

On the emotions that accompany autobiographical memories: Dysphoria disrupts the fading affect bias

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Participants in two studies recalled autobiographical events and reported both the affect experienced at event occurrence and the affect associated with event recollection. The intensity of affect associated with a recalled event generally decreased, but the affective fading was greater for negative events than for positive events. The magnitude of this *fading affect bias* also varied with participants' dysphoria levels: Dysphorics showed a smaller fading affect bias than non-dysphorics. Additional analyses suggested that the fading affect bias is not a product of: (1) distorted retrospective memory for the affect originally accompanying events; (2) differences in the initial affect intensity of positive and negative events; or (3) differences in the ages of positive and negative events. Other variables that might be related to the fading affect bias are discussed.

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Past research has examined how the emotions prompted by an event are related to subsequent memories for that event. For example, flashbulb memory research has shown that the content of seemingly vivid and emotional memories becomes increasingly distorted as retention intervals increase (e.g., Neisser & Harsch, 1992). Such research has explored emotion and memory for everyday events (Betz & Skowronski, 1997; Thompson, Skowronski, Larsen, & Betz, 1996), memory for extraordinary public events (e.g., Conway, 1995), and memory for private traumatic events (e.g., Nadel & Jacobs, 1998). However, a related and largely ignored issue concerns the fate of event emotions in memory. Specifically, how might the passage of time be related to the emotions that are evoked when an event is recalled?

One theory relevant to this question is Taylor's (1991) *mobilisation-minimisation hypothesis*. Taylor's hypothesis suggests that the long-term suppression of negative affect is a healthy coping mechanism. According to this hypothesis, when a person experiences a negative event, two sets of mechanisms are activated. The first mechanism is the mobilisation of resources: People activate their biological, psychological, and social resources to cope with the immediate consequences of a negative event. Such activation is usually not necessary to cope with a positive event. The second mechanism is minimisation. To return to a state of homeostasis, opponent processes work to dampen the impact of the negative event. As with mobilisation, minimisation occurs biologically, cognitively, and socially, and minimisation is usually stronger for negative events than for positive events.

When applied to the memory domain, this theory implies that, as time passes, the intensity of emotions associated with negative events should decrease more rapidly than the intensity of emotions associated with positive events. Several studies have provided empirical support for this proposition. For example, participants in a study by Cason (1932) described from three to eight emotional memories from the previous week. These participants then rated the current affect provoked by each memory and the affect associated with the original event. Participants made similar judgements about the same events three weeks later. Cason found that the intensity of the feelings associated with all events became weaker over time. However, this weakening was significantly greater for negative events.

Holmes (1970) designed a study to both replicate Cason's (1932) findings and to explore whether this effect could explain why positive events and stimuli tend to be better remembered than negative events (for more on this positivity bias, see Matlin & Stang, 1978). Holmes hypothesised that positive events may be better remembered because they retain more of their original affect than negative events. Holmes asked 26 participants to record pleasant and unpleasant events and to record the affect associated with those events. One week later, as part of an event recall task, he again assessed the affect associated with the events. Holmes found that unpleasant events faded in emotional intensity more

than pleasant events, which replicated Cason's results. One additional point to be made about the Holmes' study is that it minimises the possibility that the fading affect bias is caused by retrospective distortions in memory for the affect originally associated with events. This is because the affect initially associated with events was assessed soon after the events occurred. Holmes also found that participants were less likely to recall experiences that decreased in affective intensity compared to experiences that did not decrease in intensity. However, Holmes was unable to provide definitive evidence that the positivity bias was caused by a difference in emotional fading between pleasant and unpleasant events.

