their behavior as well (Legate et al., 2013). However, these consequences might be less aversive for phubbers than for phubbees: Phubbers reported experiencing lower need threat and lower feelings of ostracism than did phubbees. Only regarding mood no significant difference between phubbees and phubbers emerged.

As argued by Giesen and Echterhoff (2018), this similarity in mood might be caused by the automatic operation of the ostracism detection system. Specifically, this system warns the individual when any sign of ostracism is detected by inducing negative mood. Compared to need threat, mood is an especially suitable warning signal because it has high informational value (Schwarz and Clore, 1983, 1996). Specifically, negative mood signals environmental threats or risks to fundamental goal achievement. Because phubbing can be perceived as an ostracism cue, it is no surprise that it activates the detection system, causing similar negative mood in phubbees and phubbers.

Even though the negative consequences for phubbers are plausible given prior findings on ostracism (Legate et al., 2013; Giesen and Echterhoff, 2018), they must be interpreted with caution. Specifically, given the retrospective nature of the present study, we do not know what motivated the phubbers to turn their attention to their mobile phones. While feelings of ostracism fully mediated the effect of the condition on both need satisfaction and mood for phubbees (vs. participants in the attentive conversation condition), they only partially mediated the effect of the condition on need satisfaction and mood for phubbers. It is likely that additional factors influenced phubbers mood and need satisfaction, and it is possible that negative mood and lower need satisfaction caused the phubbing behavior in the first place. Exploratory qualitative analyses of the texts

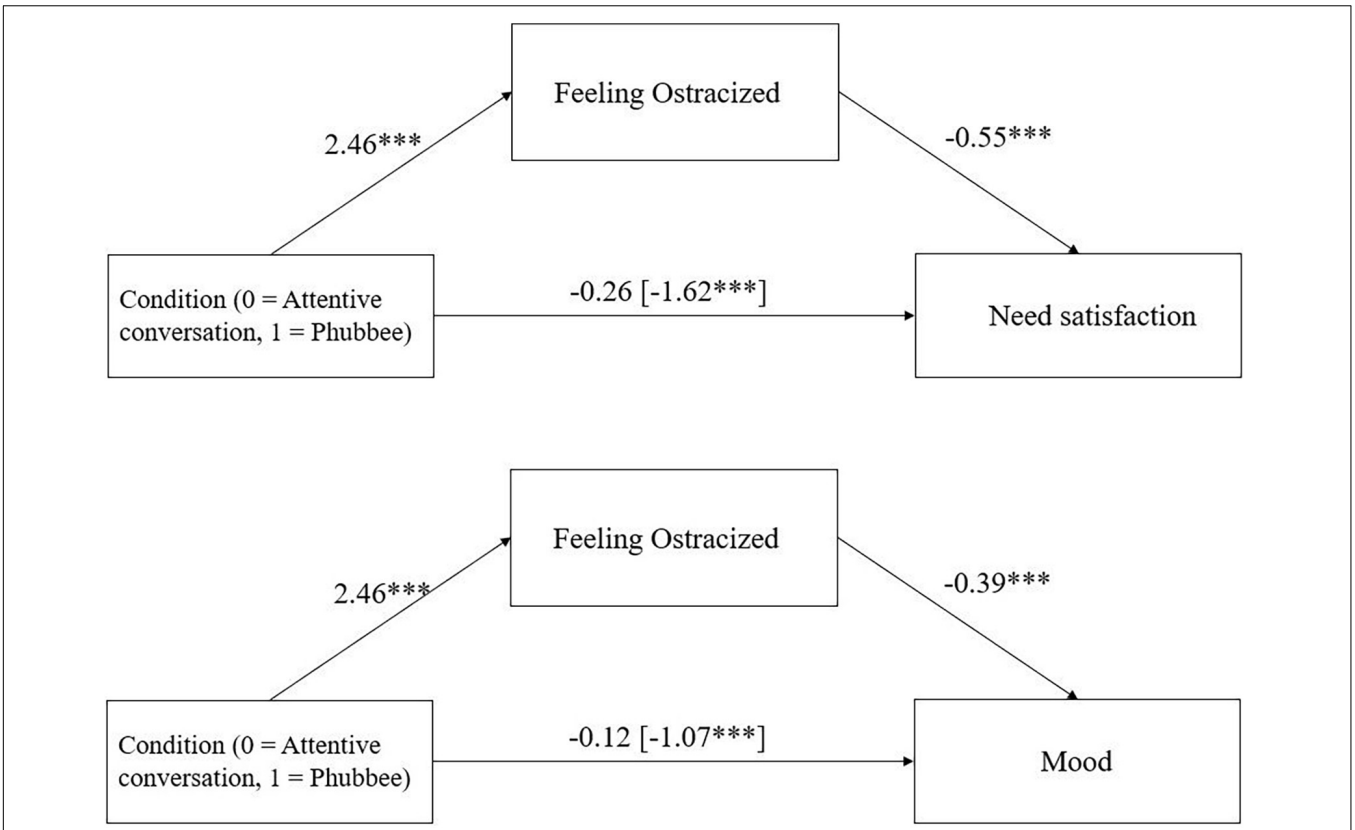

FIGURE 1 | Mediation effect of condition (attentive conversation vs. phubbee) via feelings of ostracism on need satisfaction and mood in Study 1 including the direct effect of condition on need satisfaction and mood (with total effect in parentheses). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

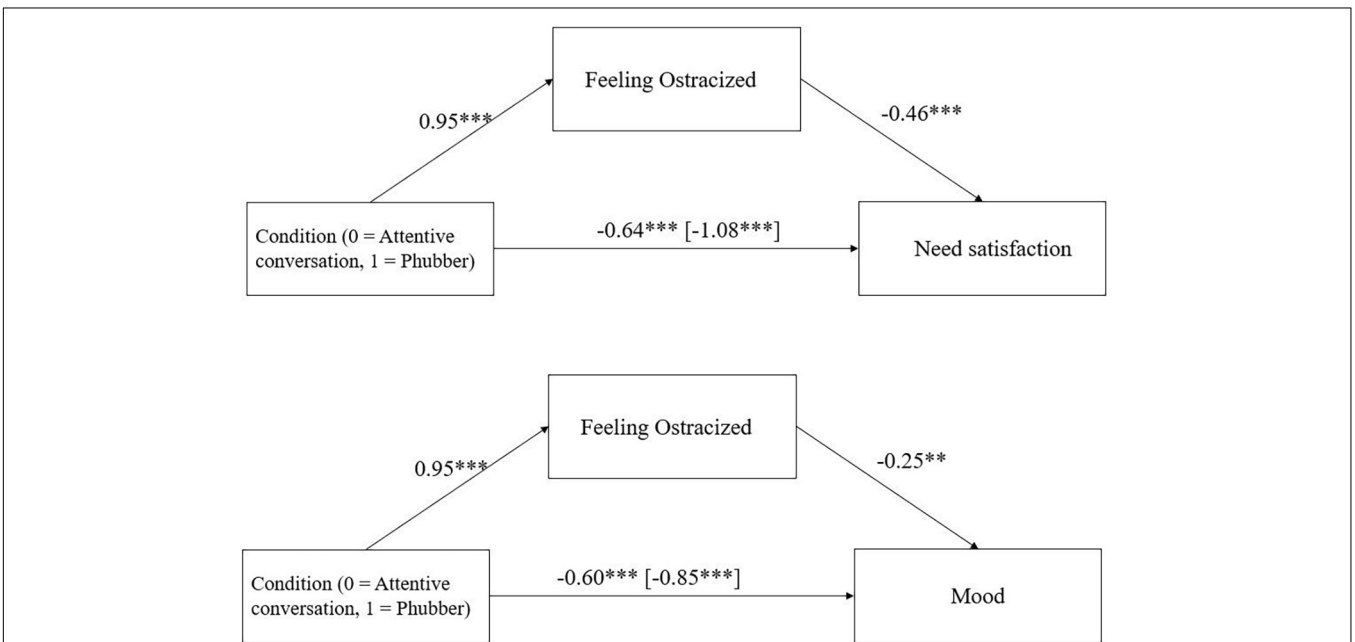

FIGURE 2 | Mediation effect of condition (attentive conversation vs. phubber) via feelings of ostracism on need satisfaction and mood in Study 1 including the direct effect of condition on need satisfaction and mood (with total effect in parentheses). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

written by our participants revealed that phubbers tended to use their mobile phones especially when they were bored or annoyed by the conversation, or when they had received a text message. Future research is needed to further investigate the circumstances under which individuals start interacting with their mobile phones, and when this might cause negative feelings for themselves.

Additionally, by asking participants to remember a past phubbing episode, the procedure of Study 1 may convey potential demand characteristics (Orne, 1962). Similarly, participants might have remembered their own intrapersonal consequences as being more negative than they actually were. To overcome these limitations, in Study 2 we manipulated phubbing in an ongoing conversation.

STUDY 2

To examine effects of phubbing on need threat, mood, feelings of ostracism, and behavioral trust, we conducted another experiment in a standardized laboratory setting. Like Gonzales and Wu (2016), we manipulated phubbing (vs. neutral behavior) during a 10-min conversation in Study 2. However, in contrast to the study by Gonzales and Wu, phubbers in our study only focused their attention on the mobile phone for a short period of time and continued their conversation with the participant afterward. We thus ensured high external validity by manipulating phubbing more realistically (Misra et al., 2016). Additionally, we varied different relevant aspects of phubbing. More specifically, a confederate either interacted once vs. three times with her or his mobile phone during the conversation, initiated this interaction in a proactive vs. reactive way, and pretended to read a text message vs. to read and also answer it. Since we assume phubbing to be perceived as ostracism, we predicted that all kinds of phubbing affect need satisfaction, mood and feelings of ostracism. These variations of phubbing had not previously been varied systematically. We explored the effects of these variations in our analyses.

In addition to self-reported effects on fundamental needs, mood, and feelings of ostracism, we assessed, for the first time, behavioral consequences of phubbing. More precisely, we measured the phubbee's behavioral trust toward the phubber by means of the trust game (Berg et al., 1995). Prior research on ostracism has demonstrated that ostracism causes a reduction of trust shown in this game (Hillebrandt et al., 2011). Therefore, we expect that phubbing will cause participants to display less behavioral trust when they were previously phubbed (vs. when they were not). Finally, to replicate and extend prior research on phubbing, we assessed different interpersonal variables that were previously shown to be negatively affected by phubbing (e.g., perceived politeness and attentiveness of the phubber; Vanden Abeele et al., 2016).

Methods

Participants and Design

The design of Study 2 was a 2 (phubbing frequency: 1 vs. 3 times) × 2 (phubbing initiation: proactive vs. reactive) × 2 (modality: reading vs. writing) between-subjects design. Additionally, we recruited participants for a control condition (Attentive Conversation). Participants were randomly assigned to the conditions. To determine the required sample size, we calculated a power analysis with G*Power (Faul et al., 2009) based on the 2 × 2 × 2 design, with $d = 0.71$ (Hillebrandt et al., 2011), $1\text{-}\beta = 0.95$, and $\alpha = 0.05$. The analysis revealed a required sample size of $N = 106$ participants. To be able to control for potential dropout or unusable data, we recruited an additional 5% of participants (i.e., $N = 112$). To make a meaningful comparison of main effects with the Attentive Conversation condition possible, an additional 52 participants (i.e., half of the *a priori* calculated samples size) were recruited for the Attentive Conversation condition. One participant was excluded from further analyses because of incomplete data due to computer problems. The final sample size consisted of $N = 165$ participants (118 female, 47 male), with a mean age of 23.88 years ($SD = 5.37$ years).

Procedure

Upon entering the laboratory, participants were introduced to the second alleged other participant (i.e., the confederate; the gender of the confederate was counterbalanced between participants). Both read and signed an informed consent. Afterward, they had a 10-min long conversation, which was videotaped. During this interaction, phubbing was manipulated. Thereafter, reflexive needs and mood were assessed and the trust game (Berg et al., 1995) was played via the computer. Furthermore, to replicate and extend previous findings on the consequences of phubbing, we assessed the following situationally influenced variables: politeness and attentiveness of the phubber (Vanden Abeele et al., 2016), self-reported trust, and inclusion of other in the self (Aron et al., 1997)[3]. Finally, potential moderators[4] and demographic data were assessed. At the end of the study, participants were debriefed and received course credit or 4 € as compensation for their participation.

Materials

Phubbing Manipulation

Participants were told that the present study was conducted to investigate interpersonal processes in zero-acquaintance conversations and that they would have a conversation with another unacquainted participant for 10 min. In fact, this other participant was a male or female confederate who followed a prescribed script during the interaction. During the conversation,

[3]See **Supplementary Material** for a description of the measures and the respective findings.

[4]In total, we measured eight moderators in the second study: agreeableness (Rammstedt et al., 2013), attachment anxiety (Thomson et al., 2012), self-esteem (Von Collani and Herzberg, 2003), need to belong (Hartung and Renner, 2014), experience with being phubbed by others, experience with phubbing others, and injunctive and descriptive social norms of phubbing (Chotpitayasunondh and Douglas, 2016). Since the internal reliability of the descriptive and injunctive norm questionnaires ($\alpha = 0.39$ and $\alpha = 0.21$) as well as the agreeableness scale ($\alpha = 0.46$) were too low, these scales were not considered in further analyses. Furthermore, to prevent an inflation of the Type I error rate for the remaining moderation analyses, the critical alpha level was adjusted by means of the Bonferroni correction (Holm, 1979; $\alpha = 0.05/5 = 0.01$). The analyses revealed no significant moderations except for experience with phubbing others (all other $Fs < 5.60$; all other $ps \geq 0.020$). This variable is described in detail in **Supplementary Material**.

the participant and confederate were sitting in front of each other and their task was to answer 12 personal questions to induce self-disclosure (e.g., "What is your most treasured memory?"; Aron et al., 1997). The answers by the confederate were standardized and memorized. During the conversation, the confederate and participant were asked to take the time into account (i.e., 10 min) so that they could ideally discuss all questions. For that purpose, a clock was put on the table. When taking seat, the confederate always put his or her mobile phone down, with the display facing toward the table, to rule out effects of the mere presence of a mobile phone on perceived conversation quality (Przybylski and Weinstein, 2013). After 10 min of the conversation, the experimenter knocked on the door and allegedly led the confederate to a different room, where she or he could finish the rest of the experiment.

During the conversation, phubbing was manipulated. To manipulate the frequency of phubbing, the confederate either used his or her mobile phone once (1x Phubbing condition) after about 6 min or three times (3x Phubbing condition; after about 3, 6, and 9 min). To manipulate the initiation of phubbing, the experimenter either sent a message at the predefined times to the confederate, causing the ringtone of their mobile phone to sound (reactive initiation) or did not send a message (proactive condition). In the reactive phubbing condition, the confederate picked up the phone only after the ringtone. In the proactive phubbing condition, no ringtone sounded, so the confederate self-initiated the phone interaction. The modality of phubbing was then manipulated by pretending to read a message or by reading as well as typing a message. The average duration of phubbing was 10.70 s (SD = 5.51) in the 1x Phubbing condition and 11.93 s (SD = 8.41) per phubbing in the 3x Phubbing condition. In the Attentive Conversation condition, the confederate drank three times from his or her water bottle (after about 3, 6, and 9min). The average duration of drinking water was 3.46 s (SD = 1.97). The total duration of 3x drinking did not differ significantly from the duration of 1x Phubbing, $t(76.20) = 0.25$, $p = 0.800$, $d = 0.06$. It did differ from the total duration of 3x Phubbing, $t(57.21) = 6.94$, $p < 0.001$, $d = 1.23$.

Need Satisfaction, Mood and Feelings of Ostracism

Need satisfaction was assessed by means of the same adapted need-threat scale already used in Study 1 (α = 0.87; Williams, 2009). Mood (α = 0.79) and feelings of ostracism (r_{SB} = 0.88; Williams, 2009) were also assessed as in Study 1, except that the PANAS (Krohne et al., 1996) was not included in the present study. Thus, mood was only assessed by means of the eight items by Williams (2009) for the sake of parsimony.

Trust Game

Behavioral trust was measured by means of an adapted version of the trust game (Berg et al., 1995). In this game, the participant was informed that they and the confederate would be randomly given the role of a sender or receiver of lots for vouchers of an online shop. In reality, the participant was always the sender. They received ten lots and had to decide how many lots she or he wanted to send to the confederate. Before this decision, they were informed that the chosen amount would be tripled and given to the confederate, who in turn would decide how many lots they want to send back to the participant. This included the option to send back no lots. Thus, it was possible that the participant (the sender) could end up with fewer lots than before if the recipient sent back no lots or too few lots. On the contrary, the participant could increase her or his number of lots if he or she trusted the confederate to send back enough lots. Therefore, the amount of sent lots is an index of the level of trust the participant has in the confederate.

TABLE 4 | Mean need satisfaction (SDs in parentheses) as a function of modality of phubbing (reading vs. writing), initiation of phubbing (proactive vs. reactive), and phubbing frequency.

		Need satisfaction	
		Frequency	
Modality	**Initiation**	**1x**	**3x**
Reading	Proactive	4.04 (0.24)	3.79 (0.55)
	Reactive	4.05 (0.47)	3.82 (0.57)
Writing	Proactive	3.96 (0.42)	3.89 (0.47)
	Reactive	3.79 (0.42)	3.82 (0.57)

n (1x/Reading/Proactive) = 14, n (1x/Reading/Reactive) = 14, n (3x/Reading/Proactive) = 15, n (3x/Reading/Reactive) = 13, n (1x/Writing/Proactive) = 14, n (1x/Writing/Reactive) = 13, n (3x/Writing/Proactive) = 13, n (3x/Writing/Reactive) = 15. Descriptive statistics of the Attentive Conversation condition: M = 3.90, SD = 0.46.

Other Situational Variables

Perceived politeness and attentiveness of the phubber was assessed as by Vanden Abeele et al. (2016). Specifically, perceived politeness was assessed by three items (e.g., "My conversation partner behaved inappropriately", α = 0.84). Attentiveness of the phubber was measured by four items (e.g., "My conversation partner seemed involved with the conversation", α = 0.88). For both scales, participants were asked to indicate on 7-point Likert scales to what extent they agreed with each statement (1 = *I don't agree*; 7 = *I totally agree*).

Results

Need Satisfaction

To investigate the effect of the different phubbing types on need satisfaction, we conducted a 2 (frequency: 1 vs. 3 times) × 2 (initiation: proactive vs. reactive) × 2 (modality: reading vs. writing) ANOVA. The ANOVA revealed a marginally significant effect of Frequency on need satisfaction $F(1, 103) = 3.34$, $p = 0.071$, $\eta_p^2 = 0.03$, 90% CI = [0;0.1]. Participants who were phubbed three times (M = 3.80, SD = 0.50) tended to report less need satisfaction than those who were phubbed only once (M = 3.96, SD = 0.40). No interaction or other main effects were (marginally) significant (all Fs < 1.30, all ps> 0.265; see **Table 4** for the descriptive statistics).

Mood

Another ANOVA with our independent variables was conducted to investigate the effects on mood. However, the analysis

TABLE 5 | Mean feelings of ostracism (SDs in parentheses) as a function of modality of phubbing (reading vs. writing), initiation of phubbing (proactive vs. reactive), and phubbing frequency.

		Feelings of ostracism	
		Frequency	
Modality	**Initiation**	**1x**	**3x**
Reading	Proactive	1.07 (0.27)	1.87 (1.29)
	Reactive	1.23 (0.56)	1.77 (1.22)
Writing	Proactive	1.32 (0.58)	1.96 (0.95)
	Reactive	1.15 (0.38)	1.96 (1.06)

n (1x/Reading/Proactive) = 14, n (1x/Reading/Reactive) = 14, n (3x/Reading/Proactive) = 15, n (3x/Reading/Reactive) = 13, n (1x/Writing/Proactive) = 14, n (1x/Writing/Reactive) = 13, n (3x/Writing/Proactive) = 13, n (3x/Writing/Reactive) = 15. Descriptive statistics of the Attentive Conversation condition: M = 1.02, SD = 0.14.

TABLE 6 | Mean lots sent to partner (SDs in parentheses) as a function of modality of phubbing (reading vs. writing), initiation of phubbing (proactive vs. reactive), and frequency of phubbing.

		Lots	
		Frequency	
Modality	**Initiation**	**1x**	**3x**
Reading	Proactive	8.36 (2.50)	8.73 (2.66)
	Reactive	7.43 (2.56)	6.46 (3.07)
Writing	Proactive	8.64 (2.95)	6.62 (2.79)
	Reactive	7.81 (2.50)	6.43 (2.59)

n (1x/Reading/Proactive) = 14, n (1x/Reading/Reactive) = 14, n (3x/Reading/Proactive) = 15, n (3x/Reading/Reactive) = 13, n (1x/Writing/Proactive) = 14, n (1x/Writing/Reactive) = 13, n (3x/Writing/Proactive) = 13, n (3x/Writing/Reactive) = 15. Descriptive statistics of the Attentive Conversation condition: M = 8.00, SD = 2.94.

revealed no significant effects (all Fs < 2.70, ps > 0.105; see **Supplementary Material** for the descriptive statistics).

Feelings of Ostracism

Here, an ANOVA revealed that frequency of phubbing significantly affected feelings of being ignored and excluded, $F(1, 103) = 16.51$, $p < 0.001$, $\eta_p^2 = 0.148$, 90% CI = [0.05;0.23]. Participants in the 3x Phubbing condition felt more ignored and excluded ($M = 1.88$, $SD = 1.11$) than those in the 1x Phubbing condition ($M = 1.20$, $SD = 0.47$; all other Fs < 1.00, all other ps > 0.320, see **Table 5** for the descriptive statistics).

Trust Game

To investigate the effects on the trust game, we calculated another ANOVA. The analysis revealed a significant effect of Frequency on the amount of sent lots, $F(1, 103) = 4.88$, $p = 0.029$, $\eta_p^2 = 0.05$, 90% CI = [0.002;0.12]. Participants sent fewer lots to their conversation partner when they were phubbed three times ($M = 7.09$, $SD = 2.79$) compared to only once ($M = 8.16$, $SD = 2.59$). In addition, there was a marginally significant effect of the initiation of phubbing, $F(1, 103) = 3.61$, $p = 0.060$, $\eta_p^2 = 0.03$, 90% CI = [0;0.10]. Participants tended to send fewer lots to their conversation partner when he or she phubbed reactively ($M = 7.11$, $SD = 2.62$) vs. proactively ($M = 8.13$, $SD = 2.78$). No other significant effects emerged (all Fs < 2.70, ps > 0.100; see **Table 6** for the descriptive statistics). In sum, these findings indicate that the frequency of phubbing decreases participants' trust in the phubber. Furthermore, reactive phubbing seems to be slightly more negative than proactive phubbing.

Politeness

For politeness, there was a significant effect of Frequency, $F(1, 110) = 12.17$, $p = 0.001$, $\eta_p^2 = 0.11$, 90% CI = [0.03;0.19]. Conversation partners who phubbed three times were perceived as less polite ($M = 5.45$, $SD = 1.66$) than those who phubbed once ($M = 6.37$, $SD = 0.97$). There were no other significant interactions or main effects on politeness (all Fs < 1.40, all ps > 0.240).

Attentiveness

For attentiveness, the ANOVA also revealed a significant effect of Frequency, $F(1, 103) = 11.82$, $p = 0.001$, $\eta_p^2 = 0.10$, 90% CI = [0.03; 0.19]. Participants who were phubbed three times ($M = 5.56$, $SD = 1.24$) vs. once ($M = 6.25$, $SD = 0.77$) rated their partner to be less attentive. All other effects were not significant (all Fs < 1, all ps > 0.320).

Comparison With the Attentive Conversation Condition

To further investigate the consistently found effect of the frequency of phubbing, we conducted one-way ANOVAs for each dependent variable comparing the Attentive Conversation condition, the 3x Phubbing condition, and the 1x Phubbing condition. For *post hoc* tests, we applied the Bonferroni correction so that we interpret $p < 0.016$ as significant.

Feelings of Ostracism

There was a significant effect of the condition on feelings of ostracism, $F(2, 160) = 22.15$, $p < 0.001$, $\eta_p^2 = 0.22$. *Post hoc* t-tests revealed that participants in the 3x Phubbing condition felt more ignored and excluded ($M = 1.88$, $SD = 1.11$) than those in the 1x Phubbing condition ($M = 1.20$, $SD = 0.47$) who felt more excluded than participants in the Attentive Conversation condition ($M = 1.02$, $SD = 0.14$), all $|t|$ s > 2.75, all ps < 0.008.

Politeness

There was a significant main effect of the condition on perceptions of politeness, $F(2, 160) = 16.97$, $p < 0.001$, $\eta_p^2 = 0.18$. Participants experienced their partner to be less polite in the 3x Phubbing condition ($M = 4.78$, $SD = 1.66$) than in the 1x Phubbing condition ($M = 5.70$, $SD = 0.97$), $t(88.74) = -3.59$, $p < 0.001$, and in the Attentive Conversation condition ($M = 6.025$, $SD = 0.480$), $t(64.61) = 5.385$, $p < 0.001$. The difference in the perceived politeness between the Attentive Conversation condition and the 1x Phubbing condition was not significant under the Bonferroni-adjusted alpha level, $t(79.76) = 2.207$, $p = 0.030$.

Attentiveness

There was a significant main effect of condition on ratings of attentiveness, $F(2, 160) = 9.53$, $p < 0.001$, $\eta_p^2 = 0.106$. Participants in the 3x Phubbing condition rated their partner as less attentive ($M = 5.56$, $SD = 1.24$) than participants in the 1x Phubbing condition ($M = 6.25$, $SD = 0.77$), $t(91.83) = -3.54$, $p < 0.001$, and in Attentive Conversation condition ($M = 6.24$, $SD = 0.77$), $t(89.27) = 3.502$, $p < 0.001$. There was no significant difference between the Attentive Conversation condition and the 1x Phubbing condition, $t(105.95) = 0.01$, $p = 0.922$.

Need Satisfaction, Mood, and Trust Game

There was no significant main effect of the condition on need satisfaction, mood, or the trust game (all Fs < 2.41, all ps > 0.093).

Mediation Analyses

In order to examine whether there were indirect effects of the condition on need satisfaction, mood, and trust in the trust game via feelings of ostracism, we conducted mediation analyses with the R package mediation (Tingley et al., 2014) for 1x phubbing vs. 3x phubbing, 1x phubbing vs. attentive conversation, and 3x phubbing vs. attentive conversation.

1x Phubbing vs. 3x Phubbing

There was a significant indirect effect of condition via feelings of ostracism on need satisfaction, $ab = -0.23$, 95%-CI [−0.35; −0.11], $p < 0.001$,. amount of lots sent in the trust game, $ab = -0.62$, 95%-CI [−1.17; −0.19], $p = 0.002$, and mood, ab = −0.21, 95%-CI [−0.33; −0.10], $p < 0.001$ (**Figure 3**).

Attentive Conversation vs. 1x Phubbing

There was a significant indirect effect of condition via feelings of ostracism on need satisfaction, $ab = -0.05$, 95%-CI [−0.12; −0.003], $p = 0.031$,. amount of lots sent in the trust game, $ab = -0.38$, 95%-CI [−0.83; −0.06], $p = 0.013$, and mood, $ab = -0.06$, 95%-CI [−0.13; −0.01], $p = 0.013$ (**Figure 4**).

Attentive Conversation vs. 3x Phubbing

There was a significant indirect effect of condition via feelings of ostracism on need satisfaction, $ab = -0.30$, 95%-CI [−0.44; −0.18], $p < 0.001$, amount of lots sent in the trust game, $ab = -0.67$, 95%-CI [−1.34; −0.10], $p = 0.022$, and mood, $ab = -0.27$, 95%-CI [−0.40; −0.16], $p < 0.001$ (**Figure 5**).

Discussion

Study 2 revealed that the frequency of phubbing influences the extent of its negative consequences. Specifically, when participants were phubbed three times (vs. once) during the conversation, participants experienced slightly less need satisfaction and felt more ostracized by their conversation partner. However, there was no significant difference between both the 3x and 1x phubbing condition and the Attentive Conversation condition on the fundamental needs. Still, participants who experienced phubbing reported to feel more ignored and excluded than those who engaged in an attentive conversation, replicating Gonzales and Wu's (2016) as well as McDaniel and Wesselmann's (2021) findings. Furthermore, participants who were phubbed three times felt even more ignored and excluded than participants who were phubbed only once.

Possibly, the missing difference in the conditions regarding fundamental needs can be explained by the operation of an automatic ostracism-detection system (Spoor and Williams, 2007; Kerr and Levine, 2008). This system detects all minor cues of ostracism in the environment and alarms the individual by inducing social pain. Our confederates in the Attentive Conversation condition were instructed to drink water three times, and when doing so, they were likely directing their eye gaze away from the participants. Since prior research has shown that averted eye gaze can be perceived as a minor form of ostracism and is sufficient to induce need threat (Wirth et al., 2010), this might explain the lack of differences in the present study. Therefore, we nevertheless conclude that Study 2 provides further evidence for the assumption that phubbing can be perceived as ostracism, with similar consequences for the individuals' well-being.

Furthermore, as already shown in previous studies (Vanden Abeele et al., 2016), phubbing has negative effects on interpersonal variables. When the phubbee was phubbed three times (vs. once), he or she regarded the phubber as less attentive and polite. Attentiveness and politeness were thwarted more by phubbing than by drinking water. These negative effects of phubbing were also found in the trust game: When participants were phubbed three times (vs. once), they sent fewer lots to the phubber.

Next to the effects of the frequency of phubbing, the initiation type of phubbing (proactive vs. reactive) also tended to affect behavioral trust shown toward the phubber. More precisely, reactive (vs. proactive) phubbing tended to reduce the trustworthiness of the phubber in the trust game. However, these findings are not consistent with prior research (Vanden Abeele et al., 2016). Therefore, future research is needed to further investigate the consequences of reactive vs. proactive phubbing and its underlying mechanisms. Even though Vanden Abeele and colleagues have argued that reactive phubbing is more socially accepted, reactive phubbing might be more strongly perceived as an aversive or impolite interruption of the conversational flow given the sound of the ringtone. Additionally, reactive phubbing clearly indicates that the phubber reacts to another person and thus excludes the phubbee from a virtual conversation. When the phubbing is proactive, it is unclear whether the phubber is reacting to another person or is doing something else on her or his mobile phone.

We found significant indirect effects via feelings of ostracism on need satisfaction, lots sent in the trust game, and mood for all comparisons, although only few analyses showed significant total effects of the conditions. The significant indirect effects fit with our reasoning that phubbing increases feelings of ostracism which in turn reduce need satisfaction, positive mood, and trust in the phubber. The failure to detect total effects of the conditions on the dependent variables was possible due to power issues. Therefore, future research should aim to replicate these findings with larger samples.

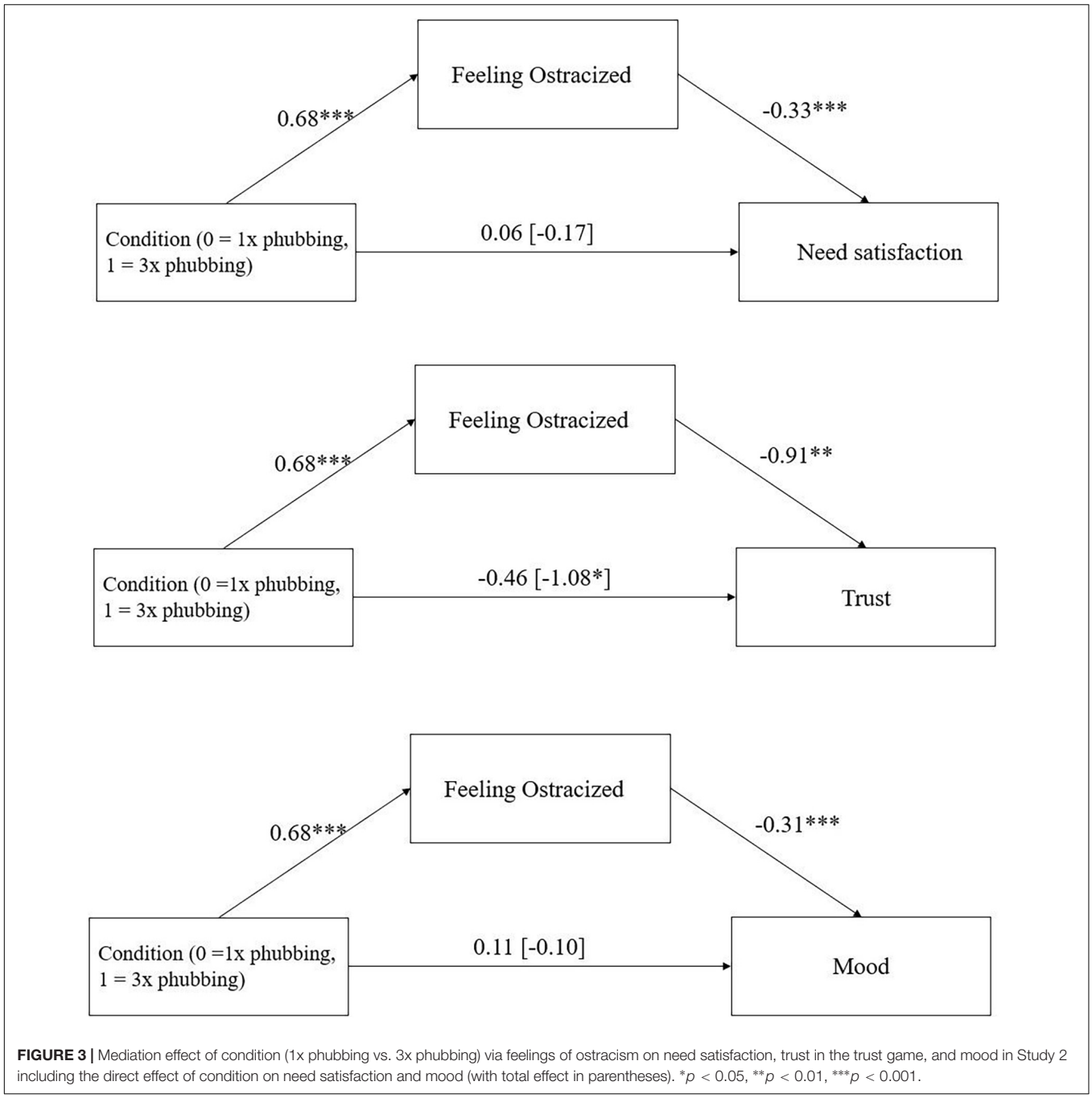

FIGURE 3 | Mediation effect of condition (1x phubbing vs. 3x phubbing) via feelings of ostracism on need satisfaction, trust in the trust game, and mood in Study 2 including the direct effect of condition on need satisfaction and mood (with total effect in parentheses). $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

GENERAL DISCUSSION

The present research replicated and extended prior research on the consequences of phubbing on mood, need threat, and feelings of ostracism (Gonzales and Wu, 2016; Chotpitayasunondh and Douglas, 2018; Hales et al., 2018; McDaniel and Wesselmann, 2021). We found that phubbing induces feelings of being ostracized (Study 1 and 2), which threatens fundamental needs, causes negative mood (Study 1 and 2), and reduces behavioral trust (Study 2). Importantly, this does not merely hold for phubbees, but also for phubbers (Study 1). However, the frequency of phubbing appears to play an important role. The more often individuals were phubbed in Study 2, the more need threat and feelings of ostracism they experienced. The frequency of phubbing further affected the phubbee's behavioral trust toward the phubber. When phubbed three times (vs. once), phubbees tended to send fewer lots to their phubbers. However, there was only a difference between the Phubbing conditions and the Attentive Conversation condition (where the confederate drank water three times) for feelings of ostracism, politeness,

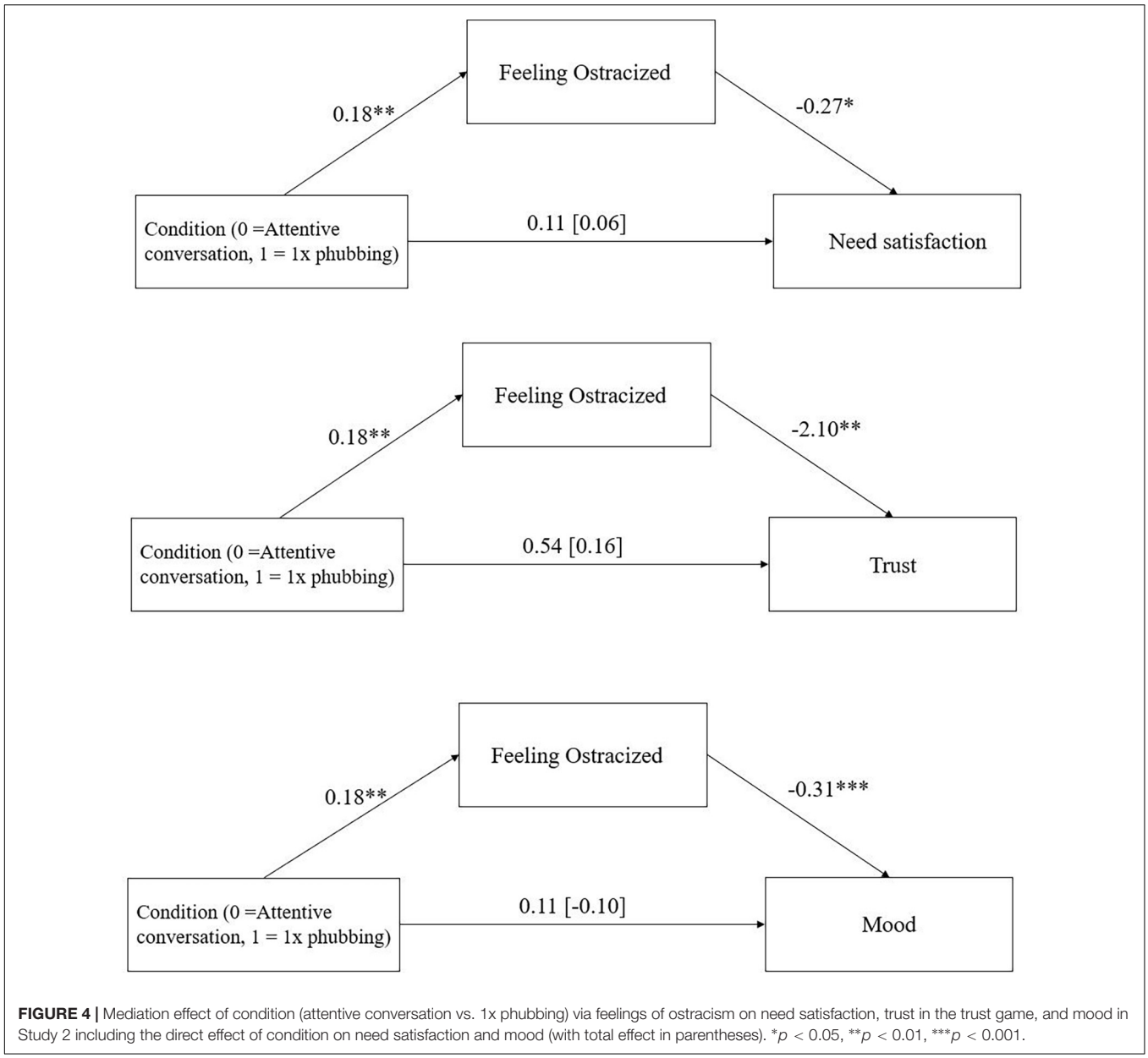

FIGURE 4 | Mediation effect of condition (attentive conversation vs. 1x phubbing) via feelings of ostracism on need satisfaction, trust in the trust game, and mood in Study 2 including the direct effect of condition on need satisfaction and mood (with total effect in parentheses). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

and attentiveness. Potential reasons for missing differences are discussed below.

