Characteristics of self-defining memory in depression vulnerability

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There has been a growing recognition of the role of memory processes in depressive vulnerability, as has been suggested by influential cognitive models of depressive disorders (Teasdale, 1988). In this study recovered depressed ($n = 35$) and never-depressed ($n = 49$) participants recalled self-defining memories following either a sad or neutral mood induction. In a neutral mood, recovered depressed and never-depressed participants did not differ in terms of the characteristics of the memories that they recalled. However, in a sad mood recovered depressed participants recalled more vivid negative memories and less emotionally intense positive memories than never-depressed participants. This study provides support for aspects of Teasdale's differential activation model and contributes to the growing recognition that depressive disorders involve disturbances in both negative and positive memory processes.

Keywords: Memory; Depression; Cognitive vulnerability.

The role of autobiographical memory in the context of depressive disorders is of interest from theoretical and applied perspectives. According to Teasdale's cognitive theory of depression, the Differential Activation Hypothesis (DAH), memory disturbances in the context of sad mood may persist beyond the resolution of a depressive episode and elevate the risk for recurrence (Teasdale, 1988). Specifically, Teasdale proposes that vulnerable individuals (i.e., those who have experienced depression in the past) do not differ from non-vulnerable individuals in a range of cognitive processes when they are in neutral mood, but that differences emerge during a sad mood. Therefore these two groups are distinguishable on these cognitive dimensions only under conditions of sad mood. Clinically, this model of depression has informed the development of relapse prevention approaches for depressive disorders, and has contributed to the

growing recognition that comprehensive interventions need to address not only symptom reduction during the acute phase of a depressive episode, but also residual cognitive deficits if recurrence rates are to be reduced (Segal et al., 2006).

With respect to the role of memory, Teasdale's model predicts that recovered depressed individuals will exhibit a bias for recalling negative material compared to never-depressed individuals, but only when they are in a sad mood (Teasdale, 1988). Evidence supports this proposition, with recovered depressed individuals showing preferential recall of negative self-related adjectives, compared to healthy controls, but only in a sad mood (Hedlund & Rude, 1995; Teasdale & Dent, 1987). Understandably these (and other studies designed to test the model) have focused exclusively on negative memories, which is to be expected given that the model makes clear predictions about the role of negative

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memories but does not make mention of how positive memory processes may be involved. A recent study investigated this issue and found that recovered depressed and never previously depressed individuals recall cued positive memories that differed in characteristics to those of never-depressed individuals, but only while in a sad mood (Werner-Seidler & Moulds, 2011). Specifically, in two studies, positive memories were recalled with lower levels of vividness by recovered depressed individuals relative to their never-depressed counterparts, but only in a sad mood. In neutral mood the groups did not differ in their ratings of positive memory vividness. Consistent with predictions made by Teasdale's model, these results extend the existing empirical base by showing that memory characteristics in sad mood differ as a function of depressive history, and suggest that depression vulnerability may include a role for deficits in the recall of positive memories in sad mood.

However, these studies were somewhat restricted by the use of a word-cue paradigm, which provides clear instructions and prompts to elicit autobiographical memories. Although word-cue techniques have provided an important and useful platform from which to examine autobiographical memory, their highly prescriptive nature does not allow for any control over the type of memory that participants recall in terms of the significance of the memory to the individual recalling it. Indeed, there has been some discussion in the literature of the limitations of cueing tasks because they index memory without necessarily directly eliciting personally meaningful material (Jansari & Parkin, 1996; Rybash & Monaghan, 1999).

Interestingly, the literature on memory in depression provides good reason to expect that the importance assigned to autobiographical memories would be linked to their characteristics (i.e., vividness, emotional intensity, sensory detail). For example, a number of studies from the intrusive memory literature have found an association between memory features and emotionality. Specifically, one study found that intrusion-related distress was associated with a sense of reliving the event (Williams & Moulds, 2007), while two other studies have reported that distressing intrusive memories are extremely sensory and are characterised by high levels of vividness (Birrer, Michael, & Munsch, 2007; Newby & Moulds, 2011). Drawing on these findings, it seems likely that personally relevant autobiographical memories would also possess particular characteristics. In fact, it might even be the case that, for fair comparisons between memories to be made, memories should ideally be matched according to the importance of the material that they contain. That is, a comparison of memories that are characterised by substantial variability in content could potentially mask reliable differences in features. Therefore this study was designed to examine the characteristics of memories recalled in sad mood that were inherently important to the individuals recalling them.

In order to examine personally relevant autobiographical memories, self-defining memories—which are, by definition, personal and important—were elicited. Self-defining memories involve recollections of highly significant personal experiences that are central to one's identity and are defined as being important, intense and reflective of key concerns about oneself and one's life (Blagov & Singer, 2004; Singer & Moffitt, 1991–1992; Singer & Salovey, 1988). Singer and Moffit (1991–1992) designed a self-defining memory task that has been widely used in cognitive memory domains, as well as in clinical research contexts (e.g., Sutherland & Bryant, 2005). This memory elicitation procedure involves prompting participants to recall multiple self-defining memories (most commonly five or ten memories), and is well suited to the objective of examining the characteristics of personally relevant, specific memories.

In this task, unlike in cued-recall, participants recall self-defining memories without parameters on memory valence being imposed (i.e., without specific instructions to recall positive or negative memories). Given that self-defining memories can be negative or positive, comparing the valence of memories recalled by the recovered and never-depressed groups without prompting allows for greater insight into the kinds of memories that these individuals spontaneously recall in the context of different mood states. That is, the design of this study allows for an investigation of how these two groups might differ in the valence of the self-defining memories that they naturally recall in a sad mood. Accordingly, our design has scope to offer insight into the kinds of self-defining memories that depression-vulnerable individuals habitually recall. Accordingly, this question provided a secondary aim of the study—to compare the valence of self-defining memories recalled by

recovered depressed and never-depressed individuals in a sad and neutral mood.

