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Sad reflections of happy times: depression vulnerability and experiences of sadness and happiness upon retrieval of positive autobiographical memories

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ABSTRACT

Instructed retrieval of positive autobiographical memories typically improves mood for healthy individuals, but not always for depressed individuals. No mood improvement may occur when depressed individuals retrieve positive memories that are self-incongruent, or when they ruminate upon positive memory retrieval. Mindfulness is associated with lower self-incongruency and rumination. The present study examined whether recurrent depression predicted emotional experience upon involuntary and voluntary retrieval of positive memories, and whether recurrent depression and trait mindfulness were associated with emotional experience upon positive memory retrieval through state rumination and self-incongruency. Recurrently and never-depressed individuals completed measures of depression, trait mindfulness, and a diary for reporting on everyday positive memories. Recurrently depressed individuals reported diminished happiness upon retrieving involuntary and voluntary positive memories compared to never-depressed individuals; and greater sadness upon involuntary positive memory retrieval, independent of current depression. Recurrent depression was associated with diminished happiness upon involuntary memory retrieval and greater sadness upon involuntary and voluntary positive memory retrieval, through state brooding, self-incongruency, or both. Higher trait mindfulness was associated with lower sadness upon involuntary and voluntary positive memory retrieval through state brooding and reflection. These findings highlight potential mechanisms in the relationship between depression vulnerability and emotional processing of positive autobiographical memories.

"My childhood days bring back sad reflections.

Of happy days so long ago."

Irish folk song

Introduction

A growing body of research suggests that depression is associated with impaired emotional processing of positive autobiographical memories. For example, while healthy individuals who have been induced with sad mood typically experience mood improvement following intentional or voluntary retrieval of positive autobiographical memories, dysphoric or depressed individuals may report no mood improvement, or even a worsening of mood (Joormann et al., 2007; Joormann & Siemer, 2004). This impaired ability to use positive autobiographical memories to repair sad mood is also evident in individuals remitted from depression (Joormann et al., 2007), suggesting that it

may constitute a persistent depressogenic vulnerability in individuals with a depression history.

While the above studies provide evidence that the emotional processing of voluntary positive autobiographical memories is disrupted in individuals with a depression history, investigations of how these individuals emotionally process positive autobiographical memories that come to mind involuntarily or spontaneously are lacking. Such memories are important to investigate, given that they are common in everyday life (Rasmussen & Berntsen, 2011), can greatly influence everyday mood (Berntsen & Hall, 2004), and as such may be crucial for understanding everyday mood and depression vulnerability in individuals with a depression history. Indeed, two recent studies suggest that whether positive memories are retrieved voluntarily or involuntarily may be important for determining how individuals with depression emotionally respond to them. In the first study, Hashimoto et al. (2021) demonstrated that depressed individuals show less mood

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impairment upon involuntary retrieval compared to voluntary retrieval of memories of positive pictures. However, this study assessed involuntary and voluntary memories of positive pictures as opposed to autobiographical memories and may not be representative for how depressed individuals respond to involuntary versus voluntary positive autobiographical memories, which are likely to have greater self-relevance. In the second study, Isham et al. (2020) showed that, contrary to currently dysphoric individuals who have been found to report comparable levels of brooding and emotion regulation impairment for involuntary and voluntary memories (del Palacio-Gonzalez et al., 2017), remitted depressed individuals with low mindfulness skills reported heightened brooding in reponse to involuntary but not voluntary autobiographical memories compared to never-depressed individuals. This finding suggests that indivdiuals with past depression may display a heightened vulnerability in the emotional processing of involuntary autobiographical memories relative to voluntary memories. Importantly, this effect was independent of memory valence, suggesting that it was not simply driven by *negative* involuntary or intrusive memories, which are commonly experienced in indivdiuals with depression (Payne, Kralj, Young, & Meiser-Stedman, 2019; Newby & Moulds, 2011), but might also occur for *positive* involuntary memories. Therefore, in the present study we wanted to investigate whether individuals with a depression history display a vulnerability in the emotional processing of positive involuntary relative to voluntary memories, which contrary to negative involuntary or intrusive memories have not received much attention in the depression literature.

In addition, we were interested in investigating two possible mechanisms underlying impaired emotional processing of positive autobiographical memories in individuals with a depression history, namely rumination and self-incongruency upon memory retrieval. Previous research has demonstrated that individuals with depression may fail to show mood improvement when asked to retrieve a positive personal past event that is incongruent with their present sense of self (Werner-Seidler et al., 2017), or process the event in a ruminative manner (i.e., think about the causes and consequences as opposed to concrete aspects of the event) (Werner-Seidler & Moulds, 2012). Other research has shown that individuals with a depression history may exhibit heightened levels of trait rumination (e.g., Watkins & Moulds, 2009), heightened brooding in response to involuntary autobiographical memories (Isham et al., 2020), and that depression symptomatology is associated with greater experienced incongruency between one's past and present self (Burrow et al., 2020). As such, individuals with a depression history may be more likely to spontaneously ruminate and experience self-incongruency upon positive autobiographical memory retrieval in everyday life, which in turn may influence everyday emotional experience.

A final point of interest in the present study was whether trait mindfulness may protect against impaired emotional processing of positive autobiographical memories through reducing rumination and self-incongruency for these memories. Previous research has demonstrated that individuals with high trait mindfulness report less habitual rumination than individuals with low trait mindfulness (e.g., Chambers et al., 2015; Desrosiers et al., 2013; Svendsen et al., 2017), and that high mindfulness skills in remitted depressed individuals may protect against brooding in response to autobiographical memories, when these come to mind involuntarily (Isham et al., 2020). There is also evidence for a similar relationship between mindfulness and measures of self-congruency. Specifically, Longo et al. (2017) found that higher levels of mindful awareness and acceptance were associated with greater self-perceived congruency between one's behaviours and sense of self. Further, Crane et al. (2008) showed that participation in Mindfulness-Based Cognitive Therapy (MBCT) lead to decreases in discrepancies between ideal self and actual self, compared to a waitlist control group.

Taken together, the above studies suggest that depression vulnerability is associated with heightened rumination and self-incongruencies, which in turn may have a detrimental impact on emotional experience. Mindfulness, on the other hand, is associated with less rumination and self-discrepancies, which in turn may enhance emotional experience. These findings raise questions of whether depression vulnerability may compromise emotional experience upon retrieval of positive autobiographical memories, through increased levels of rumination and self-discrepancies upon memory retrieval, while mindfulness may enhance emotional experience upon positive memory retrieval through decreasing rumination and self-incongruencies. Finally, there is evidence to suggest that involuntary memories may foster greater emotion regulation impairment than voluntary memories in individuals with a depression history (Isham et al., 2020), while mindfulness may be particularly helpful for targeting emotional responses to involuntary memories as opposed to voluntary memories (Isham et al., 2020). Therefore, an additional question we raise is whether there are any differences in emotional processing of involuntary and voluntary positive autobiographical memories, and their roles in depression vulnerability.

