Emotion

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Looking Beyond the Means and Into Momentary Context: Associations Between Momentary Affect and Emotion Regulation Strategy Use in Major Depressive Disorder

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People with major depressive disorder (MDD) experience difficulties in emotion regulation (ER). Most ER research has examined overall strategy use using global self-reports in MDD, but this approach does not capture people's ER strategy use in daily life in the context of continuously changing ER demands, such as momentary affect. Taking a naturalistic approach, we investigated whether the associations between the use of six ER strategies (social sharing, acceptance, savoring, reappraisal, expressive suppression, and distraction) and momentary affect differed by MDD status. Data collection took place between 2017 and 2019. Adults with MDD and a healthy control group ($N = 135$) completed 2 weeks of experience sampling (five surveys a day), in which they reported on their momentary negative affect, positive affect (PA), and the extent to which they used the six ER strategies. Analyses were conducted using multilevel modeling. Both momentary negative affect and PA were associated with use of most ER strategies. MDD status did not moderate the association between negative affect and any strategy but significantly moderated the association between PA and two strategies. Specifically, PA was positively associated with the use of reappraisal and distraction for those with MDD only (associations were nonsignificant for healthy controls). Findings suggest that ER difficulties in MDD may be partially attributed to overusing certain strategies or ineffectiveness in using certain strategies during ER episodes. It is important for future research to clarify the directionality of these findings.

Keywords: emotion regulation, momentary affect, depression, strategies, ecological momentary assessment

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Every day, people use a variety of strategies to regulate their emotions in the context of various factors, such as where someone is, who they are with, what they want to achieve, and how they feel (Gross, 2015). Emotion regulation (ER) is associated with well-being and is implicated in various forms of psychopathology, including major depressive disorder (MDD; Aldao et al., 2010; Gross & John, 2003; Hofmann, 2014). Extensive research has been conducted to elucidate ER difficulties in MDD, with most research focused on the overall use of various ER strategies in MDD assessed via global self-report measures (e.g., Joormann & Stanton, 2016; Liu & Thompson, 2017). However, in daily life, people's strategy use differs based on continuously changing cues that signal ER demands (i.e., the need to regulate), including one's situational context or internal states (English et al., 2017; Springstein & English, 2023). To fully understand where ER goes awry in MDD, it is important to clarify how people with MDD use various ER strategies based on these constantly evolving cues in daily life. Using ecological momentary assessment (EMA), the current research examined how ER strategy use varies based on one important ER-relevant cue—one's affective state. Specifically, we examined how associations

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This study was not preregistered. Data and analysis code can be found at https://osf.io/9e8zf. The results reported in this article have not been previously published or preposted online. The current research was approved by the Washington University Institutional Review Board (201709046). The authors have no conflicts of interest to disclose. This research was supported by the Spencer T. and Ann W. Olin Fellowship, Washington University in St. Louis, awarded to Daphne Y. Liu.

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between ER strategy use and one's momentary affect—the intensity of negative affect (NA) and positive affect (PA) one is feeling in the moment—differed among adults with either current MDD or no history of psychopathology (i.e., healthy controls).

People with MDD have difficulties selecting ER strategies (e.g., Liu & Thompson, 2017). Compared to healthy controls, those with MDD demonstrate greater use of strategies typically associated with negative outcomes (e.g., rumination, distraction) and reduced use of strategies typically associated with positive outcomes (e.g., reappraisal, acceptance; Aldao et al., 2010; Liu & Thompson, 2017). Depression is also associated with using less positive rumination and more dampening on average (Vanderlind et al., 2022). To date, much of this work on ER strategy use in MDD has utilized global self-report measures, through which participants report on how much they generally use different ER strategies (Liu & Thompson, 2017). Although helpful and often well-validated, these measures (a) may not accurately reflect one's daily ER strategy use (Koval et al., 2023), (b) can be subject to negative recall biases in those with MDD (Gotlib & Joormann, 2010), and (c) are unable to capture momentary context.

Growing evidence suggests that depressive psychopathology may be associated with reduced ER flexibility, which refers to one's abilities to tailor ER behaviors to momentary contexts and is considered to be a generally adaptive skill (Aldao et al., 2015; Bonanno & Burton, 2013). Specifically, people with higher (vs. lower) depressive symptoms are found to have a lower ability to evaluate contextual demands for ER and determine the most appropriate ER strategy in response (S. Chen & Bonanno, 2021). As such, those with MDD may be less attuned to momentary ER demands in daily life and vary their strategy use based on ER-relevant cues to a lesser extent than healthy controls.

The ways that people feel in the moment not only signal the need to regulate, but call for flexible ER strategy use (Dixon-Gordon et al., 2015; Mueller et al., 2024). More intense emotions may signal the need to use different strategies or levels of regulatory effort compared to less intense emotions. In fact, a number of studies suggest people's ER strategy use varies based on momentary affect in laboratory and naturalistic settings, with most evidence focused on NA (Boemo et al., 2022; Sheppes et al., 2011). For example, when asked to use reappraisal or distraction in response to negative emotional stimuli in the lab, people were more likely to use reappraisal in response to low-intensity stimuli and more likely to use distraction in response to high-intensity stimuli, highlighting that strategy use varies across affect intensity (Sheppes et al., 2011). This modulation of strategy choice may serve an adaptive function, as engaging with highly intense emotions may be overwhelming, and employing disengagement strategies, at least temporarily, may be less emotionally taxing in these cases (Sheppes et al., 2011).

Daily diary studies have also uncovered links between ER strategy use and affect in daily life. At the daily level, NA has been positively associated with rumination, suppression, worry, and avoidance (Boemo et al., 2022; Doorley & Kashdan, 2021; Nelson & Bergeman, 2021). EMA studies have found that NA is contemporaneously associated with the extent to which people used some ER strategies. For instance, momentary NA has been associated with using more suppression, worry, and rumination (Boemo et al., 2022; Houben et al., 2024). Of note, there have been mixed findings with regard to the direction and strength of associations between momentary NA and use of ER strategies (e.g., avoidance, distraction, reappraisal, acceptance), likely due to methodological differences in the measurement of affect (e.g., assessing discrete negative emotions vs. general NA; Boemo et al., 2022). Nonetheless, findings generally suggest that people vary their strategy use based on the intensity of their NA in daily life.