It was the overall aim of this study to elicit personally significant memories of recovered and never-depressed participants, and to compare these two groups under conditions of sad and neutral mood on a range of memory characteristics (e.g., vividness, emotional intensity, sensory detail). An additional question of interest was to investigate whether these two groups differed in terms of the valence of the self-defining memories that they retrieved in neutral versus sad mood. Based on predictions derived from the DAH, it was expected that in a neutral mood these groups would report comparable proportions of negative and positive memories. However, under conditions of sad mood it was hypothesised that, independent of depressive history, there would be a mood congruent effect such that participants would recall a greater proportion of negative self-defining memories than those in the neutral condition, consistent with findings from the social psychology literature (Singer & Salovey, 1993). Extending the logic of the DAH, it was also predicted that this mood congruent effect would be more pronounced in individuals with a history of depression compared to those who had never been depressed before (i.e., that in the sad condition, recovered participants would recall significantly more negative memories than never-depressed participants).

With respect to memory characteristics, again it was expected that in the neutral condition, recovered and never-depressed participants would recall self-defining memories with comparable features. However, in line with Teasdale's theoretical framework, it was expected that in a sad mood recovered depressed individuals would recall memories with different phenomenological features compared to individuals who had never experienced depression. Specifically, negative self-defining memories were predicted to possess more intense phenomenological features—that is, greater levels of vividness, emotional intensity, and sensory detail than control participants. For positive memories, based on previous findings (Werner-Seidler & Moulds, 2011), it was expected that recovered depressed individuals would recall positive memories that were less vivid, less emotionally intense, and contained less sensory detail than their never-depressed counterparts.

METHOD

Design

A 2 (Condition: sad, neutral) $\times 2$ (History: never-depressed, recovered depressed) between-participants design was employed.

Participants

A total of 90 undergraduate students (68 females, mean age $= 19.70$; $SD = 4.43$) from The University of New South Wales participated in return for course credit. Following the initial recruitment phase there was a need to increase the sample of recovered depressed participants in order to make cell numbers comparable. Therefore suitable individuals in the undergraduate sample were recruited by specifying that a history of depression was a necessary criterion to participate in the study inclusion, which was verified by administration of the Structured Clinical Interview for DSM-IV Disorders (SCID-IV; Mood Module). This method of recruiting formerly depressed individuals among university students has previously been used successfully (e.g., Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010).

Materials and measures

Beck Depression Inventory – Second edition (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a 21-item self-report measure of the presence and severity of depressive symptoms over the previous two weeks. The BDI-II possesses strong psychometric properties, including high internal consistency ($\alpha = .92$; Beck et al., 1996).

Mood rating scale. Participants completed a single-item visual analogue rating scale (VAS) that assessed their current mood at the commencement of the study (at baseline, to ensure that participants were in euthymic mood), prior to the mood induction, and again following the mood induction. The post-induction ratings served as a manipulation check to ensure that the mood induction had the intended effect. The rating scale asked participants to "Rate how are you are feeling right now" (where $0 = I$ *do not feel at all sad* and $100 = I$ *feel extremely sad*).

Mood induction. Mood was induced using 10-minute film clips. In the sad mood condition a scene from Dead Poets Society depicting a suicide was shown—which has previously been used for this purpose (e.g., Joormann, Siemer, & Gotlib, 2007). Participants were instructed to imagine how they might feel if they were in the situation and to allow themselves to be affected by the film. In the neutral condition participants watched a do-it-yourself home-improvement-style clip instructing how to lay down wooden floating floors. The video was selected especially for use in this study, and pilot data indicated that it did not change mood. Clips of this kind have successfully been used previously to induce a neutral mood (e.g., Josephson, Singer, & Salovey, 1996).

Self-defining memory task. The self-defining memory task was based on the procedure designed by Blagov and Singer (2004) and adapted for use in the current study. Participants were informed that a self-defining memory was a memory of an event that was important to them and had some relation to who they were as a person. They were told that it was the kind of memory that they would tell someone if they wanted that person to understand them on a fundamental level. Finally, participants were told that a self-defining memory could be positive or negative or both in terms of how it makes them feel, but that it had to be a memory that was important to them and that helps them to understand how they have come to be the person that they are. Participants were asked to recall self-defining memories and if they provided a general memory, they were prompted to recall a specific memory (i.e., something that happened on a particular day, at a particular time). It was necessary that participants provided specific (rather than overgeneral) self-defining memories in order for us to meaningfully compare memory characteristics between groups and conditions, so that any differences in features that emerged were not simply an artefact of differences in specificity. Therefore prompts were provided to participants in order to elicit specific memories.

In keeping with the self-defining memory protocol used in clinical research (e.g., Sutherland & Bryant, 2005), participants were asked to recall five self-defining memories. However, some studies that have examined multiple memories that are elicited after a mood induction procedure have found that systematic differences emerge

when the first memory is examined alone (e.g., Parrott & Sabini, 1990). This has been attributed to two factors: (i) the possibility that the mood induction may deteriorate over the course of the study and (ii) the possibility of carry-over, cumulative effects of recalling a self-defining memory in one valence that could in turn influence the nature and/or the emotional impact of the subsequent memory/memories recalled. Accordingly, in addition to examining all five memories, groups were compared on dimensions of interest for the first memory recalled only. Such an analysis enabled confidence that at this time point, the effects of the mood induction were optimal and no cumulative carry-over effects (e.g., no influence of recalling an emotional memory on the nature or valence of subsequent memories recalled) were possible.