Suedfeld and Eich (1995) supplied further empirical evidence supporting the existence of a positivity bias in autobiographical memory. In Experiment 2 of this research, participants were presented with 12 common, emotionally neutral probe words and asked to recall memories related to the probes. Participants were asked to rate the intensity of the event at the time the event occurred and at the time of event recall on a 9-point scale ranging from 1 (neutral) to 9 (extremely intense). Events were rated as being more intense at the time of occurrence than at the time of recall ($M_{\text{Initial}} = 5.76$; $M_{\text{Current}} = 3.92$). Although Suedfeld and Eich did not directly compare the fading of affective intensity for pleasant and unpleasant events, they did report that the average current pleasantness rating of events was slightly positive (0.17 on a +1 to -1 scale), a finding that would be expected if negative affect faded more than positive affect.

Recently, a series of studies re-examined this issue using a diary procedure (Walker, Vogl, & Thompson, 1997). Walker et al. asked participants to keep a diary of unique daily events. As an event was entered into their diary, participants rated the pleasantness of the events. After a specific retention interval (3 months in Experiment 1; 1 year in Experiment 2; and 4.5 years in Experiment 3), participants rated the emotions provoked when they were reminded of each of the recorded events. Participants also rated how well they remembered each event. As in previous research, the affective intensity of events faded over time and the intensity of negative events faded more rapidly than the intensity of positive events. As with the Holmes study, this diary methodology minimises the possibility that these effects are caused by retrospective distortions in memory for the affect originally associated with the event. Examination of the memory ratings suggested that positive events were remembered slightly better than negative events, but the results did not yield a relation between the fading of affective intensity and the memory advantage afforded by positive events. Thus, these findings confirmed the idea that the affect associated with negative events fades more rapidly over time than the affect associated with positive events, and they also suggest that memory for event content and event affect are relatively independent.

Taken together, all of these studies suggest that the autobiographical memory system does not treat the negative and positive affect associated with events

equally. Over time, that system seems to more strongly dampen the affect associated with unpleasant memories than the affect associated with pleasant memories. For ease of discussion, the differential fading of positive and negative emotions will be referred to as *the fading affect bias*.

However, this fading affect bias may not occur in the same way for everyone. For example, one might hypothesise that individuals who are mildly depressed (dysphoric) should show a different pattern of fading affect than nondysphoric individuals. The literature already provides evidence that the memories of dysphorics and nondysphorics differ in several ways. For example, dysphorics typically report less detailed memories than nondysphorics, especially when the recalled events are positive rather than negative (e.g., Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Williams & Broadbent, 1986; Williams & Scott, 1988). It is well understood that dysphorics often get caught in a vicious cycle of experiencing negative events and thinking about negative events (e.g., Teasdale, 1983). Furthermore, dysphorics report a greater number of negative memories than nondysphorics (e.g., Clark & Teasdale, 1982; Lloyd & Lishman, 1975; Reynolds & Salkovskis, 1992). A disparity in the extent to which emotions prompted by event memories fade over time might be yet another difference in the memory systems of dysphorics and nondysphorics. More specifically, we suspect that dysphorics will evince a smaller fading affect bias than nondysphorics (or no bias at all). This may occur because the negative affect associated with the negative memories of dysphorics does not fade as much as the negative affect associated with the negative memories of nondysphorics, or because the positive affect associated with positive memories fades more for dysphorics (or both). Regardless of the exact pattern that might emerge, the first goal of the studies presented in the present paper was to find evidence that dysphoria disrupts the fading affect bias.

The second goal of the study was to rule out three possible alternative explanations for the fading affect bias. The first explanation suggests that the fading affect bias might be an artifact of event age. That is, in retrospectively recalling autobiographical events, participants might recall older negative events and newer positive events. If this were the case, then the data would give the appearance of a fading affect bias even if the rate of fading were equivalent for negative and positive events. Because the bias also occurs in diary paradigms that automatically control for event age (e.g., Holmes, 1970; Walker et al., 1997), this possibility seems unlikely. Nevertheless, in our studies we examined whether recalled event age was related to the magnitude of the fading affect bias.