Thus, the first aim of the present study was to assess whether recurrently depressed and never-depressed individuals differ in the intensity of emotions experienced in response to involuntary and voluntary positive autobiographical memories. We chose to use a recurrently depressed sample (i.e., individuals reporting at least two previous episodes of depression) because individuals who have experienced repeated episodes of depression are at heightened risk of depressive recurrence (for a review, see Richards, 2011), which may result from long-lasting cognitive changes following initial episodes of

depression (e.g., Gorwood et al., 2008; Lewinsohn et al., 1981; Vanderhasselt & De Raedt, 2009). As such, it is important to identify whether recurrently depressed individuals display alterations in their emotional responses to positive autobiographical memories that may put them at heightened risk for future depressive episodes. The second study aim was to investigate possible mechanisms underlying differences in emotional responses to involuntary and voluntary positive autobiographical memories between recurrently depressed and never-depressed individuals. Specifically, we wanted to assess whether recurrent depression was associated with emotional responses to involuntary and voluntary autobiographical positive autobiographical memories through rumination and self-incongruency. Finally, we wanted to investigate whether trait mindfulness may influence emotional responses to involuntary and voluntary positive autobiographical memories through rumination and self-incongruency, and as such may protect against impaired emotional processing of positive autobiographical memories in recurrently depressed individuals.

To address these aims, we employed a naturalistic memory diary method where recurrently depressed and never-depressed individuals recorded and reported on involuntary and voluntary positive autobiographical memories and completed self-report measures of depression and trait mindfulness. Related to the first study aim, we expected that recurrently depressed individuals would report greater intensity of negative emotion and lower intensity of positive emotion in response to positive autobiographical memories compared to never-depressed individuals. We hypothesised that these effects would be greater for involuntary memories than voluntary memories. Related to the second study aim, we expected a mediation process in which recurrent depression would be associated with more rumination and self-upon memory retrieval, which in turn would be associated with less intense positive emotion and more intense negative emotion when retrieving positive autobiographical memories. Given that brooding (i.e., passive, negative self-focus) has been suggested as a particularly maladaptive facet of rumination (for a review, see Nolen-Hoeksema et al., 2008), we expected that it would be the strongest mediator of the rumination facets. We also expected that the mediation effect sizes would be larger for involuntary positive memories compared to voluntary positive memories.

Related to our final aim, we predicted a mediation process in which higher trait mindfulness would be related to less rumination and self-incongruency upon memory retrieval, which in turn would be associated with more intense positive emotions and less intense negative emotions in response to positive autobiographical memories. Based on previous evidence that trait mindfulness is associated with brooding but not reflection upon autobiographical memory retrieval (Isham et al., 2020), we expected that brooding would be the primary mediator

out of the rumination facets. We also expected that the mediation effects sizes would be larger for involuntary positive memories compared to voluntary positive memories.

Methods

Participants

Participants were recurrently depressed and never-depressed individuals. The recurrently depressed group met the criteria for at least two episodes of depression, as assessed with the Mini-International Neuropsychiatric Interview Plus (MINI+) (Sheehan et al., 1998). The group included both individuals in remission (i.e., no current clinical depressive episode) from depression and individuals who met the clinical criteria for a current depressive episode. The never-depressed participants had no past episodes of depression and scored below 10 on the DASS Depression Scale (i.e., below the cut-off for depression; Lovibond & Lovibond, 1995). All participants had to be native or fluent English speakers and in the age range 18–65 years old. The analysed sample consisted of 24 (3 male) never-depressed and 31 (2 male and two non-binary) recurrently depressed participants ($N = 55$). Three additional never-depressed participants failed to complete the memory diaries as instructed and their data was therefore not analysed.

The sample size was comparable to previous studies which have assessed involuntary and voluntary memories in depressed samples (e.g., del Palacio-Gonzalez et al., 2017; Hashimoto et al., 2021; Isham et al., 2020; Watson, Berntsen, Kuyken, & Watkins, 2012). A post-hoc sensitivity analysis for within-between interactions suggested that this sample size should be adequate for detecting small within-between interactions at a power of 0.80 and $α = .05$ when predicting sadness ($f = .17$) and happiness ($f = .15$) upon positive memory retrieval. For the mediation analyses, estimates by Fritz and MacKinnon (2007) suggest that our sample size should be sufficient for detecting mediated effects with path coefficients of medium-large effect size at a power of .80, when bias-corrected bootstrapping is employed.

The gender distributions in the study groups were statistically equal, $χ^2$ (2, $N = 55$) = 2.09, $p = .351$. There were no age differences between groups according to a Welch's test, $t(1, 52.93) = 1.27$, $p = .265$ ($M = 21.25$, $SD = 7.62$; $M = 23.97$, $SD = 10.26$). Fifty-two participants were university students (38 undergraduates; 14 non-psychology postgraduates) and 3 participants were non-students. All participants reported that they were native or fluent English speakers.

Among the recurrently depressed participants, 12 (38.7%) reported between two and four depressive episodes, six (19.4%) reported between five and ten episodes, while 13 (41.9%) reported that they had experienced more episodes than they could count (e.g., "countless", "many",

"continuous"). Seventeen of the recurrently depressed participants also met diagnostic criteria for current depression, while 14 were not currently depressed. The recurrently depressed participants reported significantly higher current and past comorbidity according to Welch's tests, $F(1, 41.74) = 28.92$, $p < .001$; $F(1, 48.04) = 37.40$, $p < .001$, compared to the controls. The most frequent current diagnosis other than major depression was generalised anxiety disorder (38.9% of total sample, $n = 21$).

Procedure

We advertised the study on university and public bulletin boards, in weekly student and staff emails, on Facebook groups, and through a participant recruitment system at the University of St Andrews. All participants completed an informed consent form prior to participation in the study. They were then asked to complete an online demographics questionnaire and were invited to the study if they met the requirements for English fluency and age. Eligible participants received an email with a personal Qualtrics link that gave them access to the online questionnaires listed below. After completing the online questionnaires, participants were invited to an interview where they were interviewed with the MINI +, went through the memory diary instructions, and were given materials necessary for completing the diary. Participants took the materials home and were asked to record memories until they had completed ten involuntary and ten voluntary positive memories. After handing in their memory diaries participants were given a debrief sheet. All participants were compensated for their participation at a rate of £5/hour. The local board for research ethics approved the study prior to commencement.