Self-defining memory questionnaire (SDMQ). Studies of self-defining memory use this standardised questionnaire that requires participants to rate their memories on the basic emotions of happiness, sadness, anger, fear, surprise, shame, disgust, guilt, interest, contempt, pride, and embarrassment (Blagov & Singer, 2004). Accordingly this instrument was administered and participants rated the basic emotions that they experienced for each self-defining memory recalled.

Memory Experiences Questionnaire (MEQ; Sutin & Robins, 2007). The MEQ is a self-report measure that indexes a range of phenomenological characteristics of autobiographical memory. A single item from the relevant subscales was included to avoid administering an excessively long questionnaire after each memory was recalled. The specific memory features assessed were vividness (e.g., "My memory for this event was very vivid"), sensory detail ("As I remembered the event, I can hear it in my mind"), and emotional intensity ("My emotions are very intense concerning this event"). In addition, rather than using the 5-point scale of the original MEQ, for consistency the wording of the items was adapted so that participants could respond using the same scale as they did to rate the basic emotions on the SDMQ. Specifically, participants were instructed to indicate the extent to which each characteristic was a feature of their memory (i.e., "How vivid is your memory?" and "Does this memory evoke powerful emotions?") where $0 = $ *not at all* and $6 = $ *extremely.*

SCID-IV – Mood Module (First, Spitzer, Gibbons, & Williams, 1996). The SCID-IV is a clinical interview used to diagnose DSM-IV Axis 1 psychological disorders. The mood module was administered at the beginning of the experimental session to assess for current and previous major depressive episodes (MDEs) by a psychologist with extensive experience with this interview (AW-S). Responses on the SCID-IV indicated that six participants met criteria for a current MDE and were therefore excluded from the study. For inclusion in the recovered depressed group participants needed to report symptoms consistent with at least one previous MDE but not have experienced them in the last month ($n = 35$). Participants were allocated to the never-depressed group if they denied symptoms consistent with a diagnosis of current or past MDE ($n = 49$). There were 84 participants in the final sample.

Procedure

Participants were tested individually in a 1-hour session. The experiment was introduced as a study investigating mood, memory, and imagination. Participants provided informed consent and then completed the questionnaire package that included demographic information, BDI-II, and a baseline mood rating. They were then randomly assigned to either the neutral or sad mood induction and watched the corresponding film clip. Immediately after the mood induction participants were given the second mood rating scale (to check that mood had been manipulated as intended) and instructed to describe the main theme of the movie (to ensure that they had attended to the clip as instructed). Participants were then asked to recall five self-defining memories, and completed the SDMQ and MEQ following each memory. Participants were thanked for their time and fully debriefed.

RESULTS

Participant characteristics

Demographic information and sample characteristics are presented in Table 1. A series of 2 (Condition: sad, neutral) $\times 2$ (History: never-depressed, recovered depressed) ANOVAs with age and depression symptoms (BDI-II) as the dependent variables were conducted to ensure that the groups did not differ on these variables. For age there were no main effects of condition, $F(1, 80) = 1.32, p > .05$, or history, $F(1, 80) = .31, p > .05$, and no condition by history interaction, $F(1, 80) = .01, p > .05$, illustrating that age was comparable across groups.

For BDI-II there was a main effect of condition, $F(1, 80) = 6.96, p < .05$, and a main effect of history, $F(1, 80) = 7.36, p < .05$, but no condition by history interaction, $F(1, 80) = 1.56, p > .05$. Follow-up independent samples t-tests indicated that, collapsed across condition, participants allocated to the sad induction condition reported higher levels of depressive symptoms, $t(82) = 2.76, p < .05$. Collapsed across induction condition, there was a trend towards individuals with a history of depression reporting higher levels of depressive symptoms, $t(82) = -1.93, p = .057$. Given these differences at baseline, symptoms of depression were entered as a covariate for all subsequent analyses.

TABLE 1
Participant characteristics and celf-report measures

	Sad (n = 45)		Neutral (n = 39)	
	Never-Depressed (n = 27)	*Recovered* (n = 18)	*Never-Depressed* (n = 22)	*Recovered* (n = 17)
Age	18.89 (.86)	19.56 (1.05)	20.13 (.95)	20.59 (1.08)
BDI-II	10.26 (1.78)	18.39 (2.18)	7.41 (1.98)	10.41 (2.24)
Number MDEs	–	2.56 (2.20)	–	1.59 (0.72)
Psychological Treatment (%)	3.7	22.2	0	5.9
Pharmacological Treatment (%)	0	11.1	0	5.9
Sad (pre)	2.85 (.34)	3.83 (.41)	1.91 (.37)	2.53 (.33)
Sad (post)	5.74 (.33)	5.50 (.40)	1.77 (.36)	2.24 (.41)

Values refer to mean (and standard deviation) scores. BDI-II = Beck Depression Inventory II; MDEs = Major Depressive Episodes; Sad (pre) = Ratings of sad mood before the induction; Sad (post) = Ratings of sad mood following the induction.

Mood ratings

To ensure that there were no differences in baseline mood as a function of condition or depressive history, a 2 (Condition: sad, neutral) $\times$ 2 (History: never-depressed, recovered depressed) analysis of covariance (ANCOVA) was conducted with BDI-II scores entered as a covariate and baseline sad mood ratings as the dependent variable. The groups did not differ as a function of condition, $F(1, 79) = 2.26$, $p > .05$, or depressive history, $F(1, 79) = .15$, $p > .05$, and there was no condition by history interaction, $F(1, 79) = .20$, $p > .05$. This indicates that mood was comparable between the groups at baseline.