Prior research on whether the usage of mobile phones affects interpersonal relationships has mainly been correlational, revealing an association between phubbing and conversational quality as well as relationship quality (Cameron and Webster, 2011; Klein, 2014; Misra et al., 2016; Roberts and David, 2016; Bröning and Wartberg, 2022). Some experiments have focused on impression formation and conversational quality, showing that the presence and usage of mobile phones reduces conversational quality and has a negative effect on the phubbee's impression of the phubber (Przybylski and Weinstein, 2013; Vanden Abeele et al., 2016). Gonzales and Wu (2016) and Hales et al. (2018) as well as Chotpitayasunondh and Douglas (2018) were the first to demonstrate that phubbing can be perceived as ostracism. Our research replicates the findings of Hales et al. (2018) as well as Chotpitayasunondh and Douglas (2018) by showing that remembering a past phubbing episode or imagining being phubbed causes feelings of being ostracized, negative mood and need threat. Moreover, Gonzales and Wu (2016) showed that an experimentally induced phubbing episode during an ongoing conversation induces feelings of being ostracized. Our research extends these findings by showing that phubbing also has negative consequences for phubbers. In addition, by studying behavior in the trust game, we provided the first evidence on how individuals behave toward those who use their mobile phone in the presence of others.

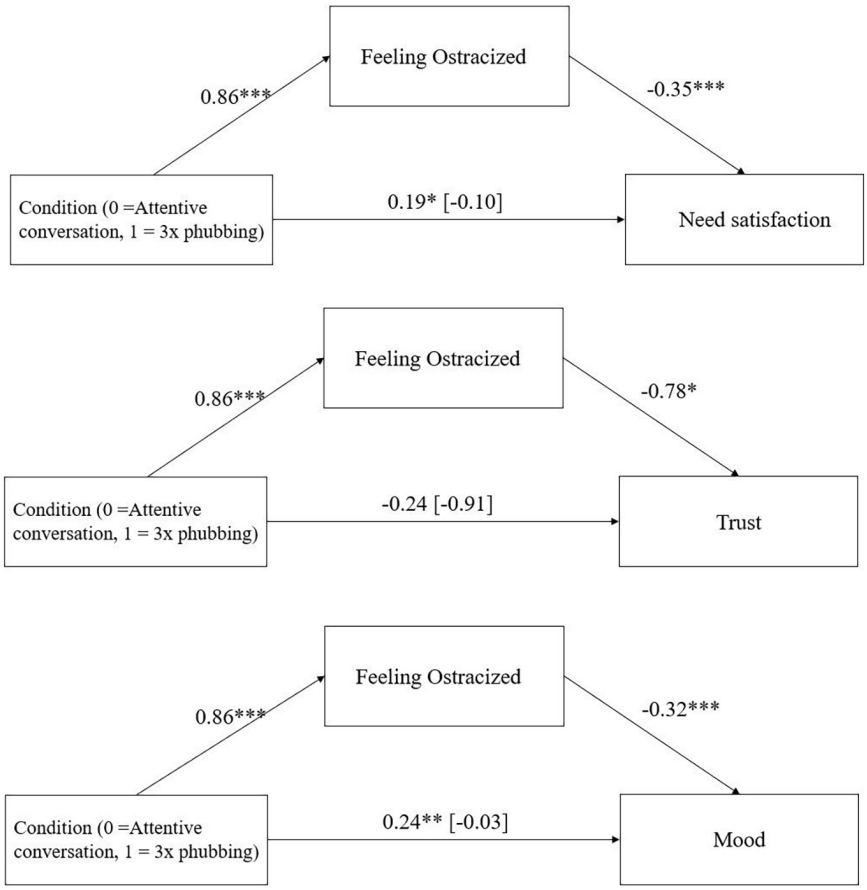

FIGURE 5 | Mediation effect of condition (attentive conversation vs. 3x phubbing) via feelings of ostracism on need satisfaction, trust in the trust game, and mood in Study 2 including the direct effect of condition on need satisfaction and mood (with total effect in parentheses). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Phubbers divide their attention between their mobile phone and the physically present interaction partner and likely exclude her or him from a digital interaction (Klein, 2014; Vanden Abeele et al., 2016). The innate ostracism detection system alarms the individual automatically when any minor cue of ostracism, including phubbing, is detected by causing immediate social pain (Kerr and Levine, 2008).

Given this social pain inflicted by phubbing, it is not surprising that phubbing also negatively affects behavior shown toward the phubber. Research on ostracism has already demonstrated that ostracized individuals show less behavioral trust toward their ostracizers than included individuals and send them fewer lots in the trust game (Hillebrandt et al., 2011). Our second study replicates this finding and extends it to phubbing. Thus, phubbees exhibit lower trust in phubbers when they are phubbed more frequently.

Overall, our present research demonstrates that we can learn about phubbing by deriving knowledge from the existing ostracism literature. But also research on inattentive listening can additionally help us to understand the consequences of phubbing. For example, it has been shown that narrators reduce the quantity and quality of what they tell their listener when they are interacting with an inattentive listener (see Pasupathi and Rich, 2005), narrators have worse memory for what they were talking about (Pasupathi et al., 1998; Pasupathi and Hoyt, 2010), and reduce their self-verification during the conversation (Pasupathi and Rich, 2005). Correlational research has further shown that perceived listening quality is related to perceived sympathy of the conversation partner, trust in her or him, and the mood of the narrator (Lloyd et al., 2015). Thus, when phubbing is perceived as inattentive listening, this might also partially explain our findings. This could also explain why there were fewer differences between the Phubbing conditions and the Attentive Conversation condition because the confederate in the Attentive Conversation condition might also have appeared inattentive when she or he drank from her or his water bottle. Yet, participants felt more ostracized in the 1x Phubbing condition than in the Attentive Conversation condition, even though the total duration of breaks in the conversation did not differ between these two conditions. Thus, the finding that participants felt more excluded in the phubbing conditions than in the Attentive Conversation condition cannot merely be explained by the fact that confederates were distracted from the conversation for

a longer time period in the phubbing than in the Attentive Conversation condition.

Limitations and Future Research

One limitation of the present line of research is the retrospective nature of Study 1. Since our participants were asked to remember a past phubbing episode, it is unclear whether phubbing really has negative consequences for the phubbers' well-being and causes their need threat and negative mood. Alternatively, this need threat and negative mood might have been the reason why they initiated the phubbing in the first place. Various reasons for phubbing behavior have been discussed, ranging from social media addiction to social anxiety (Rahman et al., 2022) as well as negative emotions such as boredom or fear of missing out (Al−Saggaf and O'Donnell, 2019). With our correlational data, we cannot determine whether negative mood was an antecedent or consequence of phubbing for phubbers. However, research demonstrating negative effects of ostracism for ostracizers provide support for the conclusion that phubbing may have caused phubbers' negative mood and need threat (Legate et al., 2013). In addition, our confederates in Study 2 repeatedly complained about the aversive experience of phubbing someone, similar to confederates in a study by Williams and Sommer (1997) who were instructed to ostracize participants in a ball tossing game. Nevertheless, future research is needed to provide further evidence for the aversive consequences of phubbing for the phubber. For example, in future research participants' well-being could be assessed after they were instructed to phub another person in the lab (see Vanden Abeele et al., 2016).

Another limitation is that we could not standardize the depth of the conversation in which phubbing occurred. Of course, the conversation topics in Study 2 were standardized, yet the depth of the answers given by the participants might have varied. Probably, phubbing is perceived as even more inappropriate when the conversation becomes less shallow, more personal, and more elaborate (Przybylski and Weinstein, 2013). We suspect that phubbing has even more negative effects on personal well-being, trust and the willingness to cooperate for less superficial, more personally engaging conversations. Future research could compare the effects of phubbing between such levels of conversations.

Also, phubbing occurs more often between people who knew each other before such as friends, partners, and family members than between strangers (Al-Saggaf and MacCulloch, 2019). The observed effects of phubbing could vary depending on relationship closeness with the interaction partner. Future research could compare effects of phubbing by a stranger with phubbing by a closer interaction partner. Another limitation of Study 2 is that we did not examine whether the gender composition of the pairs had an impact on the effects of phubbing due to power limitations. Previous research shows that participants are more competitive in bargaining games when played with participants of the same gender (Sutter et al., 2009). Thus, gender composition could also have impacted participants' behavior in the trust game. While we controlled for possible gender effects by counterbalancing the gender of the confederate between conditions, future research could examine whether there are interaction effects of the phubbing condition and gender composition regarding behavior in the trust game.

There are also limitations concerning our Attentive Conversation condition in Study 2 (i.e., 3x drinking water). First, this condition might have been too conservative to serve as a suitable control. Specifically, when drinking water, our confederates likely averted their eye-gaze away from our participants. Prior research on averted eye contact has demonstrated that this is sufficient to induce feelings of ostracism and need threat (Wirth et al., 2010). Thus, since reduced eye contact induces social pain, it is reasonable that there were no significant differences between our Phubbing conditions and the Attentive Conversation condition for need satisfaction and behavioral trust. Future research should implement a control group in which no or fewer cues of ostracism are present.

Second, one might argue that the duration of drinking in the Attentive Conversation condition was too short in comparison with the total duration of phubbing in the 3x Phubbing condition. Thus, significant differences between these two conditions on feelings of ostracism, perceived politeness and alertness could be explained by the duration of the conversational interruption. However, the total duration of drinking did not differ from the duration of phubbing in the 1x Phubbing condition. If the duration of the conversational interruption would have been an underlying mechanism of our effects, the 1x Phubbing condition and the 3x water drinking in the Attentive Conversation condition should both be significantly different from the 3x Phubbing condition on our dependent variables. In addition, we found a difference between the 1x Phubbing condition and the Attentive Conversation condition on feelings of ostracism and politeness. Thus, there must be another mechanism explaining the lack of significant differences with the control group on our main dependent variables. Future research is needed to identify this mechanism.

Finally, there are limitations regarding the power of Study 2. In calculating the required sample size, we assumed a large effect of the phubbing conditions. However, the design was quite complex for our sample size and the study was therefore underpowered to conduct potential smaller effects of the quite subtle variations in phubbing behavior. It is thus also possible that the failure to detect differences between conditions regarding need satisfaction was due to the study being underpowered. Although this type of study with confederates in the laboratory is quite labor intensive, future research should nevertheless aspire to further examine effects of phubbing behavior in larger samples.

CONCLUSION

The present research demonstrated that phubbing has similar negative consequences as ostracism by threatening fundamental human needs and inducing negative mood. However, these negative consequences backfire on the phubber: Individuals who were phubbed more often, showed less behavioral trust toward their phubbers, which reduces the phubbers' chances of gaining the benefits they can usually draw from

interpersonal interactions. It is important that we are aware of the negative consequences of phubbing—an omnipresent and seemingly subtle behavior—which is increasingly gaining normative acceptance (Chotpitayasunondh and Douglas, 2016). Only by knowing the consequences can we deliberately choose how we want to treat and affect our conversation partners and influence the impression we make. One possible intervention for preventing phubbing would be to remind potential phubbers of the negative, backfiring effects of phubbing. Chronically accessible memories for such negative reverberations would deter potential phubbers from repeating acts of phubbing. Our research shows that it is worth considering the behavioral option put forward by an Australian campaign: "Stop phubbing" (Stop Phubbing, n.d.).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JK, AG-L, and GE designed the studies and wrote the manuscript. AG-L performed the studies. AG-L and JK analyzed the data. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the German Research Foundation (Deutsche Forschungsgemeinschaft, reference No. EC 317/9-1) and the Open Access Publication Fund of the University of Münster.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.883901/full#supplementary-material

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frontiers | Frontiers in Psychology

TYPE Brief Research Report
PUBLISHED 28 July 2022
DOI 10.3389/fpsyg.2022.922201

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 17 April 2022
ACCEPTED 11 July 2022
PUBLISHED 28 July 2022

CITATION
Park J and Joshanloo M (2022) Mediating and moderating effects of perceived social support on the relationship between discrimination and well-being: A study of South Koreans living in Japan. *Front. Psychol.* 13:922201. doi: 10.3389/fpsyg.2022.922201

Mediating and moderating effects of perceived social support on the relationship between discrimination and well-being: A study of South Koreans living in Japan

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We examined the relationship between discrimination and mental wellbeing among South Korean residents (N = 181) in Japan. The roles of need for belonging (NTB) as a mediator and identification with one's group as a moderator of this relationship were examined. Perceived social support was also examined as both a potential moderator and mediator. We also included a measure of perceived in-group inclusion in the host society, the Circle of Ingroup Inclusion (CII), to examine its influence on the relationship between discrimination and wellbeing. Three types of coping styles-active constructive coping, passive constructive coping, and destructive coping-were controlled for in the analysis. Results showed that participants' educational level, socioeconomic status, and different coping styles predicted wellbeing; however, discrimination was the strongest (negative) predictor of wellbeing. Social support was both a moderator and mediator of the relationship between discrimination and wellbeing, suggesting that perceived social support not only buffers the negative effect of discrimination on wellbeing, but also partially explains the negative association between discrimination and wellbeing. NTB was not a significant mediator. Identification with one's ethnic group and perceived membership in one's group also did not affect the relationship. The results suggest that it is important to consider social support based on interpersonal relationships among members of minority groups in Japanese society. The psychological factors involved in acculturation processes may be different in different ethnic groups. This study calls for greater consideration of group-specific characteristics in understanding acculturation processes and interactions between groups in society.

KEYWORDS

discrimination, wellbeing, social support, Korean migrants, Japanese society, ingroup inclusion, need to belong, ethnic identity

Introduction

Discrimination in minority groups

People can feel socially excluded in subtle forms in daily lives. This happens more often in ethnic minority groups who have different cultural backgrounds from the majority. The members feel excluded in both their interpersonal relations and at the societal level when they receive messages that themselves as the members of the ethnic group, or their social groups, are devalued and marginalized by mainstream society (Wesselmann et al., 2019). The social exclusion often exists as out-group discrimination in intergroup relations.

Discrimination is a crucial factor that explains mental problems of ethnic minority populations (Williams et al., 1997). Molero et al. (2013) suggests four types of discrimination depending on its visibleness and the target. The study found that subtle (vs. blatant) and individual (vs. group) discrimination showed the most harmful effect on psychological wellbeing of the stigmatized. Many studies so far have exclusively focused on immigration societies (e.g., European countries, United States). Although East Asian societies are known as relatively traditional and homogenous, they are becoming rapidly multicultural with increasing foreign populations in this global age. In awareness of the importance of examining different minority groups across contexts, the current study examines South Korean (Korean, hereafter) newcomers in Japan regarding their psychological experiences and the effects on wellbeing.

Korean residents in Japan

Koreans are the second largest migrant group in Japan, following the Chinese (Japan Ministry of Justice, 2020). The majority of Korean newcomers comprises high-skilled individuals who settled down for career development and their accompanying families. Lee et al. (2016) identifies interpersonal relationship as one of the major stressors in this group's acculturation. Dominants generally appear to show less prejudicial attitudes toward high-skilled (vs. low-skilled) immigrants (Hainmueller and Hiscox, 2010). Hence, the discrimination experienced in Korean newcomers can be relatively mild. However, there have been long historical conflicts between Japan and South Korea (Jin et al., 2022). As implied in far-right groups' hate speech reported on media, there are certain forms of prejudice and discrimination toward this minority group. In fact, inter-group conflicts occur rather implicitly, and subtle experiences influence individuals' acculturation and wellbeing (Molero et al., 2013). Therefore, the current study aims to examine the perceived level of discrimination in Korean newcomers and how their experiences influence wellbeing.

Social support and need to belong

In this paper, social support refers to the feelings and perception of being cared for by others and having a reliable network to turn to when needed in daily lives or in times of threat (Taylor, 2011), not instrumental support or social-support-seeking (see also, Pascoe and Smart Richman, 2009). Social support helps individuals maintain wellbeing in stressful environments (Cobo-Rendón et al., 2020). In contexts of social exclusion, support buffers the negative relationship between discrimination and psychological distress (e.g., Ajrouch et al., 2010). Despite some supportive findings, however, Schmitt et al. (2014) meta-analysis suggests that the moderation or buffering effects are inconclusive. Therefore, our current study aims to test the effect with Korean newcomers in Japan. On the other hand, the mediating role of perceived social support is little investigated. Interestingly, Goreis et al. (2020) identifies social support not moderating but mediating between discrimination and psychological distress among Russian immigrants in Germany. The study suggests that those who face discrimination tend to perceive social support less available, which leads to increase in distress. To relate it to the current study, it is expected that those who experience more discrimination would perceive support less available, which leads to decrease in wellbeing.

NTB is another potential mediator in the relationship. This concept refers to a human emotional need to affiliate with and be accepted by members of a group (Leary, 2010). In an experimental study, socially excluded individuals experienced not only higher (lower) negative (positive) emotions but also higher NTB (Chen et al., 2017). This phenomenon can be interpreted with *threatened belonging* (Baumeister and Leary, 1995). According to the need-threat theory of ostracism, one's sense of belongingness is basic human need; thus, it is an important part of one's wellbeing. However, rejection-related experiences, such as ethnic discrimination in the host society, would threaten the basic need. Thus, the individual would increase NTB to fill the lack. Thus, higher NTB would reflect a lower sense of belongingness at present. If the deficiency goes on for a long time, because of lack of supportive environments or because of rejection, various long-term negative effects will follow (Richman and Leary, 2009). Based on this reasoning, it is expected that NTB would mediate the relationship between discrimination and wellbeing.

Ingroup identification

According to social identity theory, one's ingroup identification is an important part of self-concept (Tajfel et al., 1979). Positive ingroup membership internalized in self can prevent the individual from out-group threat, which can reduce the negative effects on mental health. Ingroup identification also fosters individuals to believe in their capacity

to cope with the negative experience, which contributes to wellbeing (Outten et al., 2008). Accordingly, studies of intergroup conflicts support that ingroup identification moderates the negative effects of discrimination on wellbeing (e.g., Heim et al., 2010; Lee and Ahn, 2013). However, this moderation is inconclusive. For example, some studies report no supportive findings with Russian immigrants in Germany (Goreis et al., 2020) or Muslim women in New Zealand (Jasperse et al., 2012). To our knowledge, however, the relationships have been rarely examined East Asian minorities. Therefore, the current study aims to fill this gap by testing whether the moderation effect of ingroup identity is supported in South Koreans in Japan.

We speculate that the perceived inclusion of the ethnic ingroup in the host society can moderate the relationship between discrimination and wellbeing. Whereas ethnic discrimination reflects a specific form of exclusion, one can hold a sense of ingroup belongingness in terms of to what extent the ethnic ingroup is included and respected by the host group in the larger society. In relation to acculturation theory, this concept can be understood as ethnic group members' theories of how the host group expect the minority group to acculturate to the larger society in terms of maintenance of the heritage culture and interactions with the host group, Berry, 2017). It is possible that inclusion (or exclusion) of the ethnic ingroup also influences wellbeing and acculturation in the members of the minority group. Thus, we explored whether the sense of inclusion of the ethnic ingroup moderates the relationship between discrimination and wellbeing.

The present study

As an initial approach to understand the dynamic process of intergroup relations in Japanese society, we tested the following hypotheses with Korean residents.

H1. Perceived discrimination in the larger society would predict overall aspects of wellbeing negatively. We explored whether the negative association would be significant, regardless of personal coping strategies and other demographic factors.

H2-1. Perceived social support would reduce the negative association between discrimination and welleing.

H2-2. Perceived social support would mediate the relationship between discrimination and wellbeing.

H3. NTB would mediate the relationship between discrimination and wellbeing. Discrimination would influence wellbeing negatively partly through the increased NTB.

H4. Ethnic identification would reduce the association between discrimination and wellbeing.

We additionally explored whether perceived ingroup inclusion in the host society would function positively by protecting wellbeing from discrimination.

Methods

Participants

A total of 181 South Korean residents in Japan (female 47.5%, mean age = 36.06, *SD* = 8.751) were recruited through a Korean community webpage on Facebook in February, 2022. 63.5% answered that they came to Japan for work, 17.1% for study, 16.0% for marriage, and 3.3% for other purposes. The highest education level for 88.8% of participants was undergraduate or higher categories. The average length of stay in Japan was 9.3 years (*SD* = 7.3 years).

Measures

Discrimination

We measured ethnic discrimination with two scales: Perceived Discrimination Scale (PDS, 5 items, Berry, 2017) and Everyday Discrimination Scale (EDS, 5 items, Sternthal et al., 2011). Each item of the PDS was rated on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree* (e.g., "*I have been teased or insulted because of my Korean background*"). Each item in the EDS was rated on a 6-point scale ranging from 1 = *never* to 6 = *almost everyday* (e.g., "*You receive poorer service than other people at restaurants or stores*"). Because the two measurements are rated on different units [i.e., the level of (dis)agreement for PDS, and the level of frequency for EDS], we did not unify the scales and used the original 5 and 6-point scales, respectively. The scree plot for the 10 items showed that a one-factor structure would be the best choice for this scale (eigenvalue = 4.396), with factor loadings ranging between 0.582 and 0.768.

Wellbeing

The study included four wellbeing variables. Internationally Reliable Short-Form of the Positive and Negative Affect Schedule (I-PANAS-SF, 10 items, Thompson, 2007) measured emotional experiences for the past week. Satisfaction With Life Scale (SWLS, 5 items, Diener et al., 1985) measured overall life satisfaction. Psychological wellbeing (PWB, 18 items, Ryff et al., 2010) measured six aspects of life: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Each item in all these scales was rated on a 5-point scale. Instead of a linear composite (e.g., averaging the four variables), we used principal axis factoring to measure wellbeing as a latent

construct and to capture the common variance among the four variables. The resulting factor scores serve as a general wellbeing variable (Joshanloo, 2021). A factor analysis with a single factor was conducted, and factor scores were saved for all participants. The resulting variable was used as an outcome in this study (eigenvalue = 1.705, range of factor loadings = 0.858 and 0.332, for psychological wellbeing and positive affect, respectively).

Social support

Enriched Social Support Inventory (ESSI, Mitchell et al., 2003) consists of 7 items; however, we selected 6 items measuring perceived availability of social support excluding an item asking marriage status (Goreis et al., 2020). The scale asks about the availability of anybody regardless of ethnic groups who can help around the individual, not specific others like partners or friends (e.g., "*Is there someone available to give you good advice about a problem?*"). Each item was rated on a 5-point scale (1 = *none of the time* to 5 = *all the time*).

Need for belonging

We used a single-item scale of NTB (SIN-B, Nichols and Webster, 2013, *"I have a strong need to belong"*), rated on a 5-point scale. This measurement showed good test-retest reliability across 4 months and validity of this measurement in the previous study.

Coping styles

Brief COPE (Carver, 1997) was adopted and revised to measure discrimination-specific coping (Goreis et al., 2020). Following the previous study, we adopted 24 items out of the original 28 items that include emotional and instrumental aspects of support. Each item was rated on a 6-point scale (1 = *strongly disagree* to 5 = *strongly agree*). We factor-analyzed 12 constructive coping and 12 destructive coping items separately using principal axis factoring and promax rotation. We used only items with factor loadings above 0.3 to calculate new variables and dropped items with lower loadings. The scree plot for the constructive coping items indicated that a two-factor structure (eigenvalues = 2.727 and 1.846) would be best. Four items loaded on the first factor (factor loadings ranged between 0.772 and 0.866.) This factor was labeled *active constructive coping* (e.g., "*I try to come up with a strategy about what to do*"). Six items loaded on the second factor (between 0.375 and 0.674) labeled *passive constructive coping* (e.g., "*I look for something good in what is happening*"). Two items did not have sufficiently high loadings and were excluded. The scree plot for 9 negative items indicated a single factor structure (eigenvalue = 3.228, factor loadings ranged from 0.411 to 0.725). This factor was labeled *destructive coping* (e.g., "*I've been criticizing myself*"). Three items with low loadings were excluded.

Ethnic identity

Three items were adopted from the Ethnic Identification Scale (EIS, Berry, 2017). Each item was rated on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*, e.g., "*I am proud of being Korean*").

Circle of ingroup inclusion

Perceived ingroup inclusion was developed following the measure of the Inclusion of Ingroup in the Self (Tropp and Wright, 2001). The circle of ingroup inclusion (CII) measures perception of the inclusion of the ethnic ingroup in the larger society by varying the difference between the two groups. Two circles, one reflecting ethnic (Korean) ingroup and the other reflecting Japanese group, were prepared. Participants were asked to select one of the seven patterns that vary in the distance between the two circles, so that a greater score reflects a higher level of inclusion of the ethnic ingroup. This measure showed negative correlations with PDS (r = –0.375, $p < 0.001$) and EDS (r = –0.186, p = 0.012), but no relationship with EIS (r = 0.013, p = 0.865). That is, the more the ingroup perceives being excluded from the larger society, the more discrimination is experienced, independent of ingroup identification. These support construct validity and discriminant validity of the new measure.

Demographic information

Age, gender, education level, socioeconomic status (5-point scale), length of stay in Japan, and purpose of stay were included at the end of the questionnaire.

Procedure

The study was conducted as a part of a project on the childcare and wellbeing in Asian societies. Invitation emails were sent to those who showed an interest in the survey. After reading the consent form, participants completed the survey which took 15∼20 min. The measures for our main variables were followed by other irrelevant measures to the current study (e.g., childcare experiences and gender role beliefs). After completion, participants were reimbursed with a 1,000 yen voucher. The study was approved by the Research Ethics committee of the first author's university (no. 21067).

Results

Overview

All of the main variables are listed in **Table 1**. To see the mean values, participants' ethnic discrimination experiences appeared to be mild (below the mid-point). Overall, the

ratings on other variables were also positive, consistent with the mild circumstances observed in the high-skilled Koreans (Lee et al., 2016).

Discrimination as a predictor of wellbeing

In model 1, wellbeing was regressed on discrimination $R^2 = 0.260$, $F(1, 179) = 62.752$, $p < 0.001$. As shown in Table 2, discrimination was a significant predictor. In model 2, we controlled for the demographic variables of the study, and again, discrimination was a significant predictor $R^2 = 0.399$, $F(6, 169) = 18.665$, $p < 0.001$. In a third model, we controlled for the three coping variables, $R^2 = 0.524$, $F(9, 166) = 20.325$, $p < 0.001$. Table 2 shows that discrimination was still a significant predictor of wellbeing, after holding all the demographic and coping variables constant. Thus, the findings give strong support to H1.

Social support as a moderator

A moderation analysis with social support was performed, controlling for gender, age, education, socio-economic status, and length of stay, $R^2 = 0.470$, $F(8, 167) = 18.499$, $p < 0.001$. In support of H2-1, social support was a significant moderator (interaction term coefficient = 0.156, $p = 0.035$). The interaction is shown in Figure 1. As can be seen, the negative relationship between discrimination and wellbeing is weaker at higher levels of social support, whereas this relationship is stronger at lower levels of social support.

TABLE 1 List of the main variables in the current study and their reliabilities (α), means and *SD*s.

Measures	Cronbach's α	Mean	*SD*
Discrimination	0.880	1.950	0.725
Wellbeing	0.663	0.000	0.913
PANAS_negative	0.821	2.065	0.836
PANAS_positive	0.681	3.069	0.778
SWLS	0.859	3.263	0.851
PWB	0.810	3.648	0.513
Active constructive coping	0.883	3.711	0.935
Passive constructive coping	0.712	2.846	0.834
Destructive coping	0.816	2.082	0.735
CII	–	3.980	1.509
Ethnic identity	0.798	3.900	0.848
Social support	0.920	4.059	0.878
NTB	–	3.350	1.129

Mediation analysis

In a mediation analysis using the process macro (Hayes, 2022), we examined whether social support and NTB are two mediators of the relationship between discrimination and wellbeing, controlling for the same demographic variables used in the regression analyses. The number of bootstrap samples for percentile bootstrap confidence intervals was 5,000. Discrimination was a significant predictor of social support ($b = -0.417$, $p < 0.001$) and need to belong ($b = -0.235$, $p = 0.045$). Social support (but not NTB) was a significant predictor of wellbeing ($b = 0.266$, $p < 0.001$), in support of H2-2 but not H3. The bootstrap confidence interval of the indirect effect of discrimination via social support did not include zero (–0.204 and –0.041), whereas the indirect effect via NTB included zero (–0.026 and 0.035). Hence, only support is a significant mediator. Considering that the direct effect of discrimination on wellbeing remained significant ($b = -0.521$, $p < 0.001$), it can be concluded that support partially mediated the relationship.

Ingroup identification or perceived ingroup inclusion as moderators

Using the process macro, a moderation analysis with centered variables was performed, $R^2 = 0.461$, $F(10, 165) = 14.128$, $p < 0.001$ (Table 3). In the model, discrimination negatively, and ingroup identification, education, and socioeconomic status positively predicted wellbeing. None of the interaction terms were significant. Hence, the moderation effect of ethnic identification (H4) was not supported in our study. Also, we did not find evidence that perceived ingroup inclusion in the host society influences the association between individual-level discrimination and wellbeing.

Discussion

The current study supports negative associations between perceived and experienced ethnic discrimination and wellbeing in Korean newcomers in Japan. Although education level, socioeconomic status, and adaptiveness of coping strategies were predictors of wellbeing, discrimination was still significant even when those factors were controlled for. In the serial analyses, discrimination was a stronger predictor of wellbeing than other variables included, even than socioeconomic status. In literature, most studies have focused on psychological malfunctioning and distress, especially in minority groups in societies where discrimination is more visible (e.g., African Americans, Williams et al., 1997). However, our findings suggest that the effects can be also applied to the general aspect of wellbeing. Those who experience greater social

TABLE 2 Serial models of discrimination predicting general wellbeing.

Predictor	B	CI: Lower	CI: Upper	*t*	*p*	β
Model 1						
Discrimination	**−0.642**	−0.802	−0.482	−7.922	0.000	−0.509
Model 2						
Discrimination	**−0.630**	−0.779	−0.482	−8.389	0.000	−0.503
Male	**−0.285**	−0.510	−0.061	−2.507	0.013	−0.157
Age	0.001	−0.016	0.019	0.153	0.879	0.013
Education	**0.184**	0.049	0.320	2.685	0.008	0.166
SES	**0.207**	0.082	0.333	3.254	0.001	0.202
Length of stay	0.000	−0.002	0.002	0.007	0.994	0.001
Model 3						
Discrimination	**−0.483**	−0.624	−0.342	−6.775	0.000	−0.385
Male	−0.199	−0.402	0.004	−1.933	0.055	−0.110
Age	−0.007	−0.023	0.009	−0.805	0.422	−0.063
Education	**0.175**	0.053	0.297	2.834	0.005	0.158
SES	**0.188**	0.073	0.303	3.234	0.001	0.183
Length of stay	0.000	−0.002	0.002	−0.027	0.978	−0.002
Active constructive coping	**0.166**	0.055	0.276	2.968	0.003	0.169
Passive constructive coping	**0.169**	0.048	0.290	2.763	0.006	0.157
Destructive coping	**−0.399**	−0.549	−0.249	−5.245	0.000	−0.318

CI, confidence interval. Bold values denote statistical significance at the $p < 0.05$ level.

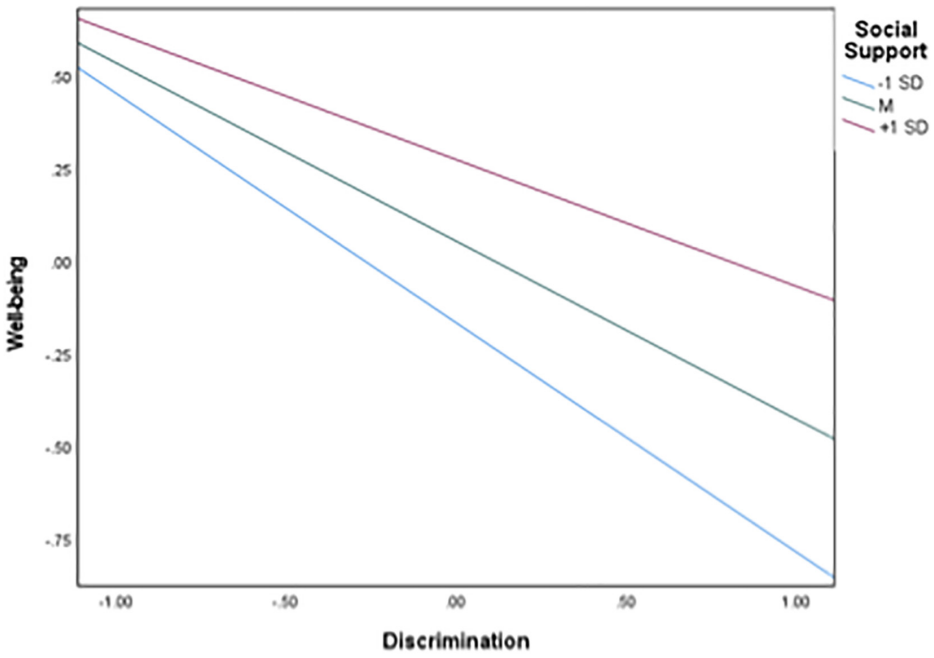

FIGURE 1
Results of the simple slope analysis.

exclusion experience not only more negative affect and less positive affect but also lower life satisfaction and psychological wellbeing (autonomy, environmental mastery, personal growth, positive interpersonal relations, purpose in life, and self-acceptance). Moreover, the current study implies that the negative association exists even in minority groups of high status newcomers whose discrimination experiences are relatively mild (Hainmueller and Hiscox, 2010).

TABLE 3 Moderation analysis on wellbeing in South Korean residents.

Predictor	Unstandardized coefficient	CI: Lower	CI: Upper	*t*	*p*
Discrimination	**−0.563**	−0.714	−0.412	−7.349	0.000
Ingroup identification	**0.270**	0.145	0.396	4.249	0.000
Discrimination*ingroup identification	0.031	−0.125	0.188	0.393	0.695
CII	0.046	−0.028	0.121	1.227	0.222
Discrimination*CII	0.028	−0.060	0.115	0.624	0.533
Male	−0.193	−0.412	0.027	−1.733	0.085
Age	−0.002	−0.019	0.015	−0.206	0.837
Education	**0.196**	0.065	0.327	2.948	0.004
SES	**0.213**	0.090	0.336	3.415	0.001
Length of stay	0.000	−0.002	0.002	−0.079	0.937

CI, confidence interval. Bold values denote statistical significance at the $p < 0.05$ level.

In support of the buffering role, the current study identified the moderation effect of perceived social support on the relationship between discrimination and wellbeing in the Korean sample. It also found supporting evidence of the mediation effect, implying that social support (i.e., perceived availability of someone who can help when needed) partly explains the association between discrimination and wellbeing. These findings suggest the importance of the perceived social support for wellbeing in ethnic minority groups in the larger society. In particular, the mediation model is relatively new in the study of ethnic discrimination. Loneliness may be an important concept to explain the association. Discrimination is associated with feelings of loneliness, especially in minority groups such as older retirees (Lee and Bierman, 2019) and people with psychotic disorders (Świtaj et al., 2015). Loneliness is suggested to have an important impact mental health (Wang et al., 2020). Studies also suggest large negative correlations between loneliness and social support—lonely people are less likely to perceive availability of social support (for review, Wang et al., 2018). Given the negative impact of loneliness on mental health, our findings suggest the study of loneliness in ethnocultural minorities as an important future direction in acculturation research.

In that social support is a crucial factor for mental health of socially marginalized individuals (Cobo-Rendón et al., 2020), the current findings may provide implications for how to support ethnic minority groups for their positive acculturation and wellbeing. Although active support-seeking behaviors or active provision of support are suggested to be beneficial for reducing the negative effects of ethnic discrimination (Ajrouch et al., 2010), East Asians are less likely to attempt support-seeking behaviors than Westerners, because of concern about interpersonal relationships and face (Taylor et al., 2004). The current findings may reflect the cultural obstacles in support-seeking or receiving in Asian minorities. This is noteworthy in that relationship is a key factor affecting acculturation and wellbeing in Korean newcomers in Japan (Lee et al., 2016). Understanding social norms and cultural practices in Asian minority groups may help develop effective ways of social support in the larger society. Moreover, social support and support-seeking behaviors in Korean and other Asian minority groups in Japanese society are important issues future research needs to keep uncovering.