Both MDD and depressive symptomatology are associated with difficulty identifying and differentiating experienced emotions (Honkalampi et al., 2001; Thompson et al., 2015). If people with MDD cannot accurately perceive their affective intensity—an ER-relevant contextual demand—they may struggle more than healthy controls with selecting an effective strategy that is appropriate for the context. Additionally, research has linked depressive symptoms and depressed mood to a reduced tendency to discontinue using an ineffective ER strategy and switch to another strategy that may be more effective (M. S. Chen et al., 2024; S. Chen & Bonanno, 2021). Therefore, even when those with MDD accurately perceive their momentary affect, they may be more likely to get "stuck" using the same strategies they typically use. Thus, ER strategy use among those with MDD may be less tied to their momentary NA intensity due to less flexibility in updating ER strategies. As such, the degree to which those with MDD vary their ER strategy use based on their momentary NA may be weaker compared to that of healthy controls.

In contrast to research examining how those with MDD regulate in the context of NA, there is a dearth of investigations on ER strategy use in the context of PA (Boemo et al., 2022). At the daily level, PA has been significantly positively associated with use of acceptance, reappraisal, and problem solving and has not been significantly associated with use of suppression (Boemo et al., 2022). However, most daily diary and EMA research on PA and ER strategy use has only examined a handful of strategies or has investigated changes in ER behaviors (e.g., strategy choice) as they relate to stressor and event intensity, rather than affect intensity (Blanke et al., 2022; Quoidbach et al., 2010). One study examined the moderating role of depression in associations between momentary PA and ER strategy use, finding that depressive symptoms did not moderate associations between the use of ER strategies and PA (Vanderlind et al., 2022). However, this study used a subclinical sample and focused specifically on positive rumination and dampening. Thus, there is a critical need for a basic understanding of the link between ER strategy use and PA intensity in those with MDD, especially in the context of a wider range of strategies. It may be the case that, similar to NA, the use of ER strategies varies as a function of momentary PA intensity, but the association is generally weaker for those with MDD compared to healthy controls due to their reduced ability to identify emotions and select context-appropriate ER strategies. On the other hand, existing evidence on ER in the context of PA suggests a different lens of conceptualizing how PA intensity may be associated with strategy use in MDD. Specifically, people with MDD display unique patterns of ER in response to PA, often dampening their PA (Millgram et al., 2023; Werner-Seidler et al., 2013). Additionally, MDD is associated with infrequent upregulation of PA (Vanderlind et al., 2020) and trouble holding positive affective experiences in working memory (Vardi et al., 2024).

Regarding strategy use, individuals with MDD are more likely than those with no MDD to choose distraction versus positive rumination (e.g., reminiscing, basking, savoring; Martin & Tesser, 1996) when regulating PA in laboratory settings and daily life (Millgram et al., 2023), perhaps due to discomfort with highly intense PA or perceptions that positive rumination constitutes

bragging (Vanderlind et al., 2020; Yoon & Rottenberg, 2020; but see also Liu et al., 2023). Thus, people with MDD may be more inclined to use strategies to disengage from PA when it is highly intense compared to healthy controls. This line of research would suggest that people with MDD would show a greater tendency to disengage from PA (e.g., use expressive suppression or distraction) and a lower tendency to engage with PA (e.g., use savoring) at higher (vs. lower) levels of PA compared to healthy controls.

The Present Study

The present study took a naturalistic approach to investigate how ER strategy use is associated with varying levels of momentary affect intensity for individuals with and without current MDD in daily life. We expand upon the existing literature that has used EMA to clarify ER and affect in daily life in clinical populations, such as those with posttraumatic stress disorder (Short et al., 2018), anorexia nervosa (Wayda-Zalewska et al., 2022), obsessive–compulsive disorder (Bischof et al., 2024), self-injurious thoughts and behaviors (Kleiman et al., 2018), and borderline personality disorder (Houben et al., 2024). As many current EMA studies focus on links between ER and affective valence as opposed to intensity or specifically on PA (Boemo et al., 2022; Vanderlind et al., 2022), we aimed to build a basic understanding of how those with and without MDD regulate their emotions in the context of different intensities of NA and PA. We focused on six commonly used ER strategies: social sharing, acceptance, savoring, reappraisal, expressive suppression, and distraction. We aimed to examine the extent to which MDD status moderated the association between the use of these six ER strategies and the intensity of momentary NA (Aim 1) and momentary PA (Aim 2). We expected that the associations between ER strategy use and affect would differ based on people's MDD status. For NA, we expected a generally weaker association between the use of each strategy and NA intensity for people with current MDD compared to healthy controls. However, for PA, we did not put forth an a priori hypothesis about whether MDD would weaken or strengthen the association between strategy use and PA intensity for reasons discussed above.

Method

Participants

Study participants were recruited via online advertisements and a volunteer registry as part of a larger study on affect and depression. Upon expressing interest in the study, individuals completed a phone screen conducted by study staff and undergraduate research assistants who asked about demographic information and MDD symptoms. Those who endorsed symptoms of a clinical or control group were invited to complete a presession online survey. The sample included in the present research was 135 adults (63% women, 37% men; $M_{age} = 44.2$ years, $SD_{age} = 16.0$ years, age range = 18–77) who had current MDD ($n = 48$) or were healthy controls ($n = 87$). Participants reported the following racial categories: 4.4% Asian, 20.0% Black, 0.7% American Indian or Alaskan Native, 68.1% White, and 6.7% multiracial or other race. Participants in the MDD group were currently experiencing a major depressive episode as part of either MDD or persistent depressive disorder. Healthy controls had no past or current depressive or anxiety disorders. We also recruited people with remitted MDD, but the data were not analyzed to limit the number of group comparisons and to keep the scope focused on current MDD.[1] Individuals were excluded from the study if they were not fluent in English, if they had severe hearing or vision loss, if they did not meet criteria for one of the three groups, if they had current bipolar I or II disorder, or if they had any history of psychotic symptoms. The diagnostic group was assessed by advanced clinical psychology doctoral students using relevant modules of the *Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (First et al., 2015). Interrater reliability was perfect ($\kappa = 1.0$).

