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Choosing to Avoid the Positive? Emotion Regulation Strategy Choice in Depression

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Individuals with major depressive disorder (MDD) are more likely than nondepressed individuals to use emotion regulation strategies that decrease pleasant emotions (e.g., distraction from positive stimuli) and increase unpleasant emotions (e.g., negative rumination). If such strategies are actively chosen, these choices may partly reflect weaker motivation for pleasant emotions or stronger motivation for unpleasant emotions. Therefore, this investigation tested, for the first time, whether such strategies are actively chosen, even when alternatives are available. In Study 1, using a behavioral task, MDD participants ($N = 38$) were more likely than healthy controls ($N = 39$) to choose to use distraction over positive rumination in response to pleasant stimuli, resulting in reductions in pleasant affect. When instructed to choose the strategy that would make them feel better, however, MDD participants did not differ from controls in their strategy choices. In Study 2, using ecological momentary assessments, MDD participants ($N = 58$) were more likely than controls ($N = 62$) to use distraction from pleasant emotions and to use negative rumination in daily life. This pattern of strategy use was predicted by stronger motivation for unpleasant emotions among MDD participants, compared to controls. Stronger motivation for unpleasant emotions in daily life also predicted increases in unpleasant affect and decreases in pleasant affect. Findings suggest that compared to nondepressed individuals, people with MDD are more likely to choose emotion regulation strategies that decrease pleasant emotions.

General Scientific Summary

People with major depressive disorder (MDD) often use emotion regulation strategies that decrease pleasant emotions. This investigation demonstrates that individuals with MDD may choose such strategies, even when alternatives are available, and that activating motivation to feel better may alter such choices. This pattern of strategy use in MDD is evident both in controlled experimental settings and in daily life and is associated with a relatively weaker motivation to avoid unpleasant emotions.

Keywords: depression, emotion regulation, distraction, rumination, choice

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Study 1 was preregistered. The preregistration is available at: <https://aspredicted.org/yi5ew.pdf>. Study 1 data, materials, and analysis code are available on the Open Science Framework at: https://osf.io/tmq9j/?view_only=121bba28f7eb47db87bab44cec1a5ef7. Study 2 was not preregistered. Analysis code for Study 2 is also available on the Open Science Framework at: https://osf.io/tmq9j/?view_only=121bba28f7eb47db87bab44cec1a5ef7. In Study 2, we analyzed data that were collected as part of an unrelated larger research project. This project includes unpublished novel paradigms and findings which are currently under review or in preparation. Therefore, the data and materials for Study 2 are available upon request. They will be made publicly available upon publication of the project's results.

Yael Millgram served as lead for conceptualization, formal analysis, investigation, methodology, writing—original draft, and writing—review and editing and served in a supporting role for funding acquisition. Shir Mizrahi Lakan served in a supporting role for writing—review and editing. Jutta Joormann served in a supporting role for conceptualization, methodology, writing—original draft, and writing—review and editing. Mor Nahum served in a supporting role for writing—original draft and writing—review and editing. Orly Shimony served in a supporting role for investigation and writing—review and editing. Maya Tamir served as lead for funding acquisition, resources, and supervision and contributed equally to conceptualization, methodology, writing—original draft, and writing—review and editing. Yael Millgram, Shir Mizrahi Lakan, and Maya Tamir contributed equally to project administration. Shir Mizrahi Lakan, Mor Nahum, and Maya Tamir contributed equally to investigation.

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Major depressive disorder (MDD) is a debilitating affective disorder, affecting over 300 million people worldwide (World Health Organization, 2017). Deficits in emotion regulation contribute to disrupted affect in depression (Joormann & Stanton, 2016). Although in behavioral tasks in laboratory settings depressed individuals demonstrate comparable ability to implement effective emotion regulation strategies, they are more likely than healthy controls to report using strategies that decrease pleasant emotions and increase unpleasant emotions in daily life (Yoon & Rottenberg, 2020). Integrating these findings across different methodologies led researchers to suggest that emotion regulation deficits in depression involve maladaptive selection of emotion regulation strategies (see Liu & Thompson, 2017 for a review). Yet, the selection of emotion regulation strategies in depression has been assessed mainly by self-reports of strategy implementation (Liu & Thompson, 2017). Though informative, these reports should be interpreted with caution, since they are vulnerable to memory and response biases found in depression (Hindash & Amir, 2012; Marchetti et al., 2018), and may fail to distinguish between strategies that are actively chosen (e.g., choosing to ruminate instead of distracting from unpleasant events), and strategies that are implemented involuntarily (e.g., automatic ruminative thoughts that involuntarily come to mind). To clarify strategy selection in depression, in this investigation, we tested whether people diagnosed with MDD differ from healthy controls in their active choices of emotion regulation strategies, following exposure to pleasant and unpleasant stimuli.

If depressed individuals are more likely than controls to actively choose strategies that decrease pleasant emotions or increase unpleasant emotions, it is important to understand what underlies such choices. One possibility is that they are partly driven by weaker short-term pro-hedonic motivation among depressed (vs. healthy) individuals. Pro-hedonic motivation refers to people's motivation to feel pleasant emotions or avoid unpleasant emotions. Depressed individuals may be less motivated to feel pleasant emotions or avoid feeling unpleasant emotions at the moment, reflecting weaker short-term pro-hedonic motivation, compared to healthy controls (Millgram et al., 2020). Therefore, we also tested whether strategy choices could be altered by activating short-term pro-hedonic motivation. Finally, we examined the emotion regulation strategy use of depressed and healthy individuals in daily life and the associations between strategy use and pro-hedonic motivation.

Emotion Regulation Strategy Use in Depression

Depressed individuals are more likely than healthy individuals to use emotion regulation strategies that decrease pleasant emotions or increase unpleasant emotions (Yoon & Rottenberg, 2020). Research on the regulation of positive emotion in depression is relatively new (Vanderlind et al., 2022). However, there is evidence that depressed (vs. healthy) individuals are more likely to divert attention away from pleasant stimuli (Hankin et al., 2010). Depressive symptoms were also associated with reduced positive rumination, which involves repetitively thinking about the causes and consequences of pleasant experiences (Feldman et al., 2008). These patterns of regulation reduce positive affect and prospectively predict anhedonia, which is a core feature of MDD (Nelis et al., 2015).

With respect to unpleasant emotions, a well-established body of research has associated MDD with negative rumination, which, unlike positive rumination, involves repetitively thinking about causes and

consequences of unpleasant experiences and leads to increases in negative affect (Nolen-Hoeksema et al., 2008). Depressed (vs. healthy) individuals use negative rumination more often, leading to the onset and recurrence of depressive episodes (Nolen-Hoeksema et al., 2008). Some studies have also found that depressed (vs. healthy) individuals are less likely to distract from unpleasant stimuli (Rudich-Strassler et al., 2022). To understand disrupted affect in depression, therefore, it is important to examine the use of distraction and positive and negative rumination in depression. We focused on distraction and rumination, in particular, because both strategies predict important clinical outcomes in depression (LeMoult et al., 2016), both strategies target the same stage in the emotion generation process (i.e., attention deployment; Gross & Thompson, 2007), and both can be implemented in response to pleasant and unpleasant stimuli.