To determine whether the mood inductions had the intended effects, a 2 (Condition: sad, neutral) $\times$ 2 (History: never-depressed, recovered depressed) $\times$ 2 (Time: pre, post) mixed-model ANCOVA with repeated measures on the third factor was conducted, with sad mood ratings as the dependent variable and BDI-II scores included as a covariate. There was a main effect of time, $F(1, 79) = 39.89$, $p < .05$, a significant condition by time interaction, $F(1, 79) = 49.30$, $p < .05$, but no time by history interaction, $F(1, 79) = .20$, $p > .05$, and no time by condition by history interaction, $F(1, 79) = .54$, $p > .05$. Follow-up paired samples t-tests demonstrated that participants in the sad condition reported increased sad mood from pre- to post-induction, $t(44) = -6.42$, $p < .05$, while in the neutral condition, sad mood ratings did not change, $t(38) = 1.02$, $p > .05$. This confirms that the respective mood induction procedures effectively manipulated mood as intended, and furthermore, that the manipulations were equally effective for all participants, irrespective of depression history.

Memory specificity and valence

The five self-defining memories were coded according to specificity and valence. Memory specificity was assessed in order to ensure that any between-group differences that emerged could not be attributed to these differences. Although we considered it unlikely that there would be any differences in specificity because participants were provided with prompts to assist them to retrieve specific memories, we nevertheless conducted this check to ensure that there were no differences between the groups or conditions). Memories were defined as specific if they occurred at a particular place and time, and lasted for less than one day (Williams & Broadbent, 1986). The proportion of specific memories reported by the sample was high (95%) and analyses showed there were no differences in proportion of specific memories recalled between the groups according to condition, $F(1, 79) = .07$, $p > .05$, or depressive history, $F(1, 79) = .60$, $p > .05$, with no interaction, $F(1, 79) = .34$, $p > .05$. Valence was coded categorically as either positive (e.g., *when they announced that I had been voted school captain – I felt like it was such an achievement and I could even hear my parents cheering as I went up on stage*) or negative (e.g., *watching my grandmother take her last breath*). The number of negative and positive memories recalled was summed for each participant, out of the total five memories recalled. There were no instances of memories in which the valence was ambiguous or neutral.

Overall, 48% of the total memories recalled were negative and 52% were positive, with no between-group differences ($ps > .05$). To obtain an estimate of inter-rater reliability, an independent rater with extensive experience with memory rating guidelines re-rated 10% of the memories. For specificity, there was perfect agreement between the two assessors. For valence, the estimate of inter-rater reliability was $\alpha = .94$.

As outlined in the Method section one methodological consideration was the possibility that the mood induction may have dissipated over time or been contaminated by the valence of the preceding memory, potentially masking any memory differences when all five memories were collapsed and examined together. To this end an additional analysis was conducted, in which only the valence of the first memory recalled was the dependent variable. Such an analysis enabled confidence that at this time point, the effects of the mood induction were optimal and no carry-over effects influenced the data. Indeed, other researchers have taken this approach by examining memories recalled immediately after the delivery of a mood induction, at the time that the effects of the induction are at their strongest (Parrott & Sabini, 1990). Consistent with the results of the analyses conducted with all five memories, a high proportion of the first memories reported were specific (96%) and there were no differences in specificity; i.e., no main effect of condition, $F(1, 79) = .12$, $p > .05$, or depressive history, $F(1, 79) = 1.20$, $p > .05$, and no interaction, $F(1, 79) = .92$,

$p > .05$. For valence 51% of the first memories recalled were negative, and thus the remaining 49% were positive, again with no between-group differences ($ps > .05$).

Together these results indicate that for the first memory, as well as on average across all five memories recalled, memory specificity and valence were not influenced by mood (i.e., condition) or depressive history.

Memory features

Memory features were analysed separately for each valence category as it was not the aim of the study to compare memories between valence (i.e., to compare the features of positive and negative memories). This analytic approach was informed by our previous work in which we have found that the features of memories recalled in sad mood systematically differ as a function of valence (Werner-Seidler & Moulds, 2011).

Conceptually, then, a comparison of the characteristics of memories that differ in valence would not meaningfully address our empirical question. Accordingly, separate analyses were conducted for negative and positive memories, with the memory quality of interest as the dependent variable. To do this memories were first divided into valence categories, and then an average for each participant on the memory dimension of interest was calculated. In the case that participants recalled five memories that were all negative ($n = 6$) or all positive ($n = 4$) they were omitted from the analysis for the valence for which they did not recall any memories.

Two analyses of memory features were conducted: the first included all five memories recalled by each participant, and the second limited the analysis to the first memory recalled by each participant. For means and standard deviations, see Tables 2 and 3 for negative memories, and Tables 4 and 5 for positive memories.

Memory vividness. To evaluate whether the groups differed in terms of negative memory vividness, a 2 (Condition: neutral, sad) $\times 2$ (History: never-depressed, recovered depressed) ANCOVA was conducted with memory vividness as the dependent variable, controlling for BDI-II scores. There was no main effect of condition, $F(1, 73) = .14, p > .05$, or history, $F(1, 73) = 2.46, p > .05$, and no condition $\times$ history interaction, $F(1, 73) = .40, p > .05$. Another ANCOVA was conducted for positive memories, with vividness as the feature of interest. There were no main effects of condition, $F(1, 75) = .60, p > .05$, or history, $F(1, 75) = .03, p > .05$, and no condition $\times$ history interaction, $F(1, 75) = .01, p > .05$. Taken together these results indicate that participants recalled both negative and positive self-defining memories with comparable levels of vividness, independent of mood (i.e., condition) or depressive history.

