

Mindfulness, Rejection, and Recovery of Positive Mood and Friendliness: A Cyberball Study

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Experiencing stressful events that threaten feelings of social belonging can have far-reaching negative impacts on well-being, but there are individual differences in sensitivity to threat that might be explained by dispositional traits. In particular, naturally occurring dispositional mindfulness may be one trait that can explain such differences. To test this possibility, a pool of 495 young adults completed a measure of dispositional mindfulness and a subset of 90 ($M = 19$ years, $SD = 1.3$), selected to represent the full range of mindfulness scores, participated in an induced social rejection task (Cyberball). Threat appraisal was collected by asking about perceived exclusion and rejection post-Cyberball, and participants reported their mood and friendliness before, after, and at 3-mins of recovery, and their self-esteem and life meaning after Cyberball and at recovery. Participants higher in mindfulness reported better mood and less unfriendliness prior to Cyberball. Directly after playing Cyberball, a more heightened appraisal of threat, but not mindfulness, was associated with worse mood, less friendliness, lower self-esteem, and less life meaning. Mindfulness directly mitigated the negative effects of rejection on feelings of friendliness post rejection. When mindfulness and threat appraisal were considered in interaction, the association of perceived threat with pre- to post- changes in positive mood and friendliness was strongly negative when mindfulness was high relative to low. Further, mindfulness was associated with better recovery of mood and life meaning by 3-min after Cyberball, and these effects were additive rather than interactive.

Keywords: belonging, relatedness, ostracism, psychological needs, stress

In Self-Determination Theory (SDT; Ryan & Deci, 2000, 2017) and other theories (Baumeister & Leary, 1995), relatedness to others (or social connection and belonging) is described as a core psychological human need that is met through intimate relationships, belonging to social groups, and feeling valued by others. When the need for relatedness is fulfilled, many positive personal

and developmental outcomes follow (Schoch et al., 2015; Skinner et al., 1998; Vansteenkiste & Ryan, 2013). Conversely, the experience of social exclusion, ostracism or rejection has been found to be a powerful social signal of relatedness need threat, which can result in high levels of distress (Deci & Ryan, 2000; Vansteenkiste & Ryan, 2013; Zimmer-Gembeck, 2016) and even signs and symptoms of psychopathology (Stillman et al., 2009; Troop-Gordon et al., 2015; Williams, 1997, 2001).

Despite widespread evidence of the negative impact of rejection on well-being, research shows that individuals differ in their appraisals of situations as threatening to their relatedness, with some reporting heightened expectation and sensitivity than others (Downey & Feldman, 1996) even when situations are standardized across individuals (e.g., Zimmer-Gembeck & Nesdale, 2013). This variability suggests there are individual dispositional characteristics that both heighten and minimize the appraisal of rejection, ostracism and relatedness threat. In the present study, the aim was to test whether dispositional mindfulness minimized appraisal of relatedness threat, and was beneficial for recovery of positive mood following social rejection. Trait level (i.e., dispositional) mindfulness was expected to be adaptive for response and recovery given growing support for its beneficial properties for emotion regulation, stress responding, and well-being (Aldao et al., 2014;

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Clear et al., 2020; Hambour et al., 2018; Lucas-Thompson et al., 2019; Roeser & Pinela, 2014).

Dispositional Mindfulness and Social Threat

Mindfulness has been described as observing and responding to one's internal and external environment, while being in the present on a moment-by-moment basis, and nonjudgmentally recognizing and accepting experience (Kabat-Zinn, 1994). Mindfulness can be cultivated through the practice of mindfulness meditation (Kabat-Zinn, 1990), however mindfulness has also come to be conceptualized as an inherent capacity or trait-like personal strength, which some researchers have labeled as *dispositional mindfulness* (Brown & Ryan, 2003; Lucas-Thompson et al., 2019). Dispositional mindfulness comprises cognitive, emotional and behavioral skills. In a conceptualization that has had a great deal of influence on the field, Baer et al. (2006) proposed five facets of dispositional mindfulness to aid in understanding its components and associations with stress, coping, and well-being. The five facets include the ability to pay attention, be aware, and perceive signals of emotion accurately, along with unbiased processing that leads to a more accurate view of reality. A mindfulness composite score can be constructed by averaging the five facets. However, one facet, observing, was not administered in this study based on previous research findings that it is not highly correlated with other subscales (Abujaradeh et al., 2020; Hambour et al., 2018) and may be more valid when used with participants who practice meditation (Baer et al., 2006; Williams et al., 2014). In addition, the observing subscale has been found to have a positive association with emotional symptoms in some studies, whereas other subscales are associated with fewer symptoms (e.g., Clear et al., 2020; Hambour et al., 2018).

The benefits accrued from dispositional mindfulness and mindfulness training are becoming well-known. Research has shown that individuals higher in dispositional mindfulness report more positive emotional adjustment and more positive relationships with others (Aldao et al., 2014; Barnes et al., 2007; Clear et al., 2020; Ciesla et al., 2012; Jones et al., 2019; Norton et al., 2015), better cardiovascular responding in response to stress (Lucas-Thompson et al., 2019), and better attention and less rumination (Jones et al., 2019; Parsons et al., 2019). Moreover, although few studies have been conducted, dispositional mindfulness has also been associated with appraisals of need satisfaction or threat. For example, in one study, individuals higher in mindfulness had better sleep quality and daytime functioning, and this association was mediated by the appraisal of greater need satisfaction found among individuals higher in dispositional mindfulness (Campbell et al., 2015). Further evidence comes from a two-wave longitudinal study of athletes, whereby dispositional mindfulness was associated with increased well-being over time and this association was mediated by psychological need satisfaction (Chang et al., 2018). Taken together, such studies suggest that dispositional mindfulness may impart benefits partly because it is associated with greater psychological need fulfillment. Yet, it is unclear whether mindfulness might interfere with appraised threat level (in addition to affecting need fulfillment) when potentially threatening events occur. It is possible that dispositional mindfulness could be protective against an appraisal of threat to relatedness needs because it includes nonjudgmental perception and description of experience.

Such abilities could translate into avoiding the negative self- and other-related beliefs that can follow from negative social experiences (Hankin & Abramson 2001; Zimmer-Gembeck et al., 2016), resulting in appraising events as less personally threatening. In the current study, this was tested by examining the association between mindfulness and threat appraisal following the game of Cyberball set to simulate social rejection.