Materials

Mini-international neuropsychiatric interview plus (MINI+)

The MINI+ (Sheehan et al., 1998) is a clinical interview to assess psychological disorders. The MINI+ is compatible with diagnostic criteria of the International Classification of Diseases (ICD) and the Diagnostic and Statistical Manual of Mental Disorders (DSM). The sections of the MINI+ included in the present study were past and current major depressive episode (MDE), (hypo)manic episode, dysthymia, post-traumatic stress disorder (PTSD), panic disorder, alcohol abuse and dependence, and generalised anxiety disorder (GAD). To assess interrater-reliability, ten interviews were double-rated by two researchers trained to use the MINI+. Following initial separate interview ratings, the interrater agreement was 90% for depression diagnostics, and 97.9% for remaining diagnostics. Following discussion there was 100% agreement for all diagnostic conclusions.

Depression, anxiety, stress scales (DASS)

We used the DASS (Lovibond & Lovibond, 1995) to measure symptoms of depression, anxiety, and stress. The self-report measure consists of 42 items across depression, anxiety, and stress subscales, and uses a 4-point rating scale (0 = *Did not apply to me at all*, 3 = *Applied to me very much, or most of the time*). In the current study the Cronbach alphas were .97, .95, and .97 for the depression, anxiety, and stress subscales, respectively.

Ruminative response scale (RRS)

We employed the RRS (Nolen-Hoeksema & Morrow, 1991) to assess dispositional rumination, brooding and reflection. The total scale consists of 22 statements that describe ruminative responses to depressed mood. This can be divided into subscales of reflection and brooding, composed of five items each (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The scales use a 4-point rating scale (1 = *Almost never*, 4 = *Almost always*). The scales exhibited good internal consistency in the present study (α = .95, α = .78, and α = 84. for the full scale, reflection subscale, and brooding subscale, respectively).

Five facet mindfulness questionnaire (FFMQ)

We measured trait mindfulness with the FFMQ (Baer et al., 2006). This self-report measure consists of 39 statements that are rated on a 5-point scale (1 = *Never or very rarely true*, 5 = *Very often or always true*). The measure exhibited a Cronbach`s alpha of .95 in the present study.

Autobiographical memory diary

We employed a structured memory diary to collect involuntary and voluntary (word-cued) memories and emotional responses to those recollections. The diary structure was based on del Palacio-Gonzalez et al.'s (2017) diary used to assess involuntary and voluntary autobiographic memories in dysphoric individuals, which in turn was based on a well-established diary methodology developed by Berntsen and Hall (2004). In the present study, participants were asked to report on *positive* autobiographical memories, defined as events that made participants happy at the time when they happened. There were three main steps involved in completing the memory diary: recording and rating positive involuntary memories in a pocket-sized notebook immediately upon retrieval in everyday life; transferring notebook ratings for the positive involuntary memories to a structured memory diary later in the day and completing follow-up questions for these memories; recalling and rating a positive voluntary memory *of an event that made them happy at the time when it happened* immediately after completing the follow-up questions for each involuntary memory (Isham et al., 2020). The instruction for retrieving voluntary positive autobiographical memories has been employed previously by Joormann et al. (2007).

Participants rated each involuntary and voluntary positive memory along several dimensions (see Table 1 below). Participants also rated additional dimensions not reported in the present study, including their mood before the memory appeared, other emotions and emotion regulation strategies upon memory retrieval, valence of self-incongruency upon memory retrieval, memory specificity, and how central each memory was for their identity.

In the present study participants could record the first three memories of the day and were not given any completion deadline. Participants finished the diary at different rates (*M* = 10.52 days; *SD* = 6.32), with a mean number of 19.95 (*SD* = 0.30) recorded memories. Never-depressed and recurrently depressed participants did not differ significantly in their completion rates, Welch's *F* (1,46) = 2.49, *p* = .122.

Data analysis strategy

Group differences in symptoms and trait variables
As some of our data violated assumptions of normality and homogeneity, we employed bootstrapped t-tests to assess group differences in symptoms and trait variables. This is considered a robust method for dealing with non-normality and heterogeneity (Field, 2013). All confidence intervals (CIs) for group differences are bias-corrected (BCa) CIs based on 1000 stratified bootstrap samples and are considered statistically significant when they do not include zero.

Group differences in memory characteristics
We conducted 2×2 mixed ANOVAs to examine group differences in memory characteristics. The between-subjects measure was Group (never-depressed vs. recurrently

Table 1. Memory dimensions reported in the present study

1. [Emotions at the time of the remembered event] How positive were your emotions at the time of the event(s)? (1 = Not at all; 5 = Very)
2. [Intensity of sadness and happiness] How intensely did you experience the following emotions at the moment when you thought of the memory? (1 = Not at all; 5 = A great deal)
3. [State rumination] I considered the causes, meanings, and/or consequences of the event (1 = Not at all; 5 = To a great extent)
4. [State rumination] I played the scene over in my head as if I was replaying a movie of how the event unfolded (5 = Not at all; 1 = To a great extent)
5. [State rumination (reflection)] I analysed the events to try to understand my feelings (1 = Not at all; 5 = To a great extent)
6. [State rumination (brooding)] I thought: Why do I always react this way? (1 = Not at all; 5 = To a great extent)
7. [Self-incongruency] The person who experienced the event feels like a different person from who I am today (1 = Not at all; 5 = To a great extent)
8. [Self-incongruency] I feel similar now to who I were at the time the event occurred (5 = Not at all; 1 = To a great extent)
9. [Self-incongruency] The person who experienced the event feels like the person who I am today (5 = Not at all; 1 = To a great extent)
10. [Self-incongruency] I feel different now compared to the time the event occurred (1 = Not at all; 5 = To a great extent)

Note. Items 1–4 adapted from del Palacio-Gonzalez et al. (2017); 5–6 from Werner-Seidler and Moulds (2012); 7–10 from Werner-Seidler et al. (2017). Overall state rumination consisted of items 3-6.

depressed) and the within-subjects measure was retrieval mode (involuntary vs. voluntary).

Mediation analyses
We employed Hayes' (2018) PROCESS macro (version 3.5.) for SPSS to test atemporal mediated associations (Winer et al., 2016) between depression group and trait mindfulness, and sadness and happiness upon autobiographical memory retrieval. The PROCESS macro is a path analysis modelling tool used to estimate mediated or indirect relationships in cross-sectional as well as longitudinal data (Hayes, 2018).

