Those were the days: Memory bias for the frequency of positive events, depression, and self-enhancement

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Those were the days: Memory bias for the frequency of positive events, depression, and self-enhancement

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Past research has associated depression with memory biases pertaining to the frequency, duration, and specificity of past events. Associations have been proposed between both negative and positive memory biases and depression symptoms. However, research has not examined the occurrence of actual events over time in the study of memory bias. To address these limitations and investigate whether a negative or positive memory bias is associated with symptoms of depression, we collected weekly data on specific types of life events over a 4-year period from a sample of college students, and asked students to recall event frequency at the end of that period. Exaggerated recall of frequency for positive events but not other types of events was associated with depression symptoms, using both continuous and categorical measures. Moderator analyses indicated that these effects were evidenced primarily for memories involving the self and among individuals low in trait self-enhancement. The current study indicates that positive memory-frequency bias is an important type of memory bias associated with symptoms of depression. Results support the idea that the link between memory bias for positive event frequency and depressed mood arises out of a current-self vs past-self comparison.

Keywords: Memory; Memory bias; Autobiographical memory; Depression; Self-enhancement.

Most people are able to recall specific details of important life events. Although retrospective memory is not perfect, many individuals can centre on time, place, and characters in constructing the story of a life event (e.g., Bergouignan et al., 2008; Dalgleish et al., 2007; Williams et al., 2007). However, this is often not the case with individuals suffering from clinical or subclinical depression (Dalgleish et al., 2007). Indeed, depressed and dysphoric individuals tend to exhibit forms of memory bias, inaccurately recalling frequency, duration, or specific details of past occasions and occurrences (Bergouignan et al., 2008; Williams & Broadbent, 1986).

NEGATIVE MEMORY BIAS

Numerous studies over the past three decades have suggested the presence of a negative memory bias in depressed mood. Repeatedly, findings show that depressed samples remember a greater proportion of negative words than positive words in free-recall tasks, compared with non-depressed controls (Breslow, Kocsis, & Belkin, 1981; Denny & Hunt, 1992; Mathews & Bradley, 1983; McDowell, 1984). Additionally, research has demonstrated a negative memory bias when depressed participants recall actual life events in response to stimulus words, even when recalled frequency of
actual events is controlled (Clark & Teasdale, 1982; Diener, Larsen, & Emmons, 1984). These findings appear to be intuitive at first glance; it is to be expected that people who are feeling bad would cast a negative light on their current and past experiences, remembering events as worse than they might have been.

A number of theories have been put forth in attempts to explain the apparent phenomenon of negative memory bias in depression. Noting that the negative memory bias in depression operates primarily for memories involving the self (self-memories) as opposed to memories involving others (other-memories) (Kuiper & Derry, 1982), one proposed theory indicates that negative memory bias in depression exists due to excessive self-focused attention, with depressed individuals holding more negative self-schemas. In support of this theory, negative memory bias can be reduced when depressed individuals are focused externally, and not on themselves (Pyszczynski, Hamilton, Herrin, & Greenberg, 1989).

Another theory that may offer insight into the presence of a negative memory bias in depression relies on the concept of mood congruency, or mood-congruent-memory, meaning improved encoding and retrieval of negative material when an individual is in a negative mood state, or positive material when the individual is feeling happy or satisfied (Dalgleish & Watts, 1990; Matt, Vazquez, & Campbell, 1992; Teasdale & Russell, 1983; Watkins, 2002; Williams, Watts, MacLeod, & Mathews, 1997). However, researchers investigating processes used to regulate negative mood states have discovered that mood-incongruent memories may play a role in reversing depressed mood (Erber & Erber, 1994; Parrott & Sabini, 1990; Rusting & DeHart, 2000). Such studies have found that positive memories were more accessible to individuals in negative mood states, and that the retrieval of positive memories helped to bring about more positive moods (Josephson, Singer, & Salovey, 1996). Indeed, in a study examining mood-incongruent memory, Smith and Petty (1995) found that, for individuals high in self-esteem, the more negative their mood states the more positive their autobiographical memories. Taken together, these findings suggest that memory bias in the presence of negative mood and dysphoria may actually be characterised by a positive memory bias, with individuals more readily remembering past positive events in order to repair low mood.