Dispositional Mindfulness as a Buffer: Reactivity and Recovery From Stress

Mindfulness has been described as a resource that supports better adaptation to stressful events and the distress that can follow from them (Clear et al., 2020; Lucas-Thompson et al., 2019; Roeser & Pinela, 2014), with some studies supporting this view (Barnes et al., 2007; Berry et al., 2018). For example, in one set of seven experiments, dispositional mindfulness was found to reduce defensive responses to mortality salience and existential threat (Niemic et al., 2010). However, past research has rarely focused on the stress of social rejection. When social rejection has been the focus, the results have not been so clear. For example, in a cross-sectional survey study of adolescents (Clear et al., 2020), dispositional mindfulness did not buffer against the negative impact of peer victimization and exclusion on adolescents' internalizing symptoms and feelings of loneliness. Instead, victimization was associated with greater social anxiety, depressive symptoms and loneliness at both low and high levels of mindfulness. This study captured reports of personal experiences of peer victimization and exclusion and examined whether current self-reported dispositional mindfulness buffered concurrent symptoms and loneliness. Reactions to experiences that threaten relatedness often can be immediate, followed by a quick recovery (Hartergerink et al., 2015), but no study to date has focused specifically on whether mindfulness is of benefit because it buffers against immediate negative reactions to social stress and aids quicker emotional recovery.

Reactivity

Research shows that the neural activation linked to social rejection is similar to the experience of physical pain (Eisenberger et al., 2003; MacDonald & Jensen-Campbell, 2011). Interestingly, one of the first uses of mindfulness in modern psychology was as a tool for alleviating physical pain, whereby early research reported that mindfulness meditation was an effective form of chronic pain management (Kabat-Zinn et al., 1985). More recently, mindfulness training was found to be effective in reducing experimentally induced physical pain (Zeidan et al., 2010). In addition, neuroscientific research following a brief intervention of four 20-minute mindfulness meditation training sessions over four consecutive days suggests mindfulness meditation engages multiple brain mechanisms and areas associated with the cognitive modulation of pain, therefore it is suggested mindfulness training is capable of altering the subjective pain experience (Zeidan et al., 2010; Zeidan et al., 2011). Considering the experience of physical pain and social pain seem to share a similar pattern of neural activation, mindfulness, even when measured as dispositional mindfulness, could be effective in modulating the immediate level of social pain felt following an experience of relatedness threat in the form of social exclusion and rejection. If mindfulness can buffer

reactions in this way, it would be unique, given that a meta-analysis of 120 Cyberball studies found that social exclusion was universally painful, and no trait or other factors could be found that inhibited negative emotional reactions to social exclusion (Hartgerink et al., 2015).

Recovery

A second possibility is that mindfulness could boost recovery of positive mood and other reactions following social rejection (Molet et al., 2013). As described by Brown et al. (2007), dispositional mindfulness could have a direct role in the enhancement of self-regulated functioning that comes with ongoing attention and sensitivity to internal and external cues. In this view, individuals high in dispositional mindfulness would show better recovery after an interpersonally stressful event, because dispositional mindfulness would minimize the probability participants would experience thoughts or behavior that are linked with negative affect and other poor outcomes following interpersonal stress (Aldao & Nolen-Hoeksema, 2010; Jones et al., 2019; Nolen-Hoeksema, 1998; Skinner & Zimmer-Gembeck, 2016). Mindfulness might be a resource by helping individuals to avoid ruminating about the experience, reduce feelings of self-doubt or self-deprecation, avoid withdrawal or isolation from others, and avoid anger toward others or retribution in return (see Parsons et al., 2019).

Few past studies have examined whether mindfulness is a resource for better recovery from the distress of social rejection and exclusion using the Cyberball paradigm. In fact, only two studies were located (Martelli et al., 2018; Molet et al., 2013). In the first study (Molet et al., 2013), two groups of undergraduate university students played a game of Cyberball, one group completed a brief 12-minute experimental induction of focused attention using a guided mindfulness breath activity and one group was a control. Results indicated no group difference in need threat immediately following social rejection, although the focused attention group showed improved recovery relative to controls (Molet et al., 2013). This study supports the recovery model but not the reactivity model, whereby mindfulness could be expected to assist in a better recovery of mood or well-being from a stressful experience rather than buffer the initial reactions to the stressful experience.

In the second study (Martelli et al., 2018), 39 undergraduate university students completed a measure of dispositional mindfulness and then played a game of Cyberball while undergoing functional magnetic resonance imaging (fMRI). One hour after playing the game the participants reported their level of social distress. Participants who reported higher dispositional mindful awareness (using the MAAS; Brown & Ryan, 2003) also retrospectively reported less distress during Cyberball. Based on the results of the fMRI, the authors suggest dispositional mindfulness may be associated with effective coping with social rejection by not overactivating top-down regulatory mechanisms in the brain, potentially resulting in more effective long term emotion regulation of rejection related distress (Martelli et al., 2018). Although the use of fMRI is a unique element of this study and informative, one limitation relates to what can be concluded about mindfulness and felt social distress. There was a 1-hour lag between participation in Cyberball and distress reporting; this delay may have involved interference, which makes it difficult to attribute recovery to dispositional mindfulness. Moreover, the methodology did not allow for an examination of

the association between dispositional mindfulness and immediate reactivity to Cyberball social exclusion.

The Current Study

Social rejection has been described as so threatening that it can impair the sense of a meaningful existence and self-esteem (Baumeister & Leary, 1995; Williams, 1997, 2001; Zimmer-Gembeck, 2016). However, not all individuals are equally sensitive to rejection and ostracism; they vary in their appraisal of threat (Zimmer-Gembeck et al., 2013; Zimmer-Gembeck et al., 2016). Individual capacities, such as dispositional mindfulness, may be at work here, providing benefits of reduced appraisal of threat, less reactivity, and quicker or better recovery (Lucas-Thompson et al., 2019; Martelli et al., 2018; Molet et al., 2013). Our aim was to test these notions in young adults presented with a game of Cyberball set to exclude them from ball tossing with imagined confederates (Williams, 2009). It was hypothesized that individuals higher in dispositional mindfulness would appraise less threat to relatedness following Cyberball (Hypothesis 1), and would recover more quickly from their immediate negative responses to the game before and after controlling for their threat appraisal (Hypothesis 2). We also examined reactivity to the game, but it was not clear that mindfulness would be a correlate, given that rejection is a powerfully negative experience for most people (Hartgerink et al., 2015; Zimmer-Gembeck, 2015, 2016). Finally, interactions were expected, whereby mindfulness was expected to buffer the negative impacts of threat appraisal on mood (Hypothesis 3). Threat to relatedness was measured as feeling ignored and excluded to tap feelings directly relevant to the Cyberball task and representative of a lack of relatedness and belongingness (Zimmer-Gembeck, 2016). Aligned with theories that point to mood, self-esteem and meaning as important immediate outcomes of social exclusion (Baumeister & Leary, 1995) and the important social impact of the experience of exclusion (Zimmer-Gembeck, 2016) measured outcomes following Cyberball included a range of positive and negative emotions (e.g., happiness, sadness, anger), feelings of friendliness and unfriendliness, self-esteem, and perceived life meaning.