We tested separate mediation models for happiness upon involuntary retrieval, happiness upon voluntary retrieval, sadness upon involuntary retrieval, and sadness upon voluntary retrieval. We first conducted simple mediation analyses for all mediation variables (i.e., self-incongruency, rumination, brooding, and reflection; see Figure 1a below for an example of the simple mediation models). If effects were mediated by more than one variable, we employed parallel mediation to examine the indirect effects though each mediator, while controlling for the other (see Figure 1b below).

Never-depressed participants scored significantly higher on trait mindfulness than recurrently depressed participants (see Table 2 below). Therefore, we controlled for depression history (i.e., never-depressed vs. recurrently depressed) in the trait mindfulness mediation models to make sure that effects of trait mindfulness were not driven by high mindfulness scores among never-depressed participants.

We used bias-corrected bootstrapping to test the significance of mediation effects. Bias-corrected bootstrapping is an effective way of dealing with violations of homogeneity and normality (Field, 2013). It is also useful when dealing with smaller sample sizes as it can be used even with small samples and may improve power in tests of mediated effects (Shrout & Bolger, 2002). All confidence intervals (CIs) for indirect effects are bias-corrected (BCa) CIs based on 5000 bootstrap samples, as recommended for mediation analysis by Hayes (2018). We employed partially standardised effects as estimates of effect size for our dichotomous independent variable (i.e., depression group) (Hayes, 2018). For indirect effects of trait mindfulness, we employed completely standardised indirect effects (Preacher & Kelley, 2011) as estimates of effect size and followed recommendations by Kenny (2021) to interpret these (.01 = small effect size; .09 = medium effect size; .25 = large effect size).
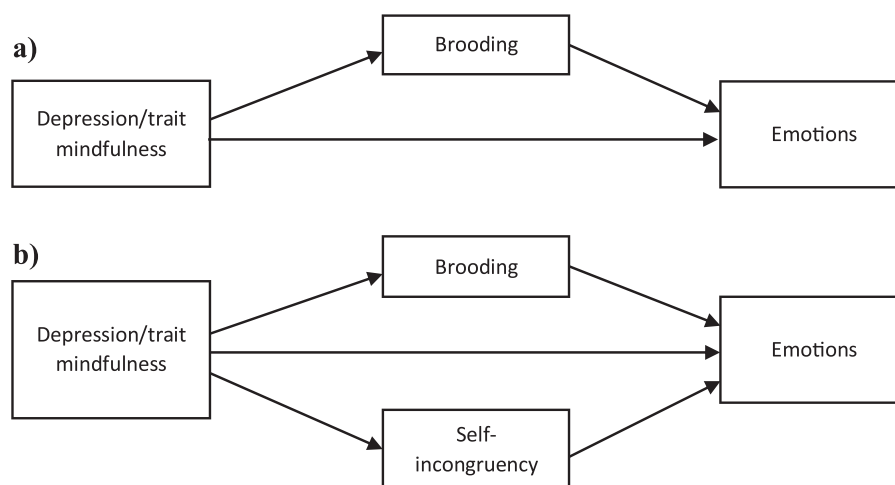
Results

Group differences in symptoms and trait variables
As shown in Table 2 there were significant group differences in all symptoms and trait measures. Recurrently

Figure 1. Examples of simple and parallel mediation models.

depressed participants reported higher depression, anxiety, stress, and rumination compared to never-depressed participants. They also reported significantly lower trait mindfulness.

Group differences in memory characteristics

Retrieval of positive memories

Before testing our hypotheses concerning group differences in emotional experience upon positive memory retrieval, we wanted to ensure that participants had reported memories that were positive. To ensure that the remembered events were positive, we asked participants to rate how positive their emotions were at the time of each event (see Table 1, item 1). From a total of 1097 recorded memories (549 involuntary; 548 voluntary), 39 (33 involuntary; 6 voluntary) memories were rated as not positive. As can be seen in Table 2 above there were no group differences in the proportion of positive memories recorded by never-depressed and recurrently depressed participants, irrespective of retrieval mode. However, the group differences approached significance for positivity ratings of the remembered positive events, suggesting that recurrently depressed participants may have rated their positive memories as less positive than never-depressed participants.

Intensity of emotions upon retrieval of positive memories

Memories rated as not positive were excluded from our analyses concerning group differences in the intensity of emotions experienced upon positive memory retrieval. As shown in Table 3 below, there were significant group differences in the intensity of both sadness and happiness experienced upon positive memory retrieval. Compared to never-depressed participants, recurrently depressed participants reported less happiness in response to positive memories, irrespective of retrieval mode. There was also a main effect of retrieval mode, suggesting that participants reported more intense happiness in response to voluntary memories compared to involuntary memories. For sadness, there was a significant effect of group suggesting that recurrently depressed participants reported greater sadness upon retrieving positive autobiographical memories. Further, the interaction of group and memory retrieval mode approached significance, suggesting that the magnitude of the group effect may depend on whether memories are retrieved voluntarily or involuntarily.

Controlling for current depression

Since the recurrently depressed group consisted of both acutely depressed and remitted depressed individuals, we were interested in testing whether the group

Table 2. Group comparisons of trait measures and symptoms.

	RD ($n = 31$)		ND ($n = 24$)				BCa 95% CI	
	M	SD	M	SD	t	Mean Diff.		
DASS Depression	22.97	9.49	1.46	1.96	−12.29*	−21.51	−24.87	−18.04
DASS Anxiety	19.52	9.75	2.17	2.93	−9.38*	−17.35	−21.04	−13.67
DASS Stress	28.35	7.74	4.33	4.01	−14.90*	−24.02	−27.37	−20.92
Rumination	59.13	10.40	37.13	10.15	−7.86*	−22.00	−27.38	−16.63
FFMQ	99.55	17.33	137.42	15.61	8.39*	37.87	27.99	47.14

Note. RD = recurrently depressed; ND = never-depressed; DASS = Depression, Anxiety, Stress Scales; ERQ = Emotion Regulation Questionnaire; FFMQ = Five Facet Mindfulness Questionnaire.
* BCa 95% confidence interval (CI) does not include zero.