While the aforementioned theories offer convincing accounts of the presence of a negative memory bias in depression, a competing possibility may be that depressed individuals actually experienced a greater frequency of negative life events, thus causing (or partially causing) their depression. A study by Teasdale and Fogarty (1979) took up this possibility, controlling for the impact of actual negative life experiences on mood by inducing both happy and depressive mood states, and measuring latency of retrieval of positive and negative memories. They found that length of time to retrieve positive memories was significantly longer in the depressive mood state than the happy mood state, while time to retrieve negative memories was unaffected by mood state. These findings suggest that mood at retrieval affects the ability to recall experiences, and not the other way around. This study also points to the importance of studying positive memories, which were affected by mood state at retrieval, and not only negative memories, which were not (Teasdale & Fogarty, 1979).

**POSITIVE MEMORY BIAS**

Substantial research has demonstrated mood-congruent memory in depressed mood, suggesting that negative memories act to sustain depression and negative mood states (e.g., Dalgleish & Watts, 1990; Matt, Vazquez, & Campbell, 1992; Teasdale & Russell, 1983; Watkins, 2002; Williams, Watts, MacLeod, & Mathews, 1997). However, researchers investigating processes used to regulate negative mood states have discovered that mood-incongruent memories may play a role in reversing depressed mood (Erber & Erber, 1994; Parrott & Sabini, 1990; Rusting & DeHart, 2000). Such studies have found that positive memories were more accessible to individuals in negative mood states, and that the retrieval of positive memories helped to bring about more positive moods (Josephson, Singer, & Salovey, 1996). Indeed, in a study examining mood-incongruent memory, Smith and Petty (1995) found that, for individuals high in self-esteem, the more negative their mood states the more positive their autobiographical memories. Taken together, these findings suggest that memory bias in the presence of negative mood and dysphoria may actually be characterised by a positive memory bias, with individuals more readily remembering past positive events in order to repair low mood.

However, for individuals with longstanding clinical or subclinical depression, positive memories may not accomplish the proposed reparative function. Relevant work by Joormann and Siemer (2004) showed that when instructed, depressed individuals recalled equal numbers of specific, positive memories as their non-depressed counterparts. However, depressed participants were unable to benefit from the recall of positive memories (i.e. improve their moods), while non-depressed participants’ moods improved. Relatedly, a later study by Joormann, Siemer, and Gotlib (2007) showed that recalling positive autobiographical memories worked to worsen depressed mood in currently depressed individuals. A proposed explanation of this phenomenon—that positive
memories actually increase levels of sadness in currently depressed individuals—was put forth by Joormann and Siemer, and is as follows: Depressed individuals are able to recall positive memories, which initially but fleetingly induce some positive feelings. However, the autobiographical recall instructions may trigger both rumination and increased self-focus in depressed participants, and initial positive feelings might then be compared with their current pervasive low mood. This comparison could then lead to increased self-focus and negative rumination, and recalled positive events may be compared to the current state, creating the sense of deterioration over time. Specifically, current and past situations may be compared, and depressed individuals are likely to experience a sense of things getting worse as time passes, which serves to make them feel worse in the moment (Joormann & Siemer, 2004).

The self-memory system works, in part, to establish a consistent, linear story of the self that fits with one’s self-concept (Conway & Pleydell-Pearce, 2000; Conway, Singer, & Tagini, 2004; D’Argembeau & Van der Linden, 2008; Williams et al., 2007). Healthy individuals in a variety of samples have exhibited a tendency to see past selves as inferior to the present self, thereby establishing their current state as a “best version” (Conway & Ross, 1984; Ross & Wilson, 2002; Wilson & Ross, 2003, 2011). Complementarily, viewing one’s past self and environment as worse than they actually were, and worse than the present, aids in constructing the impression of improvement over time (Wilson & Ross, 2003). It is possible that the opposite is true for depressed individuals: viewing the past self and environment as better than they actually were (a positive memory bias) would serve to create an illusion of deterioration over time. It would follow that an association between positive memory bias and depression would be evident primarily for self-events, which fit into the self-memory system, and not for other-events, which do not.

Fittingly, a great deal of research shows that most people see themselves as better than average on a variety of traits, and present themselves consistently in the best possible light (e.g., Sedikides & Gregg, 2008; Taylor & Brown, 1988). Moreover, research suggests that self-serving biases involve evaluating past versions of the self harshly and negatively, and that people are more likely to adopt self-enhancing illusions regarding the current and future selves than past selves, and less willing to criticise the current self than past selves (Gramzow & Willard, 2006; Robinson & Ryff, 1999). The proclivity to view oneself favourably varies predictably across individuals. The disposition towards self-serving biases, or trait self-enhancement, has been associated with low levels of depression and high levels of positive affect (Bonanno, Rennicke, & Dekel, 2005; Taylor, Lerner, Sherman, Sage, & McDowell, 2003) but also with reduced memory bias (Wang & Conway, 2004).

