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BRIEF REPORT

Remoteness and Valence of Autobiographical Memory in Depression

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Abstract
We examined whether major depressive disorder (MDD) is associated with a tendency to recall more remote, specific autobiographical memories, particularly in the context of positive memories. To this end, individuals with MDD ($n = 26$) and healthy controls ($n = 54$) completed the Autobiographical Memory Test. Consistent with the hypothesis, remoteness of specific memories in the MDD group, but not the control group, depended on valence. Compared to the control group, the MDD group recalled more remote positive events. Additionally, the MDD group's positive specific memories were significantly more remote than their negative specific memories. Retrieving remote positive memories might impair mood regulation and maintain an individual's negative mood and perpetuate depression.

Keywords Depression · Autobiographical memory · Memory remoteness · Valence effect

Introduction

Cognitive theories of depression posit that cognitive biases increase risk for the onset, maintenance, and recurrence of depression. Beck (1987) postulated that negative schemas distort views of the self, world, and future, contributing to depression's onset and maintenance. Autobiographical memories (AM), or memories of personal past experiences that shape individuals' self-concept and goal-oriented behaviors, are also colored by negative biases in depression. For example, positive AM in depression tend to be less vivid, personal, and detailed (e.g., Lemogne et al. 2006).

AM in depression are often marked by reduced specificity, or a failure to recall memories of specific events, regardless of the memory's valence (see Williams et al. 2007, for review). In addition to reduced specificity, tendency to recall remote memories may also characterize AM in depression. Recent AM are more readily available and more vivid (Rubin and Schulkind 1997). Although some studies restricted the memories' remoteness to control for its potential effects on specificity (e.g., at least 1 week old; Raes et al. 2007), the remoteness of AM in depression lacks systematic investigation (Griffith et al. 2012). As an exception to this trend, Falco, Peynircioğlu, and Hohman (2015) examined memory remoteness in college students. The tendency to retrieve remote memories was associated with the severity of depressive symptoms, but they did not examine the role of the memories' valence in dysphoric participants' tendency to retrieve remote memories.

Although depression is associated with a lack of specificity in AM regardless of the memory's valence, differences in other aspects of AM in depression are dependent on valence. For example, vividness and the amount of detail are both lower for positive, but not for negative, AM in individuals with depression compared with controls (Lemogne et al. 2006). These findings are consistent with larger literature on impaired processing of positive information in depression (Levens and Gotlib 2009). Given the preferential processing of negative (vs. positive) information in depression (see Gotlib and Joormann 2010, for review), remoteness of specific AM in depression might depend on the memory's valence. Specifically, individuals with major depressive disorder (MDD) might recall more remote positive events and relatively more recent negative events. Combined with people's general tendency to retrieve recent memories (Rubin and Schulkind 1997), preferential processing of negative information in depression might lead individuals with MDD to retrieve recent negative memories. Additionally, impaired processing of positive information in depression (Levens and

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Gotlib 2009) may impede the recall of recent positive memories, resulting in the retrieval of remote positive memories. Their difficulty retrieving recent positive memories could in turn reinforce a distorted negative worldview and maintain negative mood. Because recent AM are more influential in identity development (Demiray and Bluck 2011), lower availability of recent positive memories could also reinforce a negative view of the self and thereby impair mood regulation (Joormann and Siemer 2004). Thus, it would be important to examine whether remoteness of AM in depression depends on the valence of memories.

In this study, we examined the unstudied role of valence in the remoteness of specific memories in depression. Considering that positive information processing is impaired in depression (Levens and Gotlib 2009), we hypothesized positive memories would be more remote than the negative memories in the MDD group (vs. control).

Method

Participants

Participants were recruited from the greater Miami area in Florida through community advertisements. The participants completed a phone interview followed by an in-person interview. Individuals with severe head trauma, learning disabilities, psychotic symptoms, a manic or hypomanic episode, or alcohol or substance abuse within the past 6 months were excluded. Participants younger than 18 years old, older than 60 years old, or not fluent in English were also excluded.

Trained interviewers administered the Structured Clinical Interview for *DSM-IV* (SCID; First et al. 1996) to invited individuals. Interviewers had extensive training in and previous experience administering the SCID for research. Four independent raters listened to the SCID recordings and achieved perfect agreement with the original interviewers ($\kappa = 1.00$). Individuals who met the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association 2000) criteria for MDD were included in the MDD group ($n = 26$). They were permitted to have comorbid conditions. Twenty-five participants in the MDD group had at least one additional current diagnosis, including 21 with social anxiety disorder (SAD).[1] Individuals in the control (CTL) group ($n = 54$) had no current or past Axis I disorder.