The second alternative explanation lies in the extremity of the initial affect ratings. Participants may have recalled negative events that were more emotionally extreme than their recalled positive events. If this were the case, then the data would give the appearance of a fading affect bias. However, the bias might simply be a consequence of the fact that the affect associated with negative

events “had farther to fall” across time. To rule out this possibility we examined the extremity of the affect ratings given at event occurrence. If the extremities of those ratings are equal for positive and negative events, then this alternative hypothesis becomes untenable.

Such equivalence also eliminates a third alternative explanation for the fading affect bias: That the fading affect bias is caused by retrospective distortion of the affect that was present at event occurrence. That is, when looking back at the original events, people might experience memory distortion and erroneously recall less positive emotion for positive events and more negative emotion for negative events than was actually present. If this were the case, then these distortions ought to be reflected in the affect ratings provided for event occurrence, with negative events rated as more extreme than positive events. If the ratings of the affect that accompanied the original events are equal in intensity, then this retrospective distortion hypothesis becomes less likely. Given that the data from Holmes (1970) and Walker et al. (1997) virtually rule out the possibility that retrospective distortion is responsible for the fading affect bias, our expectation is that no evidence of retrospective distortion in memory for affect will emerge.

EXPERIMENT 1

Method

Participants

A total of 65 undergraduates at Kansas State University participated in the experiment in partial fulfilment of a course requirement. All simultaneously participated as part of a mass testing session.

Assessment of dysphoria. Participants completed the Beck Depression Inventory (BDI). The BDI is a 21-item questionnaire designed to assess the severity of depression. The range of scores on the BDI can vary from 0 to 63. Following the scoring guidelines described in Beck and Steer (1987), 46 individuals with scores of nine or less were classified as nondysphoric and 19 individuals with scores of 10 or above were classified as dysphoric.¹

Procedure

Each participant recalled six emotionally intense memories from the most recent six months of their life and wrote a description of each memory. In order to balance the valence of events recalled, participants were explicitly asked to

¹Beck and Steer (1987) classify depressives into one of three severity categories based on their scores on the BDI. The majority of our dysphoric participants fell into the “mild depression” category, hence, a simple distinction between dysphorics and nondysphorics was warranted.

recall both pleasant and unpleasant memories (this instruction apparently worked, as all participants recalled at least two memories of each valence). Participants were given 20 minutes to complete this task.

Measures of event characteristics. Participants provided three ratings for each recorded memory. Two of these were *pleasantness* ratings. The first rating reflected the pleasantness of the event at the time the event occurred. The second rating reflected the affect experienced when the event was recalled. Both ratings were made on a 21-point scale ranging from +10 (*extremely pleasant*) to -10 (*extremely unpleasant*), with 0 being neutral. Participants were explicitly cautioned that an event's pleasantness might change in several ways or it may not change at all.

Participants were also asked to estimate how long ago each event occurred. These estimates were made in months, weeks, and days. All estimates were converted to days, with one month being converted to thirty days. Nineteen events generated by participants were excluded from all analyses because the ratings provided for these events were incomplete.

Results

Affect intensity at event occurrence and at event recall. We expected that the affective intensity of events would be greater at event occurrence than at recall. To examine this possibility the absolute values of the initial and current pleasantness ratings were used to calculate two averages for each participant. The first average reflected the intensity of affect experienced at event occurrence and the second average reflected the intensity of affect at event recall. Those averages were entered into a repeated-measures *t*-test. As expected, the intensity of affect was significantly greater at event occurrence ($M = 7.51$) than at event recall ($M = 5.17$), $t(64) = 98.3$, $MS_e = 0.02$, $p < .0001$.

Initial event valence, dysphoria, and fading affect. The dependent measure in the next analysis was the decrease in affect intensity between the initial and current pleasantness ratings for each event. For each participant, a difference score was calculated for both pleasant events (intensity at occurrence - intensity at recall) and unpleasant events (intensity at recall - intensity at occurrence), such that decreases in intensity yielded positive scores. The scores were analyzed using a 2 (Dysphoria) \times 2 (Initial event valence) mixed-factor analysis of variance in which dysphoria was a between-subjects variable and initial event valence was a within-subjects variable.