THE CURRENT STUDY

We examined competing predictions—that depression would be associated with a negative memory bias, and that depression might be associated with a positive memory bias—in a unique dataset. We anticipated that, regardless of the direction of the effect, memory bias for event frequency in depressed mood would be evident primarily for events pertaining to the self rather than events that focused on the experience of others, as this pattern has been evidenced in both mood-congruency and mood-incongruency literature. Additionally, we sought to address a crucial limitation that has characterised the memory bias literature. Past research on memory bias in depression has typically focused on the recall of past events irrespective of their actual occurrence (see Van Vreeswijk & de Wilde, 2003). To remedy this deficit, in the current investigation we compared the recalled frequency of positive events with the actual frequency of positive events measured using a weekly Internet survey administered repeatedly over the course of the preceding 4 years.

Based on the above-mentioned research, we anticipated that trait self-enhancers would evidence relatively little distress and few symptoms of depression. We also expected that memory bias would not be predictive of distress or depression symptoms in individuals high in trait self-enhancement. Given that a strong potential explanation for positive memory bias in depressed mood involves a current-self vs past-self comparison (Joormann & Siemer, 2004), and that self-enhancement literature frequently involves similar comparisons (Gramzow & Willard, 2006; Robinson & Ryff, 1999; Wang & Conway, 2004), we anticipated that for low trait self-enhancers, positive memory bias might be predictive of depression symptoms.

The inclusion of accounts of events and occurrences over a 4-year period addresses an
important limitation in previous investigations of memory bias and depression. While a significant body of work suggests a potential link between depressed mood and memory bias, the failure to examine quality of actual events over time has limited conclusions that may be drawn from past research. Incorporating these reports into the study of memory bias in the presence of symptoms of depression allowed us to more firmly establish whether the specific memory bias in question does, in fact, typify depression symptoms, and how this memory bias might be characterised.

**METHOD**

**Participants and procedure**

The current project was part of a large longitudinal study examining adjustment in college students over the course of 4 years. All first-year undergraduate students at a New York City university in the fall of 2001 were mailed letters outlining details of the study, and 180 initially enrolled as participants. Students gathered in groups twice each academic year in university classrooms to complete questionnaires, including The Self-Deceptive Enhancement scale (SDE; Paulhus & Reid, 1991), measuring trait self-enhancement; the Global Severity Index (GSI), adapted from the Symptom Checklist 90-R (Derogatis, 1983), measuring distress; and the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), measuring symptoms of depression. Data from the fall of the first year (T1) and the spring of the fourth year (T2), which included each of these scales, was used for the current study. In addition, students completed a weekly web task. They received emails each week asking them to log on to a secure website and report whether or not they had experienced a variety of different potentially traumatic and positive life events. They also reported the level of impact and distress associated with each life event using a 1–10 Likert scale. Finally, in the spring of their fourth year participants completed a retrospective memory questionnaire, indicating frequency and level of distress for each life event on the weekly life events task for the previous 4 years.

The current study is based on 90 students (29 men, 61 women) who completed an average of 10 or more weekly web entries throughout the 4-year study. These participants also took part in the initial questionnaire session in the fall of their first year, and the final questionnaire session in the spring of their fourth year. Participants in the current study did not differ significantly from participants who dropped out or did not complete a sufficient number of weekly web entries in age \((p > .10)\), gender \((p > .05)\), race/ethnicity \((p > .10)\), or any other demographic variable. Participants received $250 in compensation for each year of study participation. Average number of weekly web task entries for participants was 22.34 \((SD = 2.96)\). The mean age of participants at time of enrolment was 18.04 years \((SD = .517)\). Participants were 55.6% Caucasian, 23.3% Asian American, 5.6% Hispanic American, 4.4% African American, and 11.1% other.

**Measures**

Each measure was administered twice each academic year, including the fall of the first year (T1) and the spring of the fourth year (T2). The only exception was the Center for Epidemiologic Studies Depression Scale (CES-D), which was only administered at T2. Depression at T1 was measured using the depression subscale of the Symptom Checklist-90-R (SCL-90-R), a distress measure.