Table 3. Group differences in memory valence and emotional responses to positive involuntary and voluntary autobiographical memories.

| | ND (n = 31) | | | | RD (n = 24) | | | | Effects | | | | | |
| | Involuntary | | Word-cued | | Involuntary | | Word-cued | | Group (1,53) | | Retrieval (1,53) | | Interaction (2,53) | |
	M	SD	M	SD	M	SD	M	SD	F	η_p^2	F	η_p^2	F	η_p^2
Emotion at time of the event														
Positive memories proportion	0.95	0.10	0.96	0.18	0.93	0.18	0.98	0.05	0.00	0.00	1.42	0.03	0.49	0.01
	[0.89,1.01]		[0.91,1.01]		[0.88,0.99]		[0.94,1.03]							
Positivity	4.23	0.40	4.56	0.35	4.06	0.50	4.32	0.42	3.86†	0.07	32.22*	0.38	0.39	0.01
	[4.04,4.42]		[4.40,4.72]		[3.89,4.23]		[4.18,4.46]							
Emotion intensity at retrieval														
Happiness	3.87	0.62	4.35	0.58	3.53	0.72	3.88	0.77	5.70*	0.10	29.93*	0.36	0.72	0.01
	[3.60,4.15]		[4.07,4.63]		[3.29,3.78]		[3.63,4.12]							
Sadness	1.58	0.51	1.68	0.59	2.07	0.76	1.91	0.54	6.14*	0.10	0.17	0.00	2.88†	0.10
	[1.31,1.85]		[1.45,1.91]		[1.84,2.31]		[1.71,2.11]							

Note. ND = Never-depressed; RD = Recurrently depressed.
† *p* < .10, *p* < .05.

differences from our main analyses were driven by having a current diagnosis of depression. Therefore, we conducted additional analyses where we controlled for current depression diagnosis in our main analyses for memory valence, sadness and happiness experienced upon memory retrieval (Table 3). For memory valence, the trend-like effect of depression group remained after controlling for current depression diagnosis, $F(1,52) = 3.61$, $p = .063$, $\eta p2 = 0.05$. For happiness, the effect of depression group remained significant, $F(1,52) = 4.94$, $p = .031$, $\eta p2 = 0.09$. For sadness, the group effect remained significant, $F(1,52) = 5.16$, $p = .027$, $\eta p2 = 0.09$, and the trend-like interaction of group and memory retrieval mode became statistically significant, $F(1,52) = 7.58$, $p = .008$, $\eta p2 = 0.13$. Follow-up simple effects tests showed that, when controlling for current depression diagnosis, recurrently depressed participants reported significantly greater sadness upon involuntary retrieval of positive memories $(F(1,52) = 9.27, p = .004, \eta p2 = 0.15)$ but not upon voluntary retrieval $(F(1,52) = 0.757, p = .388)$, compared to never-depressed participants.

Finally, since formerly depressed individuals often show residual depression symptoms (Fava et al., 2007) we wanted to test whether group differences were driven by level of depression symptoms. Therefore, we conducted a second set of supplementary analyses where we controlled for both current depression diagnosis and level of depression symptoms. For memory valence, happiness, and sadness the group effects from our main analyses did not remain statistically significant, $F(51,1) = 1.44$, $p = .236$; $F(51,1) = 0.13$, $p = .716$; $F(51,1) = 1.37$, $p = .248$, when controlling for current depression diagnosis and level of depression symptoms. However, for sadness, the interaction of group and memory retrieval mode did remain statistically significant, $F(51,1) = 7.86$, $p = .007$, $\eta p2 = 0.13$. Follow-up simple effects tests showed that recurrently depressed participants reported greater sadness upon involuntary retrieval of positive memories $(F(1,51) = 4.51, p = .038, \eta p2 = 0.08)$ but not upon voluntary retrieval $(F(1,51) = 0.04, p = .840)$.

Mediated effects of depression and trait mindfulness

Depression
As can be seen in Table 4 below, simple mediation analyses suggested that recurrent depression was associated with happiness upon involuntary retrieval of positive memories through self-incongruency but not through any of the rumination variables. Recurrently depressed individuals reported greater self-incongruency upon involuntary retrieval of positive memories, which in turn was associated with diminished happiness. Recurrent depression was also indirectly associated with sadness upon involuntary retrieval of positive memories, through self-incongruency and brooding. Recurrently depressed individuals brooded more and experienced greater self-incongruency upon memory retrieval, which in turn was associated with more intense sadness. Recurrent depression was not associated with sadness upon involuntary retrieval through any of the other rumination variables.

As recurrent depression was associated with sadness upon involuntary memory retrieval through both self-incongruency and brooding, we ran a parallel mediation where we included self-incongruency and brooding in the same mediation model. In this model the shared indirect effect through brooding and self-incongruency was significant, $\beta = 0.52$, 95% CI [0.24, 0.85], as well as the unique indirect effects through self-incongruency, $\beta = 0.28$, 95% CI [0.02, 0.68], and brooding ($\beta = 0.25$, 95% CI [0.01, 0.60]).

There was no evidence that recurrent depression was associated with happiness upon voluntary retrieval of positive memories through self-incongruency or any of the rumination variables. However, recurrent depression was indirectly associated with sadness upon voluntary retrieval of positive memories, through self-incongruency but not through any of the rumination variables. Recurrently depressed individuals experienced greater self-incongruency upon memory retrieval, which in turn was associated with greater sadness.

Table 4. Standardised Simple Path Coefficients and Indirect Effects for Depression Mediation Models.

	IV -> M	M -> S	M -> H	IV -> S	IV -> H	IV -> M -> S	BCa 95% CI	IV -> M -> H	BCa 95% CI
Involuntary									
Self-incongruency	1.00*	0.38*	−0.34*	0.33	−0.15	0.38*	[0.12,0.74]	−0.34*	[−0.72,−0.07]
Rumination	0.40	0.34*	−0.08	0.57*	−0.46†	0.14	[−0.01,0.44]	−0.03	[−0.28,0.07]
Brooding	0.61*	0.46*	−0.02	0.43†	−0.48†	0.28*	[0.06,0.60]	−0.01	[−0.25,0.17]
Reflection	−0.05	0.45*	0.01	0.73*	−0.49†	−0.02	[−0.26,0.24]	−0.00	[−0.09,0.07]
Voluntary									
Self-incongruency	0.78*	0.41*	−0.07	0.10	−0.60*	0.32*	[0.11,0.67]	−0.06	[−0.37,0.15]
Rumination	0.26	0.16	0.01	0.37	−0.65*	0.04	[−0.03,0.25]	0.00	[−0.09,0.14]
Brooding	0.51†	0.31*	0.19	0.26	−0.75*	0.16	[−0.00,0.46]	0.10	[−0.02,0.34]
Reflection	−0.04	0.28*	0.14	0.42	−0.65*	−0.01	[−0.20,0.14]	−0.01	[−0.16,0.08]

Note. IV = independent variable; M = mediator; S = sadness; H = happiness.
† $p \leq .10$ * BCa bootstrap 95% CI does not include zero.