These analyses were repeated with the first memory only as the dependent variable. For negative memory vividness there was no main effect of condition, $F(1, 39) = .59, p > .05$, or history, $F(1, 39) = .13, p > .05$, but there was a significant condition $\times$ history interaction, $F(1, 39) = 4.64, p < .05$. Follow-up t-tests showed that for individuals in the neutral condition, there were no differences in ratings of the vividness of negative memories between recovered depressed and never-depressed individuals, $t(15) = .38, p > .05$. However, in the sad mood condition participants with a history of depression recalled more vivid negative memories compared to their never-depressed counterparts, $t(24) = -3.02, p < .05$. For positive memory vividness there

TABLE 2
Negative self-defining memory feature ratings for all five memories

	Sad		Neutral		
	Never-Depressed (n = 25)	*Recovered Depressed* (n = 18)	*Never-Depressed* (n = 19)	*Recovered Depressed* (n = 16)	*Group Differences at α = .05*
Vividness	4.26 (1.49)	4.96 (0.78)	4.39 (1.07)	4.60 (1.13)	
Sensory Detail	3.01 (1.49)	3.86 (1.21)	2.97 (1.39)	3.67 (1.51)	
Emotional Intensity	4.45 (1.01)	4.60 (1.32)	4.15 (1.32)	4.25 (1.41)	

Values refer to mean (and standard deviation) scores. Ratings presented out of six, where a higher score reflects a greater variable level.

TABLE 3
Negative self-defining memory feature ratings for first memory recalled

| | Sad | | Neutral | | |
	Never-Depressed (n = 14)	Recovered Depressed (n = 12)	Never-Depressed (n = 9)	Recovered Depressed (n = 8)	Group Differences at $\alpha = .05$
Vividness	4.43 (1.28)	5.66 (0.65)	5.33 (0.86)	5.12 (1.35)	RD > ND (Sad Condition Only)
Sensory Detail	3.35 (1.73)	4.00 (1.41)	3.33 (1.58)	3.36 (1.50)	
Emotional Intensity	4.57 (1.22)	4.50 (1.38)	4.77 (1.39)	4.75 (1.83)	

Values refer to mean (and standard deviation) scores. Ratings presented out of six, where a higher score reflects a greater variable level).

TABLE 4
Positive self-defining memory feature ratings for all five memories

| | Sad | | Neutral | | |
	Never-Depressed (n = 26)	Recovered Depressed (n = 15)	Never-Depressed (n = 22)	Recovered Depressed (n = 17)	Group Differences at $\alpha = .05$
Vividness	4.18 (1.59)	4.39 (0.71)	4.23 (1.19)	4.33 (1.51)	
Sensory Detail	3.59 (1.18)	3.14 (1.26)	3.34 (1.47)	4.05 (0.94)	$RD_{Sad} < RD_{Neutral}$
Emotional Intensity	4.02 (0.94)	3.61 (0.89)	4.26 (1.22)	4.38 (0.94)	Neutral > Sad

Values refer to mean (and standard deviation) scores. Ratings presented out of six, where a higher score reflects a greater variable level.

TABLE 5
Positive self-defining memory feature ratings for first memory recalled

| | Sad | | Neutral | | |
	Never-Depressed (n = 13)	Recovered Depressed (n = 6)	Never-Depressed (n = 13)	Recovered Depressed (n = 9)	Group Differences at $\alpha = .05$
Vividness	4.38 (1.66)	4.33 (1.36)	3.92 (1.65)	4.11 (1.76)	
Sensory Detail	2.84 (1.21)	4.16 (0.41)	2.46 (1.71)	4.00 (1.09)	RD > ND
Emotional Intensity	4.46 (1.19)	3.00 (1.67)	4.00 (0.19)	4.55 (1.33)	RD > ND (Sad condition only)

Values refer to mean (and standard deviation) scores. Ratings presented out of six, where a higher score reflects a greater variable level.

were no main effects of condition, $F(1, 37) = .05$, $p > .05$, or history, $F(1, 37) = .24$, $p > .05$, and no condition × history interaction, $F(1, 37) = .08$, $p > .05$. This indicates that participants recalled positive self-defining memories with comparable levels of vividness, regardless of mood (i.e., condition) or depressive history.

Sensory detail. To evaluate whether the groups differed in terms of the sensory detail of their negative self-defining memories a 2 (Condition: neutral, sad) × 2 (History: never-depressed, recovered depressed) ANCOVA was conducted

with sensory detail as the dependent variable, controlling for BDI-II scores. There was no main effect of condition, $F(1, 73) = .00$, $p > .05$, or history, $F(1, 73) = 3.57$, $p > .05$, and no condition × history interaction, $F(1, 73) = .00$, $p > .05$. For the sensory detail of positive self-defining memories there was no main effect of condition, $F(1, 75) = 2.36$, $p > .05$, or history, $F(1, 75) = .00$, $p > .05$, but there was a condition × history interaction, $F(1, 75) = 4.86$, $p < .05$. Follow-up independent samples t-tests indicated that, for never-depressed individuals, the sensory detail of their positive memories did not differ between

those in a neutral mood as compared to a sad mood state, $t(46) = .64$, $p > .05$, while, for participants who had experienced depression in the past, their positive memories contained less sensory detail when they were in the sad mood condition as compared to the neutral mood condition, $t(30) = -2.32$, $p < .05$. This indicates that mood condition did not influence sensory detail of positive self-defining memories for never-depressed individuals, but recovered depressed participants recalled memories with less sensory detail when they were in a sad mood, compared to recovered depressed individuals in a neutral mood state.