A significant Dysphoria \times Pleasantness interaction emerged, $F(1, 63) = 4.86$, $MS_e = 0.48$, $p < .05$. The means for this interaction are depicted in Figure 1. These means confirm the hypothesis that dysphorics show a smaller fading

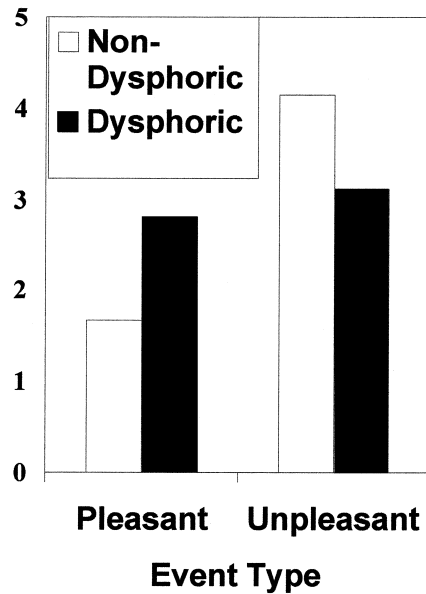


Figure 1. The mean drop in affect intensity for pleasant and unpleasant events for dysphoric and nondysphoric participants in Experiment 1.

affect bias than nondysphorics. Bonferroni-corrected simple effects tests ($\alpha = .025$) showed that unpleasant affect faded significantly more than pleasant affect for non-dysphorics, $t(45) = 4.60$, $MS_e = 0.52$, $p < .0001$, but not for dysphorics, $t(18) = 2.04$, $MS_e = 0.68$, $p > .05$.

Event age and fading affect. It is possible that the fading affect bias may have occurred because the negative events were older and more readily forgotten than the positive events. However, contradicting this hypothesis, negative events were not judged to be reliably older than positive events, $t(64) = 1.16$, $MS_e = 56.31$, $p > .05$. The absence of an age difference between positive and negative events makes it unlikely that event age mediates the fading affect bias.

To further ensure that event age was not responsible for our effects, two additional analyses were conducted. For the first analysis the average age difference between the recalled positive and negative events was calculated for each participant. The average difference between the magnitude of affective fading for positive events and negative events (a measure of the fading affect bias) was also calculated for each participant. This fading affect difference score was then used as the dependent measure in an ANCOVA with the age difference score as the covariate and dysphoria as the independent variable. The results of

the analysis showed that age did not affect the effects of dysphoria on the fading affect bias, $F(1, 62) = 6.07$, $MS_e = 0.38$, $p < .05$. In a second analysis the relation between the age difference score and the fading affect bias was examined in only the nondysphorics. We reasoned that if the event age difference was responsible for the fading affect bias, then it was most likely to emerge in those participants who most strongly evinced that bias (the nondysphorics). However, the correlation between these two difference scores was not significant, $r(64) = .05$, $p > .05$. Thus, event age cannot serve as a mediator for the fading affect bias.

Initial event intensity, initial event valence, and fading affect. Initial event intensity was explored as a possible cause of the fading affect bias. Negative events could have been given more extreme initial ratings than positive events, which would mean that the negative events essentially had farther to fall over time. Alternatively, retrospective biases in recall might cause negative events to be recalled as being more extreme than positive events. To explore these possibilities, the absolute values of the initial pleasantness ratings were compared for positive and negative events. We averaged these ratings for each participant and entered these averages into a paired samples *t*-test. The intensity of the initial ratings given to positive events ($M = 7.61$) and negative events ($M = 7.06$) did not significantly differ, $t(64) = 1.68$, $MS_e = 0.32$, $p > .05$. Hence, the fading affect bias cannot be attributed to differences in initial event intensity. We also explored the possibility that there was a difference in between dysphorics and nondysphorics in the initial event intensities. We averaged these ratings for each participant and entered the averages into a between-subjects *t*-test. The intensity of ratings given to events by dysphorics ($M = 7.42$) did not significantly differ from the ratings given to events by nondysphorics ($M = 7.25$), $t(63) = 0.97$, $MS_e = 0.35$, $p > .05$.