Controlling for Current Depression. We were interested in testing whether the significant indirect associations in our recurrent depression mediation analyses were driven by having a current diagnosis of depression. Therefore, we conducted supplementary mediation analyses where we controlled for current depression diagnosis. When controlling for current depression diagnosis, the simple indirect associations for recurrent depression though self-incongruency remained significant for both sadness upon voluntary memory retrieval, $\beta = 0.37$, 95% CI [0.11, 0.75], sadness upon involuntary memory retrieval, $\beta = 0.42$, 95% CI [0.12, 0.87], and happiness upon involuntary retrieval, $\beta = -0.40$, 95% CI [−0.82, −0.07]. The simple indirect associations for recurrent depression through brooding remained significant for sadness upon involuntary memory retrieval, $\beta = 0.40$, 95% CI [0.06, 0.96]. In parallel mediation analysis, the shared indirect association through brooding and self-incongruency remained significant for sadness upon involuntary retrieval, $\beta = 0.68$, 95% CI [0.31, 1.05], as did the unique indirect association for recurrent depression through self-incongruency, $\beta = 0.32$, 95% CI [0.04, 0.79], and brooding, $\beta = 0.36$, 95% CI [0.02, 0.96]. These findings suggest that the indirect associations for recurrent depression though brooding and self-incongruency did not depend on having a current diagnosis of depression.

Finally, given that formerly depressed individuals often report residual depression symptoms (Fava et al., 2007) we wanted to test whether the significant indirect effects in our mediation analyses were driven by level of depression symptoms. Therefore, we conducted a second set of supplementary mediation analyses where we controlled for both current depression diagnosis and level of depression symptoms. When controlling for both current depression diagnosis and level of depression symptoms, none of the indirect associations through brooding and self-incongruency remained statistically significant. This suggests that the indirect associations may be driven by residual depressive symptoms.

Trait mindfulness

As can be seen in Table 5 below, simple mediation analyses suggested that trait mindfulness was indirectly associated with sadness upon retrieval of positive memories through brooding, for both involuntary and voluntary positive memories. Individuals with higher trait mindfulness brooded less upon memory retrieval, which in turn was associated with less sadness upon memory retrieval. Higher trait mindfulness was also indirectly associated with less sadness through lower reflection, upon both involuntary and voluntary positive memory retrieval. None of the remaining indirect associations between trait mindfulness and positive or negative emotional experience were statistically significant.

As trait mindfulness was associated with sadness upon involuntary and voluntary memory retrieval through both reflection and brooding, we ran parallel mediation analyses where we included reflection and brooding in the same mediation models. For involuntary memories, the shared indirect association through reflection and brooding was significant, $\beta = -.0.22$, 95% CI [−0.51, −0.04], as well as the unique indirect associations through reflection,

Table 5. Standardised simple Path Coefficients and Indirect Effects for Trait Mindfulness Mediation Models.

	IV -> M	M -> S	M -> H	IV -> S	IV -> H	IV -> M -> S	BCa 95% CI	IV -> M -> H	BCa 95% CI
Involuntary									
Self-incongruency	−0.12	0.37*	−0.32*	−0.10	0.22	−0.05	[−0.23,0.08]	0.04	[−0.06,0.26]
Rumination	−0.26	0.34*	−0.06	−0.05	0.24	−0.09	[−0.32,0.02]	0.01	[−0.06,0.21]
Brooding	−0.38*	0.47*	0.03	0.04	0.27	−0.18*	[−0.44,−0.02]	−0.01	[−0.15,0.13]
Reflection	−0.36	0.46*	0.05	0.02	0.28	−0.17*	[−0.40,−0.01]	−0.02	[−0.17,0.08]
Voluntary									
Self-incongruency	−0.05	0.41*	−0.07	0.14	0.10	−0.02	[−0.19,0.14]	0.00	[−0.04,0.11]
Rumination	−0.42*	0.19	0.03	0.20	0.12	−0.08	[−0.33,0.02]	−0.01	[−0.19,0.11]
Brooding	−0.36†	0.35*	0.22	0.24	0.18	−0.13*	[−0.38,−0.01]	−0.08	[−0.28,0.01]
Reflection	−0.46*	0.33*	0.17	0.27	0.18	−0.15*	[−0.42,−0.02]	−0.08	[−0.29,0.03]

Note. IV = independent variable; M = mediator; S = sadness; H = happiness.
† $p \leq .10$ * BCa bootstrap 95% CI does not include zero.

$\beta = -0.11$, 95% CI [−0.33, −0.01], and brooding, $\beta = -0.11$, 95% CI [−0.34, −0.00]. For voluntary memories, the shared indirect association through reflection and brooding was significant, $\beta = -.0.20$, 95% CI [−0.46, −0.05]. However, the unique indirect associations through each mediator did not remain statistically significant (reflection: $\beta = -0.10$, 95% CI [−0.36, 0.01]; brooding: $\beta = -0.09$, 95% CI [−0.34, 0.01]).

Discussion

Recent research suggests that formerly depressed individuals may experience less mood improvement upon voluntary retrieval of positive autobiographical memories compared to never-depressed individuals, when induced with sad mood (Joormann et al., 2007). In the present study we extended this research by investigating whether recurrently depressed and never-depressed individuals differ in the intensity of happiness and sadness experienced upon everyday retrieval of positive *involuntary* and *voluntary* autobiographical memories. Further, we investigated whether recurrent depression indirectly influences happiness and sadness upon positive memory retrieval, through state rumination and self-incongruency. Finally, we were interested in whether trait mindfulness indirectly affects happiness and sadness upon positive memory retrieval, through rumination and self-incongruency, while controlling for depression history.