Procedure

For their first in-person laboratory session, participants provided informed consent, completed self-report measures, and were assessed by a trained clinical psychology graduate student using relevant modules of the *Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders*, fifth edition, specifically A: Mood Episodes, Cyclothymic Disorder, and Persistent Depressive Disorder; B: Psychotic and Associated Symptoms; and F: Anxiety Disorders (assessing generalized anxiety disorder, social anxiety disorder, panic disorder, and agoraphobia). Following the interview, participants who met criteria for one of the diagnostic groups completed a semistructured EMA tutorial (approximately 30 min). Tutorials were led by undergraduate research assistants and included a practice survey. The next day, participants began the EMA protocol in which they completed up to five surveys per day for 2 weeks on their mobile device using the iOS mobile application Status/Post, designed by Christopher Metts. Participants chose a 15-hr window in which surveys arrived semirandomly within five 3-hr blocks of time (mean time between surveys = 3 hr, 0 min, and 18 s; SD = 1 hr, 1 min, and 35 s). Participants received 70 surveys over the course of the 2 weeks. For each survey, participants had 15 min to start the survey before it expired and data were coded as missing, and they were presented with two reminder tones. A total of 11,191 surveys were collected with an average completion rate of 74.8% ($SD = 18.3\%$). The EMA compliance rate did not significantly vary by group. Data collection took place between 2017 and 2019, and all study procedures were approved by the Washington University in St. Louis institutional review board.

EMA Measures

Current Affect

In each EMA survey, participants were asked to report on their *current* negative and positive emotions in response to the statement "I felt [emotion] at the time of the beep." Six negative (boredom, sluggishness, sadness, frustration, nervousness, anger) and six positive (happiness, relaxation, contentment, calmness, excitedness, enthusiasm) emotions were presented in random order at each survey. We selected both low- and high-arousal emotions from the affective

[1] Nonetheless, we repeated our analyses with the remitted MDD group to test whether any differences found between the current MDD group and healthy controls were specific to being in a current episode of depression. See Supplemental Section 2 and Supplemental Table S3 for a summary of findings involving the remitted MDD group.

circumplex (Barrett & Russell, 1999) in a way that is similar to prior work (e.g., Selby et al., 2014). Participants responded using a 5-point Likert scale from 0 (*not at all*) to 4 (*extremely*). For each survey, composite scores for momentary NA and PA intensity were obtained by averaging items for NA and PA, respectively. Internal consistency for NA ($NA\omega_{within} = .63$, $NA\omega_{between} = .89$) and PA ($PA\omega_{within} = .82$, $PA\omega_{between} = .92$) ranged from acceptable to excellent.

Current ER Engagement and Strategy Use

ER engagement was assessed in each EMA survey via two questions asking participants whether and how they were trying to influence their NA (or PA): "At the time of the beep, how were you trying to influence your NEGATIVE (POSITIVE) emotions?" For each question, participants could choose from the following: "increase them," "decrease them," "maintain them," and "I was not trying to influence them." Participants were considered to be engaging in ER of NA (or PA) if they indicated they were increasing, decreasing, or maintaining NA (or PA). They were considered to be engaging in ER of any emotion if they were engaging in ER of NA and/or PA, in which case they would then report their use of ER strategies.

To assess use of ER strategies, participants responded to six items asking about how they influenced their emotions "at the time of the beep." Using a 5-point Likert scale (0 = *not at all*, 4 = *extremely*), participants indicated the extent to which they used the following six strategies: "I shared feelings with others" (social sharing), "I accepted the situation" (acceptance), "I savored the moment" (savoring), "I thought about the situation differently" (reappraisal), "I kept emotions to myself" (expressive suppression), and "I distracted myself" (distraction). These items were selected based on prior work assessing everyday ER strategy use with EMA (e.g., Brans et al., 2013; Heiy & Cheavens, 2014).

Analytic Plan

We conducted multilevel modeling with surveys (Level 1) nested within participants (Level 2), using R statistical software (Version 4.4.2; R Core Team, 2023). To aid in understanding our findings, we first examined descriptive data of intensity of affect, frequency of regulating emotion, and use of the six ER strategies aggregated across all EMA surveys among people with MDD and healthy controls. To test our main research questions of whether MDD status moderated the association between strategy use and momentary affect, we ran separate multilevel linear regression models for each of the six ER strategies (six models total). For these analyses, we used the lmer() function from the *lme4* package (Bates et al., 2015). We used the default estimator (i.e., restricted maximum likelihood) and approach to handling missing data (i.e., listwise deletion). We also loaded the *lmerTest* package in R, which allowed us to additionally obtain *p* values from the summary tables of the lmer models (Kuznetsova et al., 2017). For each model, we entered predictors in two steps. We first regressed momentary strategy use (Level 1) on momentary NA (Level 1) and momentary PA (Level 1), with the MDD status variable added as a covariate (Level 2), which provided the associations between use of each strategy and momentary affect (NA and PA) across groups. As a second step, we added the interactions between group and momentary affect (NA and PA), which allowed us to test how the associations between use of each strategy and momentary NA (Aim 1) and PA (Aim 2) varied by MDD status. To achieve accurate statistical inference for cross-level interactions, we modeled random slopes of momentary NA and PA as recommended by Heisig and Schaeffer (2019). Survey number was included in all models as a covariate to account for the temporal trend of strategy use. The full model for each strategy is presented as Equations 1 and 2, with γ_{11} and γ_{21} being of interest to Aim 1 and Aim 2, respectively.