Method

Participants

The 90 participants (16 to 23 years of age, 73% women) were students at a large Australian university recruited from a pool of 495 students who had participated in a survey that included a measure of dispositional mindfulness. This pool of students was classified as in the bottom third, middle third, and top third of dispositional mindfulness scores, and then stratified random sampling was used to identify individuals to contact, with recruitment starting approximately 1-week after survey data had been collected. This resulted in a substantial range of dispositional mindfulness scores across the 90 participants, from 1.74 to 4.55.

Of the 90 participants, 81% identified as being white/Caucasian, 10% Asian, 1% Australian First Peoples/Pacific Islander; the remaining 8% identified as other. According to G*Power, a post hoc power analysis shows that the 90 participants allowed for 80% power to detect an effect size of .25 in a regression with four

independent variables (with $\alpha = .05$). Based on power analysis, our sample size was planned to be 105 but we limited the data collection period to three months. Data collection was set at three months to minimize the lag between reporting of dispositional mindfulness and participation in Cyberball. After three months, 90 participants had completed the Cyberball task.

Procedure

After approval from the Griffith University Human Research Ethics Committee (protocol 2016/538), 105 students from the pool of 495 were contacted via phone or e-mail, with 90 (86%) participating. Participants attended a research laboratory where more information about the study was provided and consent to participate was collected in writing prior to beginning the 30-minute session. Each participant was seated in front of a computer in a room alone and asked to complete a short questionnaire and then told the study was focused on mental visualization and, to practice their skills, they would be playing an internet ball-toss game with two same-sex students located at other universities. Cyberball (3-player version for Inquisit 5), the internet ball tossing game, was designed to manipulate rejection (i.e., exclusion, ostracism; Williams et al., 2000). The game was set for 74 total throws over 3.5 minutes, whereby the participant received the ball 3 times at the start of the game then not again for the remainder of the game. Participants then completed a brief post-Cyberball questionnaire. Upon finishing the questionnaire, participants were asked to remain seated while the other students at different universities finished the questionnaire. The experimenter waited 3 minutes before returning to the room. On returning, the experimenter asked the participant to complete a subset of the items from the Cyberball questionnaire for a second time according to how they felt "right now". The 3-minute lag time was based on research that showed this time lag was sufficient to produce significant declines in perceptions of psychological need threat (Molet et al., 2013). Following a debrief, participants were thanked, advised of the aims of the study, and received a gift voucher.

Measures Completed One Time

Dispositional Mindfulness

Participants completed four subscales of the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006; see also Abujaradeh et al., 2020) to measure describing, acting with awareness, nonjudgement of experience, and nonreactivity to inner experience. The describing subscale (8 items) measured the ability to recognize and mentally label stimuli and emotional states with words (e.g., "I am good at finding the words to describe my feelings"). The acting with awareness subscale (8 items) measured the ability to attend to one's actions in the moment while avoiding dissociation or acting automatically (e.g., "I do jobs or tasks automatically, without being aware of what I'm doing" – reverse coded). The nonjudging of experience subscale (8 items) measured the ability to refrain from judgment or self-critical attitudes about one's sensations, cognitions, and emotions (e.g., "I tell myself I shouldn't be thinking the way I'm thinking" – reverse coded). The nonreactivity to inner experience subscale (7 items) measured one's ability to allow thoughts and feelings to come and go,

without attention becoming stuck (e.g., "I perceive my feelings and emotions without having to react to them"). Items were rated from 1 (*never or very rarely true*) to 5 (*almost always or always true*) and were averaged so that higher scores indicated more mindfulness, Cronbach's α ranged from .71 to .93.

Appraised Threat to Relatedness

Two items served as a measure of threat appraisal ("I was ignored", "I was excluded", Williams, 2009). These were completed immediately post-Cyberball. Items were rated from 1 (*not at all*) to 5 (*extremely*) and were averaged, Cronbach's $\alpha = .72$. The average score was very high, $M = 3.98$, $SD = 0.99$, with only 11 participants with an average score under 3.

Repeated Measures

Items were drawn from previous research to assess responses to social rejection (Williams, 2009). All items were rated from 1 (*not at all*) to 5 (*extremely*).

Positive and Negative Mood

Three items assessed positive mood ("I feel . . . good", . . . pleasant", . . . happy") and two items assessed negative mood ("I feel . . . bad", . . . sad"). Items were averaged to create positive and negative mood composites, Positive Cronbach's $\alpha = .77$ pre, .91 post, .88 recovery; Negative Cronbach's $\alpha = .75$ pre, .81 post, .84 recovery.

Anger, Friendly, and Unfriendly

Anger (e.g., "I feel angry"), friendliness (e.g., "I feel friendly"), and unfriendliness (e.g., "I feel unfriendly") were assessed with one item each. These items were analyzed separately, as they were not highly correlated with positive or negative mood or with each other.

Self-Esteem

Five items assessed self-esteem (e.g., "I feel good about myself"). Items were completed twice only - immediately after the Cyberball task and again 3 minutes later. Items were averaged so that higher scores indicated higher self-esteem, Cronbach's α were .83 post and .85 recovery.

Meaning

Four items assessed meaningful existence (e.g., "I feel invisible" - reverse coded). Items were completed twice only - immediately after the Cyberball task and again 3 minutes later. Items were averaged so that higher scores indicated more meaning, Cronbach's α were .71 post and .79 recovery.

Overview of Data Analyses

After reporting associations of all measures with gender and age, results are presented in three parts. First, to test whether individuals higher in dispositional mindfulness perceived less threat to relatedness, the correlation of dispositional mindfulness with threat appraisal immediately following Cyberball is presented. In addition, as a preliminary test of whether mindfulness (as well as perceived threat) was related to reactivity and recovery from

Cyberball, correlations of mindfulness and perceived threat with all other measures are presented.