NTB was not a significant mediator in the current study. There are a few alternative interpretations. First, it might be premature to conclude about the relationship between discrimination and NTB. Indeed, some propose negative associations between perceived discrimination and NTB—because of self-serving bias, individuals with stronger NTB can perceive their own discrimination relatively less than their ingroup fellows' (Carvallo and Pelham, 2006). The current study did not compare perceived discrimination between the self and the other ingroup members, which calls for future investigation. The other alternative considers a possible group-specific characteristics regarding the NTB-related mechanism. Both belongingness and social support are closely related to social bonding. However, belongingness is oriented toward one's sense of *group affiliation* more strongly than social support is (Taylor, 2011). Thus, we suspect that, to many Korean newcomers who hold high agency and self-esteem (Lee et al., 2016), the group-oriented need is not so important for coping. In other words, belongingness is not a critical factor in ethnic groups where discrimination-related experiences are mild or the personal agency is high.

Inconsistent with our prediction, ethnic identity did not moderate the association between discrimination and wellbeing. Also, perception of ingroup inclusion in the host society showed no significant effects. These results do not support the buffering effects of one's ingroup identification or sense of inclusion. They rather imply that the negative effect of discrimination on wellbeing exists regardless of ingroup identification. Effects of ingroup identification may be inconclusive and vary across contexts (Jasperse et al., 2012; Goreis et al., 2020). Although tentative, it is suggested that the functional aspect of the ethnic

identity suggested in some contexts (e.g., Heim et al., 2010; Lee and Ahn, 2013) might have not developed enough in newcomers, so that the benefit of ingroup identification is little for their self-regulation against outgroup threats.

This study did have some limitations that need to be addressed in future studies. First, due to the nature of the cross-sectional study that used self-report measures only, we could not demonstrate causal relationships or temporal ordering issues between variables, such as discrimination leading to decrease in perceived availability of social support, or increase in NTB (c.f., Chen et al., 2017). Conducting more controlled experiments or longitudinal studies can get benefit in understanding causal relationships by examining the effects of discrimination-experienced experiences and presence of social support. Also, employing a multiple-item NTB scale can help clarifying the effect of the NTB. Finally, we recommend examining experiences in diverse ethnic minorities including more prejudiced old-comers who may differ in demographic characteristics (e.g., education, income) and ethnic identity to capture a more inclusive picture of the minority groups' intergroup experiences in the larger society and their effects on wellbeing.

Conclusion

The current study identified that ethnic discrimination experienced in Korean newcomers living in Japan is negatively associated with general aspects of wellbeing. This finding supports that the negative effects of discrimination are significant even in mildly discriminated groups in society. Perceived availability of social support buffers the negative effects of discrimination on wellbeing. It also mediates the association, implying the importance of interpersonal relationships and connectedness for the wellbeing in the minority group members. Although ethnic identity is positively associated with wellbeing, it does not seem to buffer the negative influence of discrimination on people's life. Likewise, we did not find the mediating effects of NTB. These findings suggest possible variations in factors affecting acculturation strategies and wellbeing in ethnic minority groups, depending on the levels of ethnic identity, social status, and agency. Future research can benefit by examining diverse ethnic groups to understand the dynamic processes and psychological consequences on wellbeing.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Nagoya University of Commerce and Business. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JP designed the study, developed the conceptual framework, collected the data, and wrote up the manuscript. MJ developed the analytical models, analyzed the data, and summarized the results. Both authors contributed to the article and approved the submitted version.

Funding

This study was supported by Grants-in-Aid 20KK0056 from the Japan Society for the Promotion of Science.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers | Frontiers in Psychology

TYPE Brief Research Report
PUBLISHED 01 August 2022
DOI 10.3389/fpsyg.2022.912698

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 04 April 2022
ACCEPTED 27 June 2022
PUBLISHED 01 August 2022

CITATION
Dvir M and Nagar M (2022) Would victims blame victims? Effects of ostracism, sexual objectification, and empathy on victim blaming. *Front. Psychol.* 13:912698. doi: 10.3389/fpsyg.2022.912698

Would victims blame victims? Effects of ostracism, sexual objectification, and empathy on victim blaming

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In the current research, we examined whether ostracism and sexual objectification affect the tendency to blame the victim of sexual harassment. Previous research concerning victim blame examined the attribution of blame considering the characteristics of the victim, the perpetrator, and the relation between them. However, no research to date examined whether situational factors of the perceiver can affect their perception and judgment of blame. We propose that sexual objectification and ostracism may elicit empathy toward the victim, and in turn, reduce victim blame. In two experimental studies, women were instructed to imagine interacting with a videotaped man who either gazed at their body (objectification), away from them (ostracism), or at their face (treated well). Then, they were asked to read a newspaper article (study 1) or watch a video (study 2) portraying encounters in which the man's sexual advances continued after the woman expressed discomfort and lack of interest. In study 1, we found that sexually objectified women attributed less blame to the woman compared with the women who were treated well, with ostracized women falling in between and marginally different from both. In study 2, using mediation analysis we found an indirect effect such that sexually objectified women experienced greater empathy toward the victim, which was associated with reduced attribution of blame. It appears that greater similarity between the situation of the perceiver and the situation of the victim elicits greater empathy. This adds to the previous knowledge that personality similarities result in higher empathy.

KEYWORDS

victim blame, ostracism, social exclusion, empathy, sexual objectification, eye gaze, objectifying gaze

Sexual objectification such as unwanted sexual looks or gestures, texts and calls of sexual nature, attempted sexual assaults, and others, is extremely common, with women are two times as much likely to be the victims (81% of women compared with 43% of men; Stop Street Harassment., 2018). During 2017, the #MeToo movement raised awareness to sexual harassment and encouraged victims to report their experiences with sexual harassment, rapidly gaining popularity and spreading worldwide. Surprisingly, even then, victims of sexual harassment and assault were frequently accused of being responsible, at least to some extent, for the incident (e.g., Lucarini et al., 2020).

Although men are more likely to engage in victim blaming toward a female victim, studies have shown that women engage in victim blaming as well (e.g., Culda et al., 2018). Scholars argue that women who engage in victim blaming do so as a means of self-defense (Culda et al., 2018). Once you believe that one is responsible for her own destiny, it is easier to believe that you will not find yourself in a similar situation. Victim blaming leaves the victim hurt and alone, ostracized, and excluded by others. Past research has yet to examine how the situation in which women are in may affect the perception of these events and their attribute of blame toward a victim of sexual harassment. The aim of this research is to explore whether being the victim of sexual objectification or ostracism affects women's attribution of blame to other victims.

Ostracism is defined as being ignored and excluded (Williams, 2009). Once an individual detects signs of ostracism, feelings of pain and negative affect rise, in addition to threat to four fundamental needs: the need to belong and possess social relations, the need to be in control of one's social situation, the need to maintain positive self-esteem, and the need to believe that one's existence has meaning (Williams, 2009). The aim to restore those threatened needs may alter the ostracized individual's perceptions of social situations. Whereas, most research focused on complete ostracism, when one is completely ignored and excluded, some research also explored partial ostracism, in which one is ignored and excluded intermittently—such as being kept out of the loop on a certain topic while still being included in the conversation (Jones et al., 2009; Iannone et al., 2018) or receiving some attention but less so than what would be expected as fair inclusion (Williams, 2007). Importantly, recent research demonstrated that women experience sexual objectification as a form of partial ostracism and as a result experience threat to the same fundamental needs (Dvir et al., 2021). Sexually objectified women realize that their body is the focus of attention, but simultaneously feel that their thoughts and feelings are disregarded, and thus feel ostracized.

Sexual objectification occurs when one is treated as if her body and sexual function represent her as a whole, as if she is merely a body that exists for the use and pleasure of others (Bartky, 1990; Fredrickson and Roberts, 1997). Sexual objectification of women is a significant part of the socialization of girls and women in the western societies, is expressed in the way women are portrayed in media, and is a part of the daily experience of women in interpersonal interactions when they are treated as if their bodies represent them (Fredrickson and Roberts, 1997; Szillis and Stahlberg, 2007; Holland et al., 2017). The eye gaze alone has been known to signal sexual objectification when one is leering at a woman's body (i.e., the objectifying gaze). Various research demonstrated the harmful effects of sexual objectification on women's mood and well-being, self-perception, self-presentation and cognitive performance (Moradi and Huang, 2008; Saguy et al., 2010; Gervais et al., 2011, 2013; Guizzo and Cadinu, 2017).

Empathy is the human capacity to understand, share, and respond to the emotions of others. It is a complex process that is achieved by two levels: on the basic level, empathy is achieved through direct perception of another person's behavior, implying one's automatic feelings toward the other (emotional empathy); on the higher level, empathy is achieved through cognition, involving psychological understanding, inference from social cues, communication, and perspective taking (cognitive empathy) (Decety, 2005; Smith, 2006; Fuchs, 2017). These levels mutually influence one another. It is argued that empathy is a psychological process of involvement, which evokes one's emotional response. This emotional response is expressed as one feels what is appropriate for another person's situation, not one's own (Hoffman, 2000).

Since we, as humans, are equipped with a mechanism to enhance social connection, one might wonder about the effects of social exclusion on our empathic mechanism. In other words, how this mechanism of social bonding will work when our social ties are torn apart. On the one hand, being ostracized (fully or partially) may illicit one's emotional responses, making them hypersensitive to others, while trying harder to be a part of a group and increase social interactions with others. On the other hand, ostracism may deplete one's cognitive and affective resources, leading to lower capacity to react empathically to another person's suffering. Research, thus far, has supported both directions. Most of the studies have supported the latter response showing that ostracized individuals become more aggressive toward others (Twenge et al., 2001; Twenge and Campbell, 2003; Buckley et al., 2004), are less willing to help and present less prosocial behavior (Coyne et al., 2011; van Bommel et al., 2016; Kothgassner et al., 2017), and showed less empathy for another person's suffering (DeWall and Baumeister, 2006). However, some studies have supported the former direction, indicating that ostracized individuals showed greater perspective taking (e.g., were able to instruct a blindfolded other through a maze) compared with non-ostracized individuals (Knowles, 2014), and greater sensitivity to social cues (Pickett et al., 2004; Nordgren et al., 2011). In addition, studies found that watching another person being ostracized triggers an automatic empathic response to ostracism, causing the observer to react as if they are being ostracized themselves. This effect was magnified when participants were instructed to empathize with the ostracized individual (Wesselmann et al., 2009). Interestingly, ostracism does not elicit empathy toward ostracized women if they are portrayed in a sexually objectified manner. In a study, participants were ostracized, and then watched a sexually objectified (vs. personalized) woman being ostracized (Cogoni et al., 2021). Then, they rated how they felt during the task and how the target felt (very negative to very positive). Results

indicated that individuals' rating of the target's feelings was less congruent with their own feelings when the target was sexually objectified (compared with not objectified). Following ostracism, individuals were less able to empathize with a sexually objectified woman. Other studies have not found significant effects of ostracism on empathy (Bass et al., 2014; Kandaurova and Lee, 2019).

Unlike ostracism, the effects of sexual objectification on empathy have not been examined thus far. It is important to note that only recently researchers started to examine the causal effects of sexual objectification. Reason being that sexual objectification manipulations are elaborate and expensive, require lab setting and trained confederates (e.g., Saguy et al., 2010; Gervais et al., 2011; Dvir et al., 2021). However, leaning on the empathy literature that illustrated the importance of perceiving the other as similar to the self in eliciting empathy (Davis, 1994; Batson et al., 2005), we propose that the more people perceive the situation others are in as similar to their own, the better they can relate and empathize with them. It is therefore interesting to examine how empathy, whether induced or reduced by sexual objectification and ostracism, will affect victim blaming.

The literature on victim blame have focused on characteristics of the victim and her behavior, characteristics of the perpetrator and his relation to the victim, and characteristics of the situation they were in. Mainly, the attribution of the blame to the victim is more likely when alcohol or drugs are present (Wild et al., 1998; Hayes-Smith and Levett, 2010); when the victim was wearing more revealing clothes (Whatley, 2005; Loughnan et al., 2013); when the victim did not attempt to resist the assault (Krulewitz, 1981); and in cases when the victim and the perpetrator had previous association with one another (acquaintance assault; e.g., Grubb and Harrower, 2008). In addition, little research has examined the effects of empathy for the victim on the attribution of blame. In general, empathy for the victim correlated with less victim blaming (Diehl et al., 2014; Gravelin et al., 2019; Bongiorno et al., 2020). No study to date has examined how situational factors of the observer (e.g., being ostracized) affect the tendency to blame the victim.

In two studies, we aimed to examine the interplay between ostracism, sexual objectification (partial ostracism), empathy, and victim blame among women. In study 1, we examined whether ostracized and objectified women would attribute less blame to a sexually harassed woman in a newspaper article. In study 2, we aimed to examine empathy as a potential mechanism that attenuates the effect of ostracism and sexual objectification on victim blame.

Study 1

Methods

Participants and design

In total, 146 women participated in the study virtually from their personal computers ($M_{age} = 25.98$, $SD = 3.91$; $\text{Range}_{\text{Age}} =$ 18–39). Most participants identified as heterosexual (96.6%). An *a-priori* power analysis to achieve 80% power ($\alpha = 0.05$; *partial* $\eta^2 = 0.07$) determined a desired sample size of 138 participants. Link to the study was distributed on social media with a post inviting to volunteer for a study about interpretation of social situations. Participants were randomly assigned to one of three conditions: ostracism, sexual objectification, and control.

Procedure

After reading a short description of the study and indicating their informed consent, participants were asked to practice their mental visualization skills by imagining they are interacting with the person who will appear in the upcoming video. They were asked to imagine that they just met and interact with the person for the first time. Participants were asked to mentally visualize the situation to the best of their ability, by imagining the topic of the conversation, the characteristics of the situation, and the identity of the person. The participants watched a 2-minutes video portraying a man where the man's eye gaze was manipulated (Dvir et al., 2021). Participants were randomly assigned to be either ostracized—the man's eye gaze alternated between directly at the participants face and *away* to the side; sexually objectified—the man's eye gaze alternated between directly at the participants face and down to her *body*; or treated well (control condition)—the man's eye gaze was directly at the participants *face* for the whole time. After watching the video, the participants described what they mentally visualized during the exercise, and completed objectification-related questionnaires.

Then, the participants read a bogus newspaper article describing an encounter between two students, a man and a woman, from the woman's perspective (see Supplementary Material). The article purposefully described a situation that is regarded in the media as being in the "gray area" to allow for different interpretations. Throughout the article, the man's sexual advances continue and become fiercer. The woman describes being confused and reluctant at first; gradually, she becomes upset, expressing her discomfort and lack of interest. Because the man persisted, the woman eventually left. After reading the article, participants answered questions regarding their interpretation of the event described in the article and victim blaming.

At last, participants completed manipulation and attention checks, indicated whether they encountered technical issues, and completed a demographic background questionnaire.

Measures

Unless otherwise is specified, all the measures[1] were on a 7-point scale ranging from not at *all* (1) to *extremely* (7).

Objectification-related measures

Sexual objectification

Participants rated their agreement with the statements "I felt objectified" and "I felt sexually objectified" during the interaction (2 items; $\alpha = 0.90$).

Self-objectification

Participants indicated their agreement with statements on the State Self-Objectification Scale regarding their feelings while imagining the interaction (Saguy et al., 2010); 3 items; e.g. "I felt as though I am more of a body than a person"; $\alpha = 0.85$.

Victim blame

Participants indicated the extent to which they believe that the woman was at fault for the incident, that the woman's behavior elicited the man's actions, and the extent to which the woman "asked for it" (3 items; e.g., "To what extent the woman in the article is at fault for what happened?"; $\alpha = 0.80$).

Manipulation and attention checks

Eye gaze direction

Participants indicated the direction of the person in the video's eye gaze (checked all that may apply: upward, downward, forward, to the side, and other).

Subject of article

Participants were asked to indicate the subject of the article: meeting between friends from the man's/woman's perspective, blind date from the man's/woman's perspective, or business meeting from the employer's/employee's perspective.

Statistical analysis

To examine the effects of the condition (i.e., *away* - ostracism, *body* - sexual objectification, and *face* - control) on the outcome variables a series of one-way ANOVA was conducted, unless stated otherwise.

1 Relevant measures are presented below, we have collected additional measures including self-esteem for other purposes.

Results and discussion

Preliminary analysis

Manipulation checks

Eye gaze direction

A chi-square test of independence was performed to examine the relation between the video conditions and the participant's perception of the man's eye gaze direction. The relation was significant, $\chi^2_{(4)} = 227.16$, $p < 0.001$, indicating that the majority of the participants in each condition correctly identified the direction of the man's eye gaze: Ostracism (side eye gaze; 90.2%), sexual objectification (down eye gaze; 90.9%), and control (direct eye gaze; 94%).

Subject of article

Most participants reported reading an article about a meeting between friends from the woman's perspective (91.8%).

Process check

We used process checks to examine whether the manipulation was not only noticeable but also elicited the process intended (e.g., downward eye gaze to the body is interpreted as sexual objectification). Participants in the *sexual objectification (body)* condition felt more sexually objectified as compared with both the *control (face)* and *ostracism (away)* conditions, $F_{(2,142)} = 160.32$, $p < 0.001$, *partial* $\eta^2 = 0.69$ (LSD simple effects <0.001). In addition, participants in the *sexual objectification* condition reported higher self-objectification as compared with the *control* and *ostracism* conditions, $F_{(2,143)} = 120.98$, $p < 0.001$, *partial* $\eta^2 = 0.63$ (LSD simple effect $ps < 0.001$). For means and SDs see Table 1.

Main analysis

Victim blame

Analysis of variance revealed a significant effect for condition, $F_{(2,143)} = 7.78$, $p = 0.001$, *partial* $\eta^2 = 0.10$. Participants in the *control* condition blamed the victim more ($M = 2.05$, $SD = 0.94$) compared with the participants in the *sexual objectification* condition ($M = 1.42$, $SD = 0.62$; LSD $p < 0.001$) and marginally more than participants in the *ostracism* condition ($M = 1.72$, $SD = 0.88$; LSD $p = 0.056$). Participants in the *ostracism* condition blamed the victim marginally more than participants in the *sexual objectification* condition (LSD $p = 0.079$).

To summarize, women who experienced sexual objectification attributed less blame to the victim (the woman) than women who were treated well. The extent to which ostracized women blamed the victim fell in between women who experienced sexual objectification and women

TABLE 1 Means and standard deviations of sexual and self-objectification as a function of condition (face, away, body) in Study 1 and Study 2.

	Study 1		Study 2	
	Sexual objectification	Self-objectification	Sexual objectification	Self-objectification
Face	1.17 ± 0.50	1.46 ± 0.76	1.60 ± 0.80	2.05 ± 1.02
Away	1.54 ± 0.93	1.62 ± 0.98	1.98 ± 1.16	2.42 ± 1.40
Body	5.47 ± 2.00	4.90 ± 1.74	3.21 ± 2.17	2.80 ± 1.62

in the control condition, and marginally differed from both. Thus, in study 2, we aimed to explore whether empathy can mediate the effect. If the degree to which one can empathize with another depends on the similarity of their own situation to that of the target, then sexually objectified women should empathize with a victim of sexual harassment the most, which will in turn reduce victim blaming. Because ostracism and sexual objectification share similarities, ostracized women may be able to empathize with the target of sexual harassment as well, more so than women who are treated well, but less so than women who were sexually objectified themselves. In addition, in study 2, we chose to utilize a different stimulus to examine the generalizability of the effect. Instead of the newspaper article that dealt with a relatable young woman who was attempting to study for an exam with a male friend, we used a video clip in which a well-known talk show host is interviewing an actress.

Study 2

Methods

Participants and design

In total, 181 women ($M_{age} = 23.24$, $SD = 2.85$) participated in the study virtually from their personal computers. An *a-priori* power analysis to achieve 80% power based on the effect size of study 1 ($\alpha = 0.05$; partial $\eta^2 = 0.1$) determined a desired sample size of 144 participants to reveal a significant effect for ANOVA, and 120 for the mediation analysis ($\alpha = 0.05$; effect size $f^2 = 0.15$). We recruited additional 25% to account for possible attrition. Participants were recruited using an internet-based platform called iPanel. Relevant participants who take a part in this online panel were invited to participate in the study. Exclusion criteria were participants with prior experiences of sexual assault. Participants were randomly assigned to one of three conditions: ostracism, sexual objectification, and control.

Procedure

The procedure was similar to the procedure in study 1. Participants underwent the same manipulation as in study 1 and were either ostracized, sexually objectified, or treated well by a video-taped man. After watching the video, participants described what they mentally visualized during the exercise, and completed objectification-related questionnaires.

Then, the participants watched a video[2] in which a talk show host (Jay Leno) interviewed an actress (Judith Light). During the interview, the interviewer insisted on talking with the actress about sex, asking provocative questions and touching her in a sexual manner. He continued to do so even after the actress was visibly uncomfortable and tried to change the subject multiple times. After watching the interview, participants completed the same measures as in study 1 including event interpretation and attribution of blame.

At last, participants completed manipulation and attention checks, indicated whether they encountered technical issues during the study, and completed a demographic background questionnaire.

Measures

Measures were identical to the measures in study 1: sexual objectification ($\alpha = 0.85$), self-objectification ($\alpha = 0.73$), and victim blaming ($\alpha = 0.91$); with the addition of the following measures. All the measures were on a 7-point scale ranging from not at *all* (1) to *extremely* (7).

Manipulation and attention checks

Subject of video

Participants were asked to indicate the subject of the video: meeting between business partners, a talk show host (man) interviewing an actress, a talk show host (woman) interviewing an actor, or instructions video for a device.

Empathy

Participants were asked to indicate the extent to which they felt empathy toward the woman ("To what extent do you empathize with the woman in the video?"; 1 item).

Statistical analysis

To examine the effects of the condition (i.e., ostracism, sexual objectification, and control) on the outcome variables

2 Link to the video: https://youtu.be/ntyA18mRMHk.

TABLE 2 Means and standard deviations of empathy for the woman in the video and victim blame as a function of manipulation condition (face, away, body).

	Face	Away	Body
Empathy for the woman	4.11 ± 2.05	4.16 ± 2.10	4.93 ± 1.75
Victim blame	4.16 ± 1.82	4.21 ± 0.82	3.94 ± 0.75

a series of one-way ANOVA was conducted, unless stated otherwise.

Results and discussion

Preliminary analysis

Manipulation checks

Eye gaze direction

A chi-square test of independence was performed to examine the relation between the video conditions and the participant's perception of the man's eye gaze direction. The relation was significant, $\chi^2_{(4)} = 129.85$, $p < 0.001$, indicating that the majority of the participants in each condition correctly identified the direction of the man's eye gaze: ostracism (side eye gaze; 70.9%), sexual objectification (down eye gaze; 65.6%), and control (direct eye gaze; 82.5%).

Subject of video

All the participants reported watching a video presenting a talk show host (man) interviewing an actress.

Process check

Participants in the *sexual objectification* condition felt more sexually objectified as compared with both the *control* and *ostracism* conditions, $F_{(2,178)} = 19.20$, $p < 0.001$, *partial* $\eta^2 = 0.18$ (LSD simple effects <0.001). In addition, participants in the *sexual objectification* condition reported higher self-objectification as compared with the *control* condition, $F_{(2,178)} = 4.65$, $p = 0.011$, *partial* $\eta^2 = 0.05$ (LSD simple effect $p = 0.003$). For means and SDs see Table 1.

Main analysis

Empathy for the woman

Participants in the *sexual objectification* condition empathized with the woman as compared with both the *control* and *ostracism* conditions, $F_{(2,178)} = 3.50$, $p = 0.03$, *partial* $\eta^2 = 0.04$ (LSD simple effects $p < 0.03$). For means and SDs see Table 2.

Victim blame

No significant effect was found to eye gaze direction manipulation on victim blaming, $F_{(2,178)} < 1$. For means and SDs see Table 2.

Mediation analysis

Because the lack of a direct effect does not rule out the possibility of a significant indirect effect, a mediation analysis was conducted to examine whether sexual objectification and ostracism lead to greater empathy toward the victim, which in turn leads to lower victim blaming. For this analysis, a mediation model with a three-level categorical independent variable (i.e., condition: *face, body,* and *away*) was conducted using model 4 in the PROCESS macro for SPSS (Hayes, 2013). A bootstrapping procedure of 10,000 resamples was used to generate 95% CIs around the coefficients, and the direct and indirect effects for inference testing. Ninety-five percent CIs not containing zero indicate a significant effect.

As seen in Figure 1, participants in the *sexual objectification (body)* condition (vs. *control-face* condition) reported greater empathy toward the woman. The extent to which they felt empathy was significantly associated with lower victim blaming. This resulted in a significant indirect effect of condition on victim blaming through empathy [indirect effect = −0.24, 95% CI (−0.45, −0.04)]. The degree to which participants in the *ostracism (away)* condition felt empathy toward the victim did not significantly differ from those in the *control (face)* condition, thus, the overall indirect effect was not significant [indirect effect = −0.02, 95% CI (−0.25, 0.21)].

General discussion

The findings from both studies are consistent in showing that an experience of sexual objectification reduces the tendency to blame another victim of sexual objectification. In study 1, women who were sexually objectified blamed the victim to a lesser extent than women who were treated well, with women who experienced ostracism falling in between: blaming the victim marginally more than sexually objectified women, and marginally less than women who were treated well. This is the first study to show effects of sexual objectification on victim blaming.

Study 2 was purposefully designed to impose a more challenging test of the effect. The scenario presented in study 2 was less relatable to the participants as it seemed more remote: the dynamic was between two famous individuals in Hollywood, and the interview took place several years ago—when norms regarding sexual misconduct were vague. Signals of approval and appropriateness of the treatment were communicated by the characteristics of the situation, including high-authority figure (the host), laughing audience, and the actress's outfit; all

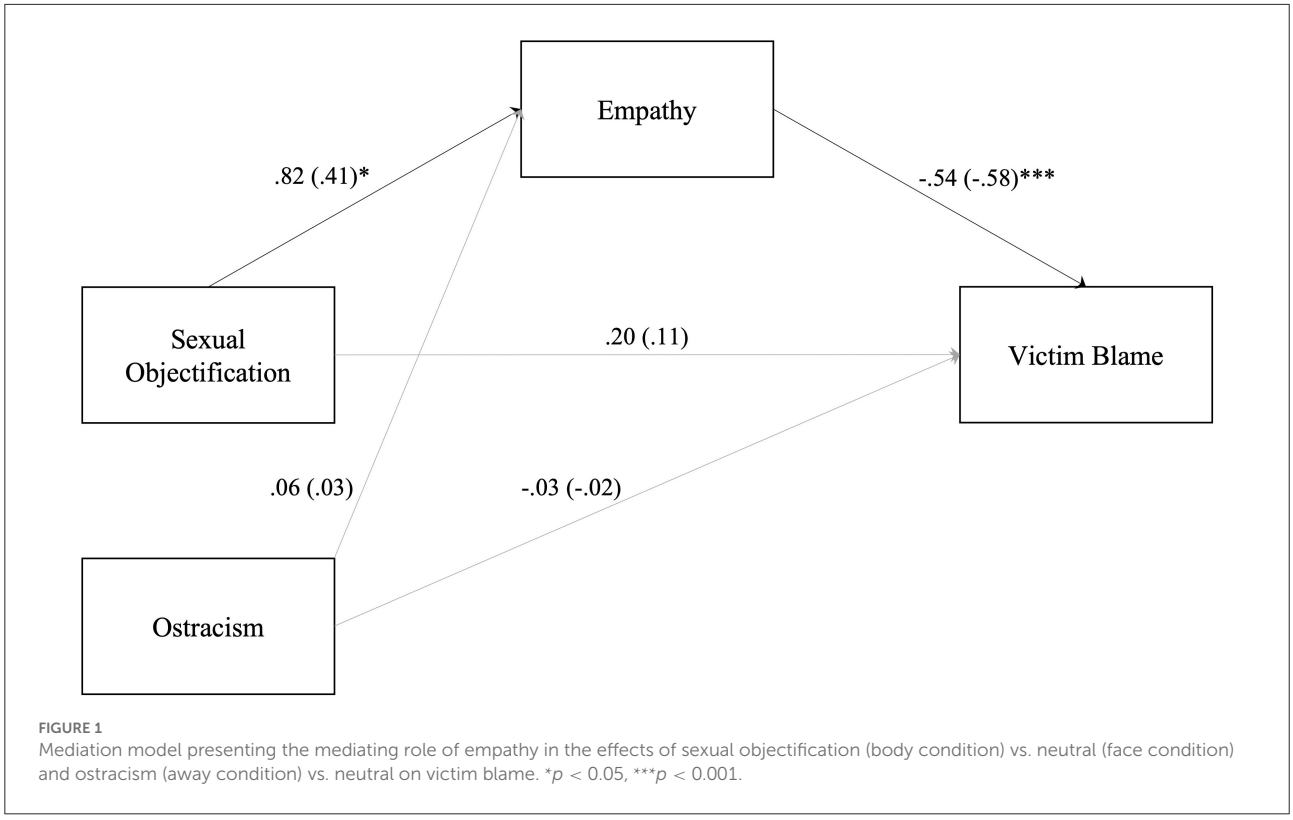

FIGURE 1
Mediation model presenting the mediating role of empathy in the effects of sexual objectification (body condition) vs. neutral (face condition) and ostracism (away condition) vs. neutral on victim blame. *$p < 0.05$, ***$p < 0.001$.

communicate that this is the norm of a talk show interview and resemble characteristics that were found to increase victim blame in previous research (Loughnan et al., 2013). In this study, a direct effect of sexual objectification or ostracism on victim blaming was not detected. This inconsistency of results may be due to the added complexity we stated earlier, additional evidence is needed to clarify the relationship between objectification and victim blaming. However, and more importantly, an indirect effect through empathy was detected: sexually objectified women experienced more empathy toward the victim, which was associated with reduced victim blaming. This finding alone raise questions regarding the way female victims are portrayed by the media (newspapers, TV, and social networks), and emphasize the need to present victims in a relatable manner to induce empathy and avoid victim blaming.

This work is first to demonstrate that the tendency to blame the victim is affected by situational factors of the perceiver. Whereas, research concerning the phenomena of victim blaming focused on characteristics of the victim, perpetrator, their relation, and the situation they are in, or on individual characteristics of the perceiver (e.g., rape myth acceptance; Bevens et al., 2018); we were able to demonstrate that experiencing sexual objectification (in both studies) and ostracism (in study 1) affected the tendency to blame the victim directly (study 1) and indirectly (study 2). It is known that the vast majority of adult women had experienced some form of sexual objectification (Bartky, 1990), and that all adult individuals (men and women) had experienced ostracism (Williams, 2009; Nezlek et al., 2012). In light of this, it seems that it is not simply the past experience that affects victim blame, but rather the immediacy and salience of that experience (manipulation during our studies) that affect the ability to empathize with the victim and in turn, the attribution of blame. Future studies should examine the interplay between situational factors and individual characteristics in the context of victim blame.

Previous research demonstrated that the more people perceive others as similar to themselves, the better they can sympathize and empathize with them (Davis, 1994; Batson et al., 2005). In a related vein, we propose that the more people perceive the situation others are in as similar to their own, the better they can relate and empathize with them—and that, in the context of sexual harassment reduces attribution of blame.

Sexual objectification is experienced as a form of ostracism. However, sexual objectification is a unique form of ostracism in that women still receive attention, although usually unwarranted, to their body and sexual functions while their core is being ignored. That makes sexual objectification resemble the sexual harassment in the studies the most, ostracism share some commonalities with sexual harassment but to a lesser extent and being treated well the least similar to sexual harassment. Thus, women who experienced sexual objectification were able

to experience the greatest empathy to the victim and attributed less blame. Future research should explore this matching hypothesis further and examine whether the type of ostracism one experiences elicits empathy to others who go through a similar experience. Further avenues for future research include examining whether the exposure to other sexist behaviors (e.g., verbal harassment or sexist humor) could also increase sense of common fate and empathy among women and provoke similar effect on victim blaming; whether trait self-objectification leads to a similar empathy–victim blaming relationship and how it may interact with state sexual objectification; and at last, examine different gender compositions.

In our studies, we have examined empathy using a single item asking directly regarding feelings of empathy. Still, empathy is a complex phenomenon, with investigators referring to two aspects. Cognitive empathy relates to the cognitive nature of empathy, emphasizing the ability to adopt another person's point of view (perspective taking) and theory of mind (e.g., see Davis, 1994; Eslinger, 1998). Emotional empathy relates to the emotional facets of empathy. Referring to one's affective reactions to the experience of others (Davis, 1994) and to aspects of helping behavior (Batson et al., 1981). The main difference between emotional and cognitive empathy is that the latter relies on cognitive and intellectual understanding of another person's point of view that is a slow and high process, whereas the former adds sharing of another person's feelings, which is elicited immediately and automatically (Mehrabian and Epstein, 1972; Fuchs, 2017). In our studies, we did not differentiate between types of empathy. Since we manipulated similar situations of the perceiver and the sexually harassed target one can hypothesize that automatic emotional aspect of empathy was at play (congruent feelings of perceiver and target). Unfortunately, we were unable to test this in the current research. Future examination of different aspects of empathy in the context of objectification, ostracism, and victim blaming is warranted.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Max Stern Yezreel Valley College IRB. Participants indicated their informed consent electronically.

Author contributions

MD and MN involved in all stages of research including planning and executing the research, analyzing the data, and crafting the manuscript. Both authors contributed to the article and approved the submitted version.

Funding

This research was conducted with the support of the Center for Integration in Science at Ministry of Aliya and Integration, State of Israel.

Acknowledgments

The authors would like to thank Ms. Karin Tzruya for her assistance in data collection.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.912698/full#supplementary-material

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TYPE Original Research
PUBLISHED 18 August 2022
DOI 10.3389/fpsyg.2022.916305

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 09 April 2022
ACCEPTED 26 July 2022
PUBLISHED 18 August 2022

CITATION
Park J, Woolley J and Mendes WB (2022) The effects of intranasal oxytocin on black participants' responses to outgroup acceptance and rejection.
Front. Psychol. 13:916305.
doi: 10.3389/fpsyg.2022.916305

The effects of intranasal oxytocin on black participants' responses to outgroup acceptance and rejection

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Social acceptance (vs. rejection) is assumed to have widespread positive effects on the recipient; however, ethnic/racial minorities often react *negatively* to social acceptance by White individuals. One possibility for such reactions might be their lack of trust in the genuineness of White individuals' positive evaluations. Here, we examined the role that oxytocin—a neuropeptide putatively linked to social processes—plays in modulating reactions to acceptance or rejection during interracial interactions. Black participants (N = 103) received intranasal oxytocin or placebo and interacted with a White, same-sex stranger who provided positive or negative social feedback. After positive feedback, participants given oxytocin (vs. placebo) tended to display approach-oriented cardiovascular responses of challenge (vs. threat), exhibited more cooperative behavior, and perceived the partner to have more favorable attitudes toward them after the interaction. Following negative feedback, oxytocin reduced anger suppression. Oxytocin did not modulate testosterone reactivity directly, but our exploratory analysis showed that the less participants suppressed anger during the interaction with their partner, the greater testosterone reactivity they displayed after the interaction. These results survived the correction for multiple testing with a false discovery rate (FDR) of 20%, but not with a rate of 10 or 5%. Discussion centers on the interplay between oxytocin and social context in shaping interracial interactions.

KEYWORDS

attributional ambiguity, social acceptance, social rejection, intergroup trust, oxytocin, social salience, interracial

Introduction

Social belongingness is a fundamental human need (Baumeister and Leary, 1995); individuals strive to connect with others and gain social approval, and when such a need is met, the resulting sense of acceptance can lead to a variety of positive psychological and biological outcomes (Crocker et al., 1993; Dickerson et al., 2004). Given the

significance of social acceptance, however, it would seem puzzling that research finds ethnic/racial minoritized individuals sometimes react *negatively* to social acceptance by White individuals, resulting in lowered self-esteem, feelings of depression, and threat (Crocker et al., 1991; Hoyt et al., 2007; Mendes et al., 2008).

Why might minoritized individuals show these paradoxical responses? One possibility for such reactions might be their lack of trust in the genuineness of White partners' positive evaluations. Minorities may perceive the positive feedback to be motivated by White partners' external concern to avoid appearing prejudiced to others, and thus, disingenuous (Crocker and Major, 1989; Major and O'Brien, 2005). The suspicion about the motives underlying positive responses may, in turn, undermine benefits typically associated with social acceptance. Here, we attempt to examine if intranasal oxytocin would modulate affective and social processes stemming from intergroup acceptance (vs. rejection), potentially *via* promoting prosocial outcomes, such as intergroup trust.

Oxytocin is a neuropeptide that has been implicated in the regulation of a wide range of social behavior—both prosocial and antisocial—depending on social contexts (Bartz et al., 2011; Olff et al., 2013; Shamay-Tsoory and Abu-Akel, 2016). In particular, when administered in situations that involve *positive* social interactions, oxytocin has been shown to increase affiliative motive and prosocial behaviors (see Macdonald and Macdonald, 2010; Striepens et al., 2011 for reviews). Thus, the goal of the present research was to examine whether and how intranasal oxytocin (vs. placebo) influences Black participants' physiological, affective, and behavioral responses to receiving positive (or negative) social feedback from a White interaction partner.