Level 1 model:

$$\begin{aligned}\text{Strategy Use}_{ij} = {} & \beta_{0j} + \beta_{1j}\text{Momentary NA intensity} \\ & + \beta_{2j}\text{Momentary PA intensity} \\ & + \beta_{3j}\text{Survey number} + r_{ij}.\end{aligned} \tag{1}$$

Level 2 model:

$$\begin{aligned}\beta_{0j} &= \gamma_{00} + \gamma_{01}\text{Group} + u_{0j} \\ \beta_{1j} &= \gamma_{10} + \gamma_{11}\text{Group} + u_{1j} \\ \beta_{2j} &= \gamma_{20} + \gamma_{21}\text{Group} + u_{2j} \\ \beta_{3j} &= \gamma_{30} + \gamma_{31}\text{Group}.\end{aligned} \tag{2}$$

In all models, both NA and PA were simultaneously entered in each model so that results for one (e.g., PA) controlled for the other (e.g., NA). Additionally, momentary NA and PA variables were person-mean-centered; specifically, for each person, we subtracted the person's mean NA (or PA) from each of their momentary NA (or PA) ratings. We person-mean-centered momentary NA (or PA) so that their values represented how much NA or PA one experienced relative to their usual level and thus reflected pure within-person variations with between-person variations partialled out.

Transparency and Openness

The current research was a secondary analysis and was not preregistered. There was no a priori power analysis conducted for the current research questions. Our Level 1 sample size depended on participants' compliance rate, as well as on participants' survey responses, as the display of ER strategy questions was contingent on participants endorsing engaging in ER, which was a question presented prior to the ER strategy questions. Consistent with existing recommendations (Hoenig & Heisey, 2001; Levine & Ensom, 2001; O'Keefe, 2007), we did not conduct a *post hoc* power analysis but instead provide 95% confidence intervals of all effect sizes of interest to provide readers with a plausible range of population effect sizes. Based on evaluating our data, our empirical Level 1 sample size was on average 17.3 surveys per participant (see Descriptive Analyses below for more details). To inform the planning of future research that aims to test group differences in the associations between momentary affect and ER strategy use, we conducted power analyses using the Shiny app *PowerAnalysisIL* (Lafit et al., 2021), via the R statistical software (Version 4.4.2; R Core Team, 2023) and its *shiny* package (Chang et al., 2019). We focused our power analyses on the cross-level interactions examining differences in the associations between affect and strategy use between the MDD and healthy control groups, considering the very limited research in this area and the notorious difficulty of achieving adequate power for detecting cross-level interactions in multilevel modeling (Mathieu et al., 2012). We conducted power analyses for three of the interactions we examined. See Supplemental Section 1 for detailed procedures and

findings of these analyses. Our data and analysis code can be found at https://osf.io/9e8zf. Data exclusions are described under the "Participants" subsection.

Results

Descriptive Analyses

We first present descriptive findings of overall levels of affect, ER frequency, and ER strategy use across all EMA surveys by group. We include them to help with interpreting the findings but note that these have been reported elsewhere (Liu et al., 2023; Thompson et al., 2021). People with MDD ($M = 0.73$, $SD = 0.41$) had significantly higher NA than healthy controls ($M = 0.34$, $SD = 0.35$; $b = 0.40$, $SE = 0.07$, $p < .001$). Those with MDD ($M = 1.16$, $SD = 0.62$) also reported significantly lower PA than healthy controls ($M = 1.61$, $SD = 0.60$; $b = -0.46$, $SE = 0.11$, $p < .001$; Thompson et al., 2021).

Participants on average reported regulating emotion in 33.5% ($SD = 0.27$, range: 0–1) of all EMA completed surveys. Those with MDD ($M = 0.40$, $SD = 0.27$) regulated emotion more frequently than healthy controls ($M = 0.30$, $SD = 0.27$; $b = 0.69$, $SE = 0.31$, $p = .03$), which was the case for both NA and PA (Liu et al., 2023). Four participants (two MDD and two healthy control participants) did not report any ER episodes during the EMA period and were excluded from the main analyses. The remaining participants (46 MDD and 85 healthy control) reported a total of 2,260 ER episodes (i.e., 17.3 ER episodes per person on average). The two groups significantly differed in use of one of the six ER strategies assessed during ER episodes. People with MDD ($M = 1.34$, $SD = 0.60$) showed significantly more overall use of distraction than healthy controls ($M = 0.95$, $SD = 0.79$; Liu et al., 2023) when regulating emotion.

Main Analyses

Results of the main analyses are summarized in Table 1. As the first step, we examined how people's use of ER strategies varied as a function of their momentary NA and PA (see Table 2, Panel A for full results). Participants' use of most strategies varied as a function of their momentary affect during ER episodes. Greater momentary NA was associated with more use of social sharing, reappraisal, and distraction; was associated with lower use of savoring; and was not related to the use of acceptance and expressive suppression. Greater momentary PA was associated with more use of social sharing, acceptance, savoring, and reappraisal but was not associated with the use of expressive suppression and distraction.

We then examined how the associations between momentary affect and strategy use during ER episodes varied by MDD status (Aims 1 and 2; see Table 2, Panel B for full results). Contrary to what we hypothesized, group status did not moderate the association between momentary NA and any of the six strategies (Figure 1). In contrast, MDD status moderated the associations between momentary PA and the use of two of the six strategies: reappraisal and distraction (Figure 2). Simple slope analyses revealed that for reappraisal (Figure 2D) and distraction (Figure 2F), higher momentary PA was associated with greater use of reappraisal and distraction for those with current MDD, but momentary PA was not associated with the use of reappraisal or distraction among healthy controls.

Follow-Up Analyses

Group Differences in Strategy Use at Lower and Higher Than Usual PA

To aid in the interpretation of the stronger associations between momentary PA and the use of reappraisal and distraction in the MDD (vs. healthy control) group, we further examined whether the two groups showed significantly different levels in using these strategies at varying levels of person-mean-centered momentary PA defined by its *SD* (i.e., 0.69): when momentary PA is much lower than usual (i.e., −2 *SD*), lower than usual (i.e., −1 *SD*), at one's average level, higher than usual (i.e., +1 *SD*), and much higher than usual (i.e., +2 *SD*; see Figure 2). We used the emtrends() function from the *emmeans* package to accomplish this (Lenth et al., 2025).