Choices of Emotion Regulation Strategies in Depression

People can have varying degrees of control over behavior, ranging from involuntary reflexes to deliberate actions (O'Doherty et al., 2017). When people retrospectively report on the emotion regulation strategies they implemented, their reports may therefore reflect a spectrum of behaviors ranging from involuntary reactions to stimuli (e.g., automatically closing one's eyes in response to an aversive stimulus), to a deliberate choice of one emotion regulation strategy over others (e.g., deciding to pull one's gaze away from a stimulus instead of concentrating on it). Such spectrum can also include behaviors over which people have intermediate levels of control. For instance, people may choose certain strategies because they are unaware of alternatives, or because they do not believe they are able to implement alternative strategies. People could also choose one strategy (e.g., try to problem-solve) but ultimately end up implementing another (e.g., end up using negative rumination). Since emotion regulation strategy selection in MDD was assessed by retrospective self-reports, it remains unknown which processes these reports reflect. Additionally, the self-reports of depressed individuals could be influenced by negative memory biases (Marchetti et al., 2018), and by depressed individuals' tendency to endorse negative self-relevant characteristics (Hindash & Amir, 2012).

Therefore, to better understand emotion regulation strategy selection in depression, we behaviorally assessed depressed and healthy individuals' active choices between strategies. Behavioral assessment of choices cannot distinguish between deliberate choices and choices over which people have intermediate levels of control (e.g., choices based on erroneous beliefs or habits; Dolan & Dayan, 2013). However, behavioral choices are unlikely to reflect passive involuntary reactions to stimuli (O'Doherty et al., 2017), because they involve active and intentional selection between available alternatives. Therefore, assessing strategy choice can provide information on which strategies MDD (vs. healthy) participants choose rather than strategies they involuntarily implement. Furthermore, because participants are made aware of available options, behavioral choices of strategies cannot be attributed to unawareness of alternatives. Finally, choices are assessed in real-time, ruling out influences of memory and response biases. Therefore, behaviorally assessing strategy choice could help unpack some of the complexities in understanding strategy selection in MDD.

To the best of our knowledge, spontaneous behavioral choices between emotion regulation strategies have not yet been empirically assessed in depression. However, previous research has offered two theoretical hypotheses regarding the degree of control depressed

individuals have over the strategy of negative rumination. According to one hypothesis, depressed individuals do not choose to use negative rumination, rather they engage in it involuntarily due to deficits in cognitive control (Joormann & Vanderlind, 2014). According to another hypothesis, depressed individuals choose negative rumination as a coping strategy, because they believe it enhances self-awareness (Papageorgiou & Wells, 2001).

Integrating these hypotheses, one study proposed that depressed individuals find it hard to change preestablished positive beliefs about negative cognitions (Takano et al., 2019). In this study, choosing to recall negative over positive memories was initially reinforced, but then the task's reward structure was reversed, such that recalling negative (over positive) memories was punished. Depressive symptoms were associated with delays in updating choices once recalling negative memories was no longer rewarding. This study shows that depressed people may choose behaviors that increase unpleasant feelings, even when such behaviors are punished. However, these patterns may also reflect a general switching deficit found in depression (De Lissnyder et al., 2012). Additionally, spontaneous choices of emotion regulation strategies, regardless of external reinforcement, were never assessed in depression. In this investigation, therefore, we behaviorally assessed spontaneous choices between distraction versus rumination following exposure to pleasant and unpleasant stimuli. We hypothesized that depressed individuals would be more likely than controls to choose distraction over positive rumination in response to pleasant stimuli, but will choose negative rumination over distraction in response to unpleasant stimuli.

Different emotion regulation strategies lead to different outcomes (Webb et al., 2012). Though choices between strategies are likely driven by various reasons, one of them could be the extent to which people are motivated to attain those emotional outcomes at the moment (Millgram, Sheppes, et al., 2019). If depressed individuals are more likely than controls to choose distraction over positive rumination in response to pleasant stimuli, and negative rumination over distraction in response to unpleasant stimuli, these choices might reflect weaker short-term pro-hedonic motivation. Indeed, compared to controls, depressed individuals reported wanting to experience pleasant emotions to a lesser degree and unpleasant emotions to a greater degree (Millgram et al., 2015; Millgram, Joormann, et al., 2019). They were also less likely than controls to choose to engage with pleasant stimuli, and more likely to engage with unpleasant stimuli (Millgram et al., 2015; Millgram, Joormann, et al., 2019). Accordingly, we tested whether the strategy choices of depressed (vs. healthy) participants partly reflect weaker short-term pro-hedonic motivation.

The Current Investigation

Participants diagnosed with MDD and healthy controls completed an emotion regulation choice task (Study 1). We modified a validated paradigm (Sheppes et al., 2014), where participants choose between two strategies. We used autobiographical memories as emotional stimuli, to capture choices in response to personally relevant events. To test whether strategy choices of depressed (vs. control) individuals partly reflect weaker short-term pro-hedonic motivation, we compared spontaneous choices of strategies, and choices of strategies when short-term pro-hedonic motivation was activated. Thus, the task included two blocks.

In the first block, participants recalled personal pleasant and unpleasant events. They then chose between distraction and

rumination in response to each memory. We predicted that depressed individuals would be more likely than controls to choose distraction over positive rumination in response to pleasant memories, and choose negative rumination over distraction in response to unpleasant memories.

In the second block, participants were instructed to choose the strategy they thought would make them feel the most positive and least negative. If depressed individuals spontaneously choose options they think will make them feel better, their choices should not change when short-term pro-hedonic motivation is activated (vs. not). If depressed individuals do not spontaneously choose options they think will make them feel better, explicitly activating short-term pro-hedonic motivation should change their strategy choices. Finally, we also expected choices to shape subsequent emotional experiences. We expected positive rumination to increase pleasant affect and distraction to decrease pleasant affect in response to pleasant memories. We also expected negative rumination to increase unpleasant affect and distraction to decrease unpleasant affect, in response to unpleasant memories.

Behavioral tasks may or may not correspond to emotion regulation in daily life (Liu & Thompson, 2017). Therefore, in Study 2, we used ecological momentary assessments (EMAs; Shiffman et al., 2008) to assess strategy implementation and motivation for pleasant and unpleasant emotions in daily life. We tested whether depressed and healthy individuals differed in their use of positive rumination, negative rumination, and distraction in response to pleasant and unpleasant emotions. We also tested whether patterns of strategy implementation are predicted by participants' motivation for pleasant and unpleasant emotions, and the emotional consequences of these motivations.

Study 1

In Study 1, we used a behavioral choice task to test whether depressed and healthy individuals differ in their active choices of distraction and rumination in response to pleasant and unpleasant autobiographical memories. We also compared participants' spontaneous choices of strategies and participants' choices when activating pro-hedonic motivation.

Method

Participants

The study included 38 participants diagnosed with current MDD and 39 healthy controls. Based on power analysis, $N = 66$ allowed to detect a small effect size for a within-between interaction ($\eta_p^2 = 0.03$, $\alpha = 0.05$, $1 - \beta = 0.80$). To ensure we reach this sample size we oversampled by approximately 20%.