**Self-Enhancement.** The Self-Deceptive Enhancement (SDE) scale, a subscale of the Balanced Inventory for Desirable Responding (BIDR; Paulhus & Reid, 1991), was used to measure exaggerated self-confidence or unrealistically high opinions of the self among participants. The SDE is made up of 20 items endorsed on a 7-point Likert scale, with responses of 6 or 7 (or reverse-coded responses of 1 or 2) were scored with a 1, and other responses scored with a 0. The SDE is comparable with other measures of self-enhancement (Bonanno, Field, Kovacevik, & Kaltman, 2002; Paulhus, 1998; Taylor et al., 2003). Through factor analysis the SDE has been shown to be independent from general impression management, or a tendency to present the self in a socially favourable light (Paulhus & Reid, 1991). Test–retest reliability of the SDE across a 5-week span
was .69, and coefficient alpha has ranged from .68
to .80 (Paulhus, 1991). In the current study the
coefficient alpha for the SDE was .70.

**Distress.** Distress was measured using items
from the Anxiety, Depression, and Hostility sub-
scales of the Symptom Checklist-90-R (SCL-90-R;
Derogatis, 1983). A brief distress measure was
created, which summed and averaged items from
these scales to form a Global Severity Index (GSI;
Bonanno, Notarius, Gunzerath, Keltner, & Hor-
owitz, 1998). Each item was endorsed on a scale
from 0–4, with 0 indicating "not at all" and 4
indicating "extremely". Distress was measured at
T1, just after students began their first semester,
and at T2, just before graduation. The GSI has
shown adequate internal consistency (.77 to .86)
and good 1-week test–retest reliability (.78 to .90;
Derogatis, 1983; Derogatis & Melisaratos, 1983).
The coefficient alpha for the GSI in the current
study was .93.

**Depression symptoms.** Symptoms of depression
at T1 were measured using the Depression sub-
scale of the Symptom Checklist-90-R. Self-
reported symptoms of depression at T2 were
measured using the Center for Epidemiologic
Studies Depression Scale (CES-D; Radloff,
1977). This scale was administered only in the
spring of the fourth year (T2). The CES-D consists
of 20 items, examples of which include “I felt
depressed”, and “I could not get ‘going’”. Select
items were reverse-coded such as “I was happy”,
and “I felt hopeful about the future”. Potential
responses included “Rarely or none of the time
(less than 1 day)”, “Some or a little of the time (1–
2 days)”, “Occasionally or a moderate amount of
time (3–4 days)”, and “Most or all of the time (5–7
days)”. Possible scores range from 0 to 60, with
higher scores indicating more depression symp-
toms. The CES-D has shown adequate test–retest
reliability and internal consistency across a wide
range of subsamples (Roberts, Rhoades, & Ver-
non, 1990) and discriminates between depressed
patients and controls (Boyd, Weissman, Thomp-
son, & Myers, 1982). In the current study the
coefficient alpha for this measure was .85.

**Weekly life events survey.** Participants were sent
e-mails each week directing them to a secure
website where they completed an Internet ques-
tionnaire. Each participant was provided with an
anonymous username and password with which to
log on to the website. The life events questionnaire
asked whether participants had experienced each
of 50 life events (with response options of “yes” or
the default “no”) and to rate on a scale from 0–4
how much the event impacted them, and how
distressing they found the event to be. The life
events questionnaire included potentially traumatic
events such as suicide or attempted suicide of
someone close to you, parents’ divorce, serious
physical injury or illness, and death of someone
close to you or important in your life. Positive
events were also included, such as beginning of a
new relationship, a positive change in personal
finances, and an outstanding personal achievement.

This questionnaire was adapted from Holmes
and Rahe’s (1967) inventory. However, while the
original survey was intended for events that had
occurred within the past year, this questionnaire
focused on events from the past week. Further, the
original point values for events were not used.
Select items were removed, such as events focused
on career or children, and others added, such as
school-related events, in order to make the invent-
ory more applicable to a college-aged sample.

**Retrospective life events questionnaire.** This
questionnaire, administered during the spring of
the fourth year, included each of the 50 potential
life events from the weekly life events survey.
Participants had to indicate how many times they
experienced each event over the 4-year period,
and how distressing each event had been on a
scale from 0–4.

**RESULTS**

Over the 4-year study almost all students reported
experiencing at least one of each category of life
events measured on the weekly life events surveys:
positive event (95.79%); potentially traumatic
event (91.80%); academic/financial stressor
(98.36%); interpersonal/family stressor (98.36%);
and change in lifestyle (100%). Means for total
number of each category of events experienced (as
reported weekly during the 4-year period) and
recalled at the end of the 4-year period are
reported in Table 1. While means did not signifi-
cantly differ between number of events experi-
enced and number of events recalled for most
categories, this does not indicate that participants
called frequency of events accurately. Indeed,
some participants overestimated frequency and
other participants underestimated frequency,
resulting in similar means. For positive events,
58.9% of participants under-remembered the
frequency of occurrence from the previous 4-year period, and 27.8% over-remembered. For potentially traumatic events, 65.1% under-remembered frequency, while 23.8% over-remembered; for academic/financial stressors, 73.0% under-remembered, and 23.8% over-remembered frequency; for interpersonal/family stressors, 76.2% of participants under-remembered frequency, while 19.0% over-remembered; and for changes in lifestyle, 52.4% under-remembered frequency, and 25.4% over-remembered.