Paradoxical responses to social acceptance

Substantial evidence has accumulated suggesting that social acceptance from majority group members directed at minorities can engender negative consequences. For example, Crocker et al. (1991) found that after receiving positive interpersonal feedback from a White partner, Black participants showed reductions in their self-esteem, particularly when they had reason to attribute the feedback as stemming from their race—that is, when they believed their partner knew their race. Receiving positive feedback did not reduce self-esteem when participants thought their partner was unaware of their race. Similarly, Hoyt et al. (2007) found that Latin Americans who attributed White partners' positive behaviors to their race experienced lower self-esteem compared to those who did not make such attributions. Mendes et al. (2008) extended these findings by examining physiological mechanisms underlying minorities' reactions to outgroup acceptance. Following positive feedback from White partners, Black participants exhibited cardiovascular responses characteristic of threat (less cardiac efficiency and vasoconstriction), whereas those receiving positive feedback from same-race partners showed challenge reactivity (increased cardiac efficiency and vasodilation). Importantly, the deleterious effects of positive feedback were only evident among Black participants; White participants responded positively to positive feedback, regardless of whether their partner was the same- or different-race.

What accounts for these paradoxical responses? Attributional ambiguity theory suggests that minorities might doubt the motives underlying positive feedback from White partners and distrust the authenticity of the feedback (Crocker and Major, 1989; Major and O'Brien, 2005; Major et al., 2016). Because of cultural and legal prohibition against expression of prejudice in current U.S. society, many White individuals are concerned about appearing racist (Plant and Devine, 2003). They might be strongly motivated to regulate their actions not to display any signs of racial bias, in some cases, by over-correcting—that is, acting overly friendly toward minorities (Harber et al., 2010; Mendes and Koslov, 2013). As a result, minorities are likely to experience considerable attributional ambiguity about the true intentions behind White individuals' positive treatment directed toward them. Initially, minorities may be motivated to believe that the positive behaviors were driven by genuine liking or respect (e.g., Sinclair and Kunda, 2000). However, they may subsequently engage in additional attributional processing and adjust the initial judgment by considering the possibility that the positive behaviors were driven by European Americans' external concerns over appearing prejudiced. The uncertainty arising from the conflict between these two cognitions might in turn create deleterious reactions (van den Bos, 2009). For example, when minorities' uncertainty about the motives underlying White people's positive behaviors were assessed with the Suspicion of Motives Index (SOMI; Major et al., 2013), those who were more suspicious about White people's motives were more accurate at detecting their external motivation to appear non-prejudiced (LaCosse et al., 2015). Moreover, highly suspicious individuals react more negatively to White people's positive behaviors, for example, with heightened threat vigilance, elevated stress responses, and decreased self-esteem (see Kunstman and Fitzpatrick, 2018 for review).

If the lack of trust is the underlying mechanism of minorities' negative reactions, it may then be anticipated that in conditions where suspicion is eliminated, and thus, trust can be enhanced, minorities should react more favorably to the positive feedback because the feedback would be attributionally less ambiguous under such conditions. As an initial attempt to test this idea, we used a pharmacological intervention with intranasal oxytocin to examine whether this hormone would promote positive outcomes in the context of positive (vs. negative) interactions, such as intergroup trust.

Oxytocin and social processes: The social salience hypothesis

Earlier work in this area focused on the prosocial effects of oxytocin. Several studies reported that oxytocin facilitates affiliative prosocial behaviors, such as trust, cooperation, empathy, and generosity (e.g., Kosfeld et al., 2005; Hurlemann et al., 2010; Arueti et al., 2013). An initial study showed that participants given intranasal oxytocin, relative to placebo, gave more money to others in a trust game (Kosfeld et al., 2005; but see also Nave et al., 2015; Declerck et al., 2020 for recent failed replications). This finding was conceptually replicated by Baumgartner et al. (2008), who further showed that the prosocial effects of oxytocin were explained by reductions in activity in the amygdala, thereby suggesting that oxytocin may promote trust by reducing fear and anxiety about potential negative consequences of social interaction, such as betrayals (see Churchland and Winkielman, 2012 for similar argument).

More recent work, however, suggests that the effects of oxytocin are more nuanced than are often claimed by showing that many of the previously reported prosocial effects of oxytocin are context-dependent (Shamay-Tsoory et al., 2009; Mikolajczak et al., 2010; DeWall et al., 2014). For example, increasing evidence suggests that oxytocin facilitates prosociality only in contexts relatively free of negative interpersonal cues. Oxytocin promotes trust toward a partner who is perceived as trustworthy (vs. untrustworthy; Mikolajczak et al., 2010), and only toward ingroup members, but not toward outgroup members, when the interaction involves intergroup competition where negative aspects of outgroup members are likely made salient (De Dreu et al., 2010; De Dreu, 2012). Moreover, in the presence of negative interpersonal cues, oxytocin even facilitates antisocial reactions, such as experiences of envy and schadenfreude in response to monetary loss in a competitive game (Shamay-Tsoory et al., 2009) and aggressive behaviors following provocation (Ne'eman et al., 2016).

To reconcile these disparate findings, it has been proposed that oxytocin modulates attention-orienting responses to contextual social cues, thereby enhancing perceptual salience and processing of these cues (i.e., the social salience hypothesis; Bartz et al., 2011; Olff et al., 2013; Shamay-Tsoory and Abu-Akel, 2016). According to this view, oxytocin can produce a wide variety of responses—both positive and negative—depending on the available social stimuli in a given context. Oxytocin may promote prosociality when the context involves positive interpersonal cues (Mikolajczak et al., 2010), whereas it is likely to facilitate competitive or aggressive behaviors when the context involves negative interpersonal cues (De Dreu et al., 2010; DeWall et al., 2014; Ne'eman et al., 2016). The enhanced salience of social cues, enabled by oxytocin, may in turn, motivate individuals to make an immediate reaction based on intuitive processing in response to imminent situational contingencies. In support of this formulation, recent evidence suggests that oxytocin facilitates intuitive and spontaneous actions than deliberate and controlled responses (Ma et al., 2015; Ten Velden et al., 2016).

Taken together, this body of work suggests that oxytocin may play a different role in interracial interactions depending on available social cues, such as the type of feedback people receive. We predicted that oxytocin would enhance affiliative motive and prosociality when positive social cues are salient—that is, when Black participants receive positive feedback from the White partner. The initial attention to the positive feedback, if enhanced under the condition of oxytocin, can bolster and validate the feedback while inhibiting biased reactions based on additional attributional information. As a consequence, Black participants in this condition would react more favorably to the positive feedback, with increased liking, approach tendencies, and cooperation. In contrast, social rejection from an outgroup member typically engenders antagonistic reactions, such as aggression and anger (Major et al., 2002; Mendes et al., 2008). We predicted that oxytocin might amplify these negative emotional reactions, due to the enhanced perceptual sensitivity to the negative social cue (i.e., the outgroup member as a source of rejection).

It is important to note, though, that while there has been a surge of research on the role that oxytocin plays in human behaviors over the past two decades, there has also been a fair amount of research questioning the role and reliability of oxytocin effects on social behavior. Critical reviews have questioned the affective specificity of oxytocin, the extent to which intranasal oxytocin has direct effects on the central nervous system, and whether there is a strong foundation of data supporting the conclusions (e.g., Nave et al., 2015; Declerck et al., 2020; Mierop et al., 2020). To address some of these criticisms, we took seriously the role of social context to examine the effects of intranasal oxytocin on social behavior using face-to-face interactions by following best practices in oxytocin research available at the time.

Research overview

Our goal was to examine the role that intranasal oxytocin plays in modulating minorities' responses to outgroup acceptance or rejection by adopting a paradigm by Mendes et al. (2008). This allowed us to conceptually replicate some of their main findings and extend them by including intranasal administration of oxytocin vs. placebo as an additional factor during interracial interactions in a placebo controlled, double-blind experiment.

We hypothesized that oxytocin would lead Black participants to react more favorably to the positive feedback by the White partner, with increased approach motivation, cooperation, and liking. These outcomes were assessed

based on participants' physiological, behavioral, and affective responses. First, participants' motivational states of approach (vs. avoidance) were captured based on challenge vs. threat patterns of cardiovascular responses (Blascovich and Mendes, 2000). Second, we included a public goods provision task to measure participants' cooperative behavior. Third, participants' partner perceptions and affective responses were assessed with self-report measures.

In contrast, we hypothesized that the prosocial effects of oxytocin would be diminished in the negative feedback condition. Instead, we predicted that oxytocin might amplify antagonistic reactions typically following outgroup rejection, such as anger responses. We tested this hypothesis in two ways. First, we administered the Anger Expression Scale (AX; Spielberger et al., 1986) to assess the extent to which participants expressed, suppressed, or controlled their angry feelings during the interaction with their partner. Second, to alleviate concerns regarding self-presentational issues, we also measured testosterone responses that are often associated with experiences of anger and dominance (e.g., Mehta et al., 2008).

Materials and methods

Participants

One hundred and six Black Americans between the ages of 20 and 35 (61 women; 45 men, M_{age} = 25.31, SD_{age} = 4.83) were recruited from the community. The study took place in San Francisco, which has less than 6% Black/African American residents, underscoring the social context of individuals as numerical minorities. We planned to recruit a minimum of 100 participants, with 25 participants per condition. This sample size was determined *a priori* based on previous studies that involved a similar pharmacological intervention and physiological assessments (e.g., Kubzansky et al., 2012; Human et al., 2018). A discussion of the sample size and associated power is included later in the paper (see Robustness Checks section). Prior to the lab session, participants were screened for exclusion criteria, including (a) current or past psychiatric disorder (e.g., clinical depression or clinical anxiety), (b) significant medical illnesses (e.g., heart arrhythmia or hypertension), (c) pregnancy, and (d) obesity (body mass index > 35). Before coming into the lab, participants were asked to abstain from caffeine, alcohol, and exercise for at least 2 h. They were compensated $50 and received additional $17 bonus (see below).

Procedure

The study involved a 2 Intranasal spray (oxytocin vs. placebo) × 2 Feedback (positive vs. negative) between-participants, double-blind, placebo-controlled design. The placebo conditions offered an opportunity to conceptually replicate Mendes et al. (2008). All procedure and materials were approved by the Institutional Review Board at the study site. The study consisted of six phases and took approximately 2 h. See **Figure 1** for the timeline of the study.

Phase 1: Arrival and baseline saliva assessment

To minimize the effects of circadian fluctuations in testosterone levels (Touitou and Haus, 2000), participants were scheduled to come to the lab between 12:00 pm and 5:30 pm. After providing informed consent, female participants were asked to provide a urine sample for a pregnancy test and were excused from participation if the tests were positive. Participants then provided a 1.5 mL saliva sample that served as baseline testosterone assessment (Time 1 [T1]). Participants were instructed to expectorate into a sterile polypropylene microtubule (IBL tubes). Right afterward, participants completed the *baseline questionnaire* to assess their baseline affective states.

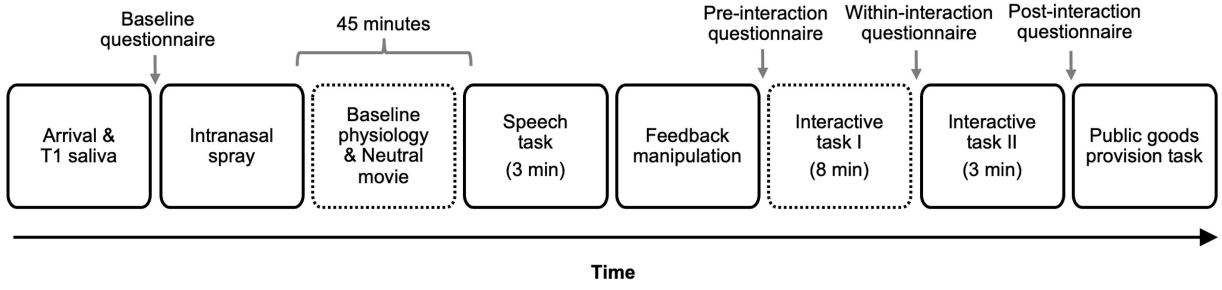

FIGURE 1
Study timeline. T1 indicates Time 1. The number in parenthesis indicates the duration of the task for tasks with fixed duration. Time 2 [T2] and Time 3 [T3] saliva samples were obtained 18 and 33 min following the onset of the first interactive task (i.e., taboo game), respectively. Dotted outlines indicate the times when cardiovascular responses were assessed. Reactivity indices were computed on three physiological parameters (heart rate, pre-ejection period, and cardiac output) by subtracting participants' baseline responses obtained during the last minute of the initial resting period from the physiological responses obtained during the first segment of the interactive task.

Phase 2: Intranasal spray and baseline physiological recording

Next, participants self-administered a nasal spray containing 40 international units (IU) of oxytocin (syntocinon spray, Novartis) or placebo (containing all inactive ingredients except the neuropeptide) in the presence of the study MD (second author) or a trained project director (see Woolley et al., 2016; Petereit et al., 2019; Thorson et al., 2021; for a similar procedure). After the administration of the intranasal spray, we attached sensors for physiological measurement and participants' physiological responses were recorded for 5 min while they sat quietly (see Cardiovascular Responses section for more details on physiological assessment). Prior work suggests that intranasal oxytocin begins to exert an influence on behavioral and physiological responses at least 30 min after the administration and last for a minimum of 90 min (Norman et al., 2011). Thus, after the baseline recording, participants were asked to complete a 30-min relaxation period that included watching an emotionally neutral film (a documentary about hiking the Appalachian Trail). Approximately 45 min after the intranasal spray, the first task of the study (i.e., speech task, see below) was introduced. From the first active task to the last task occurred within a 90-min time frame.

Phase 3: Speech task

At least 45 min following the intranasal spray, participants were given instructions for the speech task. From this point forward, we adopted the protocol used in Mendes et al. (2008).[1] Participants were told that they would interact with another participant (i.e., a confederate), who was in a different lab room. All participants verbally consented to continue with this part of the experiment and were then introduced to a gender-matched, White confederate. We made an audiovisual connection between the two experiment rooms so that the participant and the confederate could see and hear each other over large television monitors (42").

After the brief introduction, the participant and the confederate were informed that they would be randomly assigned to one of two roles—a performer or an evaluator—for the upcoming speech task. The participant was asked to select one of two cards (A or B) from a random assignment box and was told that the person who chose card A (or B) would be assigned to the performer condition while the person who chose card B (or A) would be assigned to the evaluator condition. Regardless of the card choice, the participant was always the performer who was told to deliver a speech on the topic of "Why I make a good friend" for 3 min while their partner listened to the speech.

After providing speech instructions, we disconnected the audiovisual connection between the two rooms so that the confederate could not see or hear the participant's speech; however, the participant was told that the connection was still on and their partner could see and hear their speech. After a 1-min preparation period, the participant delivered the speech for 3 min.

Phase 4: Feedback manipulation

After the speech, the experimenter returned to the room and asked participants to answer several questions on the computer about their experience during the speech and explained to them that some of this information would be electronically exchanged with their partner. After completing the questionnaire, participants were asked to click "SEND" button on the computer screen to send their answers to their partner and click "RECEIVE" button to receive their partner's responses, which included the partner's evaluation form.

We used a similar evaluation form used in Mendes et al. (2008) to provide participants either positive or negative feedback. Specifically, the evaluation form listed the following five statements with the partner's ostensible rating on each statement made on a scale of −4 to +4: "I would like to work at the same business or job as my partner," "I would like to work closely on a project or team with my partner," "I would like to get to know my partner better," "I would enjoy being neighbors with my partner," and "I would like to be close friends with my partner." Participants in the positive feedback condition received favorable ratings on all five items (+3 for the first two statements and +4 for the rest three), while those in the negative feedback condition received generally unfavorable ratings (0 for the first three statements and −1, and −2 for the fourth, and fifth, respectively). We developed this slightly modified version because the feedback used in Mendes et al. (2008) targeted college students (e.g., "I would enjoy being roommates with the other subject"), whereas our participants were older and typically not college students.

Both the experimenters and confederates were kept unaware of the feedback manipulation; they were not only

1 The current design allowed us to conceptually replicate Mendes et al. (2008), with the following three differences. First, Mendes et al. (2008) tested both White and Black participants, but in this study we tested Black participants only, as an attempt to examine the mechanism underlying minorities' paradoxically negative reactions to positive feedback by White individuals, motivated by the attributional ambiguity theory. Second, several measures used by Mendes et al. (2008) were not included in the current work; (a) The self-report measure of attributions to discrimination was not administered because we were concerned that it would make race salient and contaminate other outcomes. (b) We did not analyze dyads' performance during the cooperative task because the confederate's performance was scripted during the task to minimize their possible impact. (c) Mendes et al. (2008) analyzed participants' non-verbal behavior and emotional displays by coding the videotaped cooperative task that is not included in this project. Three, we administered several exploratory measures, including self-report measures of demand/resource appraisals, a tactile finger-spelling task, and saliva collection for hormone responses. We report results from most of these exploratory measures in the **Supplementary Materials**.

unaware to the type of the feedback but also to the fact that we were manipulating feedback at all. The authors were the only lab personnel who knew that this study included the feedback manipulation. These efforts to keep the manipulation a secret to our research staff and confederates protected against the possibility that the confederates, either consciously or unconsciously, attempted to modify their behavior to either align with or counter the presumed feedback. After participants reviewed the evaluation form, the experimenter returned to the room and asked participants to complete the *pre-interaction questionnaire*, which included measures of participants' affective states as well as their partner perception.

Phase 5: In-person interaction

After the completion of the questionnaire, the experimenter moved the confederate to the participant's room so that they could perform two interactive tasks together. They were told that depending on the joint performance on these two tasks, they could each earn an additional monetary bonus ($11). The participant and the confederate first engaged in a cooperative task, based on the game of taboo, where each player alternated providing clues for target words for 2 min without using any of the five "taboo" words listed on their prompt cards (see West et al., 2017). The dyad was told that they would receive points for every correct response and lose points if a taboo word was used. This task lasted for 8 min. The confederate's performance and reactions were scripted during this task; it was pre-determined whether they would correctly guess or not during their turns as well as the prompts they provided to their partner during the participant's turns. In addition, the confederates were trained to act in the same neutral way toward participants, regardless of how the participant acted toward them. After the dyad completed the game, participants filled out the *within-interaction questionnaire,* which included measures of affective states and anger expression.

The dyad then performed another interactive task (i.e., a tactile finger-spelling task; West et al., 2017) for 3 min.[2] After the completion of this task, the confederate was moved back to their original room, and the participant was asked to complete the *post-interaction questionnaire* alone to assess their affective states and partner perception one more time. The participant then provided the second (T2) and third (T3) saliva samples, 18 and 33 min following the beginning of the taboo game, respectively.

Phase 6: Public goods provision task

After the third saliva assessment, the experimenter removed the physiological sensors and provided instructions for the public goods provision task. Participants were told that they and their partner each earned a total $11 bonus from the two interactive tasks they performed together and would both be asked to decide how much of the $11 they want to put in a "common pot." They were told that the total money in the common pot would be multiplied by 1.5 point and divided equally between them (resulting in a maximum bonus of $16.5 for each). We used the amount of money participants put in the common pot as a behavioral index of cooperation (e.g., Ishii and Kurzban, 2008; M = 4.78 dollars, SD = 1.43). At the end of the task, we probed for suspicion and debriefed participants. All participants received the maximum $17 (rounded-up) bonus in addition to the $50 compensation.

Measures

Cardiovascular responses

We obtained cardiovascular responses from participants with the intent to differentiate *challenge* and *threat* reactivity, which typically includes pre-ejection period (PEP; a measure of sympathetic nervous system [SNS] activation), cardiac output (CO; a measure of cardiac efficiency), and total peripheral resistance (TPR; a measure of overall vasoconstriction and vasodilation in the arterioles). To obtain these measures, we used impedance cardiography, electrocardiography, and blood pressure monitored throughout the study. Impedance cardiography was obtained with a HIC-2000 Bio-Electric Impedance Cardiograph (Bio-Impedance Technology, Chapel Hill, NC, United States), using a tetrapolar aluminum/mylar tape electrode system, which provided basal transthoracic impedance (Z0) and the first derivative basal impedance (dZ/dt). Electrocardiography was recorded with two Ag/AgCI electrodes placed in a modified Lead II configuration (right upper chest, left lower rib). These signals were interfaced with a Biopac MP150 data acquisition system (Goleta, CA, United States). All data were edited and scored off-line in 1-min bins using IMP (3.0) module from Mindware Technologies (Gahanna, OH, United States). We extracted PEP, CO, and heart rate (HR) as the primary measures of interest.

We also obtained continuous blood pressure responses to estimate TPR. Unfortunately, the blood pressure monitor we used (Continuous Non-invasive Arterial Pressure monitor: CNAP Monitor 500; CNSystems Medizintechnik AG, Grax, Austria) provided highly unstable and unreliable blood pressure responses from implausible values of 30 mmHg to 210 mmHg

2 During this task, the confederate was instructed to spell out target words using the letters of American Sign Language (ASL), and the participant had to guess the words by touching their partner's hand. The dyad each put their dominant hands inside a box placed on the table between them so that they could not see each other's hand and had to feel their partner's hand to guess the words. This task was designed to force the dyad to touch, which may be more uncomfortable for people who are less familiar with interracial encounters (see **Supplementary Materials** for more details).

and this was exacerbated during the tasks likely due to participant movement that we could not control. Due to the invalidity of the blood pressure responses, we were thus unable to estimate TPR, which requires blood pressure responses.

Based on the available data we collected, we computed reactivity indices on three physiological parameters (i.e., HR, PEP, and CO). To examine how oxytocin, social feedback, and the interaction between the two influenced cardiovascular reactivity following the feedback, we computed change scores by subtracting participants' baseline responses obtained during the last minute of the initial resting period from the physiological responses obtained during the first segment of the interactive task (i.e., taboo game) to yield each reactivity index (see Mendes et al., 2008 for a similar approach).[3]

Testosterone responses

Immediately following the experiment, the saliva samples were frozen at −80°C. Upon completion of the study, the samples were shipped on dry ice to Dirk Hellhammer's lab at the University of Trier, Germany, where they thawed and spun at 3,000 rpms before assaying. The samples were analyzed for testosterone concentrations with an enzyme immunoassay kit (Salimetrics, State College, PA, United States). The lower limits of detection for testosterone were 1 pg/mL. The samples were assayed twice and the intra-assay coefficients of variation (CV) were 5.5, 5.5, and 6.3 for T1, T2, and T3 testosterone, respectively. The averaged data of the two assays were used for the analysis. We did not include low or high control samples in the assay plates to calculate inter-assay CVs. To adjust for gender difference in testosterone responses (e.g., Archer, 2006), we used scores standardized within gender in the analysis (see Maner et al., 2008 for a similar approach).[4]

Self-report measures

Partner perception

We assessed participants' perception about their partner in two ways, based on their own liking toward their partner (i.e., how much I like my partner) and based on their inferred liking by the partner (i.e., how much I think my partner likes me). These assessments were obtained at two time points following the feedback manipulation—(a) immediately after reviewing the evaluation form but before the in-person interaction with the partner and (b) after the in-person interaction. First, participants' partner liking before the in-person interaction was assessed with four items (e.g., "I am looking forward to meeting this person," "This person is the type of person who would be my friend"; $\alpha = 0.86$), on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). After the in-person interaction, participants rated their liking toward their partner again, based on five items (e.g., "I like my partner," "I trust my partner"; $\alpha = 0.88$). Second, participants' inferred liking by the partner was assessed before the in-person interaction with two items (i.e., "My partner is looking forward to meeting me," "My partner will like me"; $\alpha = 0.82$). After the in-person interaction, participants once again rated their inferred liking based on four items (e.g., "My partner likes me," "My partner trusts me"; $\alpha = 0.90$).

Affective states

We measured participants' global positive affect and negative affect with the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) at four time points throughout the study—(a) at baseline, (b) before their in-person interaction with the partner, (c) within the in-person interaction (i.e., after completing the first interactive task), and (d) after the in-person interaction. This allowed us to examine whether oxytocin modulates natural fluctuations in affective reactions over time after receiving the feedback, while controlling for baseline affect. At each time point, participants rated on a 5-point scale (1 = *not at all*, 5 = *a great deal*) the extent to which they felt 10 positive emotions (e.g., excited, active; αs ranged from 0.88 to 0.90) and 12 negative emotions (e.g., upset, hostile; αs ranged from 0.77 to 0.85).

Anger expression

After completing the taboo game, we assessed participants' anger expression with the 24-item Anger Expression Scale (AX; Spielberger et al., 1986). Participants used a 4-point scale (1 = *strongly disagree*, 4 = *strongly agree*) to indicate the extent to which they felt like right now, outwardly expressing anger (anger-out; e.g., "slamming doors," "saying nasty things"; $\alpha = 0.67$), suppressing anger/hostility (anger-in; e.g., "I want to pout or sulk," "I am boiling inside, but I am not showing it"; $\alpha = 0.73$), and controlling anger expression (anger-control; e.g.,

3 The last minute of the resting period responses did not differ as a function of intranasal spray and/or feedback, except that there was a main effect of intranasal spray on the baseline PEP, $F(1,96) = 6.20$, $p = 0.015$, $\eta_p^2 = 0.06$, 90% CI [0.01, 0.15]. Participants who were given oxytocin exhibited lower levels of baseline PEP ($M = 115.97$, $SE = 1.41$) compared to those who were given placebo ($M = 121.15$, $SE = 1.53$). To adjust for this baseline difference, when we analyzed PEP reactivity by controlling for participants' baseline PEP, this did not change the results. Similarly, instead of using the difference scores to yield each reactivity index, analyzing the physiological responses obtained during the first segment of the interactive task after controlling for the baseline responses did not substantially alter the results.

4 In addition to assaying testosterone, we also assayed cortisol. We did not have an *a priori* prediction about how oxytocin might influence stress hormones in each feedback condition, and yet, given that some prior research found the modulating effects of oxytocin on stress reactivity (Cardoso et al., 2014), we analyzed this variable for an exploratory purpose. As saliva samples were obtained at three time points—at baseline (T1) and at 18 min and 33 min following the onset of the first interactive task (T2 and T3, respectively), we performed a 2 Intranasal spray × 2 Feedback × 2 Time (T2 vs. T3) mixed ANCOVA, while controlling for T1 cortisol responses. We also controlled for gender to adjust for possible gender differences in cortisol reactivity (Kudielka and Kirschbaum, 2005). Neither the main effects nor the interactions between the predictor variables were statistically significant, $Fs < 2.29$, $ps > 0.133$, suggesting that there was no evidence that oxytocin and/or feedback modulated stress reactivity.

"I control my angry feelings," "I can stop myself from losing my temper"; α = 0.68).[5]

Results

Data analyses overview

During debriefing, three participants (one in oxytocin/negative feedback condition, one in oxytocin/positive feedback condition, and one in placebo/positive feedback condition) indicated that they were suspicious about the authenticity of their "partner" and believed that their partner was a confederate. Thus, the data from these participants were excluded from all analyses, which left 103 participants with analyzable data (58 women; M_{age} = 25.40, SD_{age} = 4.86).

Before data analyses, we checked outliers (i.e., responses outside the three interquartile range) in physiological responses and found three such values (one in PEP and two in CO). These values were retained in the analysis after being winsorized at the 90^{th} percentile to minimize their impact (Jose and Winkler, 2008; Wilcox, 2011). Preliminary analyses showed that gender did not influence any of the outcome variables we assessed (except, not surprisingly, for testosterone, which we analyzed following typical analytic strategies based on gender differences in testosterone levels) and it also did not interact with intranasal spray and/or feedback to predict any of these variables, so we do not discuss this variable further. See **Table 1** for descriptive statistics of key study variables (and see **Supplementary Table 1** for inter-correlations).[6]

We hypothesized that Black participants would respond more favorably following positive feedback from the White partner after the intranasal spray of oxytocin (vs. placebo), resulting in greater approach motivation indexed by challenge (vs. threat) patterns of cardiovascular reactivity, greater cooperative behavior, more favorable perceptions about their partner, and increased positive (vs. negative) affect. In contrast, we hypothesized that oxytocin would amplify negative emotional reactions following negative feedback, indexed by greater self-reported anger display and elevated testosterone reactivity.

To test our primary hypothesis, we conducted a 2 Intranasal spray (oxytocin vs. placebo) × 2 Feedback (positive vs. negative) analysis of variance (ANOVA) for each outcome variable. In addition, for certain outcome variables that were assessed more than one time point throughout the study, such as partner perception ratings (two times), affective states (four times, with the baseline value as a covariate), and testosterone reactivity (three times, with the baseline value as a covariate), we added a within-participants time factor to examine whether oxytocin effects manifest differently as a function of time following the feedback manipulation (i.e., Intranasal spray × Feedback × Time). We predicted that it may take time for oxytocin to exert its effects, such that the hypothesized effects might be stronger during or after the in-person interaction with the partner, rather than immediately following the feedback manipulation (but before the in-person interaction). For any significant interaction effect, we tested subsequent simple effects by applying Bonferroni corrections for multiple comparisons. Finally, as an exploratory analysis, we examined whether and how testosterone responses were associated with participants' self-reported anger responses, to begin to address how these two different proxies of angry reactions might be related. See **Table 2** for main results from all outcome variables.

Cardiovascular responses

First, we examined whether intranasal spray, feedback, and/or the interaction between the two influenced cardiovascular responses. All analyses focused on cardiovascular "reactivity" scores, computed by subtracting participants' baseline responses from the responses obtained during the first 2 min of the cooperative task.

Before conducting our main analyses, we first examined if our paradigm successfully induced SNS activation among our sample (i.e., a necessary condition to differentiate challenge vs. threat reactivity; Blascovich and Mendes, 2000) by performing a 2 Intranasal spray × 2 Feedback ANOVA on HR and PEP reactivity scores, separately. Previous studies suggest that emotional responses following negative feedback such as anger can increase SNS activation more so than emotional responses following positive feedback such as experiences of high arousal positive emotions (Stemmler, 1989; Mendes et al., 2008; Kreibig, 2010; but see also Mendes and Park, 2014 for the

5 The materials and data for the current paper are available at Open Science Framework (OSF): https://osf.io/xbfh4/?view_only=1daab5fc6856465db54afb165156bcf3.

6 Some studies suggest that oxytocin effects may depend on individual's menstrual cycle phase (e.g., Engel et al., 2019). We thus examined whether the menstrual cycle phase (follicular [41.4%] vs. luteal [55.2%]) influenced the results among participants who menstruated. None of the outcome variables was predicted by this variable, $Fs < 1.42$, $ps > 0.239$, except that those in the luteal phase shared more money during the public goods provision task than those in the follicular phase, $F(1,53) = 4.46$, $p = 0.039$, $\eta_p^2 = 0.08$, 90% CI [0.00, 0.20]. However, when we adjusted for the effect of the menstrual cycle, this did not alter the results from our main analysis. Specifically, we regressed the amount of shared money on the menstrual cycle phase and analyzed the residuals from this regression analysis for those who menstruated while analyzing the original data for those who didn't menstruate. As shown in the main analysis, the Intranasal spray × Feedback interaction was statistically significant, $F(1,96) = 4.15$, $p = 0.044$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.12]. In addition, we also tested whether the use of hormonal contraceptives (yes [27.6%] vs. no [70.7%]) modulated our results. Several outcomes were predicted by this variable, including participants' partner liking and positive affect before the in-person interaction and testosterone responses both at T2 and T3, $Fs > 3.35$, $ps < 0.073$, $\eta_p^2 s < 0.06$. However, when we controlled for this variable, this did not change the pattern of our results.

10.3389/fpsyg.2022.916305

TABLE 1 Descriptive statistics of study variables assessed at four time points throughout the study.

Variables	Baseline		Before interaction		During interaction		After interaction	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Primary measures								
Heart rate	67.34	9.14			83.92	13.08		
Pre-ejection period	118.05	11.41			107.97	11.89		
Cardiac output	5.81	2.35			6.21	2.62		
Cooperative behavior ($)							4.77	1.43
Partner liking			4.60	1.24			5.42	1.03
Inferred liking by partner			4.34	1.52			4.93	1.21
Positive affect	3.14	0.90	3.13	0.92	3.44	0.87	3.40	0.92
Negative affect	1.40	0.43	1.44	0.46	1.29	0.43	1.23	0.39
Anger expression					1.31	0.32		
Anger suppression					1.60	0.35		
Anger control					3.17	0.57		
Testosterone (pg/mL)								
Total sample	93.03	57.56			86.68	56.89	80.10	53.68
Males	139.88	54.80			132.90	54.03	125.00	48.81
Females	57.48	25.03			51.61	25.11	46.03	23.91
Exploratory measures								
Demand/resource appraisals					80.00	22.58		
Social touch (seconds)					0.57	0.31		
Cortisol (ug/dL)								
Total sample	4.83	3.54			3.71	2.43	3.39	2.25
Males	5.30	4.39			4.22	2.44	3.80	2.34
Females	4.48	2.71			3.32	2.37	3.08	2.15

Cardiovascular responses, cooperative behavior (the amount of money participants put in the common pot during the public goods provision task), and testosterone responses are the raw data before transformation. The results from the three exploratory measures are reported either as a footnote (see Footnote 4 for cortisol reactivity) or in the **Supplementary Materials** (for demand/resource appraisals and social touch, operationalized as the amount of time the dyad touched their hands during the tactile finger-spelling task). The second and third saliva samples were obtained at 18 and 33 min following the beginning of the in-person interaction, respectively.

moderating effects of contexts). We observed a similar pattern, such that participants in the negative feedback condition tended to show descriptively greater SNS activation—characterized with a greater increase in HR (M = 18.22, SE = 1.52) and a greater decrease in PEP (M = –11.31, SE = 1.38) from baseline levels—than those in the positive feedback condition (HR: M = 14.96, SE = 1.54; PEP: M = –9.51, SE = 1.39), but these effects did not reach statistical significance, $F(1,95) = 2.27$, $p = 0.135$, and $F(1,95) = 0.85$, $p = 0.359$, respectively. Neither the main effect of intranasal spray nor its interaction with feedback was significant, Fs < 0.74, ps > 0.392. Importantly though, participants in all four conditions showed a significant increase in SNS activation from baseline levels, indexed by an increase in HR, ts > 7.02, ps < 0.001, Cohen's ds > 1.46, and a decrease in PEP, ts > |–4.55|, ps < 0.001, Cohen's ds > 0.89, thereby meeting the necessary condition to further explore challenge vs. threat reactivity.

For our primary analysis, we then examined both PEP and CO reactivity to differentiate states of challenge vs. threat, following an established approach (Blascovich and Mendes, 2000; Mendes et al., 2008). Challenge states are characterized as an increase in SNS (a decrease in PEP) and cardiac efficiency (an increase in CO), whereas cardiovascular responses exhibited in threat states are associated with an increase in SNS and less efficient cardiac output (no change or a decrease in CO). As noted above and also shown in **Figure 2A**, participants in all four conditions showed a significant decrease in PEP from baseline, and thus, we examined CO reactivity to further differentiate states of challenge vs. threat.

The main effects of intranasal spray and feedback were not significant on CO reactivity, Fs < 1.86, ps > 0.176. Importantly though, there was a trend of the interaction between intranasal spray and feedback, $F(1,96) = 3.46$, $p = 0.066$, $\eta_p^2 = 0.04$, 90% Confidence Interval (CI) [0.00, 0.11]. To decompose this interaction effect, we tested the simple effect of intranasal spray on CO reactivity in each feedback condition separately. In the positive feedback condition, the effect of intranasal spray approached statistical significance, $F(1,96) = 2.80$, $p = 0.097$, $\eta_p^2 = 0.03$, 90% CI [0.00, 0.10]; participants who were given oxytocin tended to show greater CO reactivity (M = 0.44,

TABLE 2 Summary of the results from the primary analysis (Intranasal spray × Feedback) and exploratory analysis (Intranasal spray × Feedback × Time).

		F-tests						
Variable	***N***	**Intranasal spray**	**Feedback**	**Time**	**I × F**	**I × T**	**F × T**	**I × F × T**
Challenge vs. threat								
CO reactivity	100	0.26	1.86		3.46†			
PEP reactivity	99	0.16	0.85		0.02			
Cooperative behavior	102	0.39	3.92*		5.87*			
Partner perception								
Partner liking	100	0.03	89.11***	127.94***	0.54	2.94†	14.28***	1.79
Inferred liking by partner	100	0.38	126.59***	25.01***	0.07	2.50	9.06**	3.96*
Affective states								
Positive affect	84	1.67	7.32***	6.95***	0.68	0.13	7.35***	0.09
Negative affect	84	0.54	5.75*	0.98	1.42	0.41	0.84	0.24
Anger reactions								
Anger expression	102	1.79	0.32	1.44				
Anger suppression	102	3.38†	3.56†	4.00*				
Anger control	102	1.12	1.13	0.02				
Testosterone reactivity	102	1.40	0.41	0.00	1.29	0.30	0.15	0.48

I × F, Intranasal spray × Feedback; I × T, Intranasal spray × Time; F × T, Feedback × Time; I × F × T, Intranasal spray × Feedback × Time. The analyses for affective states and testosterone reactivity were conducted controlling for their baseline values.
†$p < 0.10$, *$p < 0.05$, **$p < 0.001$, ***$p < 0.001$.