Second, to focus on the impact of mindfulness on reactivity to Cyberball, before and after considering threat to relatedness, we regressed the five post-Cyberball measures, which were also completed before Cyberball, on the following independent variables: the same response measured pre-Cyberball, dispositional mindfulness and appraisal of relatedness threat, and the Mindfulness \times Threat interaction. Mindfulness and appraisal of threat were centered (as recommended when testing interactions of continuous variables; Hayes, 2015), and variables were entered in three steps, with the pre-measure and centered mindfulness entered in Step 1, centered threat entered in Step 2, and the interaction (Centered Mindfulness \times Centered Threat) entered in Step 3.

Third and finally, to test the hypothesis that mindfulness should aid recovery, before and after considering threat to relatedness, we regressed each of the seven 3-minute recovery responses on the following independent variables: the same response measured post-Cyberball, dispositional mindfulness and appraisal of relatedness threat, and the Mindfulness \times Threat interaction. Again, variables were entered in three steps, with the post-Cyberball measure and centered mindfulness entered in Step 1, centered threat entered in Step 2, and the centered Mindfulness \times Centered Threat interaction entered in Step 3. Thus, overall, we fit five “reactivity” and seven “recovery” regression models. We did not adjust the critical α of $p < .05$ for multiple analyses, but highlight below when effects were small.

Results

Associations of All Measures With Age and Gender, Descriptive Statistics, and Correlations

Age was not significantly correlated with any other measure, r 's ranged from $|.00|$ ($p = .994$) for the association of age with pre-Cyberball friendliness to $|.20|$ ($p = .066$) for the association with recovery-Cyberball unfriendliness. There were two gender differences, with pre-Cyberball friendliness higher, $r = .23$, $p = .028$ and

recovery-Cyberball self-esteem lower, $r = -.23$, $p = .030$, in females than males.

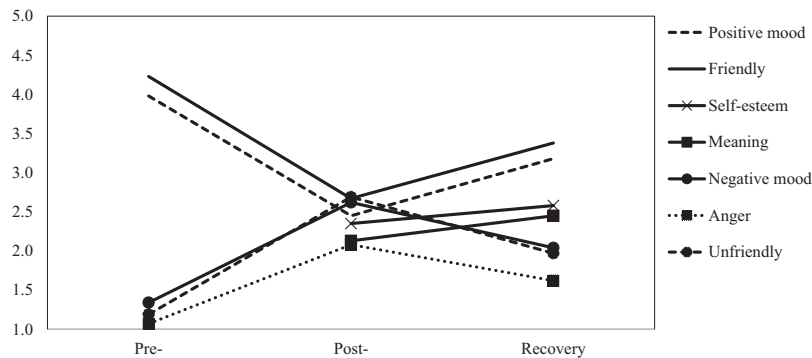
Figure 1 shows the average positive and negative mood responses from before to recovery from the Cyberball task. Paired t -tests showed that negative mood measures increased significantly from pre- to post-Cyberball, whereas positive mood measures declined, paired $t(89)$ ranged from $|7.68|$ to $|16.18|$, all $p < .001$. Cohen's D effect sizes were large, ranging from 0.94 to 1.36. In addition, from post-Cyberball to 3 minutes later, there was significant recovery across all measures, paired $t(89)$ ranged from $|3.57|$ to $|9.49|$, all $p < .01$. Again, Cohen's D effect sizes were large, ranging from 0.57 to 1.16.

M s, SD s, and Pearson's correlations of dispositional mindfulness and threat appraisal with all pre, post, and 3-minute mood measures are shown in Table 1. As can be seen, and in contrast to what was expected (Hypothesis 1), dispositional mindfulness was not significantly correlated with threat appraisal (and this was found for each dispositional mindfulness subscale), but, partially supporting Hypothesis 2, did have many significant correlations with responses before, during and at recovery from the Cyberball task. Individuals higher in dispositional mindfulness reported higher pre and recovery positive mood, and lower pre and recovery negative mood. Individuals higher in dispositional mindfulness also reported less unfriendliness pre-Cyberball, more friendliness at post and recovery, and a greater sense of meaningful existence at recovery. Appraised threat was not associated with pre-Cyberball mood, but threat was significantly associated with all mood measures taken post-Cyberball and at 3-minute recovery, with threat associated with more negative (and less positive) responses. The exception to this pattern was anger, with threat associated with more anger post-Cyberball, but threat was not associated with anger at recovery.

Reactivity: Predicting Post-Cyberball Relative to Pre-Cyberball Mood

In models of reactivity from pre- to post-Cyberball, mindfulness was not significantly associated with positive mood, negative mood, anger, or unfriendliness in Step 1, but it was associated

Figure 1
Average Positivity and Negativity Pre-Cyberball, Post-Cyberball, and 3-Minutes Following Cyberball ($N = 90$)



Note. Measures of self-esteem and meaning were only completed post and at recovery.

Table 1

Correlations of Dispositional Mindfulness and Threat Appraisal With Pre-Cyberball, Post-Cyberball, and 3-min Recovery Measures (N = 90)

Measure	Dispositional mindfulness, <i>r</i>	Threat appraisal, <i>r</i>	<i>M</i>	<i>SD</i>
Threat appraisal (perceived rejection and exclusion)	—	—	3.98	0.99
Total mindfulness	—	-.09	3.15	0.75
Mindful awareness	.86	-.07	3.12	0.91
Mindful describing	.81	-.03	3.40	0.81
Mindful nonjudging	.87	-.02	3.03	1.02
Mindful nonreactivity	.82	-.20	3.02	0.80
Positive mood - pre	.42**	-.09	3.98	0.62
Positive mood - post	.20	-.35**	2.45	0.96
Positive mood - recovery	.23*	-.27**	3.18	0.91
Negative mood - pre	-.42**	-.10	1.34	0.56
Negative mood - post	-.16	-.57**	2.62	1.08
Negative mood - recovery	-.35**	.22*	2.04	0.87
Angry - pre	-.10	-.11	1.07	0.25
Angry - post	-.12	.39**	2.08	1.20
Angry - recovery	-.15	.10	1.62	0.96
Friendly - pre	.10	-.01	4.23	0.72
Friendly - post	.22*	-.25*	2.67	1.02
Friendly - recovery	.25*	-.29**	3.38	0.91
Unfriendly - pre	-.24*	-.07	1.19	0.52
Unfriendly - post	-.07	.46**	2.69	1.25
Unfriendly - recovery	-.13	.25*	1.97	1.06
Self-esteem - post	.19	-.50**	2.35	0.75
Self-esteem - recovery	.19	-.42**	2.58	0.79
Meaning - post	.10	-.61**	2.13	0.72
Meaning - recovery	.27**	-.28**	2.45	0.87

* $p < .05$. ** $p < .01$.