Importantly, actual number of any category of events (positive or negative) was not significantly correlated with depression or distress at either time point (see Table 2). Actual number of positive or negative events also did not significantly predict depression or distress symptoms at T2 for any category (positive events; potentially traumatic events; academic/financial stressors; interpersonal/family stressors; changes in lifestyle).

Memory discrepancy as a predictor of depression symptoms and distress

We created memory discrepancy indices (MDIs) for the frequency of positive life events; potentially traumatic events; academic/financial stressors; interpersonal/family stressors; and changes in lifestyle using the standardised residual of recalled event frequency regressed on actual event frequency. We selected this approach because a simple difference score might not adequately control for the actual frequency, which may be positively associated with the difference score (Boyce et al., 1995; Manuck, Kasprowicz, & Muldoon, 1990). The standardised residual score takes into account the sample-level correlation between actual and recalled frequency of events, and thus allows for better control of actual frequency (Boyce et al., 1995).

Mean magnitude of the MDI scores for positive events (MDI-P) was .001 (SD = 1.012); for potentially traumatic events, mean magnitude of the MDI scores was .040 (SD = 1.058); for academic/financial stressors, mean magnitude of MDI scores was −.084 (SD = .846); for interpersonal/family stressors, mean magnitude of MDI scores was −.042 (SD = .999); and for changes in lifestyle, mean magnitude of MDI scores was −.113 (SD = .771). A positive mean was indicative of overestimation, and a negative mean suggested underestimation.

When we regressed T2 depression symptoms on MDI for positive events (MDI-P) with T1 depression and gender as control variables in a hierarchical model, this analysis proved significant, $F(3, 85) = 10.87, p < .001$, explaining 27.7% of the T2 depression symptoms variance (see Table 3).1 However, in none of the models including negative events (potentially traumatic events; academic/financial stressors; interpersonal/family stressors; changes in lifestyle) were MDI scores associated with significant effects. We added self-enhancement to the model including MDI-P, and this step was significant, $F_{\text{change}}(1, 84) = 5.88, p < .05$.

TABLE 1
Means for each category of events experienced and recalled

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>T</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive events</td>
<td>10.67</td>
<td>8.56</td>
<td>−.424</td>
<td>89</td>
</tr>
<tr>
<td>Positive events recalled</td>
<td>10.03</td>
<td>14.40</td>
<td>.340</td>
<td>60</td>
</tr>
<tr>
<td>PTEs experienced</td>
<td>6.05</td>
<td>5.42</td>
<td>.173</td>
<td>60</td>
</tr>
<tr>
<td>PTEs recalled</td>
<td>6.48</td>
<td>14.90</td>
<td>.765</td>
<td>60</td>
</tr>
<tr>
<td>AFs experienced</td>
<td>28.80</td>
<td>27.18</td>
<td>−.565</td>
<td>60</td>
</tr>
<tr>
<td>AFs recalled</td>
<td>29.64</td>
<td>27.18</td>
<td>−.565</td>
<td>60</td>
</tr>
<tr>
<td>IFs experienced</td>
<td>35.77</td>
<td>27.18</td>
<td>−.565</td>
<td>60</td>
</tr>
<tr>
<td>IFs recalled</td>
<td>39.54</td>
<td>29.91</td>
<td>−1.033</td>
<td>60</td>
</tr>
<tr>
<td>CLs experienced</td>
<td>40.10</td>
<td>56.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLs recalled</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PTE = potentially traumatic event; AF = academic/financial stressor; IF = interpersonal/family stressor; CL = change in lifestyle.