Table 1
Summary of Patterns of Main Findings

ER strategy use (outcome)	Step 1 (main effect of momentary affect) Association of momentary NA and PA with strategy use during ER episode	Step 2 (interaction between momentary affect and group) Does the association between momentary NA and strategy use vary by group?	Step 2 (interaction between momentary affect and group) Does the association between momentary PA and strategy use vary by group?
Social sharing	↑NA ↑sharing ↑PA ↑sharing	No	No
Acceptance	NA: not related ↑PA ↑acceptance	No	No
Savoring	↑NA ↓savoring ↑PA ↑savoring	No	No
Reappraisal	↑NA ↑reappraisal ↑PA ↑reappraisal	No	Yes, significant positive association for the MDD group, nonsignificant association for controls
Expressive suppression	NA: not related PA: not related	No	No
Distraction	↑NA ↑distraction PA: not related	No	Yes, significant positive association for the MDD group, nonsignificant association for controls

Note. This table provides a summary of the main findings of this study. ER = emotion regulation; NA = momentary negative affect (person-mean-centered); PA = momentary positive affect (person-mean-centered); MDD = major depressive disorder.

Table 2

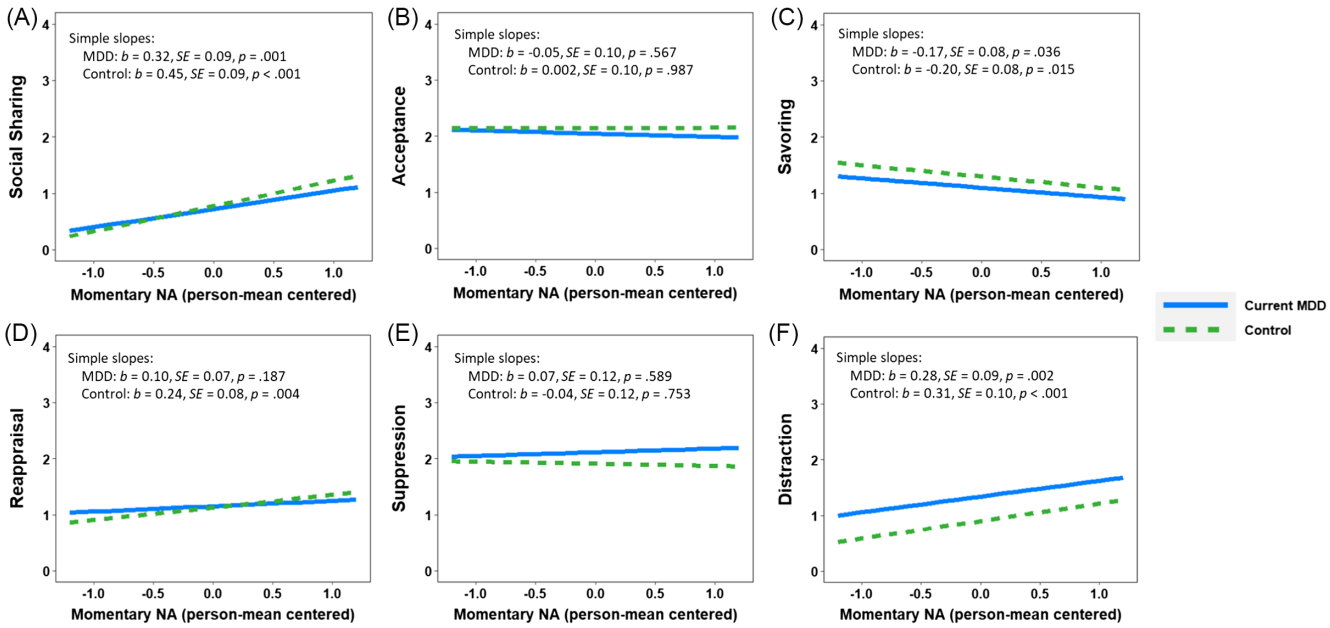
Associations Between Momentary Affect and ER Strategy Use Across and by Group