These analyses were repeated with the first-recalled negative and first-recalled positive memories. For negative memories there was no main effect of condition, $F(1, 39) = .16$, $p > .05$, or history, $F(1, 39) = .90$, $p > .05$, nor was there a condition × history interaction, $F(1, 39) = .13$, $p > .05$. These results suggest comparable levels of sensory detail between groups; that is, there was no influence of mood condition or history. For positive memories, there was no main effect of condition, $F(1, 37) = .37$, $p > .05$, nor a condition × history interaction, $F(1, 37) = .06$, $p > .05$. However, there was an unexpected main effect of depressive history such that those who had recovered from depression reported positive self-defining memories with more sensory detail than those without a history of depression, $F(1, 37) = 10.05$, $p < .05$.

Emotional intensity. To investigate the emotional intensity with which negative self-defining memories were recalled, a 2 (Condition: neutral, sad) × 2 (History: never-depressed, recovered depressed) ANCOVA with emotional intensity as the dependent variable and BDI-II scores as the covariate, was conducted. There was no main effect of condition, $F(1, 73) = 3.22$, $p > .05$, or history, $F(1, 73) = .83$, $p > .05$, and no condition × history interaction, $F(1, 73) = .09$, $p > .05$. For positive memories, the ANCOVA indicated no main effect of history, $F(1, 75) = .06$, $p > .05$, and no condition × history interaction, $F(1, 75) = .27$, $p > .05$. There was, however, a significant main effect of condition, $F(1, 75) = 4.15$, $p > .05$, such that collapsed across history, participants allocated to the neutral condition recalled more emotionally intense self-defining positive memories than those in the sad mood condition.

Again, the first memories recalled were examined on the dimension of emotional intensity.

For negative memories, there was no main effect of condition, $F(1, 39) = .26$, $p > .05$, or history, $F(1, 39) = .01$, $p > .05$, nor a condition × history interaction, $F(1, 39) = .97$, $p > .05$, indicating comparable levels of emotional intensity of negative memories independent of mood (i.e., condition) or depressive history. For positive memories there was no main effect of condition, $F(1, 37) = 1.80$, $p > .05$, and no main effect of history, $F(1, 37) = 1.27$, $p > .05$. There was, however, a condition × history interaction, $F(1, 37) = 6.30$, $p < .05$. Follow-up t-tests revealed that, for individuals in the neutral condition, there were no differences between recovered depressed and never-depressed individuals in ratings of emotional intensity of positive memories, $t(20) = -1.16$, $p > .05$. However, for participants allocated to the sad mood condition, those with a history of depression recalled less emotionally intense positive self-defining memories compared to their never-depressed counterparts, $t(17) = 2.18$, $p < .05$.

To summarise, given the theoretical underpinnings of the research question addressed in this study, an interaction needed to be detected in order to indicate a difference in memory characteristics that depended on condition and history. When all five self-defining memories were examined this effect was not detected for any of the memory features assessed with the exception of the sensory detail of positive memories, with recovered depressed participants recalling positive memories with lower levels of sensory detail while in the sad mood condition, as compared to their recovered depressed counterparts in the neutral condition. When the analysis was limited to the first memory recalled, the negative memories recalled by recovered depressed individuals were rated as more vivid relative to the negative memories recalled by their never-depressed counterparts, but this difference was only evident in the sad mood condition. Similarly, for positive memories, there was an absence of the critical interaction for any of the memory features recalled when all five memories were examined together. However, when the first memory recalled alone was examined, the positive self-defining memories recalled by recovered depressed participants were rated as less emotionally intense than those recalled by their never-depressed participants. Again, this difference only emerged in the sad mood condition.

Correlational analyses. We were interested in examining whether there were associations between the memory features examined (i.e., vividness, sensory detail, emotional intensity). To this end we conducted a series of bivariate correlations. In this analysis all five memories were examined because mood was not a factor of interest. For negative memories, vividness correlated with sensory detail, $r = .22$, $p < .05$, and emotional intensity, $r = .35$, $p < .05$, and sensory detail was also associated with emotional intensity, $r = .25$, $p < .05$. This illustrates that negative memories that were more vivid, also included more sensory detail, and were more rated as more emotional. For positive memories, vividness and sensory detail were associated, $r = .38$, $p < .05$, as were sensory detail and emotionality, $r = .38$, $p < .05$, but the association between vividness and emotionality only reached trend level, $r = .20$, $p = .08$. This indicates that, similar to negative memories, positive memories that were highly vivid, were also high in sensory detail, and further, that emotionally intense memories were accompanied by high levels of sensory detail.

Finally we examined the relationship between sad mood and memory characteristics by conducting correlations between mood ratings and the memory features of interest (i.e., vividness, sensory detail, emotional intensity) for participants in the sad mood. None of the correlations reached significance for either positive or negative memories (all $ps > .10$).

DISCUSSION

Five self-defining memories were elicited following a neutral or sad mood induction, and the memories recalled by formerly depressed and never previously depressed individuals were compared. The first goal of this study was to compare the phenomenological characteristics of the self-defining memories recalled by recovered and never-depressed individuals in a sad and neutral mood. The second goal was to compare the valence of the memories recalled by the two groups in sad and neutral mood.