with more friendliness post-Cyberball relative to pre-Cyberball (see Table 2). When threat appraisal was entered at Step 2, it was associated with more post-Cyberball negative mood, anger and unfriendliness, and less post-Cyberball positive mood and friendliness. In the third step of each regression model, when the Mindfulness \times Threat appraisal interaction was entered, it was significant in the models of positive mood (see Table 2 and Figure 2) and friendliness (see Table 2 and Figure 3). Figures 2 and 3 show pre- and post-Cyberball reports at low and high levels of mindfulness and low and high levels of threat. As can be seen in the figures, the effect of appraised threat on pre- to post- measures of positive mood and friendliness was stronger when mindfulness was high relative to low. Although interactions were hypothesized, this pattern did not conform to expectation of mindfulness as a buffer (i.e., Hypothesis 3). Instead, these interactions were explained by the higher level of positive mood and friendliness found among individuals reporting low threat appraisal and high mindfulness. Also, it is important to note, the interaction effects in the models of positive mood and friendliness were small in magnitude (p -values of .046 and .020, respectively).

Recovery: Predicting Recovery Relative to Post-Cyberball Response

In models of recovery, mindfulness was significantly associated with recovery from reactions to Cyberball across two of the seven measures, providing partial support for Hypothesis 2 (see Tables 3 and 4). Mindfulness was associated with more recovery from negative mood (see Table 3) and meaning (see Table 4) 3-minutes after Cyberball, relative to post-Cyberball. Also important to note,

the associations of mindfulness with more recovery (less negative mood and more meaning) were small (p -values of .002 and .023, respectively). Threat was not associated with recovery, and no Mindfulness \times Threat to relatedness interaction was significant, so there was no support for Hypothesis 3 with regards to recovery.

Discussion

The aim of this study was to examine whether dispositional mindfulness mitigates reactions and improves recovery from social rejection. In general, mindfulness was associated with a number of positive moods and feelings toward others before the start of the Cyberball game. Also, directly after playing Cyberball, all participants reported some threat to relatedness (i.e., they felt excluded) and reacted negatively; a more heightened appraisal of threat was associated with worse mood, lower self-esteem, and less friendliness toward others. As hypothesized, mindfulness directly mitigated the negative effects of rejection on feelings of friendliness post rejection, but was not associated with other changes in mood and reactions when examined from pre- to post-Cyberball rejection. When mindfulness and threat appraisal were considered in combination, the associations of perceived threat with both pre- to post- changes in positive mood and friendliness were stronger when mindfulness was high relative to low. Further, a surprising finding (discussed below) was the reduction in the anticipated decline in mood and friendliness in individuals high in mindfulness and low in appraisal of threat. Finally, mindfulness was associated with better recovery of mood and meaning by 3-min after Cyberball, and these effects were additive rather than interactive. Notably, most of the significant effects of mindfulness on reactivity and recovery from Cyberball were small.

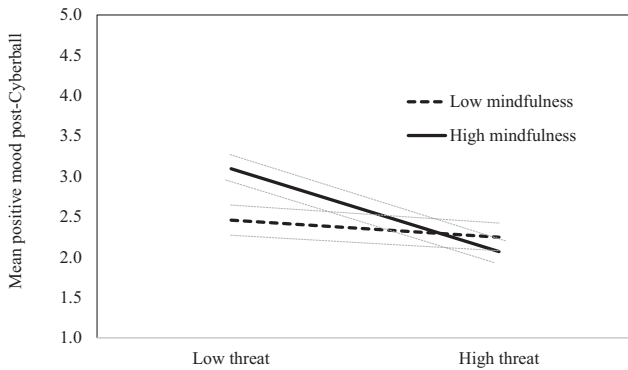
Table 2
Results of Regressing Post-Cyberball Mood and Friendliness on Pre-Cyberball Mood, Mindfulness, Threat, and the Mindfulness × Threat Interaction (N = 90)

Independent variables	Positive mood		Negative mood		Anger		Friendly		Unfriendly				
	B	95% CI	B	95% CI	B	95% CI	B	95% CI	B	95% CI			
Step 1													
DV, pre-Cball	0.51	[0.17, 0.86]	0.24	[-0.12, 0.68]	0.12	[-0.50, 0.51]	-0.11	0.23	[-0.06, 0.52]	.16	[-0.08, 0.45]		
A. Mindfulness	0.07	[-0.21, 0.35]	-0.16	[-0.49, 0.17]	-0.11	[-0.20, 0.54]	-0.13	0.28	[0.01, 0.56]	.21*	[-0.13, 0.23]		
Step 2													
DV, pre-Cball	0.47	[0.15, 0.80]	0.40	[0.04, 0.76]	.21*	[-0.29, 0.67]	-0.06	0.23	[-0.06, 0.51]	.16	0.03	[-0.45, 0.51]	
A. Mindfulness	0.05	[-0.22, 0.32]	-0.03	[-0.30, 0.24]	-0.02	[-0.14, 0.46]	0.18	0.25	[-0.02, 0.53]	.19	-0.05	[-0.38, 0.28]	
B. Threat	-0.30	[-0.49, -0.12]	-0.31**	[0.45, 0.83]	.59***	0.45	[0.21, 0.69]	.37***	-0.23	[-0.44, -0.03]	-.23*	0.57	[0.33, 0.82]
Step 3													
DV, pre-Cball	0.43	[0.11, 0.75]	0.38	[0.01, 0.74]	.20*	[-0.34, 0.62]	-0.07	0.19	[-0.10, 0.46]	.13	0.03	[-0.45, 0.51]	
A. Mindfulness	0.08	[-0.18, 0.35]	-0.05	[-0.32, 0.23]	-0.03	[-0.14, 0.46]	0.18	0.28	[0.01, 0.55]	.21*	-0.05	[-0.39, 0.28]	
B. Threat	-0.33	[-0.51, -0.15]	-0.34**	[0.46, 0.84]	.60***	0.44	[0.20, 0.68]	.36***	-0.26	[-0.46, -0.06]	-.25*	0.58	[0.33, 0.82]
A × B	-0.25	[-0.50, -0.01]	-0.19*	[0.13, 0.38]	.09	-0.13	[-0.46, 0.20]	-.08	-0.33	[-0.61, -0.05]	-.24*	0.04	[-0.29, 0.37]