Our findings related to the first study aim showed that recurrently depressed individuals reported less intense happiness upon positive memory retrieval compared to never-depressed individuals, irrespective of memory retrieval mode. This finding extends previous studies showing formerly depressed individuals showed less mood improvement upon voluntary retrieval of positive autobiographical memories compared to never-depressed individuals during sad mood (Joormann et al., 2007; Joormann & Siemer, 2004) by showing that recurrently depressed individuals experience reduced emotional benefit from the retrieval of both involuntary and voluntary positive autobiographical memories. While we found no evidence for a moderating effect of retrieval mood on happiness ratings, we did find this for sadness ratings. Specifically, recurrently depressed individuals experienced significantly greater sadness compared to never-depressed participants upon involuntary but not voluntary retrieval of positive memories. This finding is in line with previous evidence that emotion regulation impairments in individuals with a depression history may be greater for memories retrieved involuntarily compared to memories retrieved voluntarily (Isham et al., 2020). It is also consistent with findings by Hashimoto et al. (2021) in showing that the emotional impact of positive memories in individuals with depressive symptomatology may depend on the memory retrieval mode. However, while Hashimoto et al. (2021) found that involuntary positive memories are accompanied by greater mood improvement than

voluntary memories, the current study suggests that they are accompanied by greater sadness. These contradictory patterns may be explained by differences in the types of memories reported in the two studies, namely that Hashimoto et al. (2021) assessed involuntary and voluntary memories of positive pictures, while the present study assessed everyday involuntary and voluntary autobiographical memories. Further, Hashimoto et al. (2021) employed a non-clinically depressed sample, while the present study employed a sample which met the criteria for recurrent clinical depression. It is possible that recurrent depression leads to changes in the emotional processing of positive memories beyond what can be explained by depression symptoms alone. Indeed, this is supported by our finding suggesting that recurrently depressed individuals experience heightened sadness in response to involuntary memories irrespective of level of depression symptoms or whether they are experiencing a current episode of depression.

Related to the second study aim, mediation analysis suggested that recurrent depression was associated with diminished happiness in response to involuntary positive memories, through greater self-incongruency but not through any of the rumination facets. Recurrent depression was also associated with greater sadness upon involuntary memory retrieval, through brooding and self-incongruency, and with greater sadness upon voluntary memory retrieval, through self-incongruency only. Importantly, supplemental analyses suggested that these indirect effects were independent of current depression diagnosis but might be driven by residual depressive symptoms.

The above findings extend previous research which have showed that individuals with depression may not experience mood improvement when instructed to retrieve positive autobiographical memories that are incongruent with their present sense of self or are retrieved in a ruminative manner (Werner-Seidler et al., 2017; Werner-Seidler & Moulds, 2012). We demonstrated that recurrently depressed individuals spontaneously engage in and experience heightened rumination and self-incongruency upon positive memory retrieval, which in turn compromise their emotional experience in response to these memories. Our results further suggest that the influence of rumination may be driven by brooding, as opposed to reflection or overall rumination. This is consistent with the suggestion that brooding represents a particularly maladaptive facet of rumination (for a review, see Nolen-Hoeksema et al., 2008). It is also interesting to note that brooding mediated the effect of recurrent depression on sadness but not happiness upon positive memory retrieval, in line with brooding being associated with negative emotions and thinking patterns (e.g., Nolen-Hoeksema et al., 2008). As for the role of self-incongruency upon memory retrieval, positive memories are likely to be inconsistent with entrenched negative self-schemas in individuals with depression history (e.g.,

Dozois et al., 2009; LeMoult et al., 2017), and thus self-incongruency may arise when thinking about these memories. Finally, our findings suggest that self-incongruencies and brooding may be particularly problematic for positive memories that are retrieved involuntarily as opposed to voluntarily.

Related to the final study aim, simple mediation analysis suggested that higher trait mindfulness was associated with less sadness upon involuntary and voluntary memory retrieval through brooding and reflection, irrespective of depression history. Given that non-judging towards inner experiences is an important aspect of trait mindfulness (e.g., Baer et al., 2006), it is possible that mindful individuals are less likely to evaluate or judge past experiences, which may be reflected in less brooding and reflection upon memory retrieval. The fact that trait mindfulness influenced both brooding and reflection upon memory retrieval, as opposed to brooding only, is inconsistent with previous research (Isham et al., 2020). This inconsistency in findings may be due to methodological differences between the two studies, such as assessing positive memories only in the present study compared to any autobiographical memories in Isham et al.'s (2020) study.

We had predicted that trait mindfulness effects would be greater for involuntary positive memories than for voluntary positive memories. Our findings provide some support for this hypothesis, as the standardised betas for the indirect effects of mindfulness on sadness through brooding and reflection were larger for involuntary positive memories than for voluntary positive memories. However, the effects were still relatively similar and all of medium effect size. As such, evidence as to whether mindfulness is especially helpful for targeting emotional responses to involuntary compared to voluntary positive memories should be further explored in future studies.

Findings in the present study have implications for understanding depressogenic vulnerability in individuals with recurrent depression. First, comparisons of recurrently depressed and never-depressed participants while controlling for current depression diagnosis suggested that recurrently depressed individuals experience diminished happiness and heightened sadness upon retrieving positive autobiographical memories, irrespective of current depression diagnosis. Further analysis controlling for both current depression diagnosis and level of depression symptoms suggested that the diminished happiness exhibited by recurrently depressed individuals may be related to residual depression symptoms. However, the heightened sadness in response to involuntary positive memories was independent of both current depression diagnosis and on level of depression symptoms. This indicates that heightened sadness in response to involuntary positive memories may reflect an underlying depressogenic vulnerability in recurrently depressed individuals, as opposed to being an effect of acute current depression. Previous studies have found that remitted depressed

individuals experience a lack of mood improvement in response to positive voluntary memories when they have been induced with sad mood (Joormann et al., 2007). These findings are consistent with the idea that remitted depression may be characterised by heightened negative reactivity when experiencing low mood (Teasdale, 1998). Findings in the present study suggest that remitted depressed individuals may also show heightened negative reactivity in response to memories that are retrieved involuntarily as opposed to voluntarily. They support the idea that spontaneous cognitions may trigger more negative cognitive–affective processes than effortful cognitions in individuals vulnerable to depression (Marchetti et al., 2016), possibly because involuntary memories promote negative self-focus (Klinger et al., 2018) or because they require heightened emotion regulation efforts from vulnerable individuals with compromised cognitive resources (Rock et al., 2014). Future studies could incorporate measures of cognitive functioning to test the latter hypothesis.

The mediated effects of depression on sadness and happiness upon positive memory retrieval were independent of current depression diagnosis but not level of depressive symptoms. These results suggests that these indirect effects of recurrent depression through brooding and self-incongruency may be driven by residual depression symptoms. This shows that, even when recurrently depressed individuals do not meet the diagnostic criteria for current depression, they may still show clinically relevant levels of depression, brooding and self-incongruency that influence how they emotionally respond to positive memories of past events when they come to mind during daily life.

Findings in the present study also have potential implications for the treatment and prevention of depression. Talking about past events constitutes a core element in conversational therapies for depression and our findings suggest that positive autobiographical memories may be an important focus in such therapy. Specifically, our findings identify brooding and self-incongruency as potential targets for altering emotional responses to positive autobiographical memories. Individuals vulnerable to depression may benefit from interventions aimed at decreasing memory-related brooding and perceived incongruencies between their present sense of self and remembered sense of self.