	Social sharing		Acceptance		Savoring		Reappraisal		Expressive suppression		Distraction	
	Pseudo R^2 [95% CIs]		Pseudo R^2 [95% CIs]		Pseudo R^2 [95% CIs]		Pseudo R^2 [95% CIs]		Pseudo R^2 [95% CIs]		Pseudo R^2 [95% CIs]	
Predictor	*b* (*SE*)	*p*	*b* (*SE*)	*p*	*b* (*SE*)	*p*	*b* (*SE*)	*p*	*b* (*SE*)	*p*	*b* (*SE*)	*p*
Panel A: Associations between ER strategies and NA across groups												
Intercept	0.62 (0.08)	**<.001**	2.43 (0.09)	**<.001**	1.37 (0.09)	**<.001**	1.10 (0.08)	**<.001**	2.06 (0.09)	**<.001**	0.88 (0.09)	**<.001**
Time	0.004 (0.001)	**<.001**	−0.01 (0.001)	**<.001**	−0.002 (0.001)	**.030**	0.002 (0.001)	.050	−0.005 (0.001)	**<.001**	0.002 (0.001)	**.137**
NA	0.38 (0.07)	**<.001**	−0.03 (0.07)	.678	−0.18 (0.06)	**.002**	0.16 (0.05)	**.004**	0.01 (0.06)	.871	0.30 (0.06)	**<.001**
	.031 [.018, .047]		.000 [.000, .003]		.009 [.003, .018]		.006 [.001, .015]		.000 [.000, .003]		.019 [.009, .032]	
PA	0.21 (0.05)	**<.001**	0.45 (0.04)	**<.001**	0.82 (0.05)	**<.001**	0.14 (0.05)	**.002**	−0.03 (0.06)	.627	0.08 (0.04)	.056
	.018 [.009, .031]		.093 [.071, .117]		.269 [.239, .300]		.010 [.003, .021]		.000 [.000, .003]		.003 [.000, .009]	
Group	−0.03 (0.11)	.812	−0.12 (0.14)	.405	−0.20 (0.13)	.121	−0.08 (0.12)	.507	0.24 (0.14)	.104	0.35 (0.13)	**.007**
Panel B: Associations between ER strategies and NA by group												
Intercept	0.63 (0.08)	**<.001**	2.42 (0.09)	**<.001**	1.37 (0.09)	**<.001**	1.06 (0.09)	**<.001**	2.07 (0.10)	**<.001**	0.84 (0.09)	**<.001**
Time	0.004 (0.001)	**<.001**	−0.01 (0.001)	**<.001**	−0.002 (0.001)	**.030**	0.002 (0.001)	.060	−0.005 (0.001)	**<.001**	0.002 (0.001)	.142
NA	0.45 (0.09)	**<.001**	0.002 (0.10)	.987	−0.20 (0.08)	**.015**	0.22 (0.08)	**.004**	−0.04 (0.12)	.753	0.31 (0.09)	**<.001**
PA	0.24 (0.07)	**<.001**	0.41 (0.06)	**<.001**	0.80 (0.06)	**<.001**	0.07 (0.06)	.256	−0.05 (0.08)	.53	−0.01 (0.05)	.863
Group	−0.05 (0.12)	.659	−0.10 (0.14)	.477	−0.20 (0.14)	.162	0.02 (0.13)	.859	0.20 (0.16)	.193	0.44 (0.13)	**.001**
NA × Group	−0.13 (0.13)	.343	−0.06 (0.14)	.677	0.03 (0.11)	.782	−0.13 (0.10)	.220	0.10 (0.17)	.545	−0.03 (0.12)	.82
	.001 [.000, .005]		.000 [.000, .003]		.000 [.000, .003]		.001 [.000, .006]		.000 [.000, .004]		.000 [.000, .003]	
PA × Group	−0.09 (0.10)	.382	0.11 (0.09)	.196	0.05 (0.10)	.641	0.19 (0.09)	**.035**	0.04 (0.12)	.71	0.21 (0.08)	**.011**
	.001 [.000, .005]		.002 [.000, .007]		.000 [.000, .004]		.005 [.001, .012]		.000 [.000, .003]		.005 [.001, .012]	

Note. Panel A shows results of analyses examining main effects of momentary affect and group predicting momentary strategy use; Panel B shows results of the interaction between momentary affect and group in predicting momentary strategy use. Significant *p* values ($p < .05$) are presented in bold. The effect sizes (pseudo R^2) and their 95% CIs of effects of interest are presented in this table. ER = emotion regulation; *SE* = standard error; CIs = confidence intervals; Time = survey number (ranging from 1 to 70); NA = momentary negative affect (person-mean-centered); PA = momentary positive affect (person-mean-centered); Group = whether the participant belonged to the current major depressive disorder group (coded as 1) or the healthy control group (coded as 0).

Figure 1

Associations Between Momentary (NA) and ER Strategies by Group



Note. This figure shows the associations between person-mean-centered momentary NA and the use of six ER strategies (while holding momentary PA at person-mean levels) when participants were regulating emotion. The association did not significantly differ by group for any of the six strategies assessed, including (A) social sharing, (B) acceptance, (C) savoring, (D) reappraisal, (E) expressive suppression, and (F) distraction. PA = positive affect; NA = negative affect; ER = emotion regulation; MDD = major depressive disorder; *SE* = standard error. See the online article for the color version of this figure.

For reappraisal, the MDD group and healthy control groups did not significantly differ in the extent to which they used reappraisal at the five levels of momentary PA we examined (Figure 2D). For distraction, the MDD group used distraction significantly more than healthy controls at all levels of momentary PA except for when PA was much lower than usual (−2 *SD*; Figure 2F).

Discussion

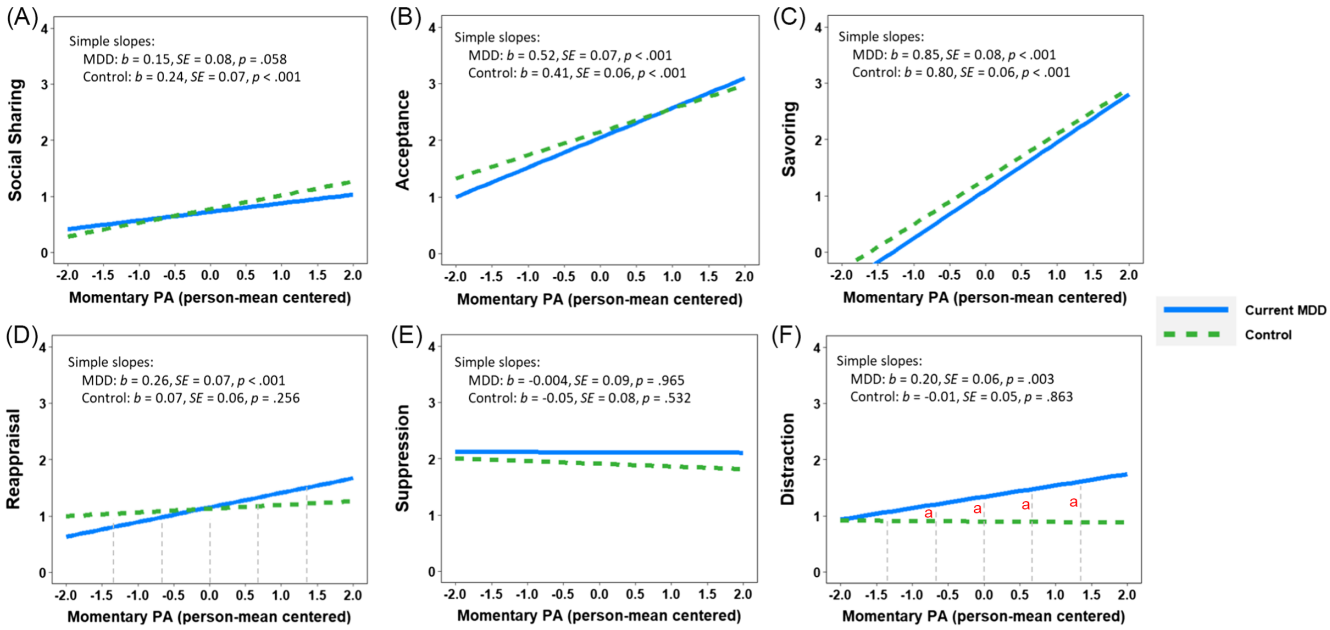
Extensive research suggests that ER has important implications for well-being and psychopathology such as MDD (Aldao et al., 2010; Gross & John, 2003; Hofmann, 2014). The present study extends existing work on global ER strategy use in MDD by focusing on ER in naturalistic settings and how it varies across levels of affect intensity. We examined six ER strategies: social sharing, acceptance, savoring, reappraisal, expressive suppression, and distraction. Findings indicate that ER strategy use generally varied based on momentary NA and PA when people were regulating emotion in daily life. Additionally, although ER strategy use was associated with momentary NA to a similar extent in those with and without MDD, ER strategy use was more closely tied to momentary PA among those with MDD versus healthy controls for two strategies: reappraisal and distraction.