Recruitment. To recruit participants who would be likely to meet diagnostic criteria for one of the groups, we administered the Beck Depression Inventory II (BDI-II; Beck et al., 1996) or Items 1, 2, and 8 from the BDI-II,¹ to a large sample of university students through the university's experiment registration system ($N = 2,825$).

¹ To facilitate recruitment, we also distributed a shorter version with three items from the BDI-II. We selected items with the highest correlations with MDD diagnoses in previous studies at the lab. Nine participants were recruited based on the short survey, and 71 participants were recruited based on the full BDI-II.

We contacted by phone participants aged 18+ years, who scored either 16 or above on the BDI-II, or scored 3 and above on the selected items from the BDI-II, and invited them to the study. We also invited participants scoring 9 or below on the BDI-II, who could meet the diagnostic criteria for the healthy control group.

Diagnostic Status. Diagnostic status was determined using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First et al., 2007), administered by trained clinical psychology graduate students. The depressed group included participants diagnosed with current MDD. We excluded participants with bipolar I or II diagnosis or any psychotic disorder. The healthy control group included participants with no lifetime history of mental health disorders (see Table 1). Fifty-five of the invited participants were excluded for not meeting the diagnostic criteria for either group. Participants received course credit or the equivalent of \$26. The study was approved by the Hebrew University's ethical review board.

Procedure

Due to the COVID-19 pandemic, the study was administered either in the lab or online.² When conducted online, clinical interviews were administered by phone. Participants were first trained in using rumination and distraction (see the online supplemental materials for the training procedure). Following Sheppes et al. (2014), distraction instructions were: "Think about something neutral and unrelated to the event. Focus on the details of the neutral event and repeat them in your mind. Do not think about the original event." Following Ray et al. (2008), rumination instructions were: "Think about your initial emotional response to the event and what made you feel that way and repeat it over and over in your mind. Do not try to alter the initial meaning of the event." Participants were given two examples for implementing each strategy in response to hypothetical pleasant and unpleasant events. Next, they implemented each strategy in response to one pleasant and one unpleasant different hypothetical events and received feedback consisting of examples for implementing the strategies in response to these events.

After training, participants completed the strategy choice task. On each trial, participants recalled a pleasant (e.g., "an instance where you felt wanted and loved"³) or unpleasant (e.g., "an instance where you felt lonely") event that occurred in the past 6 months and described it in writing. Next, participants rated how they felt in the moment (1 = *extremely negative*, 9 = *extremely positive*). Participants then chose between rumination or distraction in response to the memory, by clicking on one of these two options. Participants had 1 min to implement their chosen strategy, and then they wrote what they were thinking about as they did so. Finally, participants rated again how they felt (1 = *extremely negative*, 9 = *extremely positive*).⁴

Participants completed two blocks, each including three pleasant and three unpleasant events, in random order. In the first block, participants spontaneously chose between rumination and distraction. In the second block, participants were instructed to choose the strategy they thought would make them feel the least negative and most positive. Participants were reminded of this goal on each trial. The order of blocks was fixed to ensure that participants' spontaneous choices could not be influenced by priming pro-hedonic motivation.

Finally, participants completed questionnaires (see the online supplemental materials) and the clinical diagnostic interview

(i.e., SCID-I; First et al., 2007), which was audiotaped. Twenty percent of interviews were randomly selected for reliability assessment. Evaluators agreed on 92.2% of diagnoses, $\kappa = 0.84$, $p < .001$.

Analytic Approach

We ran multilevel models using lme4 package in R (Bates et al., 2015), with p values calculated using lmerTest (Kuznetsova et al., 2017). We included random intercepts and slopes. When models did not converge or resulted in singular fits, we removed the random effect explaining the least variance (Barr et al., 2013). To assess effect size, we calculated ORs for multilevel logistic regression models, and partial R^2 for multilevel linear regression models using the *r2glmm* package in R (Jaeger et al., 2017).

Transparency and Openness

Study 1 was preregistered. The preregistration is available at: <https://aspredicted.org/yi5ew.pdf>. In the online supplemental materials, we mention and explain any discrepancies between the preregistered analyses and the analyses in the article. Study 1 data, materials, and analysis code are available on the Open Science Framework at: https://osf.io/tmq9j/?view_only=121bba28f7eb47db87bab44cec1a5ef7.

Results

Emotional Reactions to Memories

We confirmed that memories elicited the intended emotional reactions in a multilevel linear regression. We modeled fixed effects of memory type (unpleasant, pleasant) and depression (depressed, healthy controls), to predict participants' emotional reactions to memories prior to regulation. The model converged when removing memory-item slopes. As expected, emotional reactions to unpleasant memories were more negative ($M = 4.32$, $SE = 0.14$) than reactions to pleasant memories ($M = 6.41$, $SE = 0.15$), $b = 2.39$, $SE = 0.25$, $t(63.61) = 9.45$, $p < .001$, 95% CI [1.90, 2.89], $R^2 = 0.23$. We also found a main effect for depression, $b = 1.23$, $SE = 0.24$, $t(75) = 5.06$, $p < .001$, $R^2 = 0.08$. Depressed individuals reacted more negatively ($M = 4.90$, $SE = 0.15$) than controls ($M = 5.83$, $SE = 0.14$). There was no Memory Type \times Depression interaction, $b = -0.62$, $SE = 0.33$, $t(75) = -1.90$, $p = .061$, $R^2 = 0.01$. To ensure memories elicited the intended emotional reactions, for the remainder of the analyses, we removed trials in which participants reacted negatively to pleasant memories (ratings of 4 and below; 42 out of 456 trials) and trials in which participants reacted positively to unpleasant memories (ratings of 6 and above; 81 out of 456 trials). To account for group differences in emotional reactivity, we repeated subsequent analyses controlling for reactivity. Results remained unchanged. To further confirm that participants generated memories as instructed, memories were coded by independent raters. Groups did not differ in the number of pleasant and unpleasant memories they recalled (see the online supplemental materials).

² Findings remained significant when entering mode of administration (lab, online) as an additional predictor in the models.

³ Memory items were pilot tested (see the online supplemental materials).

⁴ Participants also completed additional unrelated items, pertaining to effort, difficulty and success in regulation.

Table 1
Demographics and Clinical Characteristics (Study 1)

Variable	MDD (<i>n</i> = 38) <i>M</i> (<i>SD</i>)	Controls (<i>n</i> = 39) <i>M</i> (<i>SD</i>)	Statistic
Demographics			
Age, years	23.29 (2.83)	24.51 (4.44)	$t = -1.45$
Female, %	73.7%	71.8%	$\chi^2 = 0.03$
Education, years	13.05 (0.52)	13.38 (1.02)	$t = -1.81$
Employed, %	34.2%	42.1%	$\chi^2 = 0.50$
Clinical characteristics			
CESD-10	18.87 (4.43)	6.18 (3.59)	$t = 13.79^*$
SCL-90 (Global Severity Index)	1.50 (0.58)	0.29 (0.23)	$t = 11.99^*$
Current episode duration, months	25.09 (66.03)	—	
Currently taking medication, %	26.3%	—	
No. of past depressive episodes	1.13 (1.34)	—	
No. of comorbid disorders	0.84 (1.00)	—	
Social anxiety, %	23.7%	—	
Specific phobia, %	18.4%	—	
OCD, %	15.8%	—	
Panic disorder, %	10.5%	—	
Agoraphobia, %	7.9%	—	
PTSD, %	0.0%	—	
GAD, %	0.0%	—	

Note. MDD = major depressive disorder; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; GAD = generalized anxiety disorder; CESD-10 = Center for Epidemiologic Studies Depression Scale Revised (self-report measure of depressive symptoms); SCL-90 = Symptom Checklist-90 Revised (self-report measure of a broad range of psychological problems and symptoms of psychopathology).