Note. DV = dependent variable; 95% CI = 95% confidence interval; Lower, Upper: Threat = perceived rejection and exclusion during Cyberball, Positive Mood: Step 1 $R^2 = .13$, $F(2,87) = 6.38^{***}$, Step 2 $\Delta R^2 = .10$, $\Delta F(1,86) = 10.80^{***}$, Step 3 $\Delta R^2 = .04$, $\Delta F(1,85) = 4.11^*$, Negative Mood: Step 1 $R^2 = .04$, $F(2,87) = 1.73$, Step 2 $\Delta R^2 = .34$, $\Delta F(1,86) = 46.79^{***}$, Step 3 $\Delta R^2 = .01$, $\Delta F(1,85) = 0.98$, Anger: Step 1 $R^2 = .02$, $F(2,87) = 1.07$, Step 2 $\Delta R^2 = .14$, $\Delta F(1,86) = 13.96^{***}$, Step 3 $\Delta R^2 = .01$, $\Delta F(1,85) = 0.58$, Friendliness: Step 1 $R^2 = .08$, $F(2,87) = 3.57^*$, Step 2 $\Delta R^2 = .05$, $\Delta F(1,86) = 5.06^*$, Step 3 $\Delta R^2 = .05$, $\Delta F(1,85) = 5.63^*$, Unfriendliness: Step 1 $R^2 = .01$, $F(2,87) = 0.26$, Step 2 $\Delta R^2 = .20$, $\Delta F(1,86) = 22.23^{***}$, Step 3 $\Delta R^2 = .00$, $\Delta F(1,85) = 0.05$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Figure 2

The Association of Appraised Threat With Post-Cyberball Positive Mood at Low (-1 SD, $B = -.16$, $p < .05$) and High ($+1$ SD, $B = -.51$, $p < .001$) Levels of Mindfulness



Note. Pre-Cyberball positive mood was controlled and was set to the mean (3.98) for this illustration. B are the estimated effects of threat on positive mood at low and high levels of dispositional mindfulness.

In cross-sectional and longitudinal research, mindfulness has been found to have significant benefits for stress responding, well-being and positive feelings of relatedness (Barnes, et al., 2007; Berry et al., 2018; Brown & Ryan, 2003; Clear et al., 2020; Jones et al., 2019; Lucas-Thompson et al., 2019; Roeser & Pinela, 2014; Zimmer-Gembeck, 2020). These findings were partially supported in the current study; we found more positive and less negative mood, and less unfriendliness among participants higher in mindfulness prior to participation in the Cyberball task. While this was informative, we also expected individuals higher in dispositional mindfulness to appraise less threat to relatedness following social rejection and to maintain a more positive (or less negative) mood after social rejection. Surprisingly and in contrast to Hypothesis 1, individuals higher in dispositional mindfulness did not perceive less threat to relatedness from the Cyberball experience, relative to participants who reported a lower level of dispositional mindfulness. This suggests that the threat of rejection and exclusion is strong and immediate from even a short experience with it via Cyberball and, as has been found in previous research (Clear et al., 2020; Hartgerink et al., 2015), a trait level individual difference such as dispositional mindfulness is not sufficient to protect against the immediate emotional pain and negative feelings that can emerge from feeling rejected and excluded.

In support of SDT (Ryan & Deci, 2000, 2017; Skinner et al., 1998; Vansteenkiste, & Ryan, 2013), and consistent with previous research (Stillman et al., 2009; Troop-Gordon et al., 2015; Zimmer-Gembeck, 2016), the detrimental reports of mood and feelings toward others following a threat to the need for relatedness was pervasive in the current study. In general, there were quite negative reactions to Cyberball across all participants, although the results showed that participants who appraised the task as more threatening reported less positive and more negative mood, more anger, less friendliness and more unfriendliness toward others, and lower self-esteem and meaningful existence relative to the participants who perceived less threat. Overall, the negative impact of a heightened threat appraisal on feelings about the self and others is clear. In line with SDT and consistent with

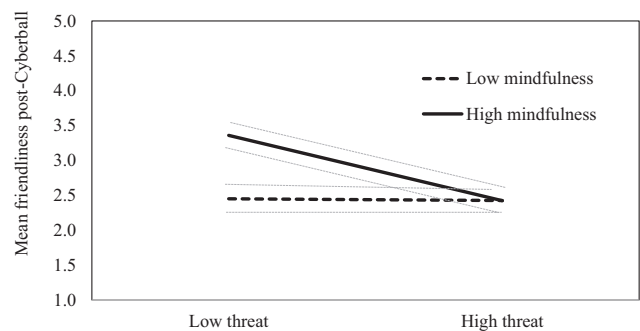
previous research, the underlying threat to the need for relatedness likely underpins the negative feelings about self and others reported by participants (Williams & Nida, 2011).

Beyond investigating the impact of perceived threat to relatedness on responses and reactivity to induced social rejection, our primary study aim was to examine the role of dispositional mindfulness. In particular, it was expected that mindfulness would dampen emotional reactions and speed of recovery from social rejection. Partially supporting this hypothesis, dispositional mindfulness was found to have one small benefit post-Cyberball (relative to pre-Cyberball); participants who reported higher dispositional mindfulness also reported more friendliness on the post-game measure. Further, interactions between mindfulness and relatedness threat revealed an additional impact of mindfulness. In both cases, there was *less* reactivity (i.e., less decline in positive mood and friendliness) among individuals who were both high in mindfulness and low in perceived threat. Although these effects were small, they do suggest that it is the combination of mindfulness and low perceived threat that is of most benefit for positivity immediately following social rejection. Given that mindfulness and threat appraisal were not significantly related in this study, future research might work to isolate what can account for low perception of threat apart from mindfulness. One possibility is rejection sensitivity. Some cross-sectional survey research has examined rejection sensitivity, finding that it is negatively associated with most subscales of the Five Facet Mindfulness Questionnaire (Hafner et al., 2019; Peters et al., 2016) and that mindfulness protects against the negative impact of rejection sensitivity on negative affect (Peters et al., 2016).

Theory and research evidence suggest individuals higher in dispositional mindfulness would not only report less negative reactivity to stress, but also should show better recovery after a stressful event due to enhanced self- or emotion-regulation (Brown et al., 2007; Hafner et al., 2019; Hambour et al., 2018; Lucas-Thompson et al., 2019; Martelli et al., 2018; Molet et al., 2013; Skinner & Zimmer-Gembeck, 2016). In other words, individuals higher in dispositional mindfulness should recover more quickly from their immediate negative responses to the Cyberball game before and

Figure 3

The Association of Threat With Post-Cyberball Friendliness at Low (-1 SD, $B = -.01$, $p = .947$) and High ($+1$ SD, $B = -.57$, $p < .001$) Level of Mindfulness



Note. Pre-Cyberball friendliness was controlled and was set to the mean (4.23) for this illustration. B are the estimated effects of threat on friendliness at low and high levels of dispositional mindfulness.