TABLE 2
Correlation matrix for depression, distress, self-enhancement, and frequency of events

<table>
<thead>
<tr>
<th>Dist T1</th>
<th>Dep T1</th>
<th>Dist T2</th>
<th>Dep T2</th>
<th>S-E</th>
<th>FreqPos</th>
<th>FreqPTE</th>
<th>FreqAFS</th>
<th>FreqIFS</th>
<th>FreqCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dist T1</td>
<td>.95***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dep T1</td>
<td>.30**</td>
<td>.35**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dist T2</td>
<td></td>
<td>.39***</td>
<td>.43***</td>
<td>.72**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dep T2</td>
<td></td>
<td></td>
<td>.24*</td>
<td>.25*</td>
<td>.24*</td>
<td>.28**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.03</td>
<td>.17</td>
<td>.20</td>
<td>.21</td>
<td>.16</td>
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<td>FreqPos</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.04</td>
<td>.13</td>
<td>.20</td>
<td>.21</td>
<td>.13</td>
</tr>
<tr>
<td>FreqPTE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.09</td>
<td>.11</td>
<td>.08</td>
<td>.11</td>
<td>.18</td>
</tr>
<tr>
<td>FreqAFS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.00</td>
<td>.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FreqIFS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FreqCL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.04</td>
<td></td>
</tr>
</tbody>
</table>

Dist = Distress; Dep = Depression; S-E = Self-enhancement; FreqPos = Actual frequency of positive events; FreqPTE = Actual frequency of potentially traumatic events; FreqAFS = Actual frequency of academic/financial stressors; FreqIFS = Actual frequency of interpersonal/family stressors; FreqCL = Actual frequency of changes in lifestyle.

1We re-ran the regression analysis using the depression subscale of the SCL-90 as the T2 outcome measure, and results were essentially identical.
Predicting T2 depression symptoms from memory discrepancy and self-enhancement

<table>
<thead>
<tr>
<th>Model and variable</th>
<th>B</th>
<th>SE</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicting T2 Depression Symptoms(^a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Depression</td>
<td>4.81***</td>
<td>.907</td>
<td>.502</td>
</tr>
<tr>
<td>Gender</td>
<td>-3.52**</td>
<td>1.27</td>
<td>-.265</td>
</tr>
<tr>
<td>MDI-P</td>
<td>.740</td>
<td>.578</td>
<td>.120</td>
</tr>
<tr>
<td>Model 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Depression</td>
<td>4.32***</td>
<td>.905</td>
<td>.451</td>
</tr>
<tr>
<td>Gender</td>
<td>-3.79**</td>
<td>1.24</td>
<td>-.285</td>
</tr>
<tr>
<td>MDI-P</td>
<td>.883</td>
<td>.565</td>
<td>.143</td>
</tr>
<tr>
<td>Self-enhancement</td>
<td>-4.78*</td>
<td>.197</td>
<td>-.227</td>
</tr>
<tr>
<td>MDI-P × Self-enhancement</td>
<td>-5.07*</td>
<td>.247</td>
<td>-.608</td>
</tr>
</tbody>
</table>

\(\beta\) = Memory discrepancy index for positive life events
\(^a\)Model 1: \(F(3, 85) = 10.88, p < .001; R^2 = .28\). Model 2: \(F(1, 84) = 10.09, p < .001; R^2 = .33\). Model 3: \(F(1, 83) = 9.23, p < .001; R^2 = .36\).

In addition, participants with positive memory-frequency bias (positive MDI scores) had significantly higher depression symptoms (\(M = 21.346, SD = 6.480\)) than participants who did not exhibit this memory bias (\(M = 17.721, SD = 6.231\)), \(t(92) = 2.496, p < .05\).

When we repeated these procedures using T2 distress instead of T2 depression symptoms, the results were essentially identical. The analysis proved significant, \(F(3, 83) = 5.75, p < .01\), explaining 17.2% of the T2-distress variance. Adding self-enhancement to the model was again significant, \(F_{\text{change}}(1, 82) = 4.97, p < .05\), and the interaction of self-enhancement and MDI-P was also significant, \(F_{\text{change}}(1, 81) = 6.25, p < .05\), accounting for 5.6% additional variance. Over-remembering positive event frequency predicted greater T2 distress only for low self-enhancers.\(^2\)

Self- vs other-positive events

Separate discrepancy indices were subsequently created for positive events centred on the self (MDI-S; e.g., “outstanding personal achievement”), and positive events centred on others (MDI-O; e.g., “marriage of someone close to you”), in order to examine differences in positive memory bias for the frequency of these two types of events. Mean magnitude of the MDI scores for positive self-events (MDI-S) was \(.026 (SD = 1.016)\); and mean magnitude of the MDI scores for positive other-events (MDI-O) was \(-.002 (SD = 1.013)\).

Next we regressed T2 depression symptoms on MDI-S, MDI-O, T1 depression, gender, self-enhancement, and the interactions of self-enhancement with MDI-S and MDI-O in a single-step model (see Table 4). Controlling for T1 depression and gender, significant predictors were MDI-S (\(\beta = .688, p < .05\)) and self-enhancement (\(\beta = -.213, p < .05\)). The interaction of MDI-S and self-enhancement was marginally significant (\(\beta = -.583, p = .067\)). MDI-O did not figure into any significant effects. The same results were produced when we regressed T2 distress on these variables, controlling for T1 distress.