* $p < .05$.

Strategy Choice

We conducted a multilevel logistic regression in which we modeled a fixed effect of depression (depressed, healthy controls), memory type (unpleasant, pleasant), and block (spontaneous, pro-hedonic), to predict strategy choice (1 = *distraction*, 0 = *rumination*). Including random slopes resulted in a singular fit, so we ran an intercept-only model. As expected, we found a Depression \times Memory Type \times Block interaction, $b = 1.37$, $SE = 0.66$, $z = 2.08$, $p = .038$, $OR = 3.93$, 95% CI [0.17, 2.90] (see Figure 1).

With regard to pleasant memories, as predicted, depressed individuals were more likely to spontaneously choose distraction over positive rumination ($P_{\text{distraction}} = 0.51$, $SE = 0.09$), compared to controls ($P_{\text{distraction}} = 0.31$, $SE = 0.08$), $b = -0.84$, $z = -2.33$, $SE = 0.36$, $p = .020$, $OR = 0.43$, 95% CI [-1.50, -0.21]. When instructed to choose the strategy that would make them feel better (block 2), depressed and healthy participants did not differ in their choices, $b = 0.06$, $z = 0.10$, $SE = 0.60$, $p = .923$, $OR = 1.06$, [-0.94, 1.38], ($P_{\text{distraction}} = 0.21$, $SE = 0.08$ for depressed, and $P_{\text{distraction}} = 0.22$, $SE = 0.08$ for control participants). Healthy participants did not differ in their choices in response to pleasant memories in the spontaneous block compared to the pro-hedonic block, $b = 0.003$, $z = 0.006$, $SE = 0.53$, $p = .995$, $OR = 1.00$, [-0.97, 1.04]. However, depressed participants were more likely to choose distraction (vs. positive rumination) in response to pleasant memories in the spontaneous block compared to the pro-hedonic block, $b = -1.00$, $z = -3.01$, $SE = 0.33$, $p = .003$, $OR = 0.37$, [-1.60, -0.28]. The Depression \times Block \times Memory Type interaction remained significant when controlling for emotional reactivity to the memories prior to regulation, $b = 1.40$, $SE = 0.66$, $z = 2.12$, $p = .034$, $OR = 4.07$.

With regard to unpleasant memories, contrary to our prediction, depressed and healthy participants did not differ in their

spontaneous strategy choices (block 1), $b = -0.11$, $z = -0.28$, $SE = 0.38$, $p = .781$, $OR = 0.90$, 95% CI [-9.44, 0.70], ($P_{\text{distraction}} = 0.60$, $SE = 0.06$ for depressed and $P_{\text{distraction}} = 0.57$, $SE = 0.07$ for control participants). When activating pro-hedonic motivation (block 2), both depressed and healthy participants were more likely to choose distraction (vs. negative rumination), compared to their spontaneous choices, $|z_s| > 2.59$, $SE < 0.38$, $p_s < .010$, ($P_{\text{distraction}} = 0.87$, $SE = 0.05$ for depressed and $P_{\text{distraction}} = 0.78$, $SE = 0.06$ for control participants), and there was no significant difference between the groups, $b = -0.63$, $z = -1.33$, $SE = 0.47$, $p = .182$, $OR = 0.53$.

To confirm that participants implemented their chosen strategies, independent raters rated the written descriptions of strategy implementation. Participants implemented their chosen strategy in 92.4% of trials. The Depression \times Block \times Memory Type interaction remained significant when omitting trials for which the chosen strategy was not implemented, $b = 1.40$, $SE = 0.68$, $z = 2.05$, $p = .041$, $OR = 4.04$ (see the online supplemental materials). Finally, we confirmed that group differences were not accounted for by difficulties to recall pleasant and unpleasant memories (see the online supplemental materials).

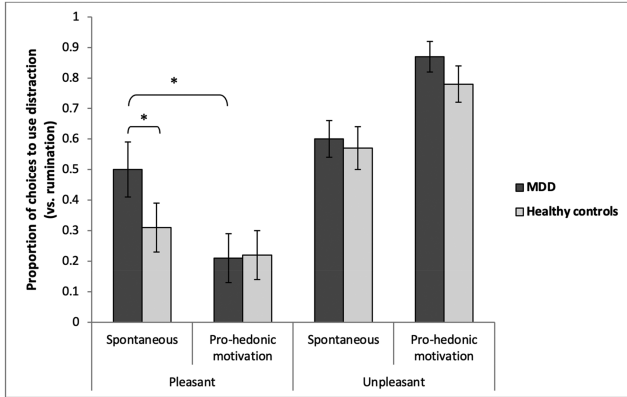
Emotional Consequences of Strategy Choice

To test whether strategy choices shaped subsequent emotional experiences, we calculated change scores of valence ratings (subtracted valence ratings preregulation from valence ratings postregulation).⁵ We conducted a multilevel linear regression with strategy choice (i.e., proportion of choices to use distraction), memory type

⁵ Results remained unchanged when repeating analyses using residuals instead of difference scores (see the online supplemental materials).

Figure 1

Proportion of Choices to Use Distraction (vs. Rumination) in Response to Pleasant and Unpleasant Memories by Depressed and Healthy Participants, When Choice Was Spontaneous or Pro-Hedonically Motivated (Study 1)



Note. Error bars represent ± 1 SEM. MDD = major depressive disorder. * $p < .05$.

(unpleasant, pleasant), and depression (depressed, healthy controls) as fixed effects, to predict changes in participants' valence ratings. Including random slopes resulted in a singular fit, so we ran an intercept-only model. As predicted, we found a Strategy Choice \times Memory Type interaction, $b = -1.87$, $SE = 0.26$, $t(760.94) = -7.22$, $p < .001$, 95% CI $[-2.37, -1.39]$, $R^2 = 0.06$ (see

Figure 2). For pleasant memories, choosing distraction more often resulted in less pleasant and more unpleasant affect, $b = -0.83$, $SE = 0.11$, $t(398.85) = -7.25$, $p < .001$, $R^2 = 0.12$. For unpleasant memories, choosing distraction more often resulted in more pleasant and less unpleasant affect, $b = 0.94$, $SE = 0.24$, $t(8.34) = 3.89$, $p = .004$, $R^2 = 0.09$. We did not find a Strategy Choice \times Memory Type \times Depression interaction, $b = 0.17$, $SE = 0.37$, $t(791.83) = 0.46$, $p = .646$, $R^2 < 0.001$, indicating that affective consequences of strategy choice were equivalent across groups.