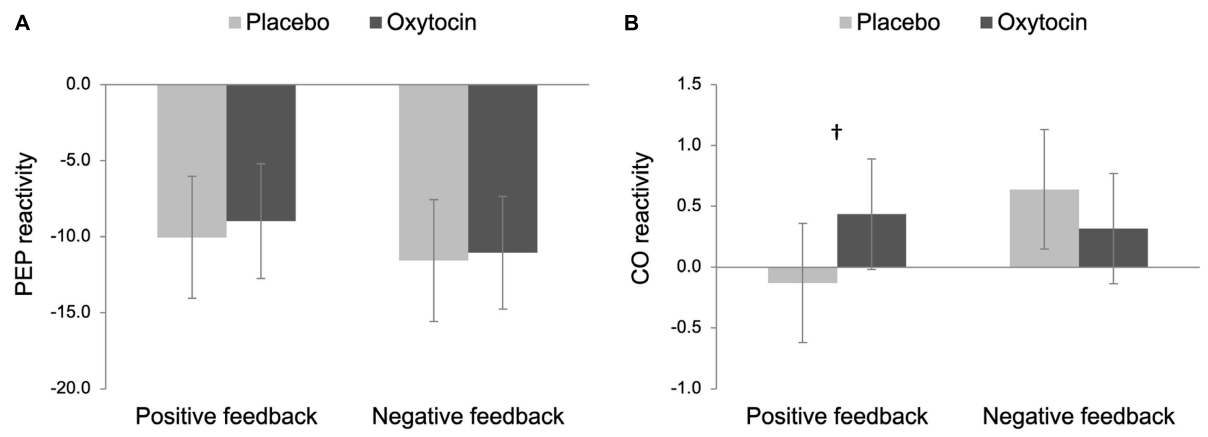

FIGURE 2
Pre-ejection period (PEP; **A**) and cardiac output (CO; **B**) reactivity as a function of intranasal spray (placebo vs. oxytocin) in each feedback condition. Lower scores on PEP reactivity indicate greater sympathetic nervous system (SNS) activation while higher scores on CO reactivity indicate greater cardiac efficiency. Challenge patterns of cardiovascular reactivity are characterized by an increase in SNS activity along with an increase in cardiac efficiency whereas threat patterns of cardiovascular reactivity are characterized by an increase in SNS along with no change in cardiac efficiency. Error bars indicate 95% confidence intervals. †$p < 0.10$.

SE = 0.17), compared to those who were given placebo (*M* = −0.13, *SE* = 0.18) (see Figure 2B). Combined with a significant decrease in PEP, the pattern displayed by participants given oxytocin is consistent with a challenge-pattern of cardiovascular reactivity. In contrast, those given placebo showed a threat-pattern of cardiovascular reactivity, characterized as a smaller or no increase in CO combined with a decrease in PEP. Among those who received negative feedback, participants who were given oxytocin did not differ from those who were given placebo, $F(1,96) = 0.92$, $p = 0.341$. Both groups showed a challenge/approach-oriented pattern of reactivity (consistent with anger).

Taken together, we replicated Mendes et al. (2008) in the placebo conditions, such that Black participants exhibited a threat-pattern of cardiovascular reactivity in the positive feedback condition while exhibiting a challenge-pattern of

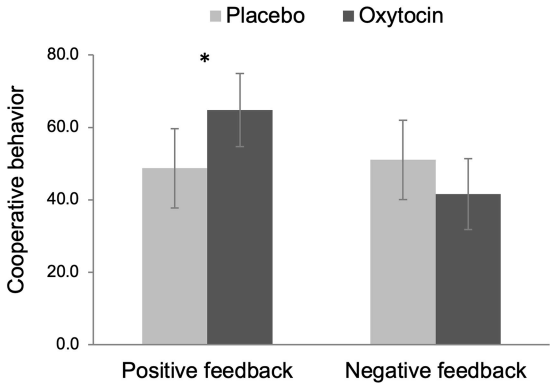

FIGURE 3
Cooperative behavior (i.e., the amount of money participants put in the common pot during the public goods provision task) as a function of intranasal spray (placebo vs. oxytocin) in each feedback condition. The data were rank-transformed to reduce skewness. Error bars indicate 95% confidence intervals.
*$p < 0.05$.

cardiovascular reactivity in the negative feedback condition. Notably, oxytocin tended to reduce Black participants' threat responses following outgroup partner's positive feedback, such that only participants in the placebo/positive feedback condition exhibited threat responses whereas the other three groups all showed challenge/approach-oriented patterns. To formally test this group difference, we conducted a *post hoc* contrast analysis on CO reactivity to compare the placebo/positive feedback condition (−3) with the rest of the three conditions (all + 1 s). This analysis yielded a significant result, $F(1,96) = 4.41$, $p = 0.038$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.13], indicating that placebo participants showed greater threat responses following positive feedback whereas participants in the other three conditions showed challenge reactivity.

Public goods provision

We operationalized cooperation as the amount of money participants put in the common pot during the public goods provision task. Because this variable did not follow a normal distribution [$D(102) = 0.35$, $p < 0.001$, Kolmogorov–Smirnov test], we rank-transformed this variable before submitting it to a 2 Intranasal spray × 2 Feedback ANOVA (see Conover and Iman, 1981 for this recommended approach). The main effect of intranasal spray was not significant, $F(1,98) = 0.39$, $p = 0.534$, but there was a tendency that participants exhibited more cooperative behavior after receiving positive (vs. negative) feedback, $F(1,98) = 3.92$, $p = 0.050$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.12]. Importantly, there was a significant Intranasal spray × Feedback interaction effect, $F(1,98) = 5.87$, $p = 0.017$, $\eta_p^2 = 0.06$, 90% CI [0.01, 0.14]. As **Figure 3** displays, among participants who received positive feedback, those given oxytocin exhibited greater cooperative behavior ($M = 64.80$, $SE = 5.09$) than those given placebo ($M = 48.76$, $SE = 5.52$), $F(1,98) = 4.57$, $p = 0.035$, $\eta_p^2 = 0.05$, 90% CI [0.00, 0.13]. In contrast, oxytocin did not modulate cooperative behavior after negative feedback, $F(1,98) = 1.64$, $p = 0.203$.

Partner perceptions

Next, we analyzed partner perception ratings that participants completed prior to and immediately following the in-person interaction, based on (a) their own liking toward their partner (i.e., how much I like my partner) and (b) their inferred liking by the partner (i.e., how much I think my partner likes me).

First, participants' partner liking ratings were submitted to a 2 Intranasal spray × 2 Feedback × 2 Time (before vs. after the in-person interaction) mixed ANOVA with intranasal spray and feedback as between-participant factors and time as a within-participant factor. This analysis yielded a significant main effect of feedback, $F(1,96) = 89.11$, $p < 0.001$, $\eta_p^2 = 0.48$, 90% CI [0.36, 0.57]. Consistent with a manipulation check, participants who received positive feedback liked their partner more ($M = 5.78$, $SE = 0.11$), compared to those who received negative feedback ($M = 4.30$, $SE = 0.11$). This finding is especially interesting because the confederates always acted with the same neutral affect toward participants and, indeed, were not aware that there was a feedback manipulation. In addition, the main effect of time was also significant, $F(1,96) = 127.94$, $p < 0.001$, $\eta_p^2 = 0.57$, 90% CI [0.46, 0.65]; in general, participants liked their partner more after the in-person interaction ($M = 5.42$, $SE = 0.08$), compared to before the in-person interaction ($M = 4.66$, $SE = 0.09$). These effects were qualified by a significant Feedback × Time two-way interaction effect, $F(1,96) = 14.28$, $p < 0.001$, $\eta_p^2 = 0.13$, 90% CI [0.04, 0.23], such that the effect of time was larger in the negative feedback condition, $F(1,96) = 112.75$, $p < 0.001$, $\eta_p^2 = 0.54$, 90% CI [0.43, 0.62], than in the positive feedback condition, $F(1,96) = 28.65$, $p < 0.001$, $\eta_p^2 = 0.23$, 90% CI [0.12, 0.34]. That is, participants who received negative feedback showed a greater increase in partner liking over time (before the interaction: $M = 3.80$, $SE = 0.12$; after the interaction: $M = 4.81$, $SE = 0.12$), compared to those who received positive feedback (before the interaction: $M = 5.53$, $SE = 0.12$; after the interaction: $M = 6.03$, $SE = 0.12$). In addition, there was a trend of the interaction between intranasal spray and time, $F(1,96) = 2.94$, $p = 0.089$, $\eta_p^2 = 0.03$, 90% CI [0.00, 0.10]; the effect of time tended to be larger among those who were given oxytocin, $F(1,96) = 96.46$, $p < 0.001$, $\eta_p^2 = 0.50$, 90% CI [0.38, 0.59], compared to those who were given placebo, $F(1,96) = 41.09$, $p < 0.001$, $\eta_p^2 = 0.30$, 90% CI [0.18, 0.41]. However, the critical two-way interaction between intranasal spray and feedback was not statistically significant,

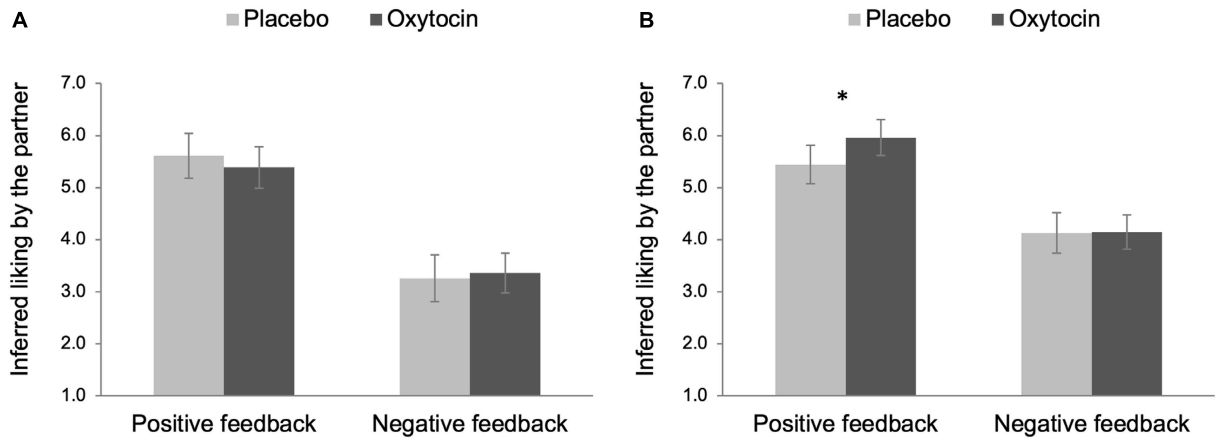

FIGURE 4
Partner perception before **(A)** and after **(B)** the in-person interaction as a function of intranasal spray (placebo vs. oxytocin) in each feedback condition. Higher number indicates that participants perceived their partner to have more favorable attitudes toward them. Error bars indicate 95% confidence intervals. *$p < 0.05$.

$F(1,96) = 0.54$, $p = 0.464$. There was also no evidence of a three-way interaction among intranasal spray, feedback, and time, $F(1,96) = 1.79$, $p = 0.184$.

Second, the same mixed ANOVA was performed on participants' inferred liking by the partner. As similarly shown above, both main effects of feedback and time were significant, $F(1,96) = 126.59$, $p < 0.001$, $\eta_p^2 = 0.57$, 90% CI [0.46, 0.65] and $F(1,96) = 25.01$, $p < 0.001$, $\eta_p^2 = 0.21$, 90% CI [0.10, 0.32], respectively. Participants perceived their partner to have more favorable attitudes toward them after receiving positive feedback ($M = 5.60$, $SE = 0.12$), compared to negative feedback ($M = 3.73$, $SE = 0.12$), and after the in-person interaction ($M = 4.92$, $SE = 0.09$), compared to before the in-person interaction ($M = 4.41$, $SE = 0.11$). The effect of time, however, was only significant in the negative feedback condition (before the interaction: $M = 3.31$, $SE = 0.15$; after the interaction: $M = 4.14$, $SE = 0.13$), $F(1,96) = 31.78$, $p < 0.001$, $\eta_p^2 = 0.25$, 90% CI [0.13, 0.36], but not in the positive feedback condition (before the interaction: $M = 5.50$, $SE = 0.15$; after the interaction: $M = 5.70$, $SE = 0.13$), $F(1,96) = 2.00$, $p = 0.160$, resulting in a significant Feedback × Time two-way interaction effect, $F(1,96) = 9.06$, $p = 0.003$, $\eta_p^2 = 0.09$, 90% CI [0.02, 0.18]. Neither the Intranasal spray × Time interaction nor the Intranasal spray × Feedback interaction was significant, $F(1,96) = 2.50$, $p = 0.117$ and $F(1,96) = 0.07$, $p = 0.786$, respectively, but importantly, we found a significant Intranasal spray × Feedback × Time three-way interaction effect, $F(1,96) = 3.96$, $p = 0.049$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.12].

We decomposed the three-way interaction effect by testing simple effects of intranasal spray on participants' inferred liking before and after the in-person interaction in each feedback condition separately. As shown in Figure 4A, there was no effect of intranasal spray on partner's inferred liking before the in-person interaction for both feedback conditions, $Fs < 0.55$, $ps > 0.458$. Intranasal spray also did not modulate partner's inferred liking after the in-person interaction in the negative feedback condition, $F(1,96) < 0.01$, $p = 0.952$. In contrast, there was a significant effect of intranasal spray in the positive feedback condition, $F(1,96) = 4.11$, $p = 0.046$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.12], indicating that after receiving positive feedback, participants given oxytocin ($M = 5.96$, $SE = 0.17$) perceived their partner to have more favorable attitudes toward them after the in-person interaction, compared to those given placebo ($M = 5.45$, $SE = 0.19$) (see Figure 4B).

Affective states

Next, we examined whether and how oxytocin modulated fluctuations in affective responses over time after receiving the feedback. We performed a 2 Intranasal spray × 2 Feedback × 3 Time (before the in-person interaction vs. during the interaction [i.e., after completing the first interactive task] vs. after the interaction) mixed ANCOVA separately for positive affect and negative affect, with intranasal spray and feedback as between-participant factors and time as a within-participant factor, while controlling for its baseline value.

When we examined participants' positive affect, there were significant main effects of time and feedback, $F(2,158) = 6.95$, $p = 0.001$, $\eta_p^2 = 0.08$, 90% CI [0.02, 0.15] and $F(1,79) = 7.32$, $p = 0.008$, $\eta_p^2 = 0.09$, 90% CI [0.01, 0.19], respectively. In general, participants experienced greater positive affect both during and after the in-person interaction ($M = 3.49$, $SE = 0.06$

and $M = 3.43$, $SE = 0.06$, respectively) than before the in-person interaction ($M = 3.17$, $SE = 0.05$). Participants also reported higher levels of positive affect after receiving positive feedback ($M = 3.50$, $SE = 0.07$), compared to negative feedback ($M = 3.23$, $SE = 0.07$). These effects were qualified by a Feedback × Time interaction effect, $F(2,158) = 7.35$, $p = 0.001$, $\eta_p^2 = 0.09$, 90% CI [0.02, 0.15]; such that participants reported greater positive affect after receiving positive (vs. negative) feedback, especially before the in-person interaction (positive feedback: $M = 3.43$, $SE = 0.07$; negative feedback: $M = 2.92$, $SE = 0.08$), $F(1,79) = 22.59$, $p < 0.001$, $\eta_p^2 = 0.22$, 90% CI [0.10, 0.34], compared to during (positive feedback: $M = 3.60$, $SE = 0.09$; negative feedback: $M = 3.38$, $SE = 0.09$) or after the in-person interaction (positive feedback: $M = 3.49$, $SE = 0.09$; negative feedback: $M = 3.38$, $SE = 0.09$), $F(1,79) = 3.14$, $p = 0.080$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.13] and $F(1,79) = 0.74$, $p = 0.391$, respectively. No other effects, including the critical Intranasal spray × Feedback interaction, reached statistical significance, $Fs < 1.67$, $ps > 0.200$.

Next, we performed the same mixed ANOVA on negative affect and found a significant main effect of feedback, $F(1,79) = 5.75$, $p = 0.019$, $\eta_p^2 = 0.07$, 90% CI [0.01, 0.17], indicating that participants reported greater negative affect after receiving negative feedback ($M = 1.40$, $SE = 0.05$) than positive feedback ($M = 1.25$, $SE = 0.04$). No other effects were statistically significant, $Fs < 1.42$, $ps > 0.237$.

Anger expression

We hypothesized that oxytocin would amplify negative emotional reactions following negative feedback, such as anger and aggression. To test this hypothesis, we first examined participants' state levels of anger expression during the in-person interaction by submitting each subscale of AX to a 2 Intranasal spray × 2 Feedback ANOVA. The effects of intranasal spray and/or feedback were negligible on both anger expression, $Fs < 1.79$, $ps > 0.184$, and anger control, $Fs < 1.13$, $ps > 0.291$. However, there emerged a significant Intranasal spray x Feedback interaction on anger suppression, $F(1,98) = 4.00$, $p = 0.048$, $\eta_p^2 = 0.04$, 90% CI [0.00, 0.12]. In response to negative feedback, participants given oxytocin reported suppressing their anger less ($M = 1.54$, $SE = 0.06$) than placebo participants ($M = 1.80$, $SE = 0.07$), $F(1,98) = 7.48$, $p = 0.007$, $\eta_p^2 = 0.07$, 90% CI [0.01, 0.16]. In contrast, oxytocin did not influence participants' tendency to suppress anger in response to positive feedback, $F(1,98) = 0.01$, $p = 0.909$.

Testosterone reactivity

Finally, we analyzed gender-adjusted testosterone responses obtained both at T2 and T3 (18 and 33 min following the beginning of the in-person interaction) by controlling for participants' baseline (T1) testosterone responses to examine whether oxytocin intensified experience of anger and dominance following social rejection, possibly indexed by elevated testosterone reactivity. Specifically, we performed a 2 Intranasal spray × 2 Feedback × 2 Time (T2 vs. T3) mixed ANCOVA, while controlling for T1 testosterone responses. Neither the main effects nor the interactions between the predictor variables were statistically significant, $Fs < 1.40$, $ps > 0.240$.

These results suggest that there was no evidence that intranasal oxytocin modulated testosterone reactivity differently as a function of feedback type at the group level. Nonetheless, we sought to examine whether self-reported anger responses predicted testosterone reactivity in each feedback condition, to begin to address how these two different proxies of anger reactions might be related at the individual level. We tested these associations separately for T2 and T3 testosterone reactivity after combining both spray conditions, as there was no effect of intranasal oxytocin on both variables. First, we regressed T2 testosterone levels on three subscales of anger expression as well as T1 testosterone as a baseline in each feedback condition. There was no significant relationship between anger expression and T2 testosterone in the negative feedback condition, $b = 0.71$, 95% CI [−0.19, 1.61], $t(47) = 1.29$, $p = 0.120$. In addition, anger control tended to predict greater T2 testosterone, $b = 0.38$, 95% CI [−0.02, 0.77], $t(47) = -1.91$, $p = 0.062$. In contrast, we found a significant negative relationship between anger suppression and T2 testosterone, $b = -0.75$, 95% CI [−1.50, −0.01], $t(47) = -2.03$, $p = 0.048$, indicating that the less participants suppressed their anger during the in-person interaction following social rejection, the greater testosterone reactivity they showed after the interaction. None of the anger subscales predicted T2 testosterone reactivity in the positive feedback condition, $ts < 0.89$, $ps > 0.377$.

Second, we conducted the same analyses with T3 testosterone reactivity. As similarly shown at T2, anger suppression negatively predicted T3 testosterone in the negative feedback condition, $b = -1.13$, 95% CI [−1.95, −0.31], $t(47) = -2.78$, $p = 0.008$. In addition, anger expression also tended to predict greater T3 testosterone, $b = 0.91$, 95% CI [−0.08, 1.90], $t(47) = 1.86$, $p = 0.070$. However, anger control was not associated with testosterone reactivity at T3, $b = 0.03$, 95% CI [−0.40, 0.47], $t(47) = 0.16$, $p = 0.874$. None of these subscales were significantly associated with T3 testosterone in the positive feedback condition, $ts < 0.94$, $ps > 0.353$.

To summarize, one consistent pattern we found across both time points is that anger suppression was *negatively* associated with testosterone reactivity in the negative feedback condition, such that those who suppressed their anger less after

receiving negative feedback from their partner showed elevated testosterone reactivity both at T2 and T3.[7,8]

Robustness checks

We used the conventional threshold with a *p*-value of 0.05 to determine statistical significance for each outcome variable. However, given that we performed simultaneous hypothesis testing on multiple outcomes (a total of 11 univariate tests; see **Table 2**), this can inflate the probability of Type I error (i.e., erroneously rejecting the null hypothesis). Thus, as a robustness check, we applied the Benjamini–Hochberg (B-H) procedure to control for the false discovery rate (FDR) for multiple testing (Benjamini and Hochberg, 1995). To evaluate our results with different levels of stringency, we performed the B-H correction with FDR thresholds of 5, 10, and 20%, which indicate that roughly 5, 10, or 20% of all significant results are interpreted as possible false positives. Specifically, we rank-ordered the raw p-values of 11 outcome variables (from lowest to highest) and compared them with their B-H critical values calculated with the FDRs of 5, 10, and 20%, respectively. When the raw *p*-value is smaller than its B-H critical value, the hypothesis testing for this variable and all testing with *p*-values smaller than the *p*-value of this variable are considered statistically significant (McDonald, 2015). As summarized in **Table 3**, all significant results survived the correction with the FDR of 20%. Notably, the result on CO reactivity, which did not reach statistical significance in our original analysis (raw *p*-value = 0.066), proved to be statically significant with this correction. However, when we applied the correction with more stringent rates of 5 or 10%, none of the effects passed these additional tests.

As another way to check the robustness of our results, we conducted a sensitivity power analysis to identify a minimal detectable effect for each outcome variable. The sensitivity power analysis using G*Power (Faul et al., 2009) showed that our primary analysis (i.e., the Intranasal spray × Feedback interaction) based on our final sample ($N = 103$) was sufficient to detect a medium size effect with Cohen's $f = 0.28$ (power = 0.80, $\alpha = 0.05$, two-tailed). In addition, for our exploratory analysis that involved repeated measures (i.e., partner perceptions, affective states, and testosterone reactivity), we calculated a minimum detectable effect of the three-way interaction effect (Intranasal spray × Feedback × Time), assuming a correlation of 0.50 among the repeated measures. We expected that participants' initial responses would serve as an anchor to affect their subsequent reactions, thereby yielding a medium-sized correlation among the repeated measures. The sensitivity power analyses showed that we had 0.80 power to detect the three-way

7 We used testosterone responses standardized within gender to adjust for gender differences in testosterone levels (e.g., Maner et al., 2008). As another way to address the gender differences, we also tested if gender moderated the relationships between anger suppression and testosterone reactivity both at T2 and T3, and it did not, $ts < 0.91$, $ps > 0.370$. Nonetheless, when we conducted the regression analyses separately for each gender group using the raw data before standardization, the relationship between anger suppression and testosterone reactivity was only significant among women at T3, $b = -21.35$, 95% CI [−40.33, −2.36], $t(52) = -2.26$, $p = 0.028$. The same pattern of the relationship was shown among men at T3 and also among both gender groups at T2, but none of them researched statistical significance, $ts > |-1.06|$, $ps < 0.293$.

8 Caution is due in interpreting the results from these exploratory analyses, because when we formally tested the moderating effect of feedback (i.e., Feedback × Anger suppression interaction), the moderation was not significant at both time points, $ts < 0.57$, $ps > 0.568$. That is, there is no evidence that the relationship between anger suppression and testosterone reactivity is limited to the negative feedback condition.

TABLE 3 Descriptive statistics for robustness checks.

Outcome variable	Analysis	Raw *P*-value	i (rank)	B-H critical value (5% FDR)	B-H critical value (10% FDR)	B-H critical value (20% FDR)	Minimal detectable effect	Observed effect
Cooperative behavior	I × F	0.017	1	0.005	0.009	**0.018**	0.28	0.23
Anger suppression	I × F	0.048	2	0.009	0.018	**0.036**	0.28	0.19
Inferred liking by partner	I × F × T	0.049	3	0.014	0.027	**0.055**	0.17	0.20
CO reactivity	I × F	0.066	4	0.018	0.036	**0.073**	0.28	0.18
Partner liking	I × F × T	0.184	5	0.023	0.045	0.091	0.17	0.13
Anger expression	I × F	0.233	6	0.027	0.055	0.109	0.28	0.12
Testosterone	I × F × T	0.489	7	0.032	0.064	0.127	0.17	0.07
Negative affect	I × F × T	0.790	8	0.036	0.073	0.145	0.15	0.05
PEP reactivity	I × F	0.887	9	0.041	0.082	0.164	0.28	0.01
Anger control	I × F	0.898	10	0.045	0.091	0.182	0.28	0.01
Positive affect	I × F × T	0.911	11	0.050	0.100	0.200	0.15	0.03

I × F, Intranasal spray × Feedback; I × F × T, Intranasal spray × Feedback × Time. B-H critical value was computed using the following equation = (i/m) × Q, where *i* indicates the rank of the raw *p*-value, *m* indicates the total number of tests (11), and *Q* indicates the false discovery rate (FDR; 5, 10, or 20%) (Benjamini and Hochberg, 1995). The bolded numbers indicate the B-H critical values of four outcome variables that survived the FDR correction of 20%. Minimal detectable effect for each outcome was calculated based on a sensitivity power analysis while observed effect was based on an actual analysis (both indicate Cohen's *f*).

interaction with a small size effect (Cohen's f = 0.17 and 0.15 for partner perceptions and testosterone reactivity [with two levels] and affective states [with three levels], respectively). Next, we compared these minimal effect sizes with the observed effect sizes from our actual analyses. As shown in **Table 3**, the observed effect was smaller than the minimal detectable effect for all outcome variables, except for one variable; for inferred liking by partner, the observed effect size (Cohen's f = 0.20) exceeded the minimal detectable effect calculated by the sensitivity power analysis (Cohen's f = 0.17), suggesting that we had a sufficient power to detect the effect for this variable. However, our study was generally underpowered to observe the obtained effect for all other variables, and thus, caution is necessary to interpret these results.

Discussion

What might seem to be a counter-intuitive finding—ethnic/racial minoritized individuals often react negatively to outgroup acceptance—is a common finding in intergroup literature that is predicted by attributional ambiguity theory. This theory proposes that minoritized individuals have additional attributional explanations for White partners' positive behaviors; they perceive the positive behaviors driven by White individuals' concerns over appearing prejudiced rather than reflecting genuine social acceptance. Theoretically, this explanation suggests that distrust is an important underlying mechanism. The key contribution of our work was to test this premise by examining the effects of intranasal oxytocin on Black participants' physiological, affective, and behavioral responses to outgroup acceptance and rejection. Our results showed that oxytocin exerted divergent effects depending on the type of feedback Black participants received from the White partner.

The role of oxytocin in positive interracial interaction

First, consistent with prior work documenting minoritized individuals' negative reactions to positive feedback from White partners (Crocker et al., 1991; Hoyt et al., 2007; Mendes et al., 2008), we found that Black participants in the placebo condition reacted to positive feedback with cardiovascular reactivity characteristic of threat (i.e., less cardiac efficiency). In contrast, this deleterious reaction tended to be attenuated in the oxytocin condition. Instead, oxytocin facilitated more benign responses, including greater cardiac efficiency, greater cooperative behavior, and more favorable partner perceptions over time. Oxytocin did not increase participants' own liking of their partner, but it enhanced participants' inferred liking by their partner after (vs. before) the in-person interaction. This result is in line with a recent finding that oxytocin facilitates more favorable inferences about other people's intentions, especially during positive social interactions (i.e., when these others were more generous during an economic decision-making game; Zhang et al., 2020). Taken together, our results suggest that oxytocin may have reduced Black participants' suspicion stemming from attributional ambiguous treatments, which in turn, led them to react more favorably to the positive feedback based on more intuitive responses (i.e., my partner is nice to me, so I am nice to him/her). These results are also consistent with the finding that when social acceptance is perceived as genuine, this can yield equally positive effects on both minority and majority members (Kunstman et al., 2013).

The role of oxytocin in negative interracial interaction

We had hypothesized that oxytocin might amplify angry reactions following outgroup rejection. We found mixed evidence for this hypothesis, depending on how anger responses were assessed. When self-reported anger responses were tested, Black participants given oxytocin (vs. placebo) reported suppressing their anger less during their interaction with the partner. This result is in support of our hypothesis and also consistent with prior findings that oxytocin facilitates angry reactions when the context involves negative interpersonal cues (Bosch et al., 2005; DeWall et al., 2014; Ne'eman et al., 2016). However, oxytocin did not modulate testosterone reactivity following negative feedback. Yet, our exploratory analysis showed a suggestive link between these two different proxies of anger reactions at the individual level. That is, the less participants suppressed anger during the interaction with their partner, the greater testosterone reactivity they displayed after the interaction. Oxytocin reduced Black participants' regulatory efforts to modulate their angry feelings following social rejection, which in turn, may have gradually increased their anger experience following the interaction, possibly indexed by the elevated levels of testosterone reactivity (Mehta et al., 2008).

Our results may seem at odds with a recent finding that oxytocin enables people to cope with an experience of rejection better (Pfundmair and Echterhoff, 2021). Yet, one critical difference between their study and ours lies in the source of rejection. It is established from the intergroup literature that social rejection from an "outgroup" member engenders antagonistic reactions (Major et al., 2002; Mendes et al., 2008). We had hypothesized, guided by the social salience hypothesis, that oxytocin would amplify such reactions when the context involves negative interpersonal cues—that is, the presence of an outgroup member as a source of rejection. In contrast, the group status of the interaction partner was not made salient in Pfundmair and Echterhoff (2021) (i.e., using avatars in the Cyberball game), which may have attenuated the deleterious reactions typically following social rejection. Future research is

necessary to test this speculation by directly manipulating the group status of the interaction partner.

The social salience hypothesis

Taken together, our findings suggest that oxytocin exerts contrasting effects depending on the nature of social contexts. Some over-hyped early reports of oxytocin focused on the seemingly uniformly positive effects, but a large and growing literature identifies the critical contextual and individual differences that can moderate oxytocin effects (e.g., Shamay-Tsoory et al., 2009; Mikolajczak et al., 2010; Bartz, 2016). Building on this evidence, it has been proposed that oxytocin enhances perceptual salience of interpersonal cues, thereby yielding both positive and negative responses depending on the available social stimuli in a given context (Bartz et al., 2011; Olff et al., 2013; Shamay-Tsoory and Abu-Akel, 2016). Our results are consistent with this hypothesis by showing that oxytocin promotes different profiles of affective and social responses depending on the type of feedback people receive during interracial encounters. Furthermore, in support of the formulation that the enhanced salience of social cues, enabled by oxytocin, may motivate people to initiate intuitive and spontaneous actions instead of deliberate and calculated responses (Ma et al., 2015; Ten Velden et al., 2016), we found that participants who were given oxytocin, relative to placebo, exhibited more intuitive reactions to the feedback. In particular, the finding that participants given oxytocin (vs. placebo) responded more favorably to the positive feedback is consistent with emerging evidence that the prosocial effects of oxytocin are modulated by the amygdala-hippocampal circuitries—the brain regions that are recruited more for intuitive, affective processing than for deliberative, controlled processing (Baumgartner et al., 2008; De Dreu et al., 2015).

Oxytocin and intergroup processes

Our work further extends the current literature on the role of oxytocin in intergroup contexts by showing that its prosocial effects are not confined to the boundary of ingroups. In a series of studies, De Dreu et al. (2010), De Dreu (2012; see also Sheng et al., 2013) found that the effects of oxytocin were moderated by group membership; oxytocin facilitated altruistic responses toward ingroup members while it increased defensive aggression and derogation against outgroup members. At first glance, these findings may seem at odds with our result that oxytocin promoted liking and cooperation toward *outgroup* members. We believe that the discrepancy between our finding and the De Dreu et al. (2010) is likely due to the fact that whereas we observed the effects of oxytocin under the condition where *positive* social cues were present (i.e., following positive social feedback), De Dreu et al. (2010) examined the role that oxytocin plays in intergroup competition, a context in which *negative* information about outgroups members was made salient. Consistent with this formulation, one study showed that oxytocin promotes prosocial behaviors toward outgroup members in the context of intergroup cooperation (Israel et al., 2012). Similarly, in the absence of salient negative cues, oxytocin increases empathetic reaction to outgroup members' pain (Shamay-Tsoory et al., 2013). Thus, our results do not necessarily contradict the De Dreu et al. (2010), as both studies show that oxytocin increases sensitivity to the available social cues—that is, social feedback and group membership, respectively. To further examine the independent effects of these contextual factors, future research is needed to examine how individuals would respond to different types of social feedback provided either by a same-race or a different-race partner. Our study design did not allow us to address this issue given our focus on Black participants only. Future extensions of this work are necessary to examine whether the modulating effects of oxytocin documented in the current work are generalizable to different racial groups or uniquely observed among minority members.

Statistical concerns

It is important to note two statistical concerns about our results. First, when we checked the robustness of our results by applying corrections for multiple testing, none of our significant results survived the B-H correction, especially when the stringent FDR thresholds of 5 or 10% were applied. Another related concern is that the *p*-values of most of our significant effects were just under the conventional threshold of 0.05 (i.e., *p*s = 0.048 and 0.049 for anger suppression and partner perception, respectively). Thus, when a more conservative threshold is used (e.g., $p < 0.005$, as recently proposed by Benjamin et al., 2018), none of our results may survive. In addition, our analysis on challenge/threat reactivity, especially the *post hoc* contrast analysis, was based on the data-driven approach, which could have inflated the risk of Type I error (Simmons et al., 2011; Button et al., 2013; Gelman and Loken, 2014). Taken together, these points suggest a possibility that our results may include false positives.

It is important to note, however, that the use of a stringent FDR threshold for multiple testing (e.g., 5%), while effective at lowering the probability of false positives, can obscure any effects that are actually present by increasing the risk of Type II error (i.e., failure to reject a false null hypothesis). The cost of missing a potentially important finding might be higher than the cost of false positives, especially during an initial discovery stage. Our study was the first investigation to test the role of intranasal oxytocin within interracial contexts among a

community sample of Black Americans by combining multiple methods from social/personality psychology, psychophysiology, and psychoneuroendocrinology. Given our novel approach, a less stringent threshold might be more appropriate to identify potentially interesting findings during this initial discovery. Importantly, when we applied the less stringent threshold with the FDR of 20% to reduce the probability of Type II error, all our significant results remained significant.

The second concern is about statistical power. As another way to check robustness, we compared the minimal detectable effect calculated based on the sensitivity power analysis with the actual, observed effect for each outcome variable. The sensitivity power analyses showed that the current sample size (N = 103) would have been sufficient to detect a small-to-medium effect, and yet, the actually observed effect size was smaller for most variables (except for one variable), suggesting that our study was not sufficiently powered. This may be concerning because underpowered studies are more prone to producing Type I errors with inflated effect sizes (Ingre, 2013). Consistent with this view, in their recent review, Walum et al. (2016) concluded that intranasal oxytocin studies are typically underpowered, and thus, most published findings might actually be false positives. Another problem of underpowered studies is a failure to detect true effects that are actually present (i.e., false negatives). It is possible that the relatively low power of the current work made it more susceptible to Type II error, thereby resulting in some weak effects. A pre-registered replication with a larger sample is necessary to test our hypothesis more reliably.

Limitations and future directions

Several limitations should be noted before concluding. First, to minimize the possible impact of the confederates, they were kept unaware of the feedback manipulation and were also trained to act in the same neutral way regardless of how the participant acted toward them. Yet, we were still not able to hold their reactions completely constant, and this may have added some variance to our results. Second, not having blood pressure responses prevented us from providing a complete replication of Mendes et al. (2008) and limits the certainty of claiming that the physiological responses are consistent with "threat" or "challenge" (see also Kubzansky et al., 2012 for a similar case related to invalid blood pressure readings). Changes in PEP and CO are consistently related to challenge and threat responses over the past 20 years of this work, and furthermore, CO responses are correlated with TPR (indeed, CO is part of the TPR equation = mean arterial blood pressure divided by CO), and yet, there is no question that not having TPR as one of the critical measures that differentiate challenge and threat is a limitation. Finally, there are several limitations regarding the testosterone measurement, such as missing information about inter-assay CVs. In addition, the use of immunoassays is less optimal than mass spectrometry-based measurement as it is known to overestimate testosterone levels among females, thereby reducing the actual gender difference in testosterone levels (Schultheiss et al., 2018). Future work should replicate and extend the current finding with the use of mass spectrometry measurement.

Conclusion

The current research examined the role that intranasal oxytocin plays in influencing Black participants' responses to outgroup acceptance and rejection. It provided the initial evidence in support of our thesis that oxytocin may enhance trust in positive interracial encounters, while amplifying negative reactions to outgroup rejection. It also highlights the need for future research to refine our knowledge concerning how oxytocin and social contexts jointly interact to influence intergroup interactions.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article.

Ethics statement

The studies involving human participants were reviewed and approved by UCSF Committee on Human Research. The participants provided their written informed consent to participate in this study.

Author contributions

WBM designed the study, oversaw scoring of physiologic data, and contributed to analyses and writing. JP supervised the study protocol and took the lead on analyzing the data and writing the manuscript. JW supervised the study protocol and contributed to data interpretation and manuscript writing. All authors contributed to the article and approved the submitted version.

Funding

This research was supported by grants from the National Science Foundation (BCS1430799) and National Institute of Mental Health T32 (MH019391).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.916305/full#supplementary-material

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frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 02 September 2022
DOI 10.3389/fpsyg.2022.885384

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 28 February 2022
ACCEPTED 25 July 2022
PUBLISHED 02 September 2022

CITATION
Wang X and Li M (2022) Hurting all the way: The emotional antecedent and consequence of social rejection. *Front. Psychol.* 13:885384. doi: 10.3389/fpsyg.2022.885384

Hurting all the way: The emotional antecedent and consequence of social rejection

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Social rejection is cold and hurtful, but how and why it is formed remains under-investigated. Our study offers one possible explanation from the rejector's perspective by developing a moderated mediation model on the emotional antecedent and consequence of social rejection. Specifically, envious individuals use social rejection to complement their inferiority, further triggering their negative affect. Drawing on social comparison theory, we conducted an experience sampling methodology (ESM) investigation of 55 frontline workers through a 10-workday-survey (Level 1 n = 515). As predicted, daily envy is positively associated with daily social rejection. Daily social rejection is positively related to daily negative affect. Furthermore, daily social rejection mediates the relationship between daily envy and daily negative affect. These effects are more robust for females than males, including the impact of envy on social rejection and the impact of envy on negative affect via social rejection. We suggest the recipient and the rejector make psychological and behavioral adjustments accordingly. We also recommend that future research extend our current study methodologically and theoretically.