Discussion

The results of Experiment 1 showed that the affect associated with events faded across time, and that this fading was greater for negative events than for positive events. This fading affect bias could not be accounted for by differences in the age of the events nor by the intensity of the initial affect associated with the events. Furthermore, the data showed that dysphoria disrupted the fading affect bias in that unpleasant affect faded more than pleasant affect for nondysphorics, but not for dysphorics.

However, the classification of individuals as dysphoric or nondysphoric provides only a very rough view of the relation between an individual's dysphoria level and the extent to which they are subject to the fading affect bias. A more practical problem concerns the unequal sample sizes in Experiment 1: Nondysphorics significantly outnumbered the dysphorics. An approach that

would examine the magnitude of the fading affect bias as a function of relatively small differences in BDI scores would overcome the problem of large differences in sample sizes. The relatively small sample size used in Experiment 1 does not fit well with this parametric approach for investigating the relation between dysphoria and the fading affect bias. Hence, we conducted a second experiment.

EXPERIMENT 2

In Experiment 2 we attempted to replicate the effects obtained in Experiment 1, but with a larger sample of participants. This larger sample, which consisted of 337 participants, was obtained by combining the results obtained from replications of the experimental procedure run on three college campuses. The methodologies employed at each data collection site differed only slightly, and these differences were not expected to affect the data. Nonetheless, we included replication as a predictive variable in our analyses to test whether the methodological differences affected our results.

Our primary intent in Experiment 2 was to explore a fine-grained breakdown of the data to determine whether the BDI scores were continuously related to decreases in the fading affect bias. One possibility is that increases in BDI scores may be associated with a gradually increasing disruption of the fading affect bias. Alternatively, a disruption in the fading affect might only occur after a “critical” BDI score has been reached.

A second goal of Experiment 2 was to control for the effects of gender. Gender is known to vary with dysphoria (Beck, 1967), so it is possible that the effects observed in Experiment 1 may have reflected gender effects instead of dysphoria effects. Participant gender was recorded in Experiment 2 and used as an additional variable in our data analyses.

Method

Participants

Replication 1. A total of 134 undergraduates at Kansas State University participated in this experiment in partial fulfillment of a course requirement. This dataset was collected in 1996.

Replication 2. A total of 44 undergraduates at Winston-Salem State University participated in this experiment in exchange for extra credit. This dataset was collected in 1998.

Replication 3. A total of 159 undergraduates at The Ohio State University at Newark participated in this experiment in partial fulfillment of course requirements. This dataset was collected in 1999 and 2000.

Procedure

Replication 1. In a mass testing session, all participants recalled four emotionally intense memories from the most recent year and wrote a short description of each memory. Participants were explicitly asked to recall both pleasant and unpleasant memories of varying emotional intensities. Participants were given 20 minutes to complete this task. Participants also provided several ratings for each memory. Later in the session, participants completed the BDI.

Replication 2. Participants were tested in small groups of two to six people. Participants began the session by completing the BDI and then retrieved six autobiographical memories. All other procedural details were identical to Replication 1.

Replication 3. Participants were tested in sessions of one to four participants, and they were asked to retrieve six memories. Other procedural details were identical to Replication 1.

Measures

Assessment of dysphoria. We used each participant's BDI score to assign participants to a category based on an approximate quintile split: low nondysphoric (BDI of 0–2; $N = 69$), moderate nondysphoric (BDI of 3–4; $N = 62$), high nondysphoric (BDI of 5–7; $N = 67$), marginally dysphoric (BDI of 8–12; $N = 72$), and dysphoric (BDI of 13 and up; $N = 67$).² Using Beck and Steer's (1987) criteria, this sample contained relatively few people who would be classified as moderately depressed and no individuals who would be classified as severely depressed. Hence, our results apply only to the lower score range of the BDI and should not be extended to include individuals who are moderately or severely depressed.