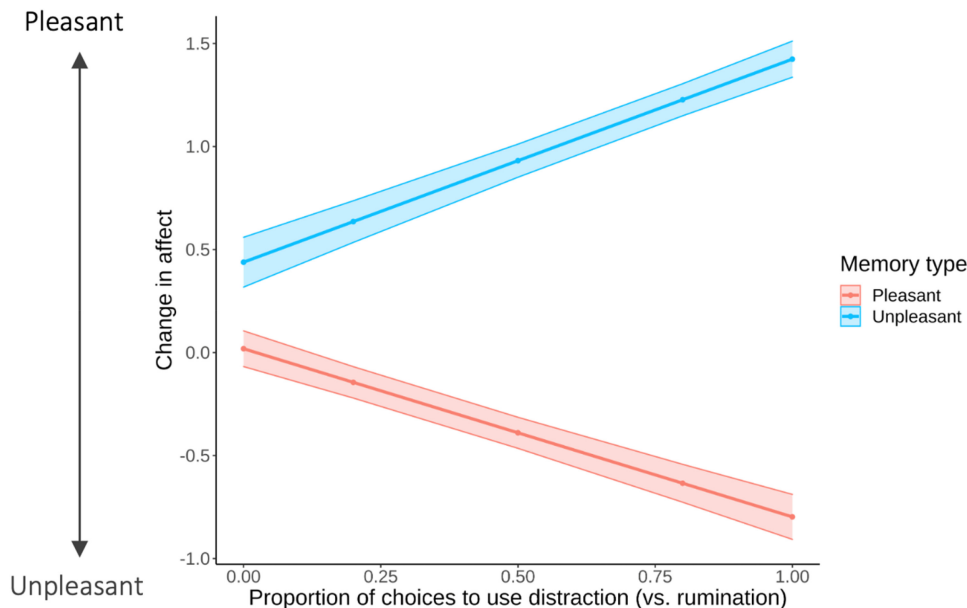
Discussion

Study 1 suggests that depressed might be more likely than healthy individuals to choose to distract from pleasant memories, resulting in lower pleasant affect. However, when instructed to choose the strategy that would make them feel better, depressed individuals made similar choices to healthy participants. Although instructions did not necessarily change depressed participants' intrinsic motivation to feel better, their choices in the pro-hedonic condition suggest that they were as knowledgeable as controls about which strategy would make them feel better. Depressed participants might have been less driven by short-term pro-hedonic motivation than healthy individuals when spontaneously choosing strategies.

Contrary to expectations, there were no group differences in choices of distraction versus negative rumination in response to unpleasant memories. Depressed individuals tend to use negative rumination more often than healthy individuals (Nolen-Hoeksema et al., 2008), but they were not more likely to actively choose negative rumination in our behavioral task. This suggests that increased use of negative rumination in depression might be involuntary rather

Figure 2

Mean Change in Valence Ratings (After vs. Before Regulation) as a Function of Memory Type and the Proportion of Choices to Use Distraction (vs. Rumination)



Note. For pleasant memories, choosing more distraction resulted in less pleasant and more unpleasant affect. For unpleasant memories, choosing more distraction resulted in more pleasant and less unpleasant affect. Error bands represent ± 1 SEM. See the online article for the color version of this figure.

than actively chosen. both depressed and healthy participants chose more distraction in response to unpleasant memories in the pro-hedonic (vs. spontaneous) condition. This suggests that when spontaneously choosing strategies, both groups were somewhat driven by nonhedonic considerations, like increasing the understanding of unpleasant events.

A limitation of Study 1 is that we used a bipolar scale to assess affect. Therefore, we could not test whether some memories elicited both unpleasant and pleasant affect, or distinguish between the implications of strategy choices for pleasant and unpleasant affect. Also, in Study 1 choices were made in controlled experimental conditions. Do these patterns of strategy choice replicate when individuals regulate emotions in daily life? An essential next step, therefore, was to test strategy implementation and pro-hedonic motivation among depressed and healthy individuals in daily life. In Study 2, we also separately assessed pleasant and unpleasant affect, and separately assessed motivations for pleasant and unpleasant emotions.

Study 2

In Study 2, we tested whether depressed individuals are more likely than controls to distract from pleasant emotions in daily life. We also tested whether distraction from pleasant emotions is predicted by motivation for pleasant and unpleasant emotions.

To this end, we analyzed data from a 10-day EMA study that included measures of motivation for unpleasant and pleasant emotions, and measures of positive rumination, negative rumination, and distraction in response to unpleasant and pleasant emotions in depression (see Mizrahi Lakan, Hu, et al., 2022). In Study 2, we also addressed some limitations of Study 1. Because in Study 1, participants chose between distraction and rumination, it remains unclear whether depressed individuals' choices reflect choices to distract from pleasant emotions, or choices to avoid positive rumination. In Study 2, we assessed distraction and rumination independently from one another. Similarly, in Study 2, we separately assessed pleasant and unpleasant affect, as well as motivations for unpleasant and pleasant emotions. Therefore, we could test whether any potential relationships between strategy implementation and pro-hedonic motivation are driven by motivation for unpleasant emotions, pleasant emotions, or both.

Method

Data were collected as part of a larger study (Mizrahi Lakan, Hu, et al., 2022). We describe parts of the protocol that are relevant to the current research questions.

Participants

The study included a different sample of 61 participants diagnosed with current MDD, and 62 healthy controls. Two depressed participants did not complete the EMA period, and one depressed participant was not included in the analyses for failing the majority of attention checks embedded in each EMA survey. This resulted in 58 participants in the depressed group. Based on a power analysis for multilevel models using “simr” package in R (Green & MacLeod, 2016) with 1,000 simulations, 60 participants per group allowed the detection of a small effect size ($R^2 = 0.03$, with $\alpha = 0.05$) with 90.20% power, 95% CI [88.19, 91.97]).

Recruitment. To recruit participants who would likely meet the diagnostic criteria for one of the groups, we administered the Patient Health Questionnaire-9 (PHQ-9; Kroenke & Spitzer, 2002) to a large sample of students through the university's experiment registration system ($N = 1,990$). Participants aged 18+ years who scored 10 or above were invited by phone to participate in the study. Participants scoring 5 or below on the PHQ-9, who were likely to meet the criteria for the healthy control group, were also invited.

Diagnostic Status. Diagnostic status was determined using the Mini-International Neuropsychiatric Interview 5.0.0 (M.I.N.I.; Sheehan et al., 1998). The interviews were administered by phone at the beginning of the study and audiotaped. Interviews were conducted by trained clinical psychology graduate students. The depressed group included participants diagnosed with current MDD. We excluded participants with bipolar I or II diagnoses or any psychotic disorder. The healthy control group included participants with no lifetime history of mental health disorders (see Table 2 for demographic and clinical characteristics). Twenty percent of interviews were randomly selected for reliability assessment. Evaluators agreed on 93% of diagnoses, $\kappa = 0.80$, $p < .001$. Hundred and three of the invited participants were excluded for not meeting diagnostic criteria for either group. The study was approved by the Hebrew University's ethical review board.

Procedure

The study included a baseline survey followed by a 10-day EMA period. All the variables used in the current analyses were drawn from the EMA period. Participants received four surveys per day. Links to each survey were sent via SMS messages to participants' mobile phones. Surveys were sent each day at 10:00 a.m., 2:00 p.m., 6:00 p.m., and 9:00 p.m., and remained open for 1 hr. Participants were paid the equivalent of \$1 for each completed survey. The maximum amount participants could earn for the EMA period was the equivalent of \$40.