KEYWORDS

social rejection, envy, social comparison, gender, negative affect

Introduction

Individuals experience rejecting and being rejected in daily life with bitter feelings (Haldorai et al., 2022). Social rejection refers to the state where the rejector denies the request of the target in social interaction (Leary et al., 1998; Freedman et al., 2017). The antecedents of social rejection are diverse and complicated, as personalities (Killian et al., 2021; Rudert et al., 2021; Yaakobi, 2021; Redmond et al., 2022; Scott et al., 2022), perceptions (Zhang et al., 2022), status characteristics (Chung et al., 2021; Norman et al., 2021; Landini, 2022; Saco, 2022), and situational factors (Li Q. et al., 2021; Rudert et al., 2021; Graupmann and Pfundmair, 2022; Liborio et al., 2022) all play important roles in shaping social rejection. Generally speaking, social rejection happens to socially-unfavorable individuals or under difficult times. The ramifications of these situations tend to be hurtful to the target of rejection (i.e., the recipient or victim)

(Haldorai et al., 2022). It is well-known that painful consequences such as aggression (Malamut et al., 2022; Rajchert et al., 2022), depression (Kwon and Jung, 2021; Wang et al., 2021), and decreased well-being (Chung et al., 2021; Jiang and Poon, 2021) are found among recipients, depicting the harmful nature of social rejection to the targets. Since human beings, as social animals, are inclined to avoid hurting others, why social rejection still prevails remains ambiguous (Legate et al., 2013).

Individuals conduct social rejection to win self-identification by their surroundings (Festinger, 1954; Buunk and Gibbons, 2007; Gerber, 2018; Gerber et al., 2018). The acceptance of socially-unfavorable individuals would indicate inferiority in their social status. Moreover, people have to isolate the target following other rejectors unwillingly for fear that they would otherwise be excluded by these rejectors (Legate et al., 2013). Furthermore, individuals feel under threat and therefore reject others. The threat could be occasional, such as the COVID-19 pandemic (Li Q. et al., 2021; Graupmann and Pfundmair, 2022), which has been studied in past researches; or it could also be status-related, i.e., arising from the superiority of the target, which is underexplored in the current cases.

Following this logic, we aim to offer an alternative explanation of the rejector's motivation in social rejection from the perspective of status threat. We have focused on the rejector's emotional clue of social rejection. As one of the symmetric parties in social rejection, the rejector feels the pain due to the loss of autonomy when s/he makes social rejection following his/her group (Legate et al., 2013). Also, an independent rejector is reported to have distressed feelings (Doolaard et al., 2020), guilt, and loss of relatedness after social rejection (Poulsen and Kashy, 2012). To further explicate the motivation and feeling when the rejector decides to perpetuate social rejection, we consider the social comparison theory, as it articulates well the psychological mechanism of status threat and relevant responses (Festinger, 1954; Buunk and Gibbons, 2007; Gerber, 2018; Gerber et al., 2018). Social comparison happens to every individual, especially those sensitive to others (Li M. M. et al., 2021). The competitiveness of contemporary society has further triggered social comparison between people (Wang et al., 2022), which may inevitably lead to envy. As the negative emotion triggered by others' good fortune (Tai et al., 2012), envy may arouse one's social rejection and further have emotional impacts on oneself.

More specifically, status threat-related social rejection may also vary with gender, a specific status characteristic; there is evidence that gender differences exist in the emotional responses of individuals to social rejection (Freedman et al., 2019; Rajchert et al., 2022). Hence, we set gender as a moderator to study gender differences in social rejection. Given that the emotional aspects of social rejection might be subtle and hard to identify, we adopt an experience sampling methodology (ESM) in this research, collecting the data on a daily basis in the consecutive ten-workday survey. This methodology also compensates for other lab studies regarding the rejector's emotion (Poulsen and Kashy, 2012; Legate et al., 2013; Doolaard et al., 2020). We integrate theories from social comparison and gender characteristics to elucidate mechanisms linking envy, social rejection, negative affect, and gender using the ESM in our study. We aim to explore that social rejection is a response to envious individuals facing status threats during the upward social comparison process.

Theory and hypotheses

Overall framework

Social rejection is a form of social denial in building interactions among individuals (Leary et al., 1998; Freedman et al., 2017). Although undesirable, social rejection is still found in many circumstances for status-related purposes (Chung et al., 2021; Norman et al., 2021; Landini, 2022; Saco, 2022). Given that past research has already provided references to social rejections among inferior targets, we focus on social rejection toward superior recipients. Our basic assumption is that superior individuals may elicit status threats to the rejector based on social comparison and therefore be rejected. The status threat, derived from the upward social comparison and emotionally presented in the form of envy, may trigger social rejection (Lee and Duffy, 2019). The emotional consequence of upward social rejection is negative, similar to other categories of social rejection identified. Moreover, we regard gender, a specific status characteristic, as one boundary condition of upward-comparison-based social rejection. Accordingly, we propose a model of the emotional antecedent and consequence of social rejection. **Figure 1** shows our proposed model.

Envy and social rejection

Envy refers to the painful emotion aroused by others' good fortune (Tai et al., 2012; Koopman et al., 2020). Individuals are likely to experience envy because of social comparison; when they feel inferior to others, they face a status threat that undermines their relative advantageous position. The inferiority could be related to different status characteristics such as demographics (Ahn et al., 2021; Javakhishvili et al., 2021), social status (Bollo et al., 2020), performance (Lee and Duffy, 2019; Sun et al., 2021), and competitiveness (Reh et al., 2018; Yu et al., 2018). This inferiority relates people to a worse self-image. Comparing oneself with superior others may threaten and impair one's social status (Gaviria et al., 2021). People may benefit from such comparison by developing themselves to earn a better social status while getting hurt by others' superiority

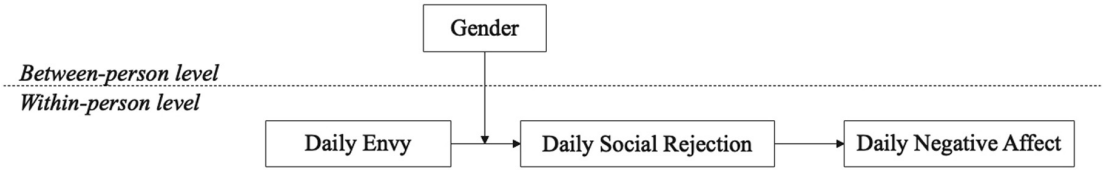

FIGURE 1
Theoretical framework for social rejection.

(Lee and Duffy, 2019; Yang and Tang, 2021; Montal-Rosenberg and Moran, 2022).

Social rejection delineates one situation where an individual denies a request from the target in the social interaction (Leary et al., 1998; Freedman et al., 2017). According to Robinson et al. (2013), two related constructs of social rejection are social exclusion and ostracism. Social exclusion is the fact that one is excluded or devalued from desired relationships or by desired relationship partners or groups (MacDonald and Leary, 2005), while workplace ostracism depicts one's subjective perception of being excluded at work (Ferris et al., 2008). In this paper, we use social rejection to describe the phenomenon that the rejector turning the recipient (or recipient's request) down in the social interaction. Current literature has revealed that social rejection is an alternative for inferior individuals: their inferiority could be based on an inferior social status indicated by demographic factors and other status characteristics (Chung et al., 2021; Norman et al., 2021; Landini, 2022; Saco, 2022).

Social rejection's negativity is mainly related to one of human's basic needs: the need for relatedness (Ryan and Deci, 2000; Haldorai et al., 2022; Lin and Fan, 2022). A downward social rejection leads to destructive consequences for the recipient because it denies accessibility to a group and produces the feeling of loneliness. This denial could further trigger the recipient's pro-social behavior (Haldorai et al., 2022) or aggression (Malamut et al., 2022; Rajchert et al., 2022). Social rejection may violate justice and moral stance, as rejection is seen as deviance from social norms (Poulsen and Kashy, 2012). For instance, individuals are forced to conduct social rejection under the pressure of conformity to satisfy their need to belong to their group, even though they may feel guilt for rejecting innocent others (Legate et al., 2013). In addition to group social rejection, personal social rejection could also lead to immoral feelings though necessary to conduct in some way (Freedman et al., 2019). To fill in the gap in the upward social rejection of the current research, we explore envy-induced social rejection, a typical occasion of upward social rejection, using social comparison theory.

Social comparison theory proposes that humans tend to compare with others to maintain a stable and accurate self-assessment, self-esteem, and self-worth, especially when objective information is unavailable or ambiguous (Greenberg and Pyszczynski, 1985; Taylor and Lobel, 1989; Aspinwall and Taylor, 1993; Suls et al., 2000; Gerber, 2018). People tend to conduct social comparisons with better-off individuals, leading to assimilation or contrast. Individuals conduct upward social comparison because they want a better self and are unsatisfied with their status quo. Their comparison target might have certain advantages perceived as inequity or unattainable for the comparer, such as being born with a silver spoon in the mouth or getting a straight-A at school. In this way, people may feel pain at others' good fortune, as the good fortune is neither accessible nor legitimate for the comparer (Tai et al., 2012). The pain is particularly evident when the envier perceives that they should earn the same life as their target (Ferreira and Botelho, 2021). To further avoid such pain, individuals may reduce the connections with the superior target through social rejection: out of sight, out of mind.

Also, social rejection prevents self-depletion and promotes self-development (Li Q. et al., 2021). Fundamentally, competence is one of human's basic psychological needs (Ryan and Deci, 2000). When interacting with the envied individuals, the envier might feel relative deprivation since their life expectations are realized by others, thwarting their needs for competence (Dineen et al., 2017). Avoiding contacts is one way to prevent further self-depletion from the need-threat perspective. It creates a safe psychological condition for self-development, particularly for highly self-critical individuals (Santor and Yazbek, 2006; Tai et al., 2012; Li M. M. et al., 2021).

Further, social rejection is a way to develop an independent identity for individuals, which might be conducive to improving one's social status. The more the target's advantages are perceived as unattainable, the more likely individuals may have to develop their specialties or skills to form their own identity. Social rejection categorizes oneself into a distinct category other than their comparing target. This contrast may help individuals relieve the pain caused by upward comparison. It may further form a unique self-construct and self-worth for the comparers in contrast to their competitors and do better than their competitors who are slightly better off in the following competitions. Thus, we propose the hypothesis:

> *Hypothesis 1: Daily envy is positively associated with daily social rejection.*

Social rejection and negative affect

Social rejection keeps the envier at a distance from their competitors to avoid status threats. However, this threat-avoidance behavior might generate negative affect equally for the recipient and rejector (Doolaard et al., 2020). Past research has observed negative affect among recipients (Stinson et al., 2011; Hebl et al., 2012; Li et al., 2012; Kawamoto et al., 2017; Miyagawa et al., 2021). As the symmetric party in social rejection, the emotional responses of the rejector still lack awareness from scholars.

Previous research reveals that social rejection could lead to the rejector's negative feelings. First of all, social rejection is a behavior that violates basic social norms (Poulsen and Kashy, 2012). The rejector feels guilt for not accepting others' requests (Ciarocco et al., 2001; Bastian et al., 2013; Legate et al., 2013). This rejection also deprives people's relatedness, generating negative feelings as their need to belong is unsatisfied (Ryan and Deci, 2000). The rejector's psychological resource is depleted during this process, although the behavior is intended to save energy for self-development (Baumeister et al., 1998; Inzlicht and Schmeichel, 2012; Mawritz et al., 2017).

The rejection takes away the opportunity to access and assimilate with superior individuals through interaction. Therefore, the rejector is not identified as a superior member of the recipient's group. Meanwhile, they lose human and social capital from the recipient (Lee and Duffy, 2019). The loss, which the rejector could have avoided, might be recognized and cause the rejector's psychological discomfort due to their fear of resource loss (Hobfoll, 1989; Hobfoll et al., 2018). As human capital and social capital are critical to one's self-development, the rejector may find it unworthy to sacrifice the human capital and social capital at the cost of self-recovery by themselves. Taking all aspects into consideration, we propose the following hypothesis:

> *Hypothesis 2: Daily social rejection is positively associated with daily negative affect.*

Mediating effect of social rejection

As an undesirable form of social interaction, social rejection is universal in daily lives. In the upward social comparison, social rejection is a status threat-related response elicited by envy (Breidenthal et al., 2020). As a consequence of seeing other's superiority, individuals have negative feelings toward themselves: They feel stressed about getting behind and unable to achieve what others already have, and depressed about the perceived unfairness in the way good fortune is distributed (Dineen et al., 2017; Pan et al., 2021; Tussing et al., 2022). The rejector is not intended to take social rejection as deviant behavior but as a way of hiding or releasing the psychological burden caused by status threats in the social interaction. Social rejection is performed as one process of emotional manifestation; it is both the agent and the approach. After social rejection, the rejector's negative affect increases due to self-loss and hurting the target of their rejection. Thus, we propose the following hypothesis:

> *Hypothesis 3: Daily social rejection mediates the relationship between daily envy and daily negative affect.*

Moderating effects of gender

Social rejection based on the upward comparison may be closely related to status characteristics, one way to reflect people's social status. A typical status characteristic affecting the level of social rejection, as depicted in the previous article, is gender (Freedman et al., 2019). Although meta-analysis does not demonstrate any gender differences in envy (Li M. M. et al., 2021), it is shown that women face a more comprehensive range of social comparisons, including appearance (Lewis and Simpson, 2012) and body image (Kiefer et al., 2006). As women embrace a higher level of communal characteristics (Schock et al., 2019), they are more environment-dependent when making self-identifications. Therefore, they are more likely to compare themselves to others, recognize others' goodness in various social comparisons and feel envious than men. The envious state may drive women to reject those better-off others as the temporal maintenance of a stable psychological state. Under such circumstances, women tend to conduct social rejection more than their male counterparts. Consequently, we propose the following hypothesis:

> *Hypothesis 4: Gender moderates the relationship between daily envy and daily social rejection. Compared with male, female reports a stronger relationship between daily envy and daily social rejection.*

Envious female is prone to conduct more social rejection, further experiencing more negative affect in the social comparison process of envy (Festinger, 1954). Social rejection has the potential benefits of maintaining one's psychological stability in the short run. However, the ultimate emotional consequence of social rejection tends to be negative for females compared with males since envy and social rejection deviate from women's social gender norms of warmth and consideration (Vial et al., 2018; Freedman et al., 2019). In alignment with the immoral stand taken by envy and social rejection, females may be more likely to fall into negative affect than males (Freedman et al., 2019). The behavior of social rejection may indicate an inferior coping of upward social comparison and status threat and, finally, turn into a women's self-blame for its social deviance. The blame could provoke more negative

affect on females than male counterparts (Brescoll, 2016; Gupta et al., 2018; Schock et al., 2019). Moreover, women tend to display more altruism and philanthropical behaviors. The action of social rejection may violate their gender characteristics and lead to negative affect such as women's guilt for not being considerate as usual. Some women may also consider social rejection from a moral perspective and regret this "immoral" behavior (Freedman et al., 2019). Therefore, we propose the following hypothesis:

> *Hypothesis 5: Gender moderates the mediating mechanism of social rejection on the relationship between daily envy and daily negative affect. Compared with male, female reports a stronger effect on the mediating mechanism of social rejection on the relationship between daily envy and daily negative affect.*

Materials and methods

Sample and procedures

To study the emotional antecedent and consequence of social rejection, we conduct a 3-week daily data collection in the electronics factory on the eastern coast using an experience sampling methodology (ESM), following the procedure of Fisher and To (2012). With the support of senior leaders, every participant voluntarily reports their daily emotions and behaviors. All participants were asked to complete an electronic survey within the notifications by phone on a daily basis. We collected data every day between 3:00 and 5:00 pm (working hours) in the 10-workday survey. All the 70 participants are frontline workers of the same working status. They work with their coworkers almost daily, have frequent contact with them, and are close to them. Sixty percent of our participants are male, and 40% are female. Fifty-five participants have completed the survey for at least three full days, remaining 78.57% valid data. These participants are 22 years old on average. Most of them (above 85%) are newcomers and have a Bachelor's degree.

Every individual is required to report their emotions and behaviors every day. Specifically, they report their perception of envy, social rejection, and negative affect. Envy on day 1 predicts social rejection and negative affect on day 1. We added the power analysis to justify the sample size by *R* procedure, which is acceptable and enough. We applied Chi-square tests to detect an effect of a given size with a given degree of confidence to report the required sample size. For the power of the Chi-square tests, when the total sample size is 515, the degree of freedom is 54. The effect size is moderate (0.3), and a significance level of 0.01 is employed, calculating the sample size by *R* to obtain a power of 0.874, which is higher than 0.80 and indicates enough power.

Measures

We follow the procedure of translation and back-translation. All responses were on a 5-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree).

Daily envy

Participants rated envy using a 5-item scale adapted by Vecchio (2005). The items were "Today, I feel most of my coworkers have it better than I do"; "Today, I feel my supervisor values the efforts of others more than he/she values my efforts"; "Today, I feel that I'll never have a job as good as some that I've seen"; "Today, I don't know why, but I seem to be the underdog at work"; and "Today, it is somewhat annoying to see others have all the luck in getting the best assignments." The average alpha coefficient for these five items was 0.926.

Daily social rejection

Participants rated social rejection with a 10-item scale adapted by Ferris et al. (2008). Sample items were "Today, I ignored envied target at work"; "Today, I left the area when the envied target entered"; and "Today, the envied target' greetings have gone unanswered at work from me." The average alpha coefficient for these ten items was 0.957.

Daily negative affect

Participants rated their negative affect using the 10-item scale developed by Watson et al. (1988). A sample item was "Today, I feel upset." The average alpha coefficient for these ten items was 0.957.

Gender, as a level-2 construct, was coded as 1 for male and 2 for female. We test the moderating effect of gender on the relationship between social rejection and emotions.

Analytic approach

We apply Mplus 7.4 to test the multilevel path analysis of the hypothesized model in **Figure 1**, considering the multilevel structure of the data (days and persons). First, we verified that there was sufficient within-individual variability to justify multilevel analysis (Podsakoff et al., 2019). There was substantial within-person variance: daily envy, 41.27%; social rejection, 35.33%; negative affect, 34.21%. Second, we centered the predictors of daily envy by group-mean and calculated the product of daily envy and gender. Third, we used a bootstrap procedure with 20,000 iterations to assess the mediation effect and estimate the bias-corrected confidence intervals (CIs) based on the Monte Carlo method (Preacher and Selig, 2012). Further, we checked the significance of the difference in this indirect effect at higher and lower levels of gender (±SD) (Hayes, 2015). In particular, we provided data and code on OSF in the following

linkage[1], including all data analysis steps and figures, to advance open science practices.

At Level-1 of the two-level model, we specified random effects of daily envy, daily social rejection, and daily negative affect. At Level-2, we specified the cross-level moderating effect of gender on the random slope between daily envy and daily social rejection and the cross-level main effect of gender on daily social rejection. Daily envy, daily social rejection, and daily negative affect were all group-mean centered on obtaining unbiased estimates (Hofmann and Gavin, 1998; Liu et al., 2015).

Results

Before testing the hypotheses, we ran a multilevel confirmatory factor analysis of the four focal variables in Figure 1 (gender, daily envy, daily social rejection, and daily negative affect). This model exhibited good fit, $\chi^2(93) = 154.97$ ($p < 0.01$); CFI = 0.985; TLI = 0.980; RMSEA = 0.036; SRMR within = 0.026; SRMR between = 0.060, supporting the construct distinctiveness of our variables. As shown in Table 1, we report the means, standard deviations, and correlations of the variables, supporting the hypothesized model.

Hypothesis 1 proposed that daily envy is positively related to social rejection, which is supported by the results in Table 2 ($\gamma = 0.51$, $p < 0.01$). Further, daily social rejection is positively associated with daily negative affect ($\gamma = 0.46$, $p < 0.01$), supporting Hypotheses 2. Hypotheses 3 examined the mediating effect of daily social rejection. The results in Table 3 show that daily envy was positively associated with daily negative affect via daily social rejection (estimate = 0.059, 95% CI [0.0130, 0.0898]). Thus, Hypotheses 3 were supported.

We examined whether gender, as a between-level variable, would moderate the within-individual, direct effect of daily envy and daily social rejection and the indirect impact of daily envy on daily negative affect through daily social rejection. Tables 2, 3 show the results of our analyses. They reveal that gender had a cross-level buffering moderating effect on the relationship between daily envy and daily social rejection ($b = 0.42$, $p < 0.01$). Further, Figure 2 shows the significance of the moderating effect, supporting Hypotheses 3.

The indirect effect of daily envy on daily negative affect via daily social rejection was significant at higher levels of gender (estimate: 0.089; 95% CI [0.0281, 0.1523]) and at lower levels (estimate: 0.026; 95% CI [0.0275, 0.1524]), which indicated significant difference in the indirect effect (estimate: 0.063; 95% CI [0.0095, 0.107]). These results supported Hypotheses 4.

1 https://osf.io/trmsa/

TABLE 1 Means, standard deviations, and correlations of the study variables for the hypothesized model.

	Mean	*SD*	1	2	3	4
Level-1 variables						
(1) Daily envy	2.28	0.83				
(2) Daily social rejection	2.38	0.88	0.227**			
(3) Daily negative affect	2.13	0.87	0.326**	0.284**		
Level-2 variables						
(4) Gender	1.37	0.48	−0.073	−0.169**	−0.050	

Level-1 $n = 515$; level-2 $n = 55$. Level-1 exogenous variables were centered at each person's mean.
*$p < 0.05$, **$p < 0.01$.

Discussion

We examined the emotional antecedents and consequences of social rejection on a daily basis by using the experience sampling method. Focusing on the rejectors' perspective, we found that daily envy triggers individuals to conduct social rejection, then induces more negative affect. Compared with envious males, envious females report a higher level of social rejection and, in turn, generate more negative affect. Our results support the moderated mediation model.

Theoretical implications

The study has four main theoretical implications. First, we deploy the ESM to capture how individuals' envy influences their level of social rejection and the consequent negative affect on a daily basis following the methodology procedure of Fisher and To (2012), which was widely used in the current studies on emotions and behaviors (Koopmann et al., 2019; Tang et al., 2022). Our study compensates for the current research field as few empirical studies have investigated the nature of social rejection through a dynamic methodology. Experience sample modeling has enabled us to record fluctuations in social rejection by day-to-day monitoring, which generates more credible results than lab testing or the traditional longitudinal study methodology.

Second, the study extends the literature on social rejection from the rejector's perspective by answering why individuals conduct social rejection and their subsequent feelings. Specifically, we test the relationship between envy, social rejection, and negative affect, articulating the psychological mechanism of social rejection from the rejector's emotional perspective. As a negative response to others' good fortune from an ambitious individual, envy is positively related to social rejection, and negative affect follows. Our results are consistent with Poulsen and Kashy (2012), Legate et al. (2013), and Doolaard et al. (2020), which all acknowledge that proactive and reactive social rejection would lead to the rejector's negative affect. We further explore the emotional clue triggering social rejection

TABLE 2 Multilevel path analysis results for the hypothesized model.

	Daily social rejection				Daily negative affect					
Predictor	***γ***	***SE***	***γ***	***SE***	***γ***	***SE***	***γ***	***SE***	***γ***	***SE***
Intercept	2.38**	0.03	2.71	0.10	0.51**	0.08	1.03**	0.10	0.28**	0.09
Level-1 predictors										
Daily envy	0.51**	0.04	−0.06	0.12	0.71**	0.03			0.62**	0.04
Daily social rejection							0.46**	0.04	0.18**	0.04
Level-2 predictors										
Gender			−0.23**	0.07						
Cross-level moderator										
Daily envy * Gender			0.42**	0.09						

Level-1 $n = 515$; level-2 $n = 55$. Level-1 exogenous variables were centered at each person's mean. *SE*, standard error.
*$p < 0.05$, **$p < 0.01$.

TABLE 3 Results of indirect and conditional indirect effects from the multilevel path analysis.

Indirect effect	Gender	Estimate	95% CI
Daily envy → Social rejection → Negative affect		0.059	[0.0130, 0.0898]
	Female	0.089	[0.0281, 0.1523]
	Male	0.026	[0.0275, 0.1524]
	Difference	0.063	[0.0095, 0.107]

Level-1 $n = 515$; level-2 $n = 55$. The CIs of the bias-corrected indirect effects and conditional indirect effects are based on 20,000 Monte Carlo bootstrap samples. All of the indirect effects were calculated, accounting for direct effects. Unstandardized effects are reported in the table. CI, confidence interval.

and depict how such negative emotion (envy) is passed through social rejection and elicits further negative affect. People facing status threats may take social rejection as one self-protection mechanism. However, such measure does not eliminate and sometimes even generate additional negative affect by immoral feelings, loss of capital, and unsatisfied need to belong.

Third, while most studies on social comparison theory investigate downward social comparison (Haldorai et al., 2022; Malamut et al., 2022; Rajchert et al., 2022), this study compensates well by studying upward social comparison. We propose that social rejection is one way people prevent themselves from self-depletion while seeing others' goodness in the upward social comparison. Past research on upward social comparison is conducted in the social interaction context, where the comparer responds to such comparisons by pro-social and anti-social behaviors (Pan et al., 2021; Yang and Tang, 2021; Boecker et al., 2022). Our study investigates the situation where individuals take an avoidance attitude toward upward social comparison by denying participation via social rejection. Our results show that avoiding social interaction does not prevent individuals from negative feelings in upward social comparison. The core factor that forms those feelings is the threat evoked by the rejector's social status and self-worth during upward social comparison, which causes the feeling of lacking competence and a subsequent feeling of lacking relatedness caused by social rejection.

Fourth, our study contributes to gender research. As one prominent status characteristic, female appears to be a distinct status characteristic in the current research (Ecker et al., 2020; Farh et al., 2020). Scholars have shown that women tend to denigrate one another due to limited opportunities for upward mobility in their organizations (Parks-Stamm et al., 2008; Derks et al., 2011; Derks et al., 2016; Haas et al., 2016; Arvate et al., 2018). Also, women are reported to contrast to envied targets by distancing themselves from similar others rather than male peers (Elmagrhi et al., 2019; Kurt Yilmaz and Surgevil Dalkilic, 2019). We extend the current gender research field by discovering that women tend to be more self-isolated from social interactions than their male counterparts. Their rejection is not only toward same-gender peers for a better self-identity but in a broader sense to all individuals who are better off than them. This behavior does not improve women's gender status or self-worth but violates their gender role and self-image as social rejection serves as deviance to gender norms.

Practical implications

The study shows that social rejection hurts the rejector. It might not be economical for the rejector to conduct social rejection since such rejection would neither improve an individual's social status and self-worth nor change their negative emotions. By contrast, the rejector may have self-adjustment if they meet competitive peers in the social environment. They may change their view toward the target of upward social comparison and further take social interaction as an opportunity to expand their social network. Also, the rejector might recognize themselves as outstanding individuals to be better engaged in a competitive environment. The request for social interaction from the target is a sign of recognition for their competence and achievement; it is conducive and offers the opportunity for both the rejector and the recipient to learn

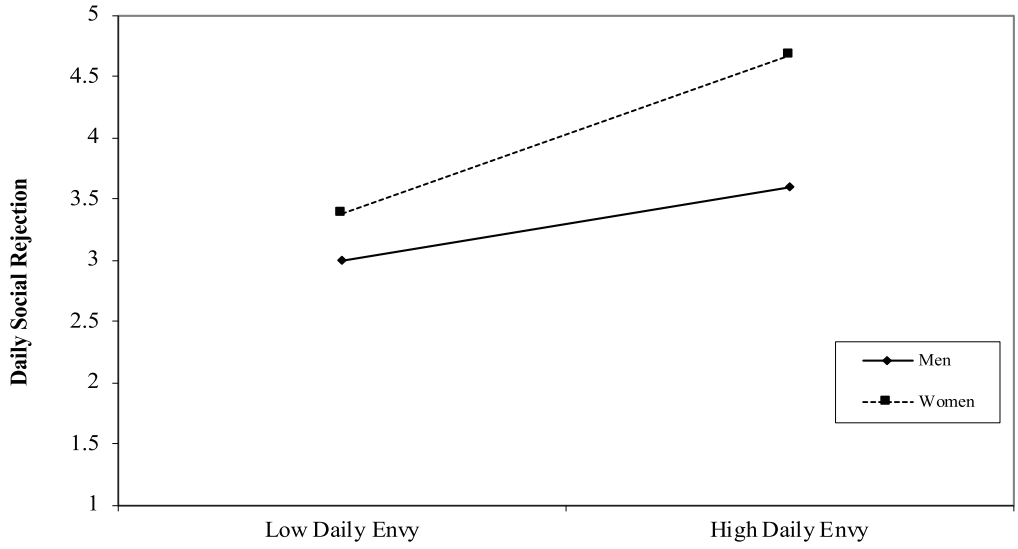

FIGURE 2
The moderating effect of gender.

and grow. By accepting the request, both parties could develop themselves and embrace a better self-image and social status. Lastly, the rejector may also stop being ashamed of taking social rejection as it is one way to release their pain and maintain physiological and mental health.

For the recipient of social rejection, the study has indicated their social competitiveness as they are the winner of social comparison in the rejector's mind. Considering this point, the recipient might feel more reasonable when rejected. Furthermore, the recipient might also pay attention to how the request is sent and their past social interactions with the rejector to improve their social skills. In addition, the recipient could take advantage of their competitive advantage to help individuals in need around them proactively. In this case, their advantage may be beneficial for expanding their social networks and reducing other people's hostility in advance. Besides, the recipient could also be more authentic than simply conducting impression management. A perfect person is unreal, and a perfect personality is interpreted as very aggressive in social competition. The recipient might ask for other people's help when getting in trouble instead of figuring it out alone. This action may provide more happiness to the recipient to save energy and feel the warmth from others.

Limitations and directions for future research

Despite our efforts in designing methods and conducting analyses, this study has three limitations. First, we collected the data from the same source, which may raise concerns about common method variance (Podsakoff et al., 2012). Future research can take other-reported measures for social rejection. For instance, the rejectors' rate of their social rejection in the workplace could be rated by their coworkers instead. Second, a potential concern exists regarding control variables. We only measured negative affect and ignored positive affect. In effect, positive affect could be considered as a control variable. Future research may also consider other control variables, which could help develop a solid study about social rejection and emotions. Third, we used negative affect as one construct to detect the rejector's feelings after conducting social rejection out of envy. To have a more profound understanding of social rejection's emotional consequences, we recommend that future research explore specific emotions like sadness, anger, or frustration to identify how social rejection is linked to each emotional reaction. In addition, future research could also explore self-protective-related antecedents to explore beyond aggressive factors such as envy. Fourth, we use survey data to make causal inferences, which might not be sufficient for solid evidence (Law et al., 2016), including the main effect and mediating effect of social rejection. Future research might conduct experimental studies as further evidence for the causal relationships. For example, scholars may conduct two time-lagged experimental studies to examine the main and mediating effects by strengthening the causal inferences. Finally, even though we have conducted the power analysis, we call for a more exact multilevel power analysis, such as powerlmm (Magnusson, 2018). As Gabriel et al. (2019) concluded, only 2 of the 107 ESM studies conducted a power analysis, showing that

"power issues are rarely discussed in ESM research" (Gabriel et al., 2019, p. 975). Future research applying ESM should conduct power analysis.

Conclusion

To test the emotional antecedents and consequences of social rejection, we use experience sample modeling to explore how daily envy drives individuals to use social rejection to complement their inferiority and finally triggers negative affect. Drawing on social comparison theory, we conducted an experience sampling methodology (ESM) investigation of 55 frontline workers through a 10-workday survey (Level 1 n = 515). As predicted, daily envy is positively associated with daily social rejection. Daily social rejection is positively related to daily negative affect. Furthermore, daily social rejection mediates the relationship between daily envy and daily negative affect. These effects are more prominent among females than males, including the impact of envy on social rejection and the impact of envy on negative affect via social rejection. We suggest the rejector stop being ashamed of taking social rejection and try to connect with others instead of rejecting the recipient to improve their self-image and social status. We also suggest that the recipient proactively improve communication skills and help people in need. The study extends the literature on social rejection, social comparison, and gender.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

Ethics statement

The studies involving human participants were reviewed and approved by Tongji University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

XW and ML were responsible for idea generation and revised the manuscript. ML conducted material preparation, data collection, and analysis. XW wrote the first draft. Both authors commented on previous versions of the manuscript and read and approved the final manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers | Frontiers in Psychology

TYPE Brief Research Report
PUBLISHED 28 October 2022
DOI 10.3389/fpsyg.2022.952760

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 25 May 2022
ACCEPTED 12 October 2022
PUBLISHED 28 October 2022

CITATION
Pfundmair M and Mahr LAM (2022) Regaining power: How feelings of exclusion during COVID-19 are associated with radicalism among critics of containment policies. *Front. Psychol.* 13:952760. doi: 10.3389/fpsyg.2022.952760

Regaining power: How feelings of exclusion during COVID-19 are associated with radicalism among critics of containment policies

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Past experimental research has shown that social exclusion can be linked with radicalism. During the COVID-19 pandemic, feelings of social isolation and loneliness rose, just like protests and violence against national anti-COVID-19 measures did. Based on these observations, we hypothesized that feelings of exclusion induced by measures to contain the spread of COVID-19 were associated with radicalism intentions to illegally and violently fight COVID-19-related regulations among critics of the containment policies (Hypothesis 1). Moreover, we expected that radicalism intentions against COVID-19-related regulations fortified needs deprived by social exclusion (Hypothesis 2). Studying a sample of individuals who opposed the measures to contain the spread of COVID-19 (N = 171), we found evidence for both hypotheses: Results revealed that feelings of social exclusion induced by COVID-19 containment measures predicted radicalism intentions. Moreover, the relationship between exclusion and radicalism was associated with fortifying power issues. Political opinion did not moderate these effects. These data replicate the exclusion-radicalism link in the COVID-19 crisis and add one more factor that may have promoted radical developments during that time. Fortifying feelings of power, radicalism appeared to foster well-being, though at a high political price.

KEYWORDS

social exclusion, COVID-19, radicalism, control, power

Introduction

With the appearance of COVID-19, another phenomenon rose: radicalism, the readiness to engage in illegal and violent political action (Moskalenko and McCauley, 2009). This could not only be observed among, in particular, right-wing extremist groups that capitalized on COVID-19 to spread disinformation that scapegoated marginalized groups and endorsed instances of violence (Davies, 2021). Also, political leaders used

pandemic-related fear and anger to promote anti-democratic agendas (Morabia, 2021). Recent research has identified a set of factors that may have promoted such radical developments. These ranged from greater acceptance of conspiracy theories (Levinsson et al., 2021) to an increase in online activities that offered the opportunity to spread misinformation at a fast rate (Davies, 2021). In the current work, we focus on another factor that may have promoted radicalism: feelings of social exclusion. Specifically, we aimed to investigate whether social exclusion that people experienced when they were hit by measures to contain the spread of COVID-19 was associated with higher radicalism.

Social exclusion, being kept apart from others physically or emotionally (Riva and Eck, 2016), is usually accompanied by tremendous psychological stress. Whether exclusion occurs in its indirect form of being ignored by others (i.e., ostracism) or is communicated *via* a direct rejection (see Wesselmann et al., 2016a), the resulting stress manifests in a broad spectrum of consequences. This ranges from a deprived sense of basic needs for belonging, self-esteem, control, and meaningful existence (e.g., Zadro et al., 2004), over a decline in cognitive performances such as effortful logic (e.g., Baumeister et al., 2002), to an activation of neural responses similar to those of physical pain (e.g., Eisenberger et al., 2003). In subsequent behavioral responses, social exclusion makes its victims show both prosocial (e.g., DeWall, 2010) and antisocial behaviors (e.g., Warburton et al., 2006). How subsequent behavior is shaped probably depends on the need that has been threatened predominantly: According to the need fortification rationale (Williams, 2009), prosocial behaviors may fortify inclusionary needs (belonging and self-esteem) as they can achieve re-inclusion; antisocial behaviors may fortify power/provocation needs (control and meaningful existence) as they can provoke power over others and acknowledgment.

Notably, social exclusion has also been associated with radicalism: Previous studies have shown that feelings of exclusion promoted the willingness to identify with and support extreme or radical organizations (Bäck et al., 2018; Hales and Williams, 2018; Renström et al., 2020) and even increased the willingness to commit violent acts on behalf of a radical group (Pfundmair, 2019; Pfundmair and Mahr, 2022). Generally speaking, social exclusion seems to be a condition that can make radicalism flourish (for a review, see Pfundmair et al., 2022). Why excluded individuals increase their openness to radicalism is a question that has only been addressed by few studies. In one study (Knapton et al., 2015), political actions in response to exclusion were mediated by a cluster of needs for belonging and self-esteem. In another study (Pfundmair, 2019), the exclusion-radicalism link was driven by the deprived need for control.

Feelings of social exclusion also rose during the COVID-19 pandemic due to enacted self-isolation (e.g., Killgore et al., 2020; Horigian et al., 2021). Social distancing measures that were used to limit the spread of COVID-19 specifically threatened basic needs for belonging, self-esteem, control, and meaningful existence (Graupmann and Pfundmair, 2022). At the same time, protests against national responses to anti-COVID-19 measures rose worldwide (see, e.g., BBC, 2021). Even acts of violence occurred, for example, when a clerk was shot after asking a customer to wear a face mask (e.g., DW, 2021). Because social exclusion generally has the power to induce radical attitudes and behaviors, it might also have been feelings of social exclusion that contributed to radicalism during COVID-19.

The current study aimed to investigate this assumption. Specifically, we hypothesized that feelings of exclusion induced by measures to contain the spread of COVID-19 were associated with radicalism intentions to illegally and violently fight COVID-19-related regulations (Hypothesis 1). Moreover, we aimed to explore whether this exclusion-radicalism link served to recover basic needs usually threatened by social exclusion. Since previous research did not provide a clear answer to which of those needs might be most relevant in this context, we decided to test each of them. Therefore, we proposed that radicalism intentions against COVID-19-related regulations would fortify one or more of the needs deprived by social exclusion (Hypothesis 2). Notably, we only investigated people who rather opposed the measures to contain the spread of COVID-19 because radicalism intentions to fight those could plausibly only emerge among them.