\(^2\)We explored adding participants’ ratings of the positive events’ impact into the regression models. This change failed to significantly increase variance explained for both T2 depression symptoms, \(F_{\text{change}}(1, 82) = 1.014, p > .10\), and T2 distress, \(F_{\text{change}}(1, 83) = .105, p > .10\).
TABLE 4

Predicting T2 depression symptoms from memory discrepancy for “self” and “other” events and other variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicting T2 Depression Symptoms&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Depression</td>
<td>4.50***</td>
<td>.901</td>
<td>.470</td>
</tr>
<tr>
<td>Gender</td>
<td>−3.30**</td>
<td>1.24</td>
<td>−.248</td>
</tr>
<tr>
<td>MDI-S</td>
<td>4.23†</td>
<td>1.97</td>
<td>.688</td>
</tr>
<tr>
<td>MDI-O</td>
<td>1.49</td>
<td>1.25</td>
<td>.242</td>
</tr>
<tr>
<td>Self-enhancement</td>
<td>−.448*</td>
<td>.195</td>
<td>−.213</td>
</tr>
<tr>
<td>MDI-S × Self-enhancement</td>
<td>−.482*</td>
<td>.260</td>
<td>−.583</td>
</tr>
<tr>
<td>MDI-O × Self-enhancement</td>
<td>−.227</td>
<td>.226</td>
<td>−.201</td>
</tr>
</tbody>
</table>

MDI-S = Memory discrepancy index for positive “self” events; MDI-O = Memory discrepancy index for positive “other” events.

<sup>b</sup>p < .10, *p < .05, **p < .01, ***p < .001.

Model: F (7, 81) = 6.89, p < .001; R² = .37.

**Categorically high depression symptoms**

Finally we examined high self-reported symptoms of depression as a categorical variable. Because the suggested cut-off for clinical depression of 16 on the CES-D creates 15%-20% false-positives (Radloff, 1977), we used a more conservative cut-off of 25. Using this cut-off, there were 14 participants (15.6%) in the group with categorically high depression symptoms. Positive memory-frequency bias and high depression symptoms evidenced significant contingency, χ²(1) = 4.81, p < .05. Cell frequencies indicated that 30.8% of participants meeting cut-off for clinically relevant depression symptoms over-remembered positive event frequency, whereas only 11.8% of participants with lower CES-D scores over-remembered positive event frequency.

**DISCUSSION**

Given the limited conclusions that may be drawn from previous research, which depended heavily on recalled memory of events, without measuring occurrences of actual life events, it has remained as yet unclear how to define memory bias in the presence of symptoms of depression. Further, it has been difficult to explain why memory bias seems to typify depressed mood. Because much previous research has depended on participants’ memories of life events, key questions have remained open: have depressed individuals actually experienced fewer positive/more negative events, thus causing their low mood? Do they remember events in a biased way because of their depression symptoms? Or does the biased memory of life events serve to create the impression of deterioration over time, thereby maintaining depressed mood? Our results address these important questions, including how memory bias in the presence of depression symptoms is characterised, and why research repeatedly shows such a close connection between depressed mood and memory bias.

Results from the current study provided clear evidence for one of our two competing predictions: symptoms of depression and distress were associated with exaggerated memory for the frequency of past positive events, and not for the frequency of past negative events. It is important to note that actual frequency of positive or negative events was not significantly correlated with distress or depression, nor were actual frequencies predictive of distress or depression; rather, it was the positive memory-frequency bias that predicted symptoms of depression and distress. By comparing the actual frequency of positive events, measured using weekly Internet surveys over a 4-year period, with recalled frequency of the same positive events at the end of the 4-year period, we were able to study memory bias for event frequency, and zero in on the existence of a positive memory-frequency bias—a distinct type of memory bias associated with symptoms of depression and distress. The discrepancy between actual and recalled positive event frequency (MDI-P) predicted increased depression symptoms and distress at the time of recall, net of distress measured at the onset of the study. MDI-P was also associated with clinically relevant depression symptoms measured as a categorical variable. MDI scores for memory of all types of negative events (potentially traumatic events, academic/financial stressors, interpersonal/family stressors, and changes in lifestyle) were not predictive of depression symptoms or distress.