Measures

Participants were told they would be answering questions pertaining to their emotions and emotion regulation.

Current Affect. Participants reported their current pleasant and unpleasant affect at the moment (“To what extent do you feel good right now?”; “To what extent do you feel bad right now?”; 1 = *not at all*, 9 = *to a large extent*; see the online supplemental materials for the convergent validity of these measures).

Affect in the Past 2 hr. Participants reported on their pleasant and unpleasant affect in the past 2 hr (“In the past 2 hr, to what extent did you feel good?”; “In the past 2 hr, to what extent did you feel bad?”; 1 = *not at all*, 9 = *to a large extent*).

Distraction and Rumination in the Past 2 hr. Distraction and rumination items were adapted from Kalokerinos et al. (2017). Participants reported on their distraction from pleasant emotions (“I tried to distract my mind away from what made me feel good and think about other things”), and their distraction from unpleasant emotions (“I tried to distract my mind away from what made me feel bad and think about other things”). Participants also reported on their use of positive rumination (“I focused on what made me feel good and thought about it over and over again”), and negative rumination (“I focused on what made me feel bad and thought

Table 2
Demographics and Clinical Characteristics (Study 2)

Variable	MDD (<i>n</i> = 58) <i>M</i> (<i>SD</i>)	Controls (<i>n</i> = 62) <i>M</i> (<i>SD</i>)	Statistic
Demographics			
Age, years	25.5 (4.6)	24.6 (2.9)	$t = -1.31$
Female, %	75.9%	74.2%	$\chi^2 = 0.04$
Education, years	13.4 (1.5)	13.4 (1.4)	$t = -0.23$
Employed, %	53.4%	54.8%	$\chi^2 = 0.02$
Clinical characteristics			
PHQ-9	15.90 (4.47)	2.89 (1.64)	$t = -20.88^*$
Current episode duration, weeks	30.8 (57.5)	—	
Currently taking medication, %	19.0%	—	
No. of past depressive episodes	4.4 (13.5)	—	
No. of comorbid disorders	1.1 (1.3)	—	
Panic disorder, %	27.6%	—	
Agoraphobia, %	22.4%	—	
Social anxiety, %	19.0%	—	
OCD, %	13.8%	—	
PTSD, %	10.3%	—	
GAD, %	0.0%	—	

Note. MDD = major depressive disorder; PHQ-9 = Patient Health Questionnaire-9; OCD = obsessive-compulsive disorder; PTSD = posttraumatic stress disorder; GAD = generalized anxiety disorder.

* $p < .05$.

about it over and over again”). Participants rated their use of each strategy in the past 2 hr on a 1–9 scale (1 = *not at all*, 9 = *to a large extent*).

Pro-Hedonic Motivation in the Past 2 hr. Consistent with previous research on motivation for emotions in depression as a function of valence (Mizrahi Lakan, Millgram, & Tamir, 2022), items represented prototypical pleasant emotions characterized by low (i.e., calm) and high (i.e., happy) arousal, and prototypical unpleasant emotions characterized by low (i.e., sad) and high (i.e., anxious) arousal. Participants rated how much they wanted to feel happy and calm (e.g., “In the past 2 hr, how much did you want to feel happy?”; 1 = *not at all*, 9 = *to a large extent*; $\omega_{\text{Between}} = 0.85$, $\omega_{\text{Within}} = 0.63$), and how much they wanted to feel sad and anxious (e.g., “In the past 2 hr, how much did you want to feel sad?”; 1 = *not at all*, 9 = *to a large extent*; $\omega_{\text{Between}} = 0.72$, $\omega_{\text{Within}} = 0.61$).⁶

Analytic Approach

We ran multilevel models (measurements nested within persons) using the lme4 package in R (Bates et al., 2015), with p values calculated using lmerTest (Kuznetsova et al., 2017). We included random intercepts and slopes. When models did not converge or resulted in singular fits, we removed the random effect explaining the least variance (Barr et al., 2013). Continuous Level-1 predictors were person-mean centered. To assess effect size, we calculated partial R^2 by using the *r2glmm* package in R (Jaeger et al., 2017).

Transparency and Openness

Study 2 was not preregistered. Analysis code for Study 2 is available on the Open Science Framework at: https://osf.io/tmq9j/?view_only=121bba28f7eb47db87bab44cec1a5ef7. In Study 2, we analyzed data that were collected as part of an unrelated larger research project. This project includes unpublished novel paradigms and findings which are currently under review or in preparation. Therefore, the

data and materials for Study 2 are available upon request. They will be made publicly available upon publication of the project’s results.

Results

Descriptive Statistics

The total number of completed surveys was 3,805. Forty-two surveys that were completed in <60 s were removed, resulting in 3,763 surveys.⁷ The average number of surveys completed per person was 31.71 ($SD = 7.03$, 79.28% compliance). Depressed participants completed fewer surveys on average ($M = 30.19$, $SD = 7.68$) than controls ($M = 33.13$, $SD = 6.09$), $t(108.7) = 2.31$, $p = .023$. We therefore repeated all analyses controlling for the number of surveys completed. Results remained identical. Descriptive statistics and zero-order correlations between study variables are presented in Table 3.

Distraction and Rumination

We ran separate models for each strategy for regulating each affective state (distraction from pleasant emotions, distraction from unpleasant emotions, positive rumination, negative rumination). In each model, we modeled a fixed effect of the group (depressed, healthy controls) to predict strategy use. To ensure that any group differences are not driven by differences in affect, we controlled for the respective affective state (i.e., we controlled for pleasant affect in the past 2 hr when assessing strategy use in response to pleasant emotions, and controlled for unpleasant affect in the past 2 hr when assessing strategy use in response to unpleasant emotions). Because the four emotion regulation strategies were

⁶ Due to relatively low reliabilities of these measures, we also ran separate analyses with each discrete emotion (see the online supplemental materials).

⁷ Results remained identical when including these surveys in the analyses (see the online supplemental materials).

Table 3
Descriptive Statistics and Zero-Order Correlations Between Variables (Study 2)

Variable	ICC	No. of surveys	M	Between-person SD	Within-person SD	1	2	3	4	5	6	7	8	9
1. Depression (1 = yes, 0 = no)	0.30	21.2%	1.64	0.89	0.96	0.21*	—	0.10*	0.07*	0.10*	0.06*	0.04*	0.03*	-0.00
2. Distraction from pleasant emotions	0.46	49.9%	2.69	1.54	1.50	0.07	0.52*	—	0.29*	-0.06*	0.19*	-0.06*	-0.13*	0.25*
3. Positive rumination	0.40	58.1%	3.28	1.63	1.82	0.28*	0.52*	0.81*	—	0.03*	0.18*	-0.03	0.10*	0.01
4. Distraction from unpleasant emotions	0.28	25.8%	1.70	0.83	1.03	0.24*	0.62*	0.46*	0.48*	—	-0.01	0.20*	0.33*	-0.23*
5. Negative rumination	0.61	96.4%	6.09	1.71	1.28	-0.16	0.07	0.31*	0.34*	0.04	—	-0.30*	-0.04*	0.23*
6. Motivation for pleasant emotions	0.29	23.1%	1.34	0.48	0.52	0.26*	0.50*	0.28*	0.26*	0.57*	-0.04	—	0.14*	-0.12*
7. Motivation for unpleasant emotions	0.42	64.6%	2.77	1.31	1.38	0.49*	0.24*	0.16	0.39*	0.40*	-0.01	0.51*	—	-0.59*
8. Current unpleasant affect	0.49	94.8%	5.17	1.53	1.45	-0.52*	-0.04	0.18*	0.04	-0.08	0.56*	-0.16	-0.49*	—
9. Current pleasant affect														