When all five self-defining memories were examined, formerly depressed and never-depressed individuals recalled negative memories with comparable levels of vividness, sensory detail, and emotional intensity than their never-depressed counterparts, irrespective of condition. Similarly, the characteristics of all five of the

positive memories recalled by recovered and never-depressed individuals in a neutral mood did not differ. Interestingly, recovered depressed individuals recalled positive memories in the sad condition with less sensory detail than recovered depressed participants in the neutral condition. This is consistent with the hypothesis that sad mood may uncover specific differences between formerly depressed and never-depressed individuals. This finding is also consistent with the findings of our previous work (Werner-Seidler & Moulds, 2011), which suggest that a sad mood may result in positive autobiographical memories being recalled by formerly depressed individuals with less intense memory characteristics.

The other noteworthy finding that emerged from our analysis of all five memories was that positive memories that were recalled following a sad mood induction were rated as less emotional than those recalled in the neutral condition, and this effect was not influenced by depressive status. This is interesting because emotional intensity is likely to be related to memory vividness and sensory detail—which is supported by our correlational analysis (although it is noted that the association between emotional intensity and vividness only reached trend level). Nonetheless, the implication that follows is that being in a sad mood might limit the accessibility of highly emotionally charged positive material, irrespective of an individual's depression history. Interestingly, research from the imagery literature is consistent with this interpretation; for example, the finding that dysphoria is associated with the impaired ability to imagine future positive events (Holmes, Lang, Moulds, & Steele, 2008; Stober, 2000) suggests that simply being in a sad mood might reduce an individual's ability to bring to mind intensely positive memories, regardless of depressive history.

To address the possibility that the effects of the mood induction may not have remained across all five of the reported memories, the characteristics of the first memory recalled following the mood induction were compared. There was also a conceptual reason for this analytic approach; that is, that there may have been carry-over, cumulative effects of recalling a self-defining memory in one valence that could in turn influence the nature and/or the emotional impact of the subsequent memory recalled. For example, if participants recalled a positive self-defining memory first, this might very well have had the effect of improving their sad mood (e.g., Josephson et al., 1996), which

might then have prompted the recall of additional, perhaps thematically related, positive memories subsequently in the experimental task. The literature is mixed in regard to delineating the conditions under which mood-congruent and incongruent effects are likely to emerge (Matt, Vázquez, & Campbell, 1992). However, there is agreement that mood does influence memory recall, and therefore the possibility that memory recall had an impact on subsequently reported memories cannot be ruled out. Indeed, the possibility of an additional and possibly cumulative emotional impact of recalling memories themselves (i.e., beyond the intended effects of the mood inductions) has clear relevance for interpretations about the relative effects of the sad and neutral mood inductions. Therefore the first memory recalled immediately following the mood induction was examined alone as a way to ensure that participants were in the intended mood state and that mood had not been further influenced by emotional memory recall. It needs to be noted that this approach necessarily resulted in the disadvantage that a much smaller number of memories were included in the analysis. As a result, insufficient power may have limited the capacity to detect an effect. Thus the findings reported below need to be interpreted cautiously.

While there were no differences in memory features between groups in the neutral condition, formerly depressed individuals recalled more vivid negative memories than their never-depressed counterparts in the sad mood condition. This finding is consistent with predictions derived from the DAH (Teasdale, 1988). The higher ratings of vividness of negative memories by recovered individuals suggest that there could be something unique about this feature. Indeed, findings from the intrusive memory domain have established that memory vividness is associated with negative affect and intrusion-related distress (Newby & Moulds, 2011). As a caveat it needs to be noted that self-defining memories, by definition, are intense and vivid in nature (Singer & Salovey, 1993). This raises the possibility that participants' vividness ratings could be confounded by the memory elicitation task. However, if this were the case, no differences as a result of depressive history or mood should be observed. As raised above, given that self-defining memories are central to an individual's sense of self (Singer & Salovey, 1993), it is plausible that formerly depressed individuals

might view their negative memories as more closely linked to their identity, which may explain why negative memories were rated as more vivid by recovered depressed individuals. Of course, this suggestion awaits empirical investigation in order to establish first, whether negative self-defining memories are more distressing to individuals with a depressive history and second, how this relates to memory vividness.

For positive memories, an unexpected finding was that collapsed across mood condition, recovered depressed individuals recalled memories that contained more sensory detail than never-depressed individuals. One possible explanation for this pattern is that perhaps those with a history of depression were more motivated to recall their positive self-defining memories in detail as a way to garner their maximal emotional benefit. However, if this were the case it would be likely that an interaction (rather than a main effect of group) would have emerged such that participants in a sad mood would be more motivated than those in a neutral mood to improve their mood via the recall of a detailed positive memory. The reason underlying this finding remains unclear and suggests that the relationship between depressive history and positive memory features will need to be investigated in future research.

Consistent with predictions, in the sad mood condition only, recovered depressed individuals recalled less emotionally intense positive memories than those who had never been depressed. This suggests that sad mood may impede the ability of formerly depressed individuals to recall important, positive events as intensely as those who have never been depressed before. One possible explanation for this result is that formerly depressed individuals might tend towards an anhedonic response to positive material while in a sad mood. This interpretation is consistent with an extension of the logic of Teasdale's model, and is in line with a substantial literature showing that currently depressed individuals show reduced reactivity to positive material (for review, see Bylsma, Morris, & Rottenberg, 2008). It is possible that recovered depressed individuals are impaired in their ability to recall emotionally intense positive memories because they simply do not experience these memories in the same way. It follows, then, that the reduced affective impact of positive memory recall on mood in this group may be expected, which is exactly what studies in the area have found (e.g., Joormann et al., 2007). While this possibility awaits empirical

examination, this result suggests that reduced reactivity to positive material may be a potential mediator of the emotional effects of positive memory recall on mood.