Method

Participants

Following the planned protocol for the more complex analysis (Hypothesis 2), we consulted Fritz and MacKinnon's (2007) recommendations to determine an adequate sample size for detecting a mediated effect. With an estimated small to medium effect, we followed their suggestions of a total sample size of 148 for a power of 0.80 and alpha and beta levels set at 0.26 using bias-corrected bootstrap tests. We aimed for additional participants to compensate for potential dropouts.

A total of 571 participants started the online study. These were recruited from various German and Austrian research platforms and took part voluntarily. Because we were only interested in people who rather opposed the measures to contain the spread of COVID-19, only those participants who indicated such an opinion were able to continue the study; all other participants were led to the final page of the questionnaire. The former group were 171 participants (30% of the total sample; 101 female, 56 male, 1 diverse, 13 no indication; mean age = 21.82 years, *SD* = 26.74; 137 German, 14 Austrian, 4 other, 16 no indication of nationality).

Collection period was from December 2021 to March 2022. During this time, in both Germany and Austria, most places

required proof of full vaccination with a COVID-19 vaccine, proof of recovery from COVID-19, or proof of a negative antigen test (or, depending on the pandemic situation, only the former two were accepted). Notably, Austria additionally established mandatory vaccinations as of February 2022.

Procedure and materials

After informed consent was obtained, participants were asked to indicate whether they rather opposed or supported the measures to contain the spread of COVID-19. This was used as a filter item; only such participants who indicated a rather opposing opinion could continue the questionnaire. Then, they were asked how socially excluded and how deprived in their basic needs they felt due to the measures to contain the spread of COVID-19. After that, we assessed their radicalism intentions as well as explicit items to depict their intentions to fight for their opinions. Then, participants indicated their political opinion and sociodemographic data. At the end, they were thoroughly debriefed.

Opinion about COVID-19 measures

Participants were asked to indicate whether they were in favor or against the current measures to contain the spread of COVID-19. They indicated their level of agreement on a 1 = *strongly oppose it*, 9 = *strongly support it* response scale. Only those participants who indicated ≤4 could continue the study.

Feelings of social exclusion

To assess how much the state measures that were taken to contain the spread of COVID-19 affected the participants' feelings of social exclusion, we provided three items. In the first item, we focused on social exclusion in a more general term; in the second and third item, we focused on specific subtypes of exclusion, viz. ostracism and rejection. Thus, on a scale from 1 = *not at all* to 7 = *very much*, participants responded to the following items: "How strongly do you feel excluded/ignored/rejected due to the COVID-19 measures?" Although theoretically different, all three items intercorrelated highly, *r*s between 0.72 and 0.82. Therefore, we combined them to an overall exclusion index ($\alpha = 0.91$).

Deprivation of basic needs

To assess the basic needs regularly deprived by social exclusion, participants responded to a 4-item needs-threat short scale (Rudert and Greifeneder, 2016). They were provided four items to answer the question of how they felt due to the COVID-19 measures. Using 7-point semantic differentials, they assessed their levels of belonging ("rejected-accepted"), self-esteem ("devalued-valued"), control ("powerless-powerful"), and meaningful existence ("invisible-recognized").

Radicalism intentions

Participants' radicalism intentions were assessed using the Activism and Radicalism Intention Scale (ARIS; Moskalenko and McCauley, 2009). Participants were instructed to indicate how much they would engage for their opinion on how to deal with the pandemic. They responded to four items of the activism intention subscale pertaining to non-violent and legal behaviors (e.g., "I would donate money to an organization that fights for my opinion about how to deal with the pandemic," $\alpha = 0.88$) and four items of the radicalism intention subscale pertaining to illegal and violent behaviors (e.g., "I would continue to support an organization that fights for my opinion about how to deal with the pandemic even if the organization sometimes breaks the law," $\alpha = 0.89$) (Notably, data on the former subscale was collected for the sake of completeness but was not included in the main analyses.). Each item was completed on a 1 = *disagree completely* to 7 = *agree completely* scale.

To check validity of the ARIS scale, we also assessed six individual items to test which measures participants would take to fight for their opinion about how to deal with the pandemic. On 1 = *not at all* to 7 = *very much* response scales, they assessed whether they would not at all fight for it, join a group with the same opinion, perform non-violent acts, accept property damage, threaten people with violence, or accept personal damage.

Political opinion

Participants were asked to map their political opinion on a scale ranging from 1 = *left* to 10 = *right* (Breyer, 2015).

Results

Preliminary results

To check validity of our radicalism scale, we explored how much activism and radicalism intentions correlated with the explicit measures participants would take to fight for their opinion. These correlations are presented in **Table 1**. Supporting the scale's validity, activism correlated most strongly with the willingness to join a group with the same opinion and to perform non-violent acts, whereas radicalism correlated most strongly with the willingness to threaten people with violence and accept property damage.

Moreover, to gain an overall impression of the sample's general intentions for radicalism, we conducted frequency analyses. Participants who indicated the highest levels (= scale point of 7) of radicalism were only a fraction of the whole sample: 2% ($n = 3$). This matched the sample's low mean value of the radicalism scale ($M = 1.90$). Accordingly, the skewness of radicalism was found to be 1.88, indicating that the distribution was right-skewed, while still normal (e.g., Hair et al., 2010).

TABLE 1 Correlations among activism and radicalism items.

	No action	Joining a group	Non-violent action	Accepting property damage	Threat of violence	Accepting personal damage
Activism	−0.18*	0.71***	0.56***	0.51***	0.40***	0.36***
Radicalism	−0.15	0.31***	0.15	0.67***	0.74***	0.66***

*$p < 0.05$, ***$p < 0.001$.

TABLE 2 Means (and standard deviations) of as well as intercorrelations between analyzed variables.

	M (SD)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Social exclusion index	4.85 (1.72)	—						
(2) Belonging	2.71 (1.43)	−0.62***	—					
(3) Self-esteem	2.50 (1.40)	−0.57***	0.79***	—				
(4) Control	1.93 (1.34)	−0.42***	0.61***	0.65***	—			
(5) Meaningful existence	2.47 (1.47)	−0.41***	0.62***	0.63***	0.66***	—		
(6) Radicalism	1.90 (1.33)	0.17*	−0.09	−0.06	0.13	0.03	—	
(7) Political opinion	4.72 (1.79)	0.09	−0.01	−0.05	0.07	0.02	−0.12	—
(8) Agreement with containment measures	2.77 (1.02)	−0.37***	0.28***	0.34***	0.17*	0.09	−0.25**	−0.01

***$p < 0.001$; **$p < 0.001$; *$p < 0.05$.

Intercorrelations between all analyzed variables can be found in **Table 2**. Consistent with other research (see Wesselmann et al., 2016b), these revealed large intercorrelations among the basic needs as well as medium to large correlations between the needs and the social exclusion index. Although clearly related, the correlation indices did not indicate a complete overlap, supporting the assumption that they are conceptually distinct. It is also worth noting that the intercorrelations revealed a (plausible) negative relationship between the participants' agreement with containment measures and social exclusion as well as radicalism and a positive relationship between the participants' agreement with containment measures and fulfilment of most of the basic needs.

Testing hypothesis 1: The link between exclusion and radicalism

To investigate whether feelings of exclusion induced by measures to contain the spread of COVID-19 were associated with radicalism intentions to illegally and violently fight COVID-19-related regulations, we conducted a regression analysis. Because radicalism is known to vary by age, gender, and political ideology (see, for example, Chermak and Gruenewald, 2015), we tested the link between exclusion and radicalism while including those as control variables. We also added nationality as control variable because COVID-19 restrictions in Germany and Austria during that time were similar but not identical. Therefore, we conducted a two-stage hierarchical multiple regression with radicalism as the dependent variable; age, gender, political orientation and nationality were entered at stage one and the exclusion index was entered at stage two.

The regression analysis revealed that at stage one, age, gender, political orientation and nationality did not significantly contribute to the regression model, $F(4,154) = 1.43$, $p = 0.228$, accounting for 3.7% of the variation in radicalism. Adding social exclusion to the regression model explained an additional 5.1% of variation in radicalism and this change in R^2 was significant, $F(5,154) = 2.85$, $p = 0.017$. Thus, feelings of social exclusion induced by COVID-19 containment policies revealed to be a meaningful predictor for radicalism intentions, see **Figure 1**.

Testing hypothesis 2: Favorable consequences of the exclusion-radicalism link

To investigate whether radicalism fortified needs deprived by social exclusion, we conducted mediation analyses using the Process tool by Hayes (2013; model 4, 5,000 bootstrap samples). We entered the exclusion index as independent variable, radicalism as mediator, and feelings of belonging, self-esteem, control, and meaningful existence as separate dependent variables. As in the former analysis, we also included age, gender, political ideology, and nationality as covariates.

The total effect revealed to be significant for all needs, belonging: $b = -0.53$, $SE = 0.05$, $t(149) = -9.79$, $p < 0.001$, self-esteem: $b = -0.45$, $SE = 0.06$, $t(149) = -7.76$, $p < 0.001$, control: $b = -0.34$, $SE = 0.06$, $t(149) = -6.53$, $p < 0.001$, meaningful existence: $b = -0.38$, $SE = 0.06$, $t(149) = -6.12$, $p < 0.001$. This replicates the well-known negative relationship between feelings of social exclusion and fulfilment of individual needs. In a next step, this relationship was decomposed into a direct link and an indirect link (i.e., transmitted through

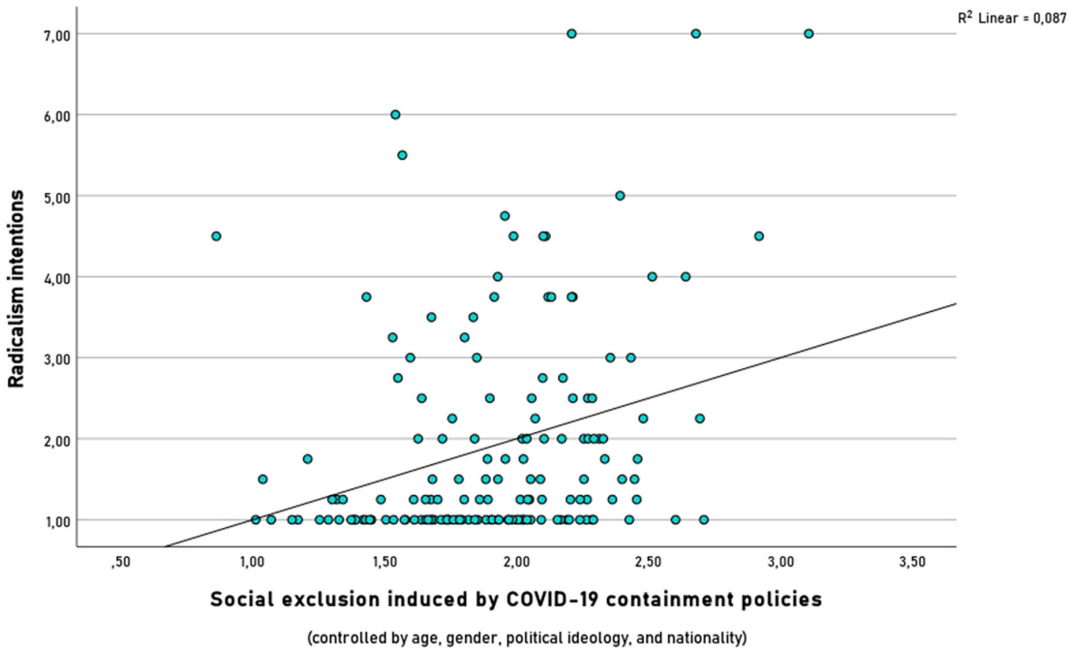

FIGURE 1
Results of the regression model: Feelings of social exclusion induced by the COVID-19 containment policies predicted radicalism intentions to illegally and violently fight against those; the regression model controlled for age, gender, political ideology, and nationality.

the mediator). The direct effect was also significant, belonging: $b = -0.54$, $SE = 0.06$, $t(149) = -9.55$, $p < 0.001$, self-esteem: $b = -0.45$, $SE = 0.06$, $t(149) = -7.76$, $p < 0.001$, control: $b = -0.38$, $SE = 0.06$, $t(149) = -6.53$, $p < 0.001$, meaningful existence: $b = -0.40$, $SE = 0.06$, $t(149) = -6.34$, $p < 0.001$. For belonging, self-esteem, and meaningful existence, the indirect effect was not statistically different from zero as evidenced by bootstrap confidence intervals that contained zero, belonging: $b = 0.003$, $SE = 0.01$, 95% CI = [−0.02, 0.02], self-esteem: $b = 0.003$, $SE = 0.01$, 95% CI = [−0.02, 0.02], meaningful existence: $b = 0.02$, $SE = 0.01$, 95% CI = [−0.001, 0.05]. However, for control, it was, $b = 0.04$, $SE = 0.02$, 95% CI = [0.01, 0.07]. That is, feelings of exclusion that were *per se* associated with lower control increased radicalism and radicalism, in turn, translated to a perceived increase of control. The path coefficients of this mediated effect are plotted in Figure 2. This regression model explained 27.8% of variation.

Additional analyses: Moderation by political opinion

To check whether the participants' political opinion influenced the current effects, we conducted additional analyses.

First of all, the political opinion was relatively equally distributed in our sample: rather left (= scale point between 1 and 4): $n = 64$, middle (= scale point of 5): $n = 42$, rather right (= scale point between 6 and 10): $n = 53$.

To investigate whether political opinion moderated the exclusion-radicalism link, we conducted a moderator analysis using the Process tool by Hayes (2013; model 1, 5,000 bootstrap samples). We entered the exclusion index as independent variable, political opinion as moderator, and radicalism as dependent variable; age, gender, and nationality were included as covariates. The regression model revealed a significant main effect of exclusion, $b = 0.40$, $SE = 0.16$, $t(148) = 2.55$, $p = 0.012$, replicating the known positive relationship between feelings of social exclusion and radicalism intentions. However, no significant main effect of political opinion, $b = 0.14$, $SE = 0.17$, $t(148) = 0.83$, $p = 0.409$, and no significant interaction effect emerged,$b = -0.05$, $SE = 0.03$, $t(148) = -1.52$, $p = 0.130$. Thus, the exclusion-radicalism link was not driven by one political subsample but, instead, existed in both more leftist and more rightist participants.

Discussion

The current study aimed to investigate feelings of exclusion induced by measures to contain the spread of COVID-19 and whether these were associated with radicalism intentions to illegally and violently fight COVID-19-related regulations. Studying a sample of individuals who opposed the measures to contain the spread of COVID-19, we indeed found evidence for this link, which supported Hypothesis 1. This not only replicated the exclusion-radicalism link observed in experimental settings

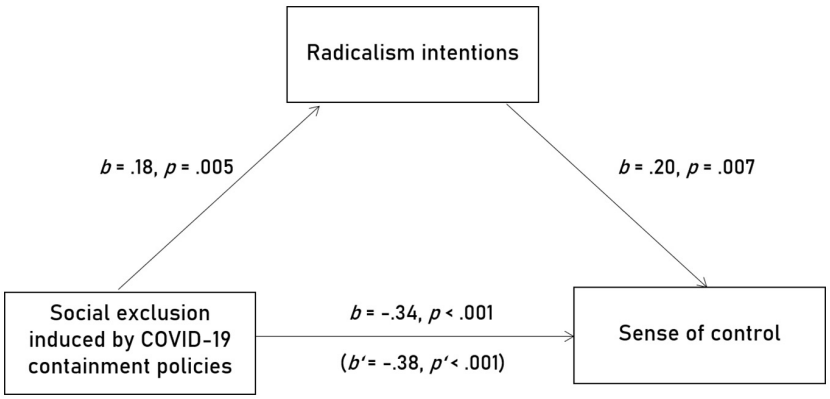

FIGURE 2
Results of the mediation analyses: Feelings of exclusion that were *per se* associated with lower control increased radicalism. In turn, radicalism translated to a perceived increase of control.

(e.g., Hales and Williams, 2018; Pfundmair, 2019; Renström et al., 2020) but added one more factor that may have promoted radical developments in the COVID-19 crisis.

A secondary aim of the current work was to investigate whether radicalism intentions against COVID-19-related regulations served to fortify needs that are usually threatened by social exclusion. We also found evidence for this claim, supporting Hypothesis 2. We specifically identified the need for control as a relevant factor in the exclusion-radicalism link, similar to previous experimental work (Pfundmair, 2019). In other words, the relationship between exclusion and radicalism was associated with recovering a sense of power. This pattern appears plausible when consulting the radicalization literature: Re-establishing a sense of certainty, a type of predictive control, is known to be one catalyzer for radicalization (see Hogg, 2014).

In additional exploratory analyses, we found the political opinion to be unrelated to the found pattern. Thus, the association between exclusion and radicalism emerged in both more leftist and more rightist individuals. This fits the observation that protests against the COVID-19 measures were approved by people of diverse political backgrounds, although the far-right was most dominant (e.g., Plümper et al., 2021). Moreover, in experimental work investigating the exclusion-radicalism link, ideology did not appear to play a moderating role (Renström et al., 2020).

Notably, in the current study, we investigated how much the state measures that were taken to contain the spread of COVID-19 affected the participants' feelings of social exclusion. That is, we measured a very specific form of exclusion which fleshed out as both limited personal interactions and political restrictions enforced against the participants' personal convictions. Previous research has already shown that social exclusion relating to larger-scale incidents in societal contexts (e.g., structural-societal conditions, politics) is also able to induce individual feelings of social exclusion. For example, women's psychological reactions to female underrepresentation in male-dominated academic fields mirrored those typically induced by interpersonal instances of exclusion (i.e., a threat to fundamental needs; McCarty et al., 2020). Another study showed that having voted for a losing-side candidate in presidential elections was associated with emotional pain of first-hand experienced social exclusion (Young et al., 2009; Claypool et al., 2020; Salvatore et al., 2021). In cases like these, perpetrators depicting the source of social exclusion are often abstract (e.g., society or the State). This might facilitate aggressive responding because exclusion is suggested to induce aggression whenever there is no adequate source of (re-)gaining acceptance (see DeWall and Bushman, 2011). Radicalism intentions after social exclusion induced by COVID-19 containment policies might fall into the same category. Furthermore, the readiness to engage in illegal and violent political action might be a particularly useful tool in this context because it is in some way directed against the abstract perpetrator, the State.

The current work benefited from its high ecological validity: We investigated people opposing the measures to contain the spread of COVID-19 in the middle of the pandemic. This field approach, however, comes with the limitation that our sample was rather small and our conclusions are correlational. Thus, we do not know whether feelings of exclusion might have induced radicalism or radicalism might have induced exclusion. Indeed, research has not only demonstrated that social exclusion can promote radicalism (e.g., Pfundmair, 2019), but also that individuals holding extreme attitudes are at a higher risk of being excluded by others (Hales and Williams, 2019). Yet, in the current study, there could be a case for the first assumption because we asked for exclusionary feelings due to the COVID-19 measures and not due to other individuals. Moreover, theoretically, our mediation model, which indicated a relationship between exclusion and rebuilding a sense of power

via radicalism, could also take a different form. Indeed, similar statistical effects emerged when we switched radicalism as a mediator with control. However, in doing so, the model no longer made sense in terms of content: While exclusion was linked to both deprived control and radicalism (the well-known effects), more control led to more radicalism (a relationship not quite comprehensible). Thus, there are reasons to embrace the proposed causality. Nevertheless, the present cross-sectional data cannot ultimately substantiate causality.

The specificity of the current sample should also be noted here. The mean value of the radicalism subscale was relatively low, which indicates that we did not investigate a sample of radicals but tendencies in radical developments. This low level of radicalism in the general population fits observations that radicalized individuals are a rather exceptional phenomenon in a society. Moreover, we only investigated radicalism intentions and not behaviors. Our scale to measure such intentions appeared highly valid since we found high correlations with the willingness to threaten people with violence, to accept property damage, and even with the willingness to accept personal damage. However, it must be considered that radical beliefs, as assessed in this work, must not inevitably lead to radical action, although they can inspire radical action (McCauley and Moskalenko, 2017). Lastly, it should be recalled that we only investigated opponents of COVID-19 measures. It is quite conceivable that increased exclusion also came with increased radicalism among supporters of the measures – then, of course, regarding the topic of how to fight for the enforcement of COVID-19-related regulations. Further, a relationship between exclusion and radicalism naturally also exists outside times of COVID-19, as evidenced by previous research (e.g., Hales and Williams, 2018; Pfundmair, 2019; Renström et al., 2020).

Altogether, the current findings bring along several theoretical implications: First, demonstrating a relationship between feelings of social exclusion and radicalism in one of the newest radical developments (radical attitudes and behaviors emerging in the string of events of the global pandemic), they replicated the exclusion-radicalism link in a field approach. Second, the current findings underline the importance of control as a motivator for radicalism. Strengthening a sense of power through radicalism seemed to help those who opposed the COVID-19 measures to cope with the social pain. A fruitful avenue for future research would be to further investigate the power of powerlessness in this context. In practical terms, on the other hand, knowledge on social exclusion as a risk factor for radicalism (not only but also) during the COVID-19 pandemic might help shape intervention efforts – which might be useful to avoid paying a high political price.

Data availability statement

Materials and data of this study can be accessed openly at https://osf.io/4HGQR.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MP performed statistical analyses, interpretation of results, and wrote the original draft. LM provided critical revisions. Both authors developed the study design, collected data, and approved the final version of the manuscript for submission.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 17 April 2023
DOI 10.3389/fpsyg.2023.1094652

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

RECEIVED 10 November 2022
ACCEPTED 29 March 2023
PUBLISHED 17 April 2023

CITATION
Yin M and Lee E-J (2023) Exposure to loneliness cues reduces prosocial behavior: Evidence from N400 and P300. *Front. Psychol.* 14:1094652. doi: 10.3389/fpsyg.2023.1094652

Exposure to loneliness cues reduces prosocial behavior: Evidence from N400 and P300

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Loneliness is a major risk factor for morbidity and mortality. However, the effect of loneliness on subsequent prosocial behavior is not well known. Understanding the neurobiological mechanisms underlying loneliness is necessary to address this research gap. We investigate the mechanism using a modified public goods game (PGG) wherein participants can choose to act for a collective or selfish interest after being exposed to loneliness cues. Both behavioral (Study 1) and event-related potential (ERP) (Study 2) measures were used to explore this relationship. In Study 1 (N=131), we found that participants exhibited decreased prosocial actions under the loneliness priming condition as opposed to the control condition. In Study 2 (N=17), frontal N400 and posterior P300 components were identified under the loneliness priming condition as opposed to the control condition. Increased (decreased) frontal N400 and posterior P300 lead to selfish (prosocial) choices. These results indicate that humans instinctively perceive loneliness as inconsistency with their desired social-relational life, which in turn stimulates coping strategies for self-preservation. This study contributes to our understanding of the neurobiological basis of loneliness associated with prosocial behavior.

KEYWORDS

loneliness, prosocial behavior, ERP, frontal N400, posterior P300

1. Introduction

Human survival and reproduction require humans to have close relationships with others (DeWall et al., 2011), and positive and lasting relationships represent fundamental human needs (Kothgassner et al., 2017). People invariably prefer living in social groups and performing the necessary actions—even at the expense of minor personal interests—to belong to the group (Hollenbeck and Zinkhan, 2006). Thus, an individual's social connection results in actions to improve society, such as volunteering their time to help others.

However, perceived social disconnection is associated with loneliness (Wu et al., 2020). Hu et al. (2020) stated loneliness reflects a discrepancy between desired and actual interpersonal relationships, whereas Shevlin et al. (2014) stated that loneliness is a subjective experience of dissatisfaction with one's social-relational life. We define loneliness as the perception of social isolation and the discrepancy between desired and actual social relationships. The discrepancy between ideals and reality is an experience of loneliness, as people tend to desire positive relationships, not isolation or exclusion (Heu et al., 2019). Previous research has demonstrated that even brief experiences of loneliness threaten the individual's psychological well-being and physical health (Zadro et al., 2004). Loneliness is a negative emotional experience that increases uncertainty, sadness, and anger and decreases happiness (Cacioppo et al., 2016). Loneliness is closely related to interpersonal hostility, anxiety, and depression (Gopinath et al., 2009; Bedard

et al., 2017). One treatment for loneliness is that individuals go out, be with and connect with others (Kellezi et al., 2019; Lapena et al., 2020). In a post-pandemic society affected by social distancing and isolation, we need to reach out to others beginning with prosocial and friendly gestures. Prosocial behavior can be a natural and easy way to combat loneliness and initiate social connections (Miles et al., 2022). Since loneliness is associated with altered social function in specific brain regions and causes severe psychological and mental consequences that cannot be cured naturally (Lam et al., 2021), thus requiring research on the relationship between loneliness and prosocial behavior (Huang et al., 2016; Van de Groep et al., 2020).

Prosocial behavior benefits others more than oneself; therefore, it frequently entails providing resources to others and sacrificing one's own interests (Debono et al., 2020). Although prosocial behavior has enormous benefits for the collective good, social relationships, and well-being in the long run, maximizing individual interests often make more sense in the short run. In existing studies, the public goods game (PGG) is used as a prosocial task to enact personal and collective interests (Fehr et al., 2002; Filkowski et al., 2016).

PGG originates from behavioral economics, and at its nature is incentives and the problem of free riding (O'Gorman et al., 2009). In this game, subjects secretly choose the number of private tokens to put into a public pot, and then the tokens in this pot are multiplied by a factor, and this "public good" payoff is divided equally among the players, so that non-contributors also keep the tokens (Hasson et al., 2010; Fosgaard and Piovesan, 2015). In the PGG, a common goal is achieved when numerous participants cooperate, and the fruit of cooperation is distributed to all participants, including both prosocial and non-prosocial individuals. Those who do not contribute yet enjoy free-ridden benefits are selfish and a participant's decision to contribute to the collective interest can be considered a prosocial act to strengthen the public interest (Milinski et al., 2006). Achieving common prosperity and dealing with climate change are examples of public goods that are relevant to the current times (Milinski et al., 2006). Here, climate can be viewed as a public good, and free riding refers to those who enjoy environmental benefits without paying a premium for environmental protection. Therefore, we use a modified PGG, wherein one can choose to act for climate protection or personal benefit.

Previous studies have suggested that loneliness affects individuals' choice to engage in prosocial behavior (Twenge et al., 2007; Hu et al., 2020). Hence, these two behavioral outcomes are plausible. On the one hand, individuals who experience loneliness behave antisocially or aggressively to avoid threats and reconstruct control (Carter-Sowell et al., 2008; Wang et al., 2012). The human brain has evolved to place individuals into short-term self-preservation mode when they are alone and have no interconnections (Grennan et al., 2021). To avoid threats, they temporarily shut down their emotional systems through over-vigilance toward themselves and emotional insensitivity toward others in potentially threatening situations (Twenge et al., 2001). On the other hand, loneliness can also motivate an individual to increase prosocial attempts to create social bonding and belong to a group (Cacioppo et al., 2016). Loneliness as the emotional state of social isolation increases individuals' prosocial attempts under certain boundary conditions. Wang et al. (2012) identified that socially excluded participants conformed more to the norm than included participants to minimize others' negative evaluations.

Therefore, wide research gaps exist regarding whether loneliness increases or reduces prosocial behavior. Notably, loneliness correlates with social behavior; hence, it is of significant value to explore the neurobiological basis of loneliness as it relates to prosocial behavior. This study aimed to explore neural signals to determine how people feel lonely and their effects on prosocial behavior. Therefore, we examined the influence of loneliness on prosocial behaviors using both behavior and electroencephalogram (EEG) studies. Using event-related potential (ERP) analysis technique, we can examine the psychological mechanism that is inherent in loneliness and the activity intensity in specific brain regions.

People want to be liked, included and accepted by other people (Zhu et al., 2018). Considering the fundamental nature of the need for belonging, social isolation precipitates significant discrepancies in the quantity or quality of social contact that individuals desire. The N400 is a negative-going deflection occurring 200–600 ms after stimulus onset, with a slight right hemisphere bias (Kutas and Federmeier, 2011). Studies on the semantic priming effect using ERP have demonstrated that a more negative N400 component can be evoked when the target and prime are semantically incongruent (Draschkow et al., 2018). Zhu et al. (2018) found that larger N400 was induced in exclusionary verbs than in inclusive verbs because the former violates interpersonal self-positivity. Moreover, the N400 can be triggered by social conflicts and violations (Huang et al., 2014). Further, Cacioppo et al. (2016) reported that loneliness is associated with a focus on threatening emotions and that lonely people exhibit an automatic (unconscious) attentional bias toward social threats, such as social rejection. Cacioppo and Hawkley (2009) observed that loneliness is associated with increased activation of the visual cortex when presented with unpleasant social images. The P300 is a positive-going deflection occurring 200–450 ms after stimulus onset (San Martín et al., 2016). This component is associated with visual attention to new stimuli (Yeung and Sanfey, 2004; San Martín et al., 2016), and its amplitude is higher in response to threatening than to neutral faces (Batty and Taylor, 2003; Holmes et al., 2008). Gray et al. (2004) reported that sensitivity to self-relevance cues induces P300. When people experience loneliness, their sensitivity and attention to negative social cues increase (Pickett and Gardner, 2005). Thus, these features of loneliness can affect subsequent social behavior.

Prosocial behavior involves considering another person's viewpoint with the intention of benefiting them (Batson and Powell, 2003). When the fundamental need for belonging is not fulfilled, individuals adopt a loneliness-perpetuation perspective (Vanhalst et al., 2015). Numerous previous studies have demonstrated the relationship between the neural response to loneliness and vulnerable behavior (Girardi et al., 2009; Serafini et al., 2018; Lam et al., 2021). Research has revealed that owing to loneliness, the prefrontal cortex, which is involved in understanding others' minds, increases regional gray matter, which induces immature functions in emotion regulation (Kong et al., 2015). Serafini et al. (2020) found abnormal levels of inflammation in specific brain regions are associated with depression and suicidal behavior. Additionally, loneliness decreased the ability to filter less relevant stimuli (Tian et al., 2017), which is associated with hypervigilance (Cacioppo et al., 2014). This attentional bias increases sensitivity to self-relevant information and decreases sensitivity to other-relevant information (Teoh et al., 2020).

In summary, this study aimed to investigate the effect of loneliness exposure on prosocial behavior. Further, we investigate the

electrophysiological mechanisms of exposure to loneliness. Our main hypothesis is that social discrepancy and attentional biases toward stimuli that individuals experience after being exposed to loneliness stimuli induce the individual's frontal N400 and posterior P300. Also, these neural responses focus on self-preservation, which will reduce prosocial behavior.

2. Materials and methods

2.1. Study 1

2.1.1. Participants

The survey was conducted using Prolific,[1] an online survey platform for data collection, participants were recruited globally. Our survey's first page elucidated the study's purpose and stated that the anonymity of responses provided during the experiment would be ensured. Participants who agreed to the experiment were randomly assigned to one of two conditions (loneliness or control) and saw scenarios related to their respective conditions. Overall, there were one hundred and thirty-one participants with a mean age of 31.9 (SD = 6.7) years. Sixty-six participants (47 women, 19 men) were in the loneliness priming condition, and sixty-five participants (49 women, 16 men) were in the control condition. Based on previous studies the sample size of 25 is adequate for per treatment condition (Maxwell, 2004; Hertzog, 2008; Park et al., 2022). Additionally, G-power 3.1.9 software was used to determine the appropriate sample size for the study. Our study included sufficiently more participants than the number of samples required for power = 0.8 and $\alpha = 0.05$ in the between-subject design (Prajapati et al., 2010).

2.1.2. Stimuli and procedure

The behavioral experiment consisted of two-condition (Loneliness vs. Control) between-subject design. Prior to the experiment, participants' emotional states of felt loneliness were measured using the University of California, Los Angeles Loneliness scale (UCLA; Russell, 1996), which comprised 10 items (e.g., "I feel alone," "I feel left out") on a 7-point scale; moreover, the measurement item's internal consistency was found to be acceptable (Cronbach's alpha = 0.86). Higher scores indicated higher loneliness levels.

Our experimental design followed Twenge et al.'s (2007) experimental design and, additionally, presented images corresponding to the conditions. In the control condition, participants read the following message: "You have a lot of relationships, and you have many friends who can help you in difficult times. The images below reflect your situation." To facilitate the participant's imagination, we presented group-level images related to social interactions to reflect the current situation. In the loneliness priming condition, participants read the following message: "No one understands you, and no one to talk to. Everyone you love left you. You are always alone. The images below reflect your situation." To facilitate the participant's imagination, we presented images of a solitary individual related to social isolation to reflect the current situation. Images were presented using the criteria of the number of people in the image and the closeness of relationships depicted. The images reflect social bonding and loneliness, like the photos used by Silva et al. (2017). The number of images for each condition was fifteen, and each condition was repeated twice.

Loneliness is related to participants' self-perception of loneliness and is accompanied by negative emotions such as dissatisfaction with social relationships. Therefore, we conducted a manipulation check for the case after the exposures. The loneliness scale was measured again, and the internal consistency of the measurement items was found to be acceptable (Cronbach's alpha = 0.96). Additionally, we measured bipolar pairs of emotional responses (happy/unhappy, pleased/annoyed, satisfied/unsatisfied, contented/melancholic, hopeful/despairing, and relaxed/bored) on a scale of 1 to 7 (Bradley and Lang, 1994). The internal consistency of the measurement items was found to be acceptable (Cronbach's alpha = 0.94); wherein higher scores indicate higher levels of negative emotions.

At the end of each condition, participants were asked to choose between eco-friendly and conventional products for five product categories: a new household drain cleaner, a lamp, batteries, bottled water, and shampoo. Following Lee et al.'s (2014) task design, eco-friendly products were described as "good for the environment, but 20% more expensive than conventional products" and non-eco-friendly products were described as "the same price as conventional products." The prosocial task score was presented as the percentage of respondents choosing eco-friendly products. To increase the experiment's realness, we informed the participants that the rewards comprised basic money and bonuses, and the higher the eco-friendly selection rate, the smaller the actual bonus they would receive. All participants received $0.5 as a basic amount plus an additional $0.1 for choosing a non-eco-friendly product.

PGG was designed to examine prosocial behavior in groups. In traditional games, participants receive money and decide whether to keep it or donate it to help others; helping others is prosocial. However, if one focuses on personal interests, accepting a free ride without donations would seem preferable. However, such free riding threatens societal welfare. In our study, we replaced donations with eco-friendly consumption to increase participants' participation by presenting tasks such as the choices they make in their daily lives. Maintaining the Earth's climate is the biggest "public goods game" played by humans (Milinski et al., 2006). Climate protection is a public good for all of us. Altruists pay more for climate protection and purchase eco-friendly products, but free-riders free-ride on climate protection by purchasing conventional products at relatively low prices.

2.1.3. Behavioral results

Participants reported no difference between the two conditions (loneliness vs. control) in the level of loneliness they felt prior to the experiment ($M_{\text{loneliness}} = 3.10$ [SD = 1.17], $M_{\text{control}} = 2.83$ [SD = 1.16], t [1, 129] = 1.31, $p = 0.194$, Cohen's $d = 0.23$). However, after the priming treatment, the level of the loneliness felt by the participants significantly differed between the loneliness priming and control conditions ($M_{\text{loneliness}} = 5.38$ [SD = 0.73], $M_{\text{control}} = 2.86$ [SD = 1.31], t [1, 129] = 13.54, $p < 0.001$, Cohen's $d = 2.38$). Additionally, participants placed in the loneliness priming condition reported a higher level of negative emotion than those in the control condition ($M_{\text{loneliness}} = 5.51$ [SD = 1.34], $M_{\text{control}} = 3.10$ [SD = 1.63], t [1, 129] = 9.22, $p < 0.001$, Cohen's $d = 1.62$).

1 https://www.prolific.co

According to *t*-test analysis using prosocial behavior as a dependent variable, prosocial behavior was significantly reduced in the loneliness priming condition ($M_{loneliness} = 0.37$ [SD = 0.31], $M_{control} = 0.49$ [SD = 0.34], t [1,129] = −2.13, $p < 0.05$, Cohen's $d = -0.37$). Therefore, the hypothesis that loneliness reduces prosocial behavior is supported.

2.1.4. Discussion

In Study 1, participants experienced more loneliness and negative emotions in the loneliness priming condition and showed reduced prosocial behaviors. Our results are consistent with previous studies showing that social connection enables people to behave sustainably (Abson et al., 2017), and that the experience of loneliness makes it difficult for people to predict future events and empathize with the suffering of others. This indicates that our experimental manipulation is successful. Future research is needed to further investigate the characteristic of loneliness. To better understand individual psychological mechanisms during the experience of loneliness, we investigate electrophysiological mechanisms of loneliness in the context of social behavior.

2.2. Study 2

2.2.1. Participants

Twenty right-handed undergraduate and graduate students (9 women, 11 men) with no history of neurological problems were paid to participate in this experiment. Their age ranged between 20 and 29 years (mean = 24.3, SD = 4.1). The procedure was approved by the Institutional Review Board (IRB) of the first author's university, and written informed consent was obtained from participants before participating in the experiment. Data from three participants were discarded because of the excessive head movements. Finally, data from 17 participants were used for analysis.

In ERP studies, increasing the data's reliability through repeated measurements is common (Muntean et al., 2021). The sample size was determined based on previous ERP studies (Petrichella et al., 2017; Yun et al., 2022). Additionally, the G-power 3.1.9 software was used to verify the sample size. Our study included sufficiently more participants than the number of samples required for power = 0.8 and $\alpha = 0.05$ in the within-subject design (Prajapati et al., 2010).