[1] We used advertisements looking for individuals with either depression or SAD for multiple unrelated studies conducted in the lab. Thus, individuals with SAD, MDD, or both responded to the ads and were included in the current study if they met diagnosis for MDD. Our recruitment strategy could have artificially increased the comorbidity rate in our sample.

Measures[2]

Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II; Beck et al. 1996) is a 21-item measure that assesses the severity of depressive symptoms. The BDI-II has good internal consistency at around 0.9 and test–retest reliability (Pearson's *r*) between 0.73 and 0.96 (Wang and Gorenstein 2013). Cronbach's alpha was 0.97 in the current study.

Liebowitz Social Anxiety Scale

Participants completed the Liebowitz Social Anxiety Scale (LSAS; Liebowitz 1987), administered as a self-report measure following recent research (e.g., Yoon and Joormann 2012). Cronbach's alpha was 0.97 in the current study.

Autobiographical Memory Test

The participants completed the full Autobiographical Memory Test (AMT; Williams and Broadbent 1986) by verbally reporting specific life events in response to a list of 16 cue words, alternating between positive (happy, loved, successful, energetic, comfortable, brave, safe, calm) and negative (lonely, failure, sad, hopeless, afraid, angry, tense, worried) cue words. In 30 s, participants were instructed to recall a specific memory, defined as a personal event that lasted less than a day. If participants successfully provided a specific memory, the participants were prompted with the question "How long ago was this?". If responses to the question were ambiguous (e.g., "several days ago", "a few weeks ago"), participants were further prompted to clarify (e.g., "Was that before or after the midterm?") and their responses were recorded. We also provided participants a calendar to help them specify the date. If participants provided non-specific memories, they were presented with the next cue word. Participants' responses were audiotaped and transcribed. Memories that were recalled after the time limit, repeated, or from the day of the interview were excluded from analyses.

Coding

Valence Rating

One coder rated separately the positivity and the negativity of participants' memories on a scale of 0 (not at all positive/negative) to 9 (extremely positive/negative). Positivity and

[2] Participants completed other questionnaires assessing personality traits (e.g., NEO), but no other symptom questionnaire was included in this study.

Table 1 Means (SDs) of participant characteristics

	Control group ($n = 54$)	MDD group ($n = 26$)
Age	37.15 (11.82)	41.19 (12.27)
Percentage female (%)	47	65
LSAS	28.08 (23.21)	75.32 (35.68)
BDI-II	3.20 (3.90)	28.35 (11.46)
Positive specific memories (%)	63 (4.3)	68 (3.8)
Negative specific memories (%)	59 (6.2)	52 (5.4)

MDD major depressive disorder

negativity were rated based on how positive or negative most people would perceive the event to be. Only the memories rated as specific (see below) were coded for their valence.

Memory Specificity

Following previous research (Williams and Broadbent 1986), two coders rated participants' memories as specific, extended, categoric, or semantic. Memories were coded as specific if the event of the memory occurred at a specific location and time and lasted less than a day. Memories were coded as extended if the event lasted more than a day, as categoric if it was a recurring incident rather than a specific event, and semantic if it was not an episodic memory. During training, the coders rated five memories and discussed their coding to reach a consensus. Coders then practiced until there was 100% agreement on 10 consecutive practice memories to ensure reliability before rating the current data. Kappa between the two coders was 0.83. Discrepancies were resolved through discussion.

Memory Remoteness

Because categoric and semantic memories are not about any particular event, it was not possible to assess their remoteness. Although it is possible to assess the remoteness of some extended memories, they were considered failure to adhere to instructions, considering that the participants were instructed to recall specific memories. Thus, we assessed the remoteness of AM rated as specific memories.[3] Specific memories for which participants failed to provide a date or a temporal descriptor even after prompts were treated as missing data. All other specific memories' remoteness was determined by comparing the reported memory date with the interview date. Time since the recalled event to the day of recall was classified into four categories following Falco et al. (2015): less than a week, a week to a month, a month to a year, and more than a year. The coding scheme provided semantic significance (e.g., week, month, year) and addressed the challenge of coding for qualitative descriptors (e.g., "a few years"). Using this coding scheme, Falco et al. (2015) demonstrated the association between depressive symptoms and memory remoteness. The coders underwent the same training procedure used for the specificity ratings. Excluding the memories on whose specificity coders disagreed, Kappa was 0.93 for the remoteness ratings. Discrepancies were resolved through discussion.

Procedures

Eligible individuals participated in the study within 2 weeks of completing the SCID. Participants provided written informed consent and completed tasks addressing other research questions. Participants then completed the AMT and questionnaires, including the BDI-II and the LSAS. Participants received $15/h. The local Institutional Review Board approved all procedures.