Both momentary NA and PA were associated with the use of most ER strategies examined in the present study. Momentary NA was associated with greater social sharing, greater reappraisal, greater distraction, and less savoring. Momentary NA was not associated with acceptance or expressive suppression. These findings regarding NA and ER are somewhat consistent with findings from a meta-analysis of ER strategies (e.g., worry, avoidance, problem-focused coping, rumination, distraction, reappraisal, suppression, acceptance) and affect in daily life (Boemo et al., 2022). In addition to clarifying links between PA and reappraisal and suppression, we also examined strategies not reviewed by Boemo et al. (2022), such as social sharing, acceptance, savoring, and distraction. Notably, Boemo et al. (2022) collapsed across studies with clinical and nonclinical samples, underscoring the importance of the present study in differentiating between those with and without psychopathology. They found preliminary evidence, via qualitative review, for a positive contemporaneous association between momentary NA and the use of distraction, although they noted evidence of a negative, nonsignificant association as well. They found mixed evidence as to the direction of association between NA and reappraisal. As Boemo et al. were unable to quantitatively analyze associations between NA and reappraisal and distraction, our findings help provide further evidence on these associations, pointing to a positive relation between NA and the use of both distraction and reappraisal. Diverging from their findings, we did not find an association between momentary NA and expressive suppression.

Surprisingly, momentary NA and ER strategy use did not differ by MDD status, which contradicted our hypothesis that ER strategy use would be less tied to momentary NA in those with MDD versus healthy controls due to reduced ER flexibility. For those with MDD, the diminished ability to evaluate negative emotional context may be more prominent in other ER stages, such as the identification stage (i.e., when individuals identify the need to regulate). A study based on the current sample found that attempts to *initiate* ER are

Figure 2

Associations Between Momentary PA and ER Strategies by Group



Note. This figure shows the associations between person-mean-centered momentary PA and the use of six ER strategies (while holding momentary negative affect at person-mean levels) when participants were regulating emotion. The association significantly differed by group for (D) reappraisal and (F) distraction, but it did not differ for (A) social sharing, (B) acceptance, (C) savoring, or (E) expressive suppression. To facilitate the interpretation of significant interactions, dashed gray lines are plotted at −2 standard deviations (*SD*), −1 *SD*, mean, +1 *SD*, and +2 *SD* of person-mean-centered momentary PA (the *SD* of momentary PA at the within-person level = 0.69). PA = positive affect; ER = emotion regulation; MDD = major depressive disorder; *SE* = standard error. See the online article for the color version of this figure.

[a]Represents that the predicted levels of strategy use were significantly different between the MDD and the control group ($p < .05$) at the corresponding level of person-mean-centered momentary PA.

less strongly tied to momentary NA among those with MDD compared to healthy controls (Liu et al., 2023). Perhaps we did not find differences between those with MDD and healthy controls because we examined later stages of the ER process, where ER deficits in the context of NA may be less noticeable (Houben et al., 2024). Similarly, Hu et al. (2024) found that the motivation to regulate emotion was less sensitive to affective cues that signal ER demands (i.e., the discrepancy between experienced and ideal affect) among those with MDD compared to healthy controls. However, it may be worthwhile to examine strategies commonly used by those with MDD, such as rumination and problem solving, to see if findings replicate (Donaldson & Lam, 2004). Despite the lack of group differences in the link between NA and ER strategy use, it remains possible that those with MDD show reduced ER flexibility in the context of NA that was not captured by the present study. For example, those with MDD (vs. healthy controls) may be more likely to fail to switch ER strategies when the current strategy is ineffective (M. S. Chen et al., 2024; S. Chen & Bonanno, 2021), which would require future studies with more frequent assessment timing or experimental manipulations in laboratory-based settings to capture.

To build upon the sparse research on ER strategy use in positive emotional contexts in MDD (Boemo et al., 2022), we investigated how ER strategy use differed by momentary PA intensity. Across groups, momentary PA was associated with greater use of social sharing, acceptance, savoring, and reappraisal but was not associated with the use of expressive suppression and distraction during ER episodes. Results are partially consistent with Boemo et al. (2022), who found that reappraisal was positively (in some cases) or nonsignificantly (in other cases) associated with PA. Expressive suppression, in contrast, was either negatively or nonsignificantly associated with PA.

MDD status significantly moderated the associations between momentary PA and two (of six) ER strategies: reappraisal and distraction. For reappraisal, momentary PA was positively associated with the use of reappraisal for the MDD group but not the control group. We also found that the association between momentary PA and distraction was stronger for those with MDD than for healthy controls. This finding on distraction was driven by the MDD group generally using distraction more than healthy controls, a difference that became more prominent as levels of momentary PA increased.