2.2.2. Stimuli and procedure

The EEG experiment comprised a one-factor (loneliness priming vs. control) within-subject design. E-prime 3.0 software was used to present the scenario, and the details are similar to Study 1. The EEG experiment for each participant was scheduled in advance and conducted in a soundproof room. Each participant was seated in a comfortable chair, while the experimenter attached EEG electrodes to their scalp.

At the beginning of each condition, there was an instruction to imagine a situation related to the condition and presented images corresponding to the conditions later. Each condition contained 15 images, and two trials were conducted for each condition. The sequences of conditions were counterbalanced across participants. Each image was presented for 3 seconds and a fixation page of a cross sign at the center of the screen was projected for 1 second in between images. After exposure, participants indicated their preference for a conventional product versus an eco-friendly product for five product categories by pressing a corresponding button (1 or 2) on the keypad. The entire EEG experiment took approximately 40 min, after which the subjects were paid $20 for their participation.

2.2.3. EEG recording and analysis

The electroencephalography data were recorded using a 32-channel MR-compatible EEG system (Brain Products GmbH, Germany). Thirty-two Ag/AgCL electrodes (AFz, AF3, AF4, AF7, AF8, F1, F2, F5, F6, FC3, FC4, FT7, FT8, FCz, C1, C2, C5, C6, CPz, CP3, CP4, TP7, TP8, P1, P2, P5, P6, Poz, PO3, PO4, PO7, and PO8) were placed on an elastic cap (actiCap, Brain Products GmbH) according to the standard international 10/20 system. The FCz channel located at the midline frontal-central was selected as the online reference channel (Leuchs, 2019; Yun et al., 2022). All electrode impedances were maintained below 10 Ω during the recording. The EEG signals were continuously sampled at the 500 Hz/channel rate.

Further data processing was performed using EEGLAB and ERPLAB (Lopez-Calderon and Luck, 2014) in MATLAB. All signals were re-referenced to the average of all channels and band-pass filtered with cutoffs at 0.05 and 30 Hz. The BSS-based electro-oculograms (EOG) procedure was applied to correct ocular artifacts (Gómez-Herrero et al., 2006). This method enables the researcher to detect ocular movements and movement-related artifacts without necessarily attaching EOG reference channels. To compute ERPs, continuous EEG was segmented in epochs of 1,000 ms, time-locked to stimulus onset, and included a 200 ms pre-stimulus baseline. EEG voltage amplitudes that exceeded a threshold of ±75 μV during the recording were excluded from the final analysis. According to the grand average ERP waveforms and topographic map (Figure 1), ten electrode sites were selected for statistical analysis as follows: five F channels (F1, F2, F5, F6, AFz) and five PO channels (PO3, PO4, PO7, PO8, and POz). The N400 and P300 components were calculated at mean amplitudes within 200–500 ms and 200–450 ms time windows, respectively. After applying the Greenhouse–Geisser correction, we performed a 2 (condition: control, loneliness) × 3 (laterality: left, midline, right) repeated-measures ANOVA for the N400 and P300.

2.2.4. ERP results

After applying the Greenhouse–Geisser correction, the repeated-measure ANOVA was performed on the mean amplitudes at frontal locations during 200–500 ms. The main effect based on the conditions of N400 was significant ($M_{loneliness} = -2.78$ μV [SD = 1.44], $M_{control} = -1.40$ μV [SD = 1.02], F [1, 16] = 7.71, $p = 0.013$, $\eta^2 = 0.33$). The significant difference between the two conditions of N400 (200–500 ms) was identified in five channels located in the frontal lobe—namely, F1, F2, F1, F2, and AFz. The main effect of the laterality (left vs. right vs. midline) was also significant (F [2, 32] = 16.17, $p < 0.001$, $\eta^2 = 0.34$). No significant differences were found for the interaction between condition × laterality (F (2, 32) = 2.23, $p > 0.1$, $\eta^2 = 0.06$). Therefore, a stronger N400 response was observed in the frontal lobe under the loneliness priming condition (Figure 1).

The main effect based on the conditions of P300 was significant ($M_{loneliness} = 3.19$ μV [SD = 1.58], $M_{control} = 2.18$ μV [SD = 1.26], F [1, 16] = 10.73, $p = 0.005$, $\eta^2 = 0.40$). The significant difference between the two conditions of P300 (200–450 ms) was identified in five channels located in the posterior lobe—namely, PO3, PO4, PO7, PO8, and POz. There were no significant differences for the main effect of the

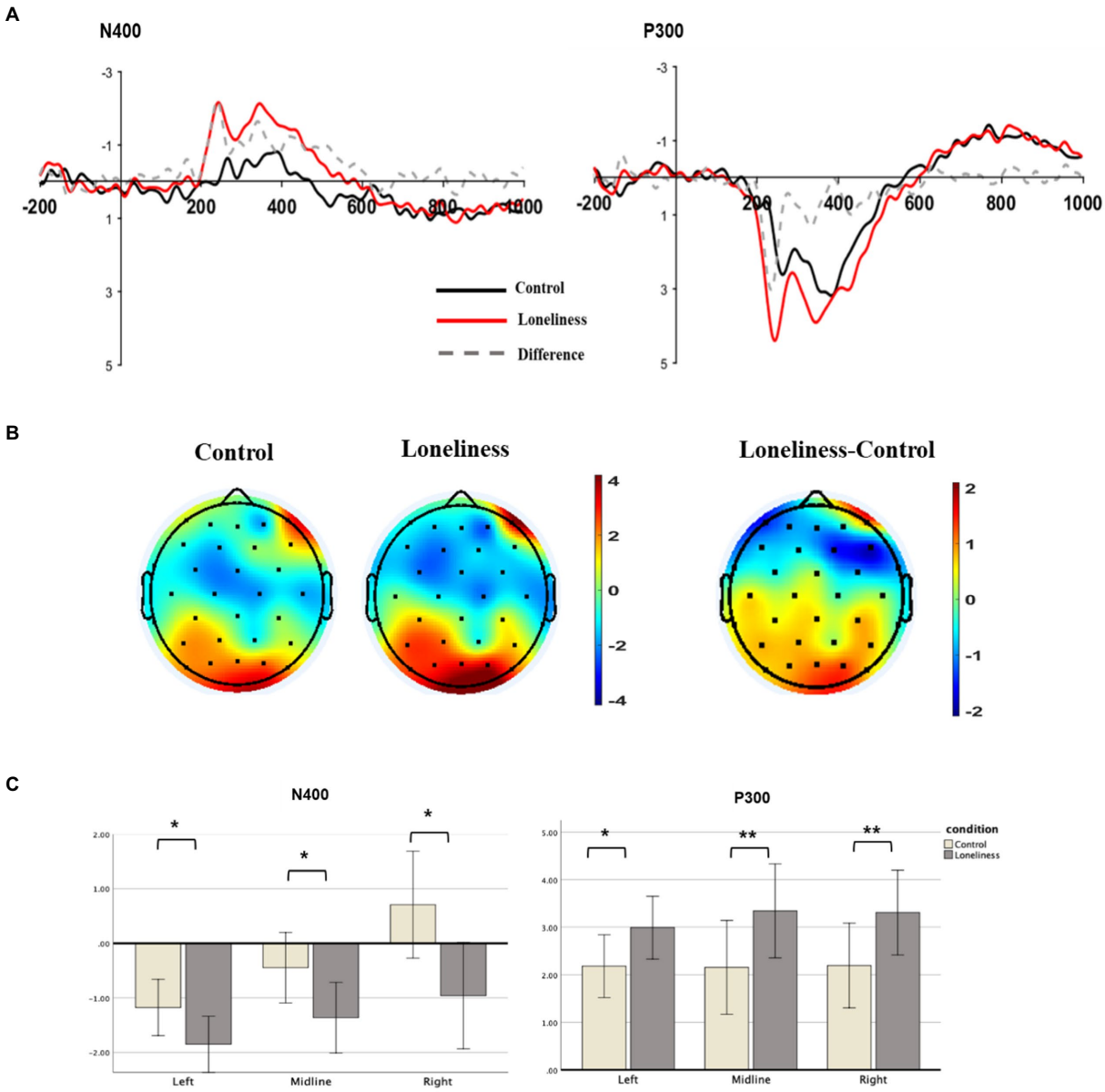

FIGURE 1
Grand mean ERP results for N400 and P300. **(A)** Grand averaged ERP waveforms on the frontal locations (F1, F2, F5, F6, AFz) and posterior locations (PO3, PO4, PO7, PO8, POz). **(B)** Topographical map for each condition and their difference at the time course from 200 to 500 ms. **(C)** Bar graph depicting mean N400 and P300 amplitudes at the frontal and posterior areas for control vs. loneliness priming conditions. The asterisk indicates a reliable difference between control vs. loneliness priming conditions. Error bars indicate standard error.

laterality (F [2, 32] = 0.28, $p > 0.1$, $\eta^2 = 0.01$) or the interaction between condition × laterality (F [2, 32] = 0.32, $p > 0.1$, $\eta^2 = 0.01$). Therefore, a stronger ERP amplitude (P300 potential) was observed in the posterior lobe under the loneliness priming condition (Figure 1).

2.2.5. Correlation between ERP and prosocial behavior

We used EEG experiments to measure the difference in prosocial behavior based on two conditions (loneliness vs. control). The paired t-tests with the percentage of prosocial choices revealed a significant difference in prosocial behavior based on the condition ($M_{\text{loneliness}} = 0.34$ [SD = 0.21], $M_{\text{control}} = 0.59$ [SD = 0.28], t [1, 16] = −4.10, $p < 0.001$, Cohen's $d = -1.01$).

Further, we investigated the relationship between prosocial behavior and the ERP data using four channels—specifically, two channels from the frontal brain (F1, F2) and two from the posterior brain (PO3, PO4), which produced robust neural signals and highly correlated with prosocial behavior. Pearson's correlation coefficient analysis revealed a significant negative relationship between the frontal N400 signal and the percentage of prosocial choices ($r = -0.38$, $p = 0.025$); see Figure 2. The larger the negative potential in the frontal lobe, the lower the prosocial behavior. Similarly, a significantly negative relationship was found between the posterior P300 and the percentage of prosocial choices ($r = -0.42$, $p = 0.012$); see Figure 2. The larger the positive potential in the posterior lobe, the lower the likelihood that an individual would engage in prosocial behavior.

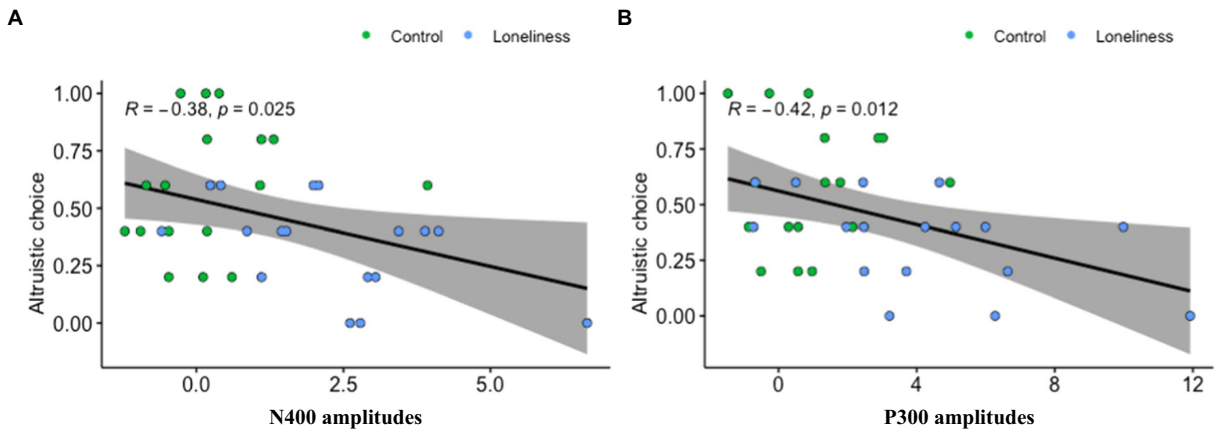

FIGURE 2
Correlation between N400/P300 and prosocial behavior. **(A)** The relationship between prosocial behavior and the ERP data using two channels from the frontal brain (F1, F2) was highly correlated with prosocial behavior. **(B)** The relationship between prosocial behavior and the ERP data using two channels from the posterior brain (PO3, PO4) was highly correlated with prosocial behavior.

2.2.6. Discussion

In Study 2, we found that participants elicited greater N400 and P300 components in the loneliness condition than in the control condition. Negative components in the frontal lobe have been previously reported in error detection, social threats, and conflict processing tasks (Aarts and Pourtois, 2012; Huang et al., 2014). Specifically, the frontal N400 has been reported in language and semantic inconsistency tasks (West et al., 2005). N400 has been found to be associated with loneliness because humans instinctively perceive 'social isolation' as inconsistent with the naturally desired state of interpersonal connection and unity. Similarly, the posterior positivity peak as P300 has been frequently reported in relation to tasks requiring visual attention (Dai and Feng, 2009). We believe that the N400 and P300 reported in this study are essentially similar to previously reported ERP elements. Our results reveal how the brain functions during human exposure to loneliness and how its neural activity is related to subsequent behavioral choices. Our findings on loneliness are associated with prosocial behavior.

3. General discussion

In this study, we investigated individual cognitive processes and subsequent actions related to loneliness. Loneliness needs to be understood because it often responds with depressive symptoms and hostile behavior (Serafini et al., 2018). We found that loneliness reduces prosocial behavior (Study 1 and 2). We found that loneliness is accompanied by a discrepancy between ideals and actual social relationships, resulting in a tendency to act in one's own interests rather than those of the community, which is represented as frontal N400 and posterior P300 components (Study 2).

Social isolation is not limited to the psychologically vulnerable but is a prevalent phenomenon in modern society. However, the social sciences, except in the field of personality disorders, have overlooked this problem. As the human brain is sensitive to loneliness cues, the N400 and P300 components are useful biomarkers for emotional processing associated with loneliness. Loneliness also affects subsequent behavior. The experience of loneliness results in a discrepancy between one's ideals and actual social relationships, which makes one tend to behave in their own interests rather than for the community's benefit. Our investigation of the correlation between loneliness-related neural activity and subsequent decision-making supports the notion of a relationship between behavioral responses and neural activity.

Our results are consistent with those of other studies on loneliness in three ways. First, we found that loneliness was caused by an emotional discrepancy between ideal and actual social relationships. The emergence and maintenance of loneliness are associated with the use of emotion-focused coping, which may include emotional suppression, withdrawal, passive resignation, or avoidance, rather than problem-solving and cognitive reconstruction (Huang et al., 2016). Staebler et al. (2011) observed that the lack of meaningful relationships, which is increasing in modern society, increases individuals' emptiness and rejection. Using the ERP waveforms, we found that negative potential (N400) peaks were activated in the frontal region when participants experienced loneliness. In short, participants' loneliness induces a discrepancy between the ideal and actual relationship, represented as an N400 peak in the frontal region.

Second, another component identified after stimulus presentation was the P300 components for loneliness conditions. At the posterior location, the loneliness priming condition elicited a larger positive potential peak than the control condition. Positive activity in the posterior lobe is involved in attention and visual perception (Woodman, 2010), which is consistent with the notion that the lonelier one feels, the more attention one pays to negative stimuli or threats (Cacioppo et al., 2016). Neuroplasticity may make individuals more sensitive to negative life events (Belsky et al., 2007). Painful experiences, such as loneliness, require greater attention because they are related to survival. This constant attention and vigilance that results from loneliness tend to focus on the self. In short, the participants' loneliness induced attentional bias, which was represented as a P300 peak in the posterior brain region.

Third, we used the PGG, which found that participants exhibited lower prosocial behavior in the loneliness priming condition.

Individuals focus on self-benefits when they are socially isolated (Yu and Han, 2021). This is consistent with previous research that prosocial behavior decreases because loneliness is a painful experience that people want to avoid (Huang et al., 2016). A sense of belonging connects individuals and groups and induces prosocial behaviors, as the emotionally connected approach to sustainability recognizes the intrinsic value of the natural world and seeks to serve community interests. By contrast, loneliness impairs prosocial behavior.

This study has some limitations that provide suggestions for future research. First, we investigated cognitive processes related to loneliness through laboratory manipulations. To obtain more general results, it is necessary to measure it integrated with real-life experience of loneliness. Second, studies have suggested that loneliness is associated with impaired social functioning (Jobe and White, 2007; Lam et al., 2021). Future studies can use fMRI to investigate a wider range of brain areas and functions, such as the deep brain limbic system or the default mode network. Third, the negative effect of loneliness on prosocial behavior can lead to different outcomes when making behavioral choices in public or interacting with others (Wang et al., 2012; Huang et al., 2016). Further studies can add other boundary conditions to compare results. Fourth, culture interacts with how loneliness is dealt with (Van Staden and Coetzee, 2010). Because the Western culture emphasizes the independent self, and the East Asian culture emphasizes interconnectedness with others, the degree of loneliness people feel varies from collective to individualistic cultures (Yum, 2003). Future research should include samples from different cultures.

Despite the above mentioned limitations, our study also provides further insights into the effect of loneliness not only on cognitive processes but also on prosocial behaviors. The whole brain markers that repeatedly appear in ERP results—specifically, the frontal N400 and posterior P300—are a reliable way to detect loneliness. As the interaction between computers and humans has increased recently, we suggest that these neural indicators can provide a service that can generate and recharge positive energy by detecting human loneliness. In addition, a sensitive response to loneliness cues further inhibits an individual's prosocial behavior and leads to a vicious cycle of relationships. Since loneliness is related to an altered immune system and psychosocial impairment, individuals have limitations in self-healing. It suggests that social support such as a community and healthcare service that can connect with others is needed to induce altruistic behavior among lonely individuals.

4. Conclusion

We investigate the psychological and neural mechanisms of loneliness, adding understanding to prosocial behavior. The loneliness priming condition elicited larger frontal N400 and posterior P300 amplitudes than the control condition. In addition, these neural markers have been found to be associated with subsequent prosocial behavior. The findings help us better understand why loneliness reduces prosocial behavior and what measures can be taken to improve prosocial behavior.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board (IRB) of Sungkyunkwan University (2021-12-018). The patients/participants provided their written informed consent to participate in this study.

Author contributions

MY: collected and analyzed the data and wrote the manuscript. E-JL: project administration and designed the experiments. All authors contributed to the article and approved the submitted version.

Funding

This research is funded by Korea National Research Foundation (NRF) (2021R1A2B5B01001391) awarded to E-JL.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers | Frontiers in Psychology

TYPE Mini Review
PUBLISHED 16 June 2023
DOI 10.3389/fpsyg.2023.1141100

OPEN ACCESS

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RECEIVED 10 January 2023
ACCEPTED 01 June 2023
PUBLISHED 16 June 2023

CITATION
Terrizzi JA Jr, Pond RS Jr, Shannon TCJ, Koopman ZK and Reich JC (2023) How does disgust regulate social rejection? a mini-review. *Front. Psychol.* 14:1141100. doi: 10.3389/fpsyg.2023.1141100

How does disgust regulate social rejection? a mini-review

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The need to belong is a fundamental aspect of human nature. Over the past two decades, researchers have uncovered many harmful effects of social rejection. However, less work has examined the emotional antecedents to rejection. The purpose of the present article was to explore how disgust––an emotion linked to avoidance and social withdrawal––serves as an important antecedent to social rejection. We argue that disgust affects social rejection through three routes. First, disgust encourages stigmatization, especially of those who exhibit cues of infectious disease. Second, disgust and disease-avoidance give rise to cultural variants (e.g., socially conservative values and assortative sociality), which mitigate social interaction. Third, when the self is perceived as a source of contamination, it promotes shame, which, subsequently, encourages withdrawal from social interaction. Directions for future research are also discussed.

KEYWORDS

disgust, shame, behavioral immune system, social rejection, social exclusion, ostracism

Introduction

Humans are intensely social. People enjoy immense benefits, both psychologically and physically, from their participation in and maintenance of positive relationships (Baumeister and Leary, 1995). Consequently, social rejection serves as a serious threat to our mental and physical well-being. Although much is known about the consequences of rejection, including poorer self-control, increased self-defeating and aggressive behavior, and even physiological responses associated with pain (e.g., Holt-Lunstad et al., 2010; DeWall et al., 2011; Eisenberger, 2011; Leary, 2015), less is well-known about its antecedents. In the present article, we review empirical evidence that suggests disgust––an emotion linked to avoidance and social withdrawal––is an important precursor to rejection. We argue that disgust is directly and indirectly linked to social rejection through a few key pathways.

We obtained articles for this review by searching the PsychINFO database and Google Scholar for published articles, using the terms: "disgust OR parasite stress OR disease threat OR behavioral immune system" AND "rejection OR exclusion OR ostracism OR avoidance." These broad terms allowed us to cast a wide net to identify relevant literature regarding the influence of disgust on rejection.

The adaptive value of social connection

Long before dating apps and Facebook, our early ancestors faced a world much harsher than our own, in which pursuing a solitary existence posed grave danger (Buss, 2008). To offset the risks of solitude, early humans formed small communities wherein members helped each other

to survive (e.g., hunting, foraging, building shelter, defense from physical threats, childcare duties; Trivers, 1971; Eastwick, 2009). Given how critical group-living was for our ancestors, they required psychological mechanisms for detecting and responding to social threats (Leary and Downs, 1995; Kurzban and Leary, 2001; Leary, 2001; Chester et al., 2012; Wesselmann et al., 2012). For instance, social pain likely evolved concurrently with early societies to promote survival (MacDonald and Leary, 2005). Studies examining neural responses to socially painful events have largely supported a model of common neural substrates for detecting physical and social pain (see Eisenberger, 2011 for a comprehensive review). Psychological mechanisms for detecting social threats are even sensitive to non-verbal cues (e.g., averted eye gaze) that may warn of potential rejection (Wirth et al., 2010).

Rejection as a social strategy likely developed alongside early group living and has been molded by selective pressures to satisfy certain adaptive needs (Williams, 1966; Cosmides and Tooby, 1994; Kurzban and Leary, 2001). Of course, our brains would likely require certain mechanisms through which to address the specific issues emerging from sociality (Wesselmann et al., 2012). Disgust is potentially one mechanism for strategically triggering social rejection to avoid costly group members (or trigger social withdrawal when the costly group member is oneself).

Disgust as an antecedent to rejection

Here, we discuss three routes by which disgust affects social rejection. First, disgust encourages stigmatization (see Oaten et al., 2011). It encourages avoidance and rejection of others (Park et al., 2003; Faulkner et al., 2004; Navarrete and Fessler, 2006; Park et al., 2006; Terrizzi et al., 2010), especially those who exhibit cues of infectious disease (Van Leeuwen and Petersen, 2018). Second, disgust and disease-avoidance (i.e., parasite stress) give rise to cultural variants (e.g., socially conservative values and assortative sociality; see Fincher and Thornhill, 2012; Terrizzi et al., 2013; Thornhill and Fincher, 2014), which mitigate social interaction. Third, disgust can promote self-isolation. When the self is perceived as a source of contamination (i.e., self-disgust; see Overton et al., 2008), it promotes shame (Terrizzi and Shook, 2020), which encourages withdrawal from social interaction (Tangney et al., 1996). We preface our discussion of these routes by outlining the adaptive challenge of infectious disease and its evolutionary solutions (i.e., the physiological immune system and the behavioral immune system).

The adaptive challenge of infectious disease

Infectious diseases present an adaptive challenge for humans. Like all living organisms, infectious agents (e.g., viruses, bacteria) are in the business of survival and reproduction. However, their reproductive success can make us sick or even die. Consequently, humans and pathogens are locked in an evolutionary arms race (see Nesse and Williams, 1994). Pathogens are evolving new methods of decoding our security system, and we are evolving new tactics for fending them off. One of our lines of defense is the physiological immune system (PIS). When an infectious agent enters the human body, the PIS produces antibodies that recognize specific portions of the pathogens, bind to them, and, hopefully, inactivate them (Delves and Roitt, 2000). Although the PIS is an effective tool for combating pathogens, it can be costly, sometimes resulting in friendly fire (i.e., attacking the very body that it is designed to protect). Fortunately, the PIS is not the only solution to the problem of infectious disease. We are also equipped with psychological mechanisms that help promote disease-avoidance.

The behavioral immune system

The behavioral immune system (BIS) is the first line of defense against infectious disease (Schaller, 2006). It is a suite of psychological mechanisms that promote disease-avoidance. The goal of the BIS is to limit exposure to infectious agents. It helps us avoid situations, people, and objects that would increase the likelihood of infection exposure. The BIS accomplishes this by triggering adaptive cognitive (e.g., infection specific thoughts), affective (e.g., disgust), and behavioral responses (e.g., avoidance, repulsion), which collaborate to produce prophylactic responses to cues of infectious disease (Schaller and Duncan, 2007).

The embodied cognitive nature of disgust

Disgust is a key component of the BIS. It is a cross-cultural human emotion (Ekman, 1970) that is believed to have originated in our ancestral past as a means of distinguishing healthy and edible items from those that may be dangerous (Rozin and Fallon, 1987). As such, the facial expression accompanying disgust results in flaring nostrils, squinted eyes, protruding tongue, and a gaping mouth, which aid in minimizing disease exposure (Rozin et al., 1994). Though there is cross-cultural variability in the triggers of disgust, some triggers like bodily by-products (e.g., blood, feces, vomit) seem to be cross-culturally universal (Curtis and Biran, 2001; Curtis et al., 2011). This is not all surprising, given how such substances often spread diseases. Indeed, pictures that are disease-relevant (e.g., resembling bodily fluids) are more cross-culturally evocative of disgust than those that are not disease-relevant (e.g., blue slime; Curtis et al., 2004).

From an evolutionary perspective, psychological systems that are designed to solve adaptive challenges are not always accurate. Rather, they promote the avoidance of errors that are the most reproductively costly (see Haselton and Buss, 2000). In the case of the BIS, this means that individuals will be more vulnerable to Type I errors (i.e., perceiving an object as a disease threat when it is not; Oaten et al., 2009). As a result, people are prone to "magical contagion" (Rozin et al., 1992). For example, participants will avoid eating fudge that is shaped like dog feces (Rozin et al., 1986).

Conceptually, disgust is a system that is turned on and off by environmental triggers (i.e., cues of infectious disease). When individuals are exposed to a disgusting object (e.g., rotten meat), it elicits disgust, which encourages disease-avoidant behavior. The salience of bodily by-products as a universal disgust elicitor is indicative of the role that human-to-human contact plays in the transmission of infectious disease. Contagious diseases are often spread by incidental contact with bodily by-products (e.g., respiratory

droplets). Given the prevalence of this route of infectious exposure, it follows that disgust will have implications for human social interaction. In the next few sections, we will discuss how disgust and disease-avoidance cause stigmatization and avoidance of others.

Disgust and stigmatization

Disgust is an avoidant emotion (Cottrell and Neuberg, 2005). Consequently, its influence on social behavior should be indicative of social conservatism, rejection, and avoidance of others (especially those who are different). Evidence of the avoidant nature of disgust and its impact on social behavior can be seen in the aggression literature. Disgust is negatively associated with physical aggression (i.e., approach-oriented aggression; Pond et al., 2012) but positively associated with relational aggression (e.g., rejection; Molho et al., 2017).

One of the ways disgust encourages avoidance of others is through the mechanism of stigma. Stigmatization is the process of categorizing groups or individuals based on undesirable characteristics, both physical (e.g., morphological differences) and moral (e.g., norm violations), as a means of segregation and avoidance (see Goffman, 1963). From a disease-avoidance perspective, stigma can be conceptualized as a strategy for decreasing the probability of exposure to infectious disease by limiting contact with "contaminated" groups (see Oaten et al., 2011). As disgust makes us prone to Type I errors, the effect that disgust has on stigmatization will default toward false positives. Thus, groups or individuals that pose no disease-threat will be avoided.

The disease-avoidant nature of stigma impacts perceptions of disease-threat. For instance, stigmatized others (e.g., out-group members) are often blamed for the onset of epidemics (Oaten et al., 2011). Stigma also has vicious long-lasting downstream effects on social identity. Stigma is often placed on individuals or groups because of strong feelings of disgust and avoidance (Major and O'brien, 2005; Oaten et al., 2011). Once a particular group has been stigmatized, the mere label (i.e., social categorization) of that group can confer contamination concerns. Thus, the label itself can metaphorically contaminate those to whom it is applied.

Interestingly, although stigma leads to social rejection by out-group members, stigmas can also drive a stronger sense of association with in-group members (Major and O'brien, 2005; Oaten et al., 2011). When our sense of self is threatened and we are rejected by others, we seek to repair that by finding support from other members of our own, stigmatized group and relying more on the group identity to depersonalize the offense (Crocker et al., 1991).

Disgust and in-group/out-group bias

Because other people are a significant source of contamination, humans attend to morphological differences that could signal disease-threat (disease cues: runny nose, swelling; Duncan et al., 2009). Some evidence suggests that attention to such cues can even trigger immunological responses that help prepare the body for disease (Schaller et al., 2010). Individuals who are particularly concerned with infectious disease show an over-perception of disease threat (i.e., perceiving and recalling disease cues where there were none; Miller and Maner, 2012).

As disgust is believed to be a disease-avoidance mechanism, it follows that it would trigger avoidance and rejection of those who exhibit cues of infectious disease (Van Leeuwen and Petersen, 2018). However, its effect on social interaction is not limited to those who display cues of infectious disease. Disgust seems to cause an in-group/out-group bias, such that it encourages avoidance of out-group members and, reciprocally, a greater affinity for in-group members. Disgust and disease-avoidant concerns are associated with prejudice and avoidance of a wide variety of out-group members, including foreigners, sexual minorities, and obese individuals (Park et al., 2003; Faulkner et al., 2004; Navarrete and Fessler, 2006; Terrizzi et al., 2010). In addition to its impact on interpersonal prejudice and avoidance, disgust seems to have a large impact on cultural values.

Cultural quarantining

Culture plays an important role in the defense against infectious disease. Parasite stress theory suggests that historic exposure to infectious disease affects the evolution of cultural value systems (see Thornhill and Fincher, 2014). In areas of the world in which there are higher rates of infectious disease and more life lost due to infectious disease, there should be more orderliness and strict adherence to social norms. Indeed, regions with higher rates of infectious disease exhibit more constraints on high-risk behaviors (e.g., sexual behaviors, drug use; Fincher et al., 2008; Schaller and Murray, 2008), tend to be more collectivistic (i.e., a cultural orientation that encourages in-group cohesion and adherence to social norms; Guernier et al., 2004; Fincher et al., 2008), and experience more religiosity and assortative sociality (i.e., preference for similar others; Fincher and Thornhill, 2012).

The potential prophylactic value of tight cultures was also observed during the COVID-19 pandemic. Tight cultures (i.e., those that are more orderly and have less crime) exhibited lower mortality rates and less prevalence of COVID-19 (Gelfand et al., 2021). Likewise, power distance (i.e., the extent to which subordinates accept the power of authority figures) and institutional collectivism (which are both associated with norm adherence) were predictive of lower rates of COVID-19 morbidity and mortality (Kumar, 2021).

Not only are regional differences in parasite stress correlated with conservative cultural values (e.g., collectivism, adherence to social norms), but so too are individual differences in disgust sensitivity and concern about infectious disease (Terrizzi et al., 2013). Those who are more sensitive to disgust and chronically concerned about disease-threat are more likely to report higher levels of socially conservative values (e.g., right-wing authoritarianism, xenophobia, religious fundamentalism). Additionally, these value systems seem to function as a means of discouraging interaction with out-groups by promoting in-group assortative sociality (Terrizzi et al., 2010, 2012, 2014).

Shame as self-directed disgust

Other people are not the only object of our disgust. Humans are self-conscious beings and, just as we make evaluations of others, we make evaluations of ourselves (i.e., self-esteem). Therefore, we can experience self-disgust, which has severe socioemotional consequences (e.g., depression and anxiety; Overton et al., 2008). Here

we demonstrate how internalized disgust (i.e., self-disgust) can lead to self-stigmatization and self-rejection.

One of the consequences of self-reflected disgust is shame. Shame is a negatively valenced self-conscious emotion that results in global self-condemnation (Tangney, 1991; Niedenthal et al., 1994). In the case of self-disgust, global condemnation is perceiving the self as a source of contamination.

Though little research has explored the relation between disgust and shame, there is some preliminary evidence for their association. Evidence suggests that perceiving facial expressions of disgust can trigger increased shame (Giner-Sorolla and Espinosa, 2011). Specifically, across two cultures (i.e., the United Kingdom and Spain), participants primed with pictures depicting facial expressions of disgust reported more shame than guilt, and participants who saw angry faces reported more guilt than shame.

Not only does perceiving facial expressions of disgust induce shame, but those more sensitive to disgust and have a greater fear of contamination are more vulnerable to shame. In a series of studies, disgust sensitivity and fear of contamination were associated with shame but not guilt, and priming individuals with disgust increased shame but not guilt in individuals who were sensitive to disgust (Terrizzi and Shook, 2020).

Just as disgust stymies social interaction as a means of limiting exposure to infectious disease, so too may shame. Shame and disgust have similar behavioral features. They both encourage avoidance and social withdrawal. Just as disgust and disease-threat encourage behavioral avoidance (Faulkner et al., 2004; Navarrete and Fessler, 2006), shame that results from moral transgressions encourages avoidance of social interaction (Orth et al., 2006; Schmader and Lickel, 2006). Likewise, both shame and disgust seem to be involved in the maintenance of social norms. They are both described as moral emotions, which encourage moral behavior and adherence to social norms (Haidt, 2003; Tangney et al., 2007), and they are both associated with moral decision-making (Tangney et al., 2007; Schnall et al., 2008). Furthermore, deficiencies in both shame and disgust are associated with psychopathy (i.e., an antisocial disregard for social norms; Morrison and Gilbert, 2001; Tangney et al., 2003; Tybur et al., 2009).

Because disgust and shame both encourage social withdrawal (Faulkner et al., 2004; Navarrete and Fessler, 2006; Orth et al., 2006; Schmader and Lickel, 2006), it is likely that intense feelings of both emotions will precede and coincide with feeling lonely, rejected, and socially disconnected. That is, disgust should promote feelings of shame, which, in turn, increase perceptions of rejection.

Discussion

Humans are tremendously social. Yet, the ironic consequence of this sociality is that social rejection is ubiquitous. It occurs everyday, and no one is immune to its harmful influence. To neatly encapsulate all the reasons for which rejection occurs is an ambitious endeavor. Humans evolved to avoid poor social exchange partners, favor their in-group (and exclude or exploit out-group members), and avoid contact with those who may be differentially likely to carry communicable pathogens. In each case, the tendency to exclude others confers survival advantages. The present review supports the idea that disgust plays an important role in the social rejection experience. Not only does this emotion trigger the avoidance of costly group members, but, when directed inward, it can result in shame, self-condemnation, and social withdrawal.

Although there is strong theoretical and empirical evidence that suggests that both disgust and shame play a critical role in human social rejection, there is room for further research. For instance, one limitation is that there is a dearth of experimental work demonstrating the extent to which disgust induces feelings of shame, and less still that identifies shame as a precursor to self-rejection and avoidance of others. Future work would benefit from manipulating disgust (both generally as well as self-disgust) and shame in the laboratory and then measuring their impact across multiple measures of rejection (both toward others and oneself).

Furthermore, we conceptualized disgust and shame as important antecedents of rejection; however, the bidirectionality of the relations is unclear. Some theoretical and empirical work has identified shame as a potential consequence of rejection (Leary, 2015; Wang et al., 2020). However, it appears that rejection does not modulate the disgust experience (Antico et al., 2018). Moreover, no work that we are aware of has identified disgust as a consequence of rejection, but rather a trigger (Park et al., 2003; Faulkner et al., 2004; Navarrete and Fessler, 2006; Terrizzi et al., 2010). Yet, the social rejection experience is complicated. The rejection literature is replete with experimental studies that focus on between-person differences within a single laboratory session. Consequently, only a few studies have examined how the experience of rejection develops within individuals over time (e.g., Nezlek et al., 2012). This is another significant limitation of the extant literature. Future work would benefit from exploring the day-to-day emotional experiences that unfold and coincide with perceived rejection and related phenomena (e.g., feelings of loneliness and disconnection, discrimination, ostracism).

Finally, the literature is dominated by Western samples of college students that are predominately White and female. Thus, it is difficult to know the extent to which results can be generalized to other populations. Future work would benefit from obtaining more diverse community samples, as well as greater cross-cultural representation.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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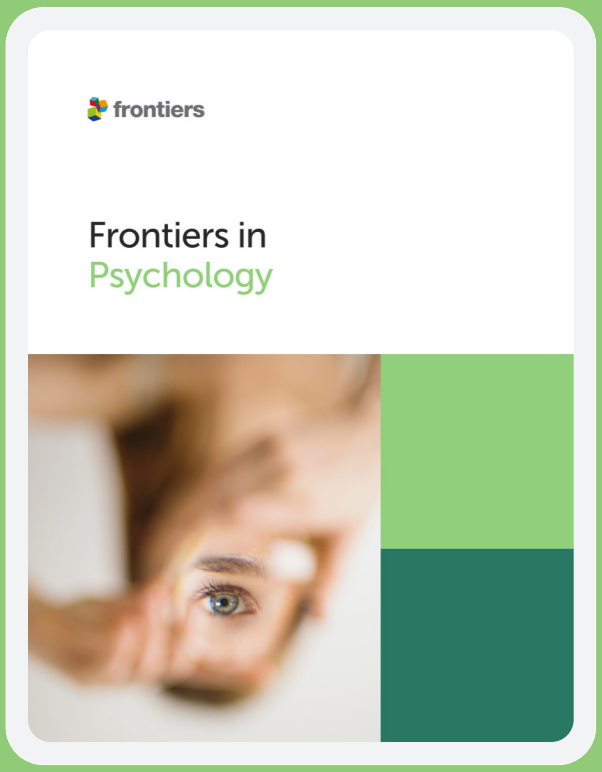

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