Results

Participant Characteristics

The participants' demographic and clinical characteristics are presented in Table 1. Not everyone responded to all items, reflected by different degrees of freedom for different analyses. The CTL and the MDD groups did not differ significantly in gender composition, $\chi^2(1) = 2.32$, $p = .13$, and age, $F(1, 76) = 0.09$, $p = .77$. As expected, the two groups significantly differed in their BDI-II, $F(1, 75) = 33.35$, $p < .01$, and LSAS scores, $F(1, 68) = 8.71$, $p < .01$.

Memory Valence

To ensure that the retrieved memories' valence matched the cue valence, a Cue (positive, negative) × Rating (positive,

[3] We also analyzed the data including extended memories considering that we could determine the remoteness of extended memories. However, extended memories whose length qualified them for more than one category according to the remoteness coding scheme (e.g., "when I was unemployed from last year to two days ago") were treated as missing data. Including extended memories yielded virtually identical results as the findings reported in the "Results" section.

negative) × Group (CTL, MDD) repeated-measures analysis of variance (ANOVA) was conducted for rating scores. The main effect for rating, $F(1, 74) = 17.06$, $p < .01$, $d_{av} = 0.10$, and the Rating x Group interaction, $F(1, 74) = 4.32$, $p = .04$, $\eta_p^2 = 0.05$, were significant. MDD group's memories tended to be more negative than the CTL group's memories, but the difference was not statistically significant, $t(76) = 1.68$, $p = .10$. Importantly, the Cue x Rating interaction was significant, $F(1, 74) = 106.99$, $p < .01$, $\eta_p^2 = 0.59$: Memories retrieved for negative cues were significantly more negative ($M = 3.47$, $SD = 1.71$) than positive ($M = 0.85$, $SD = 1.28$), $t(77) = 8.69$, $p < .01$, $d_{av} = 1.75$. Similarly, memories for positive cues were significantly more positive ($M = 2.77$, $SD = 1.82$) than negative ($M = 0.35$, $SD = 0.57$), $t(75) = 10.53$, $p < .01$, $d_{av} = 2.01$. Consequently, negative (vs. positive) cues elicited memories rated as significantly more negative, $t(75) = 14.64$, $p < .01$, $d_{av} = 2.73$, and positive (vs. negative) cues elicited memories rated as significantly more positive, $t(75) = 6.02$, $p < .01$, $d_{av} = 1.23$. Thus, memories retrieved for positive cues and memories for negative cues were considered positive and negative memories respectively.

Memory Remoteness

To examine whether the MDD group retrieved more remote specific memories, particularly for positive memories, an ordinal logistic regression analysis with group, valence, and their interaction term as predictors was conducted. Main effect for group was not significant, Wald $\chi^2(1) = 0.18$, $p = .67$. Main effect for valence was significant, with positive memories more likely to be more remote than negative memories, odds ratio (OR) = 2.55 ($B = 0.94$, $SE = 0.36$), Wald $\chi^2(1) = 6.62$, $p = .01$. Consistent with our hypothesis, the interaction was significant, OR = −0.24 ($B = -1.42$, $SE = 0.47$), Wald $\chi^2(1) = 9.03$, $p < .01$ (see Fig. 1). Follow-up analyses using Mann–Whitney U test, revealed MDD group's memories were significantly more remote than CTL group's for positive memories, $U = 368$, $p = .01$, $r = -.29$, but not negative memories, $U = 568.50$, $p = .64$. Wilcoxon signed rank test revealed no significant differences in positive and negative memories' remoteness in the CTL group, $Z = -1.87$, $p = .06$. However, the MDD group's positive (vs. negative) memories were significantly more remote, $Z = -2.29$, $p = .02$, $r = -.48$. Further, in the MDD group, BDI-II scores correlated significantly with the overall, Spearman's $r_s(23) = 0.50$, $p = .02$, and the positive memory remoteness, $r_s(23) = 0.48$, $p = .02$, but not the negative memory remoteness, $r_s(23) = 0.39$, $p = .06$. In the CTL group, BDI-II scores correlated with positive, $r_s(48) = 0.31$, $p = .03$, but not with overall, $r_s(50) = 0.20$, $p = .17$, or negative memory remoteness, $r_s(50) = 0.05$, $p = .75$.