Table 3
Results of Regressing Mood and Friendliness at Recovery on Post-Cyberball (Cball) Mood, Mindfulness, Threat, and the Mindfulness × Threat Interaction (N = 90)

Independent variables	Positive mood			Negative mood			Anger			Friendly			Unfriendly		
	B [95% CI]	β		B [95% CI]	β		B [95% CI]	β		B [95% CI]	β		B [95% CI]	β	
Step 1															
DV, post-Cball	0.64 [0.50, 0.79]	.68***	0.42 [0.28, 0.55]	.52***	0.44 [0.30, 0.58]	.55***	0.47 [0.31, 0.63]	.53***	0.43 [0.27, 0.58]	.51***			0.43 [0.27, 0.58]	.51***	
A. Mindfulness	0.12 [-0.07, 0.30]	.10	-0.30 [-0.50, -0.11]	-.27***	-0.11 [-0.34, 0.12]	-.09	0.16 [-0.06, 0.38]	.13	-0.13 [-0.39, 0.13]	-.10			-0.13 [-0.39, 0.13]	-.10	
Step 2															
DV, post-Cball	0.63 [0.48, 0.79]	.67***	0.48 [0.32, 0.65]	.60***	0.48 [0.33, 0.63]	.61***	0.44 [0.27, 0.60]	.49***	0.42 [0.25, 0.60]	.50***			0.42 [0.25, 0.60]	.50***	
A. Mindfulness	0.12 [-0.07, 0.30]	.10	-0.31 [-0.50, -0.11]	-.26***	-0.12 [-0.34, 0.11]	-.09	0.15 [-0.07, 0.37]	.12	-0.13 [-0.39, 0.13]	-.09			-0.13 [-0.39, 0.13]	-.09	
B. Threat	-0.03 [-0.17, .12]	-.03	-0.13 [-0.30, 0.05]	-.14	-0.13 [-0.32, 0.05]	-.14	-0.15 [-0.31, 0.02]	-.16	0.01 [-0.21, 0.24]	.01			0.01 [-0.21, 0.24]	.01	
Step 3															
DV, post-Cball	0.66 [0.50, 0.82]	.70***	0.49 [0.32, 0.66]	.61***	0.47 [0.32, 0.62]	.59***	0.45 [0.28, 0.62]	.51***	0.42 [0.25, 0.60]	.50***			0.42 [0.25, 0.60]	.50***	
A. Mindfulness	0.10 [-0.08, 0.29]	.09	-0.30 [-0.50, -0.11]	-.26***	-0.10 [-0.33, 0.12]	-.08	0.14 [-0.08, 0.36]	.12	-0.12 [-0.39, 0.14]	-.09			-0.12 [-0.39, 0.14]	-.09	
B. Threat	-0.01 [-0.16, 0.14]	-.01	-0.13 [-0.31, 0.05]	-.15	-0.15 [-0.33, 0.04]	-.15	-0.13 [-0.30, 0.04]	-.15	0.00 [-0.22, 0.23]	.00			0.00 [-0.22, 0.23]	.00	
A × B	0.14 [-0.06, 0.33]	.11	-0.05 [-0.25, 0.15]	-.04	-0.20 [-0.43, 0.04]	-.15	0.09 [-0.14, 0.32]	.07	-0.13 [-0.39, 0.15]	-.09			-0.13 [-0.39, 0.15]	-.09	

Note. DV = dependent variable; 95% CI = 95% confidence interval; Lower, Upper; Threat = perceived rejection and exclusion during Cyberball. Positive Mood: Step 1 $R^2 = .50$, $F(2,87) = 44.19$ ***, Step 2 $\Delta R^2 = .00$, $\Delta F(1,86) = 0.13$, Step 3 $\Delta R^2 = .01$, $\Delta F(1,85) = 1.98$. Negative Mood: Step 1 $R^2 = .38$, $F(2,87) = 27.14$ ***, Step 2 $\Delta R^2 = .01$, $\Delta F(1,86) = 1.96$, Step 3 $\Delta R^2 = .00$, $\Delta F(1,85) = 0.25$. Anger: Step 1 $R^2 = .32$, $F(2,87) = 20.51$ ***, Step 2 $\Delta R^2 = .02$, $\Delta F(1,86) = 2.11$, Step 3 $\Delta R^2 = .02$, $\Delta F(1,85) = 2.85$. Friendliness: Step 1 $R^2 = .32$, $F(2,87) = 20.58$ ***, Step 2 $\Delta R^2 = .02$, $\Delta F(1,86) = 3.06$ *, Step 3 $\Delta R^2 = .01$, $\Delta F(1,85) = 0.60$. Unfriendliness: Step 1 $R^2 = .27$, $F(2,87) = 16.06$ ***, Step 2 $\Delta R^2 = .00$, $\Delta F(1,86) = 0.02$, Step 3 $\Delta R^2 = .01$, $\Delta F(1,85) = 0.85$.
 *** $p < .01$. ** $p < .05$. * $p < .10$.

Table 4
Results of Regressing Self-Esteem and Meaning at Recovery on Post-Cyberball (Cball) Self-Esteem and Meaning, Mindfulness, Threat, and the Mindfulness \times Threat Interaction (N = 90)

Independent variables	Self-esteem		Meaning	
	B [95% CI]	β	B [95% CI]	β
Step 1				
DV, post-Cball	0.76 [0.60, 0.92]	.72***	0.53 [0.31, 0.75]	.44***
A. Mindfulness	0.06 [-0.10, 0.22]	.06	0.27 [0.05, 0.48]	.23*
Step 2				
DV, post-Cball	0.73 [0.55, 0.91]	.69***	0.54 [0.26, 0.82]	.45***
A. Mindfulness	0.06 [-0.10, 0.22]	.06	0.27 [0.05, 0.48]	.23*
B. Threat	-0.05 [-0.19, 0.08]	-.06	0.01 [-0.19, 0.22]	.02
Step 3				
DV, post-Cball	0.73 [0.55, 0.92]	.70***	0.55 [0.27, 0.83]	.46***
A. Mindfulness	0.05 [-0.10, 0.21]	.05	0.26 [0.05, 0.48]	.23*
B. Threat	-0.04 [-0.18, 0.09]	-.06	0.02 [-0.18, 0.23]	.03
A \times B	0.05 [-0.11, 0.21]	.05	0.05 [-0.17, 0.27]	.04

Note. DV = dependent variable; 95% CI = 95% confidence interval; Lower, Upper; Threat = perceived rejection and exclusion during Cyberball. Self-esteem: Step 1 $R^2 = .54$, $F(2,87) = 50.29^{***}$, Step 2 $\Delta R^2 = .00$, $\Delta F(1,86) = 0.58$, Step 3 $\Delta R^2 = .00$, $\Delta F(1,85) = 0.41$. Meaning: Step 1 $R^2 = .27$, $F(2,87) = 15.68^{***}$, Step 2 $\Delta R^2 = .00$, $\Delta F(1,86) = 0.02$, Step 3 $\Delta R^2 = .00$, $\Delta F(1,85) = 0.20$.