Note. Correlations above the diagonal are within-person correlations. Correlations below the diagonal are between-person correlations. Correlations were calculated using the psych package in R (statsBy function; Revelle, 2017). ICC represents the proportion of variance at the between-person level. % surveys = percentage of surveys where participants endorsed some degree of that variable (responses > 1). ICC = intraclass correlation coefficient.
* $p < .05$.

correlated with one another (see Table 3), when predicting each strategy, we controlled for the other three strategies.

Consistent with Study 1, we found that depressed individuals reported distracting more from pleasant emotions in daily life ($M = 1.83$, $SE = 0.11$) compared to controls ($M = 1.45$, $SE = 0.10$), $b = 0.38$, $SE = 0.14$, $t(105.09) = 2.68$, $p = .009$, 95% CI [0.10, 0.66], $R^2 = 0.03$. Depressed and healthy participants did not differ in their use of positive rumination, $b = 0.41$, $SE = 0.25$, $t(120.5) = 1.65$, $p = .101$, [-0.08, 0.90], $R^2 = 0.02$.

Depressed individuals also distracted more from unpleasant emotions ($M = 3.67$, $SE = 0.20$) compared to controls ($M = 2.92$, $SE = 0.19$), $b = 0.75$, $SE = 0.27$, $t(115.8) = 2.80$, $p = .006$, 95% CI [0.18, 1.31], $R^2 = 0.05$. Finally, depressed individuals used negative rumination to a greater extent ($M = 1.92$, $SE = 0.10$) compared to controls ($M = 1.50$, $SE = 0.10$), $b = 0.43$, $SE = 0.13$, $t(116.1) = 3.40$, $p < .001$, [0.18, 0.68], $R^2 = 0.04$.

Pro-Hedonic Motivation

Findings pertaining to motivations for discrete emotions in depression are reported by Mizrahi Lakan, Hu, et al. (2022). We ran separate models for pleasant and unpleasant emotions. In each model, we modeled a fixed effect of the group (depressed, healthy controls) to predict motivation for pleasant/unpleasant emotions. As before, we controlled for the respective affective state.

We found that depressed participants were more motivated to experience unpleasant emotions (sadness, anxiety) in their daily lives ($M = 1.48$, $SE = 0.06$) compared to healthy participants ($M = 1.21$, $SE = 0.06$), $b = 0.27$, $SE = 0.08$, $t(118.24) = 3.52$, $p < .001$, 95% CI [0.12, 0.41], $R^2 = 0.04$. Groups did not differ, however, in their motivation for pleasant emotions (happiness, calmness), $b = -0.55$, $SE = 0.31$, $t(118.04) = -1.77$, $p = .079$, [-1.15, 0.06], $R^2 = 0.04$ ($M = 5.81$, $SE = 0.22$ for depressed and $M = 6.35$, $SE = 0.21$ for control participants).

Does Pro-Hedonic Motivation Predict Strategy Use?

We ran separate models for predicting each strategy by each type of motivation. Again, when predicting each strategy, we controlled for the respective affective state in the past 2 hr, and for the other three strategies.

When using motivation for unpleasant emotions to predict distraction from pleasant emotions and distraction from unpleasant emotions, the models did not result in a singular fit only after removing the random slope for motivation for unpleasant emotions. Motivation for unpleasant emotions significantly predicted the use of more distraction from positive emotions, $b = 0.07$, $SE = 0.03$, $t(3,341) = 2.26$, $p = .024$, 95% CI [0.009, 0.13], $R^2 = 0.001$, and the use of more negative rumination, $b = 0.19$, $SE = 0.05$, $t(69.8) = 3.65$, $p < .001$, [0.08, 0.31], $R^2 = 0.02$. It was unrelated to the use of distraction from unpleasant emotions, $b = -0.06$, $SE = 0.05$, $t(3,386) = -1.38$, $p = .167$, [-0.15, 0.03], $R^2 = 0.001$, and positive rumination, $b = -0.07$, $SE = 0.04$, $t(78.45) = -1.60$, $p = .114$, [-0.16, 0.02], $R^2 = 0.001$.

When using motivation for pleasant emotions to predict positive rumination, distraction from unpleasant emotions and distraction from pleasant emotions, the models did not result in a singular fit only after removing the random slope for motivation for pleasant

emotions. When predicting distraction from pleasant emotions, we additionally had to remove the slope for distraction from negative emotions. Motivation for pleasant emotions significantly predicted the use of more positive rumination, $b = 0.10$, $SE = 0.02$, $t(3,583) = 4.95$, $p < .001$, 95% CI [0.06, 0.13], $R^2 = 0.007$, and more distraction from unpleasant emotions, $b = 0.16$, $SE = 0.02$, $t(3,599) = 7.10$, $p < .001$, [0.11, 0.20], $R^2 = 0.01$. It was unrelated to distraction from pleasant emotions, $b = 0.03$, $SE = 0.02$, $t(3,474) = 1.92$, $p = .054$, [-0.0006, 0.06], $R^2 = 0.001$, and to negative rumination, $b = 0.005$, $SE = 0.02$, $t(101.8) = 0.26$, $p = .799$, [-0.04, 0.05], $R^2 < 0.001$.

Does Pro-Hedonic Motivation Predict Changes in Affect?

We ran separate models for predicting each current affective state by motivation for unpleasant or pleasant emotions in the past 2 hr, controlling for the respective affective state in the past 2 hr. When using motivation for unpleasant emotions to predict changes in pleasant affect, the model did not result in a singular fit only after removing the random slope for motivation for unpleasant emotions. Motivation for unpleasant emotions predicted increases in unpleasant affect, $b = 0.12$, $SE = 0.04$, $t(39.1) = 3.16$, $p = .003$, 95% CI [0.03, 0.20], $R^2 = 0.005$, and decreases in pleasant affect, $b = -0.13$, $SE = 0.03$, $t(3,624) = -4.63$, $p < .001$, [-0.18, -0.07], $R^2 = 0.006$. When using motivation for pleasant emotions to predict changes in unpleasant affect, the model did not result in a singular fit only after removing the random slope for motivation for pleasant emotions. Motivation for pleasant emotions predicted increases in pleasant affect, $b = 0.08$, $SE = 0.02$, $t(90.08) = 4.07$, $p < .001$, [0.04, 0.11], $R^2 = 0.009$ and decreases in unpleasant affect, $b = -0.04$, $SE = 0.01$, $t(3,625) = -3.31$, $p < .001$, [-0.07, -0.02], $R^2 = 0.003$.