We sought to test how people show different levels of ER strategy use at varying levels of momentary affect among adults with MDD and healthy controls based on our assumption that our data at least in part reflect how momentary affect influences one's ER strategy use. However, it is critical to note that we cannot conclude directionality of these associations due to the contemporaneous assessment of affect and strategy use. It is entirely possible that strategy use was a consequence of PA in some situations and a cause of PA in others. Thus, we practice caution in interpreting these associations below and present alternative explanations for the significant group differences in the link between momentary PA and use of reappraisal and distraction.

We expect that momentary affect could influence strategy use, consistent with our theorizing that momentary affect signals ER demands (Dixon-Gordon et al., 2015; Mueller et al., 2024). In this case, during an ER episode, those with MDD used reappraisal and distraction to a greater extent in response to a higher (vs. lower) level of momentary PA, although this pattern was not observed among healthy controls. One possible explanation is that when one's momentary PA is higher during an ER episode, those with MDD may feel a greater need to increase their level of reappraisal (e.g., thinking about the situation more positively) and distraction (e.g., distracting oneself from the negative aspects of the situation) use to maintain their PA. Alternatively, those with MDD may have been thinking about the situation more negatively (i.e., minimizing) or distracting themselves from the positive situation or feelings to feel worse when their momentary PA is higher (vs. lower; Heiy & Cheavens, 2014). This latter explanation could be attributed to their weaker short-term prohedonic motivation (Millgram et al., 2023), discomfort with high-intensity emotions (Sheppes et al., 2011), or a preference for low-arousal positive emotions such as calmness (Mizrahi Lakan et al., 2023).

Although we outlined how momentary affect may impact ER, it is likely that momentary affect can sometimes be a consequence of strategy use. In this case, momentary affect represents the effectiveness of one's ER efforts. Consistent with this speculation, during an ER episode, those with MDD may have needed to increase their use of reappraisal and distraction to achieve a higher level of momentary PA, whereas the increased effort is not needed for healthy controls. This is in line with evidence that depressive symptomatology is associated with difficulty keeping positive information in working memory (Vardi et al., 2024). For example, in the case of distraction, those with MDD appeared to need to use distraction (e.g., distracting themselves from negative situations or feelings) significantly more than healthy controls to achieve high levels of momentary PA. It is important that future investigations clarify the directionality of the associations between momentary affect and ER strategy use using naturalistic methods with much shorter time intervals (Houben et al., 2024) or experimental designs (e.g., instructing participants to regulate emotions while manipulating levels of momentary affect).

Taken together, the stronger PA–strategy use associations in MDD may overall indicate that ER difficulties in MDD may be partially attributed to overusing certain strategies (in the case of affect influencing strategy use) or ineffectiveness in using certain strategies during ER episodes (in the case of strategy use influencing affect). Not only do these findings add to the existing body of literature on emotion dysregulation in MDD by focusing on ER at the momentary level in daily life in the context of PA in addition to NA, but they also have important clinical implications. These findings may be particularly useful in the context of MDD treatments that include ER modules, such as Cognitive Behavioral Therapy (Hollon & Beck, 1994) and Dialectical Behavior Therapy (Linehan, 1993). When working with clients with MDD, it may be especially important to assess their attention and thought processes when experiencing higher PA, as well as their willingness and ability to utilize appropriate ER strategies to increase and maintain PA.

It is also worth noting that those with MDD did not differ from healthy controls in the associations between momentary PA and the other four strategies, as well as momentary NA and the use of all six strategies. In other words, the two groups showed mostly similar patterns in the degree to which their ER strategy use is tied to their momentary affect during ER episodes. If future research can establish that these findings reflect the way in which momentary affect influences ER strategy use, our findings would be in contrast with our initial theorizing that those with MDD would show a weaker link between strategy use and affect due to reduced flexibility in updating ER strategies based on one's momentary affect. It is important for future experimental research to explicitly test how individuals with MDD update the extent to which they use various strategies based on the changing intensity of their NA and PA, which would inform knowledge on ER flexibility in MDD.

Constraints on Generality

Several additional limitations of the present study are worth noting. First, despite reporting on specific strategies used, participants did not report on the content of their strategy use (i.e., what they were reappraising or distracting from), which limits our ability to fully understand the nature of the findings (e.g., whether participants were distracting themselves from positive or negative situations or emotions at high levels of momentary PA). Additionally, the participants may have held multiple interpretations of the ER rating scale used to assess strategy use (i.e., rating the "extent to which they used" each strategy). Although we think it is most likely that participants' ratings of strategy use reflected their regulatory effort, participants may have answered the question based on other features of their strategy use, such as each strategy's effectiveness or the duration in which they used strategies. Future studies would benefit from including a clear operationalization of "strategy use extent" (e.g., effort) to aid in survey clarity or asking participants if they used a strategy (yes or no) before asking about the extent of use. Furthermore, the concurrent assessment of affect and strategy use made it difficult to draw conclusions about the direction of associations, and the 3-hr lag time between surveys prevented us from examining directionality between affect and strategy use at the momentary level within individual ER episodes. As mentioned, there are multiple theoretical rationales for both the affect-to-ER and ER-to-affect directions that should be tested in future investigations. Last, the low frequency of participants' endorsing regulating emotion to feel worse prevented us from systematically examining whether our findings were specific to certain types of emotion goals (e.g., whether the positive association between momentary PA and distraction use found in those with MDD was specific to ER episodes when they regulated to feel worse). Future research that collects more affect-worsening (in addition to affect-improving) ER episodes can further clarify the boundaries of our findings.

Despite these limitations, the present study extends the literature on ER strategy use in MDD as it relates to momentary affect in daily life. Although heightened NA is a cardinal symptom of MDD, we found no differences between those with and without MDD in how momentary NA intensity is associated with ER strategy use during ER episodes. Findings underscore the importance of momentary PA as a contextual factor implicated in ER patterns in MDD, which may enhance understanding of anhedonic depression, as well as the utility of naturalistic methods in providing additional insights into where ER goes awry in MDD in daily life.

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