Our findings were moderated in two important ways, each consistent with the idea that the link between positive memory-frequency bias and depression symptoms/distress arises out of a current-self versus past-self comparison. First, the general association between this memory bias and adjustment was evident primarily in low trait self-enhancers. It is possible that this finding simply reflects floor effects: high self-enhancers had generally low levels of depression/distress. However, it is plausible that the tendency for high self-enhancers to employ self-serving biases obviated the impression of deterioration over
time. Individuals low in self-enhancement seem to remember a greater degree of positive life events over the past 4 years than actually occurred, and this tendency to over-remember is predictive of depression symptoms. However, this is not the case for high self-enhancers, for whom it does not seem to matter whether they over-remember positive event frequency—they remain low in symptoms of depression and distress regardless. It is fitting that the employment of self-serving biases would erase the proposed illusion of deterioration over time.

It is likely that high self-enhancers were not susceptible to the proposed model of positive memories acting to worsen depressed mood. According to this model, outlined by Joorman and Siemer (2004), currently depressed individuals tend towards negative rumination and self-focus, and this may cause a negative comparison between current and past states, thus increasing feelings of sadness and low mood. Given findings that individuals high in self-esteem were able to use positive memories to repair negative mood states (Smith & Petty, 1995), it is to be expected that high self-enhancers would respond similarly. It is therefore not surprising that they did not evidence the same pattern as low self-enhancers: over-remembering past positive events, and this memory bias predicting distress and symptoms of depression.

Second, positive memory-frequency bias predicted depression symptoms/distress only for memories of the self, rather than memories of others, and this effect also interacted with self-enhancement. These findings are again consistent with the idea of a current-self/past-self comparison. If the theoretical underpinnings of the current study include the notion that the self-memory system works to create a consistent and coherent story of the self that aligns with one’s self-concept (Conway & Pleydell-Pearce, 2000; Conway et al., 2004; D’Argembeau & Van der Linden, 2008; Williams et al., 2007), then it is fitting that results hold only for self-memories, which figure into this self-memory system.

A possible alternative explanation for the findings of the current study is suggested by the basic tenets of the mood-congruent memory literature. According to this view, both encoding and retrieval of memories are improved when the material matches the mood (Dalgleish & Watts, 1990; Watkins, 2002). It is therefore possible that, for chronically depressed or dysphoric individuals, positive memories were generally less well encoded than negative memories, leading to more inaccurate recollections of these memories over time. However, if this were the case, we would expect to see positive memories both over-remembered and under-remembered by depressed individuals. The memory bias we observed indicates that participants with more symptoms of depression significantly over-remembered positive event frequency, and this does not seem to be sufficiently explained by mood-congruent encoding of memories. Given the direction of this memory bias, our self-comparison explanation seems to fit the findings most closely.

Several limitations must be noted. First, we did not use a clinical sample. However, there was considerable variability in depression symptoms and distress within the sample, and by using a conservative cut-off score of 25 on the CES-D we isolated a small but clinically relevant subset of individuals with categorically high symptoms of depression. The group with high depression symptoms evidenced positive memory-frequency bias quite clearly. Nonetheless, it will be important for future research to replicate these findings using a diagnostically rigorous clinical sample. Second, the current investigation examined only the discrepancy in memory frequency. It is possible that negative memory biases, or different types of positive memory biases, exist in depression with regard to intensity, tone, and impact of memories, although our results suggest that individuals with depression symptoms do not recall more negative memories than actually occurred, and do recall more positive memories than actually occurred. It will be illuminating for future investigations to examine other aspects of memory bias to more precisely define how memory bias is characterised in the presence of depressed mood.

Additionally, self-reported negative and positive ratings of past events were not used. Future research might use such ratings to ascertain whether events were experienced and/or remembered as positively by low self-enhancers as high self-enhancers. Self-reported ratings would be useful in understanding positive memory bias in the context of depression, and especially among high and low self-enhancers.

Finally, this study relied on a college population. Compared with other adult populations, college students represent a relatively homogeneous group (Peterson, 2001), and current findings might not be generalisable to populations with greater variability in race/ethnicity or socioeconomic status. Future research could investigate whether similar findings are present in older, non-collegiate samples.
Within the context of these limitations, the current study indicates that positive memory-frequency bias is an important type of memory bias associated with depression symptoms. These findings, in particular the primacy of self-memories and the fact that we observed this memory bias only for positive events, suggest a number of theoretical and empirical questions for future research. Is positive memory-frequency bias always limited to positive memories? Does the primacy of self memory bias hold for different types of events or in the context of different types of psychopathology? Might memory specificity also play a role in biased recall of positive events? We anticipate that answers to these questions will advance understanding of both memory processes and psychopathology.

REFERENCES


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