Our finding concerning the positive association between trait mindfulness and sadness in response to positive memories further indicates facets of rumination as potential psychological mechanisms underlying mindfulness-based interventions (MBIs) that may be relevant for reducing sadness in response to positive autobiographical memories. MBIs typically lead to increases in trait mindfulness (e.g., Kiken, Garland, Bluth, Palsson, & Gaylord, 2015). If this process occurs, individuals with depression history may experience less brooding and reflection upon retrieval of positive autobiographical

memories. This, in turn, may reduce sadness in response to positive autobiographical memories. Indeed, Mindfulness-Based Interventions (MBIs) have shown promise in reducing habitual rumination (Deyo et al., 2009; Ramel et al., 2004). Future studies should test whether these findings extend to everyday brooding and reflection upon retrieval of positive autobiographical memories, and whether changes in brooding lead to changes in emotional experience upon positive memory retrieval.

The present study has some limitations that should be considered when interpreting its results. First, the sample was drawn primarily from a student population, which decreases the generalizability of our findings to clinical settings. Second, while a post-hoc sensitivity analysis suggested that the sample size was sufficient to detect small within-between interactions in the performed ANOVA analyses, it may only have been sufficient to detect medium-large associations in the mediation models (Fritz & MacKinnon, 2007). Although this indicates that the sample size was insufficient to detect smaller mediated effects, such effects may be less meaningful in the context of subjective emotional experience given previous research showing that differences in affect and other outcomes of small effect size may not be meaningful enough for an individual to detect the difference (e.g., Anvari & Lakens, 2021; Norman et al., 2003). A third limitation concerns the recurrently depressed sample which consisted of both currently and remitted depressed individuals. While the categorisation of our sample in this way is in line with the existing diagnosis of major depressive disorder with recurrent episodes as defined in the DSM-5 (APA, 2013), some of the differences found between recurrently depressed and never-depressed individuals were independent of current depression diagnosis and depressive symptomatology. We have argued that this may reflect an underlying depressogenic vulnerability as opposed to a concomitant effect of depressive symptoms. However, this could be further tested in studies comparing remitted depressed and currently depressed individuals.

Another limitation relates to the way voluntary memories were cued. Voluntary memories were cued by asking participants to retrieve a positive event that made them happy when it happened. This may not be representative of everyday experiences of voluntary memories (Rasmussen et al., 2014) and differs from the more commonly used method of employing word-cues to cue voluntary memories. On the other hand, through using this approach based on previous research (Joormann et al., 2007), our aim was to maximise the likelihood of collecting voluntary memories that were positive, as compared to using word-cues that might cue positive memories for some individuals but not for others. From the proportion of positive memories retrieved by participants, the method appears successful in cuing the retrieval of positive autobiographical memories.

An additional limitation related to the memory diary concerns the ordering of involuntary and voluntary memories. While involuntary memories were reported throughout the day when they arose, voluntary memories were only retrieved and reported at one time each day, after participants had reported on their involuntary memories. This approach was used to minimise the risk that the word-cues used to elicit voluntary memories influenced the retrieval of involuntary memories, and to minimise disruption in participants' everyday life by letting them report voluntary memories when they had time. Although it is in line with the majority of previous studies done using similar diary methodologies (Berntsen & Hall, 2004), the lack of counterbalancing does raise the possibility that the observed differences between involuntary and voluntary memories may be partly due to ordering effects. That said, findings from a previous memory diary study suggests that the order of involuntary and voluntary memory reporting does not significantly influence the reported characteristics of involuntary and voluntary memories (Mace et al., 2011). Specifically, Mace et al. (2011) tested whether different orders of a voluntary (i.e., phrase-cued) memory task (i.e., before, after, or during an involuntary memory diary recording period) had an effect on different characteristics of the reported involuntary and voluntary autobiographical memories and found no effects of order for any of the assessed characteristics. Nevertheless, future studies could consider asking participants to report voluntary memories at different timepoints throughout the day or varying the order of involuntary and voluntary memory reporting (e.g., Mace et al., 2011) to minimise the potential of order effects.

There are also some limitations related to our mediation models. As memory characteristics were measured simultaneously, we were only able to assess atemporal mediation (Winer et al., 2016) and cannot conclude causation or temporal order. A process in which brooding and self-incongruency affect happiness and sadness upon autobiographical memory retrieval is plausible, given that previous findings suggest that rumination and self-incongruency are prospectively associated with increased negative mood or a lack of mood repair (Nolen-Hoeksema, 2000; Werner-Seidler & Moulds, 2012; Werner-Seidler et al., 2017). However, it is also possible that more intense sadness leads to more brooding and greater self-incongruency, that these factors influence each other reciprocally, or that brooding and self-incongruency influence emotional experience through serial mediation (for example, see Hetherington & Moulds, 2014). Thus, it is possible that the relationship between rumination, self-incongruency, and sadness is more elaborate than what we have suggested in the present study. Despite this limitation, researchers such as Hayes (2018) argue that mediation analysis using cross-sectional data can still provide useful information about relationships between variables, even if one cannot conclude causality. Future work with larger sample sizes could employ more complex mediation models in longitudinal designs or studies integrating time sensitive experimental measures

to explore underlying mechanisms in the relationship between depression vulnerability and emotional processing of positive autobiographical memories. Nonetheless, the results from the current study provide insights into directions for such future work.

Finally, in terms of explaining the emotional impact of autobiographical memories in recurrent depression, we focused on two mechanisms, namely rumination and self-incongruency experienced upon retrieval of positive memories. We acknowledge that other characteristics of positive memories, such as vividness, specificity, and vantage perspective, may also play a role in the emotional impact of these memories (e.g., van Schie et al., 2019; Vella & Moulds, 2014). At the same time, we note that previous studies assessing the mood impact of voluntary positive autobiographical memories have found minimal or no differences between currently or recovered depressed and never-depressed participants on several characteristics of positive memories, including vividness, specificity, and vantage perspective (Joormann et al., 2007; Werner-Seidler & Moulds, 2013). As such, it appears that currently or recovered depressed individuals and never depressed individuals may experience different emotional reactions to positive memories, despite being similar on several memory characteristics.

Notwithstanding the study limitations, our findings highlight mechanisms in the relationship between depression vulnerability and emotional processing of positive autobiographical memories that may inform depression prevention. The findings call for further research in the field intersecting positive autobiographical memory retrieval, emotion regulation, mindfulness, and depression prevention.

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Data availability statement

The research materials supporting this publication are attached as supplemental materials. The raw data underpinning this study cannot be made publicly available due to ethical concerns since there is not agreement from the participants to share their anonymised data.

Disclosure statement

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