Discussion

Consistent with Study 1, depressed individuals in Study 2 were more likely than controls to distract from pleasant emotions in daily life. Groups did not differ, however, in their use of positive rumination, suggesting that depressed individuals tend to distract from pleasant emotions rather than avoid ruminating about them. In response to unpleasant emotions, depressed participants were more likely to use both distraction and negative rumination compared to controls. These findings suggest that depressed (vs. healthy) individuals might react to unpleasant emotions by both distracting and ruminating, which might explain the lack of group differences in Study 1, when negative rumination and distraction were pitted against one another.

With regard to their motivations, although in both groups participants were more motivated to experience pleasant than unpleasant emotions, depressed individuals were more motivated than controls to experience unpleasant emotions. Stronger motivation for unpleasant emotions, in turn, predicted the use of more distraction from pleasant emotions, more negative rumination, increases in unpleasant affect and decreases in pleasant affect. Depressed and healthy controls did not differ, however, in their motivation for pleasant emotions. Motivation for pleasant emotions predicted more positive rumination and more distraction from unpleasant emotions, as well as increases in pleasant affect and decreases in unpleasant affect.

General Discussion

Our findings suggest that when given the opportunity to choose between emotion regulation strategies, people diagnosed with MDD and healthy individuals make different choices. In Study 1, depressed individuals were more likely than controls to choose distraction (vs. positive rumination) in response to pleasant memories, resulting in decreases in pleasant affect and increases in unpleasant affect. Whereas healthy individuals preferred positive rumination over distraction in response to pleasant memories, reflecting pro-hedonic preferences, depressed individuals were agnostic. This pattern of emotion regulation was also evident in daily life (Study 2), as depressed individuals were more likely than controls to distract from pleasant

emotions (but were equally likely to ruminate about them). These findings suggest that distraction from pleasant emotions may characterize depression and that at least in some cases, depressed individuals actively choose to use it.

Study 1 further suggests that depressed individuals' choices in response to pleasant stimuli could be altered by activating pro-hedonic motivation. When instructed to choose the strategy that would make them feel better, depressed individuals did not differ from controls in their choices. This indicates that depressed individuals were knowledgeable of the emotional consequences of strategies, but spontaneously were less likely than controls to prioritize the strategy that leads to greater short-term hedonic benefits. In Study 2, although depressed individuals wanted to experience more pleasant than unpleasant emotions in daily life, they were more motivated than healthy individuals to experience unpleasant emotions (sadness, anxiety). These somewhat stronger motivations for unpleasant emotions, in turn, predicted greater distraction from pleasant emotions and greater use of negative rumination. These findings lend support to the hypothesis that depressed individuals' use of some emotion regulation strategies may be partly driven by weaker short-term pro-hedonic motivation. Further experimental research is needed to test the causal role of motivation for unpleasant emotions in strategy choices in depression. Further research is also needed to test whether depressed individuals' choices of strategies reflect learned habits versus deliberate choices (Watkins & Nolen-Hoeksema, 2014). Furthermore, additional reasons for strategy choices in depression should be investigated. For instance, depressed individuals may choose distraction from pleasant emotions because they feel unable to use other strategies, because other strategies might be inappropriate in specific contexts, or because they may perceive positive self-focus as "bragging" (Yoon & Rottenberg, 2020). It is also important to understand what underlies weaker short-term pro-hedonic motivation in depression. For instance, depressed individuals may feel they deserve to experience unpleasant emotions (Wood et al., 2009), or they might find unpleasant emotions to be more familiar and self-consistent (Swann et al., 1992).

Contrary to our predictions, in Study 1, groups did not differ in their strategy choices in response to unpleasant memories, as both groups were more likely to choose distraction over negative rumination. Depressed individuals tend to use negative rumination more often than controls (Nolen-Hoeksema et al., 2008), but here they were not more likely to actively choose to use negative rumination. Therefore, these findings support the possibility that excessive use of negative rumination in depression might not be chosen, but instead is involuntary (Joormann & Vanderlind, 2014). In daily life, however, negative rumination was associated with increased motivation for

unpleasant emotions (Study 2). Future research is needed to understand the role of motivation in negative rumination. One possibility is that involuntary negative rumination retrospectively generates increased motivation for unpleasant emotions. Another possibility is that our behavioral task failed to capture the motivated use of negative rumination as it manifests in daily life. Future research could distinguish between these possibilities. Furthermore, in our behavioral task, both groups made fewer choices to use negative rumination when pro-hedonic motivation was activated, suggesting that depressed and healthy individuals may have been driven by non-hedonic motivations, such as increasing self-awareness (Papageorgiou & Wells, 2001) when choosing strategies spontaneously.

Together, our findings contribute to a distinction between strategy selection and strategy implementation in depression (Gross, 2015). Whereas some strategies might be implemented involuntarily (e.g., negative rumination), others might be actively chosen (e.g., distraction from pleasant emotions). By suggesting that different mechanisms might underlie the use of different strategies in depression, our findings also highlight the importance of further integration between views of emotion regulation strategies as deliberate coping styles (Papageorgiou & Wells, 2001) versus products of more automatic cognitive processes (Joormann & Vanderlind, 2014). Assessing strategy choice can help researchers and practitioners to identify when strategy implementation might reflect an active choice. If depressed individuals choose less adaptive emotion regulation strategies, it might be possible to help them choose differently. Indeed, our findings show that choices of strategies in depression are malleable and could be altered by activating pro-hedonic motivation. Weaker short-term pro-hedonic motivation, therefore, might be one of the reasons why depressed individuals use less adaptive strategies when they are able to use more adaptive ones (Yoon & Rottenberg, 2020).

Study Limitations

Our studies have shortcomings. First, to assess spontaneous strategy choices without priming specific motivations, in Study 1, the order of the spontaneous and pro-hedonic blocks was fixed. Consequently, we cannot rule out order or learning effects. The task also focused on certain aspects of positive and negative rumination (e.g., causes of feelings), but not others (e.g., consequences of feelings). These design limitations could be addressed in future research.

Second, while in Study 1, we assessed active choice of strategies, in Study 2, we retrospectively assessed strategy implementation, albeit across short periods of time (i.e., 2 hr). Therefore, in Study 2, we cannot distinguish between strategies that were chosen or involuntarily implemented. In Study 2, we also measured motivations for pleasant and unpleasant emotions using discrete emotion items, whereas pleasant and unpleasant affect were measured using general affect items. Future research should directly assess motivations for pleasant and unpleasant affect. Future studies could also investigate why motivation for pleasant emotions mostly differed between-persons, whereas motivation for unpleasant emotions mostly differed within person.

Third, our samples included university students. Future research should replicate our results in community samples, and test whether our findings apply to depressed individuals who mainly experience depressed mood versus anhedonia. There is also a need to target additional strategies other than distraction and rumination, such as dampening and reappraisal (Vanderlind et al., 2022).

Finally, longitudinal designs are required to test whether strategy choices have long-lasting clinical implications. Depressed individuals struggle to alleviate their depression. Yet, when it comes to regulating emotions, we found that they can sometimes make self-defeating choices, by choosing strategies that decrease pleasant affect. These choices could potentially be related to weaker short-term pro-hedonic motivation.

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