* $p < .05$. *** $p < .001$.

after controlling for threat appraisal (Hypothesis 2). In partial support of this hypothesis, dispositional mindfulness was associated with better recovery on two measures - negative mood and meaning in life - when they were measured 3-min after Cyberball and analyzed relative to measures taken post-Cyberball. This finding was consistent with two previous Cyberball studies, the first where participants who completed an experimental mindfulness induction prior to playing the game showed improved recovery (Molet et al., 2013), and the second where participants who self-reported higher dispositional mindful awareness also retrospectively reported less distress during Cyberball (Martelli et al., 2018). However, there was no support for mindfulness as a buffer against the negative impact of greater threat appraisal, given that there were no significant dispositional Mindfulness \times Threat to relatedness interactions. Thus, mindfulness was promotive of recovery but not protective against negative reactions to the threat of rejection and exclusion.

Only a subset of measures designed to assess reactivity and recovery from social rejection were associated with mindfulness. It is unclear why these findings were intermittent rather than consistent. One potential explanation is the age of participants in the current study. Social rejection may be particularly difficult to adjust to in the age group included here, reducing the possibility that mindfulness would be consistently promotive of less negative responses and better recovery. Research has found that Cyberball negatively affects adolescents and emerging adults more than it does young adults (Pharo et al., 2011). This has been considered as an indication of the greater social affiliation behaviors found among many adolescents and emerging adults, and a reflection of the increased importance on, and sensitivity to, stress in social relationships at this time of life (Romeo, 2013; Somerville, 2013; Zimmer-Gembeck, 2016). Despite this, however, we did control for threat appraisal, making it unlikely that heightened salience of social rejection accounts for the current findings, and we found no associations of age with any responses.

Another possible explanation is the advanced cognitive and emotional regulation capacities needed for enacting mindfulness-related coping actions quickly and competently. Such advanced skills may not be developed and/or easily accessible to teenagers, perhaps especially when they are overwhelmed with the "hot" negative feelings that come with social rejection (Reyna & Farley, 2006). In a review on the development of coping skills and emotion regulation capacity, skills in using advanced cognitive coping skills were still developing into the early 20s (Skinner & Zimmer-Gembeck, 2016). Theories and studies of brain development (Casey et al., 2019) and other research and reviews (Cohen et al., 2016; Rudolph et al., 2017; Zarrett & Eccles, 2006) support this same conclusion showing that advances in cognitive and emotional development may still continue into the early 20s or beyond. Mindfulness has been described as a metacognitive skill, and metacognition is not believed to be fully formed until at least the second decade of life (i.e., until the late teens or early 20's; Bishop et al., 2004; Friedel et al., 2015; Kuhn, 2000). Also, just like risk perceptions and decision-making, events that bring about intense emotions may interfere with regulatory abilities, like mindfulness and emotion regulation (Reyna & Farley, 2006). It is likely these advanced abilities, and the capacity to enact these skills in stressful situations, develops throughout adolescence and into emerging adulthood when young people become more self-reliant and gain a greater understanding of emotion and the control/regulation of emotions, and their coping strategies become more self-generated, sophisticated and differentiated (Ciesla et al., 2012; Davidson & Kaszniak, 2015; Trowbridge & Lawson, 2016; Zimmer-Gembeck & Skinner, 2011).

Despite some promising findings that mindfulness is a resource for maintaining more positivity and better recovery from social rejection, five limitations of the present study should be acknowledged. First, the participants were university students and included more young women than young men, so the generalizability of findings may be limited. Yet, the participants were purposely selected to range widely in self-reported mindfulness. Second, any

type of social acknowledgement after playing Cyberball has been found to decrease the sting of the experience (Rudert et al., 2017). Although researchers were informed and trained to minimize personal interactions during the task, a confederate did enter the room and talk with each participant to administer the 3-minute recovery survey. Third, we did not ask participants if they were suspicious about the purpose of the study, but did not anticipate they would guess the purpose given the lag between completing the measure of dispositional mindfulness and recruitment for the Cyberball task. Yet, this meant we could not examine the possible impact of participants' identification of the study aims on the study results.

A fourth limitation was the reliance on self-report. Future research might add observations of emotional displays to assess mood and friendliness or consider the use of implicit mood measures. One option might be to use the Linguistic Inquiry Word Count Program (LIWC; Pennebaker et al., 2007) whereby participants could describe their experiences of Cyberball and positive emotion, negative emotion, and other responses could be captured.

Fifth, dispositional mindfulness was the focus here, rather than other methods that have been used to investigate the role of mindfulness in stress responding, such as 1) using a manipulation that encouraged or taught the use of mindfulness skills (e.g., Molet et al., 2013) or 2) directly gathering reports of nonjudgement and other markers of mindfulness during and after the Cyberball task. Thus, these findings are most relevant for conclusions about how a self-reported trait of mindfulness is associated with emotional responses to social exclusion by similar strangers.

In conclusion, a key finding was that dispositional mindfulness promotes more positive emotions and views of others, and it seems to reduce negative reactions and promote better recovery of positivity following social rejection. Also, appraisal of threat from the experience of social rejection has strong associations with mood, feelings about others, self-esteem and feelings of meaning in life. Yet, a combination of high dispositional mindfulness and low appraisal of threat from rejection was associated with additional mitigation of negative reactions to social rejection. It would be productive for future research to expand this study to consider factors that can explain variation in the perception of the threat from rejection, given that it was not associated with mindfulness in this study. Individual characteristics or responses to stress, such as rejection sensitivity or social anxiety could be risk factors (Gardner & Zimmer-Gembeck, 2018; Rudolph & Zimmer-Gembeck, 2014). It might also be worthwhile considering attributions for the cause of rejection, given that evidence shows that blaming others when excluded or rejected can maintain more positive feelings, both generally and specifically with regards to the self (Bourgeois & Leary, 2001).

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