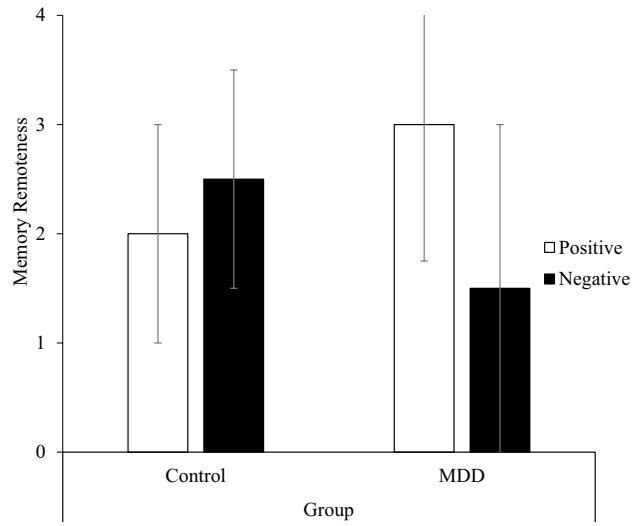

Fig. 1 Median remoteness of specific memories recalled for positive and negative cues by group. Memory remoteness is an ordinal variable categorized as follows: 1 = less than a week; 2 = less than a month, more than a week; 3 = less than a year, more than a month; 4 = more than a year. Major depressive disorder (MDD). Error bars represent interquartile range. Error bars for MDD group are truncated because they encompass a range beyond the possible remoteness values

Because most participants in the MDD group had comorbid SAD, we examined whether social anxiety in the MDD group accounted for our results. We conducted ordinal regression analyses separately for negative and positive memory remoteness with the BDI-II and the LSAS scores as predictors. For positive memory remoteness, the severity of depression, OR = 1.**77** ($B = 0.06$, $SE = 0.02$), Wald $\chi^2(1) = 6.85$, $p < .01$, *Nagelkerke Pseudo* $R^2 = 0.20$, but not social anxiety, Wald $\chi^2(1) = 0.16$, $p = .69$, was significant. That is, increases in the severity of depressive symptoms, but not social anxiety symptoms, were associated with increases in the remoteness of positive memories. Excluding social anxiety symptoms did not decrease the explained variance for the model, *Nagelkerke Pseudo* $R^2 = 0.21$. For negative memory remoteness, the model was not significant, Wald $\chi^2(2) = 0.91$, $p = .64$. Furthermore, in the MDD group, depression severity significantly predicted positive memory remoteness, OR = 1.12 ($B = 0.11$, $SE = 0.05$), Wald $\chi^2(1) = 5.58$, $p = .02$, *Nagelkerke Pseudo* $R^2 = .30$, but social anxiety levels did not, Wald $\chi^2(1) = 0.39$, $p = .53$. Similarly, depression severity, OR = 1.11 ($B = 0.11$, $SE = 0.05$), Wald $\chi^2(1) = 4.97$, $p = .03$, *Nagelkerke Pseudo* $R^2 = .26$, but not social anxiety severity, Wald $\chi^2(1) = 1.57$, $p = .21$, was a significant predictor for negative memory remoteness in the MDD group. In the CTL group, both models for positive, Wald $\chi^2(2) = 5.47$, $p = .07$, and negative memory remoteness, Wald $\chi^2(2) = 2.28$, $p = .32$, were not significant. Thus,

comorbid SAD symptoms cannot fully account for our findings.

Discussion

We examined whether individuals with MDD retrieve more remote memories when they retrieve specific AM. Consistent with the hypothesis, positive memories of the MDD group were more remote than their negative memories. MDD group's positive memories were also more remote than the CTL group's positive memories. Further, depression severity positively correlated with the remoteness of AM in the MDD group.

We extended previous research (i.e., Falco et al. 2015) by demonstrating that the memory remoteness in depression depended on memory valence. Because individuals with depression tend to appraise self-referential events as less positive (e.g., Wisco and Nolen-Hoeksema 2010), they may also interpret recent positive events as less positive. Thus, the number of recent memories they consider positive may be limited. Realizing that their remote memories are more positive compared to their recent memories may juxtapose the less positive present with the more positive past. Considering recent memories' role in shaping self-concepts (Demiray and Bluck 2011), having less recent positive memories could contribute to negative self-concept and depressed mood. Furthermore, a tendency to retrieve remote positive memories might reduce the ability of individuals with MDD to repair mood with positive memories (Joormann and Siemer 2004) and contribute to lower levels of positive emotion in MDD.

It is important to note, however, that most participants in the MDD group had other comorbid disorder(s). Thus, the current findings of more remote positive memories in the MDD (vs. CTL) group could be due to comorbid conditions, most notably SAD. In the current study, the severity of depressive symptoms, but not social anxiety symptoms, was associated with positive memories' remoteness. Nonetheless, future studies should directly compare pure MDD, pure SAD, and comorbid MDD and SAD groups to clarify the similarities and differences in remoteness of (positive) memories in these groups. Further, our sample size was relatively small. Despite the modest sample size, we successfully demonstrated that individuals with MDD recalled more remote positive memories than healthy controls and that their positive (vs. negative) memories were more remote. Retrieving more remote positive memories and recent negative memories may then contribute to the perpetuation of negative mood in depression.

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Compliance with Ethical Standards

Conflict of interest Dahyeon Kim, Lira Yoon, and Jutta Joormann declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Animal Rights No animal studies were carried out by the authors for this article.

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