The secondary aim of this study was to investigate whether the valence of self-defining memories recalled would be influenced by mood or depressive history. A mood-congruent effect was expected. The finding that individuals in a sad mood did not differ in terms of the proportion of negative and positive memories recalled from those in the neutral mood was contrary to the prediction of a mood-congruent effect. Further, this finding was observed in both series of analyses (i.e., those that examined all five memories and those that examined first-recalled memories). Although some studies have found mood-congruent memory recall in laboratory settings (e.g., Singer & Salovey, 1993), several comprehensive reviews of the literature indicate that the evidence for the phenomenon is mixed and inconsistent, and that if an effect exists it is small in magnitude (Blaney, 1986; Matt et al., 1992). These inconsistencies in the mood and memory literature, and the small effect sizes that have been reported, may in part account for the absence of a difference in the proportion of negative and positive memories recalled by participants in the current study. In terms of depressive history, it was hypothesised that having a history of depression might amplify the expected mood-congruent biases. However, in the absence of any effects of mood congruent recall, it follows that depressive history could not influence the relative proportion of negative compared to positive memories recalled.

There are a few possible factors that could account for why the recovered and never-depressed participants in a sad mood did not recall a different proportion of negative compared to positive memories. First, as already discussed, it is possible that the mood induction was not sustained throughout the self-defining memory task. As is the case in mood manipulation research, induction procedures are designed such that they are relatively transient in nature. Inherent to the task, then, is the possibility that induced mood could subsequently dissipate over the course of the experimental procedure (e.g., Knight, Maines, & Robinson, 2002). Indeed, this might have been the case in this study as participants were asked to elaborate on and evaluate each memory before proceeding to the next.

Related to this is the issue of contamination. That is, the valence and material contained in one memory may have influenced each subsequent memory recalled. Following the protocol previously used by researchers to overcome this problem (Parrott & Sabini, 1990), the first memory that participants recalled was examined separately, when presumably the effects of the mood induction were optimal. While the pattern of results did not change statistically, an examination of the means suggests that formerly depressed participants were twice as likely to recall a negative memory than a positive one for their first self-defining memory, but only in the sad mood condition. Reduced power very likely prevented this difference from reaching statistical significance. Of course, the absence of a significant difference limits the conclusions that can be drawn from the data, but the means nonetheless suggest that having a history of depression could elevate the likelihood that self-defining memories recalled in a sad mood will be negative. If this were the case, it would accord with predictions made by Teasdale's model and be suggestive of a mood congruent tendency among individuals with a history of depression. Alternatively, it is possible that some participants may have intentionally retrieved a positive memory as a way to improve their mood, while others did not. Indeed, the recall of positive memories has been shown to be an effective way to improve mood (e.g., Joormann & Siemer, 2004), and evidence suggests there are substantial individual differences in emotion regulation strategies (Kovacs, Rottenberg, & George, 2009). Therefore these individual differences in mood regulation may have accounted for substantial variability in the data, thus preventing statistical differences from emerging. Potential contamination as a result of the valence of previously retrieved memories, as well as the possibility that participants may have employed intentional mood repair strategies, are both factors that may have influenced our findings. We recommend that future studies focus exclusively on either negative or positive memories, and if multiple memories are elicited, that a mood rating be taken following each memory as a way to ensure mood comparability between participants before further memories are reported. This is particularly important in the context of self-defining memories, which (by definition) we would expect to elicit strong emotional responses.

In addition to the limitations already noted, some further issues warrant consideration. First we studied a relatively young and non-chronic student sample. According to Teasdale's model, the more chronic an individual's depressive history, the more likely they would be have a greater level of cognitive reactivity—and thus to display greater shifts in cognitive functioning in sad mood as compared to their never-depressed counterparts (Teasdale, 1988). Therefore it is possible that more clearly defined results would have emerged had we studied a sample with a more extensive depressive history. In future this work needs to be replicated in a sample of formerly depressed individuals with a more chronic history.

Second, we decided to use the self-defining memory task to overcome some of the problems associated with the word-cue paradigm. While the self-defining memory task successfully elicited personally important memories, the task might have essentially demanded that participants recall memories that naturally were high on the dimensions of interest. In this way the phenomenological features of the memories recalled could have been an artefact of the task. Although we were interested in between-group differences, it is possible that our groups were so close to ceiling that there might not have been enough variability to detect any differences.

A related issue is the context in which participants were asked to describe self-defining memories. Specifically, participants were tested in a laboratory setting and instructed to report highly personal material to an unknown experimenter. While some participants were very forthcoming in describing events (for example, many memories were concerned with themes of death, sexual experience, illness), others were not. While this issue is inherent in laboratory-based autobiographical memory research, it underscores the need for future studies will need to use a range of memory elicitation procedures to examine memory content and features. One way to do this would be to use an idiographic memory task in which participants are interviewed extensively about their memories and therefore have an opportunity to become more familiar with the experimenter (Rottenberg, Joormann, Brozovich, & Gotlib, 2005). Another method would be for participants to employ script-driven imagery procedures in which participants listen to elaborated versions of memories that they have previously reported in an experimental context (Dunn, 2010).

From a clinical perspective the results of this study suggest that it is not just *what* is being remembered that is important, but that the *way* in which important events are recalled in the context of depressive vulnerability is key. The finding that individuals who had recovered from depression recalled more vivid negative memories and less emotionally intense positive memories after a sad mood induction suggests that it this could have adverse downstream effects on mood. That is, if mild experiences of low mood activate memories that possess specific features that serve to increase the intensity of negative memories, or dampen the intensity of positive memories, it is likely that problematic affective consequences would follow, with implications for emotion regulation. This issue awaits empirical investigation.

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