These relatively fine-grained categories allowed us to explore whether the fading affect bias increased smoothly and continuously with BDI scores, or whether a critical BDI score range lead to a dramatic disruption of the fading affect bias. Findings supporting the latter possibility would be consistent with Beck and Steer's (1987) classification scheme for dysphoria and would suggest that the onset of dysphoria disrupts normal coping processes in autobiographical memory.

Pleasantness ratings. Participants were asked to make two pleasantness ratings for each event. The first rating reported the pleasantness of the event at

² Please note that in using these categories we are not proposing a formal alternative scheme for the classification of dysphoria. We grouped participants into categories that were comparable in size to best convey how the fading affect bias changes as dysphoria increases.

the time the event occurred. The second rating reported the current pleasantness of the event. Both ratings were made on a 7-point scale ranging from +3 (*extremely pleasant*) to -3 (*extremely unpleasant*), with 0 being neutral. Participants were cautioned that an event's pleasantness might have changed in several ways or may not have changed at all.³

Results

Notes on data analyses. We analysed the data in Experiment 2 using hierarchical multiple linear regression. The technique that we used is a regression analogue of the mixed-model ANOVA technique described in Cohen and Cohen (1983). This approach tends to be more complex to conduct and to interpret than standard ANOVA models, but it also tends to increase analytic power. In addition, the regression approach is better able to accommodate missing data, which was an occasional occurrence in this dataset. For example, some participants listed only events of one valence or extremity. Because the ratings for specific types of events would need to be separately averaged prior to entry into an ANOVA, the data from these participants would include missing values and would be dropped from the analysis. Because the regression approach uses each event as the unit of analysis, data from such participants are retained.

Analyses involving only between-subject variables are relatively straightforward. For example, in Experiment 2 one can first predict affective fading of an event from the three between-subject main effects (dysphoria level, gender, and replication). A second between-subject model would add the two-way interactions among these variables to the main effects. A third model would add the three-way interaction to all the other effects. Only the highest order effects in each model would be interpreted.

The within-subject models are a bit more complicated. Assigning a dummy code to each participant and using those dummy codes in the regression models helps to control for the problem of nonindependence of observations. This is the equivalent of partialling out between-subjects variance in the process of conducting a within-subjects ANOVA. As with the between-subject models, the within-subject regressions proceed in a hierarchical format. For example, in Experiment 2 an initial model might first predict the affective fading of an event from a model including all subjects (each dummy-coded) and the two within-subject variables (initial event valence and initial event extremity). A second model would include the two-way interaction among these variables as well as their interactions with all the between-subject variables. A third model would add all the three-way interactions among these variables. Cohen and Cohen

³ We also asked participants to estimate the age of the events so that we could verify the finding from Experiment 1 that event age did not mediate the effects of interest. However, many participants in Replication 2 apparently misinterpreted the instructions and omitted these age estimates or provided useless estimates. Consequently, we did not use this variable in our analyses.

(1983) suggest discretion in examining higher order interactions. Following their advice, we did not run models that included four-way interactions (or higher).

We used “pooled” error terms as opposed to the relatively “pure” error terms used in the standard ANOVA model. That is, all effects were tested against the variance that remained after all the model effects were entered (i.e., model residual). Thus, in this hierarchical approach, the degrees of freedom for the error terms used in testing the main effects differ from the degrees of freedom used in testing the interactions involving those same variables. This difference occurs because the two-way interactions are counted as part of the error variance when the main effects are tested. The same condition applies to the higher order interactions when the lower order interactions are tested (see Cohen & Cohen, 1983, for factors to consider in making error term choices, and the consequences of such choices).

Affect intensity is greater at event occurrence than at event recall. The first question addressed in the analyses was whether the emotions associated with events generally faded over time. For these analyses, the sign of each pleasantness rating was reversed for events that were rated negatively. Initially, neutral events were excluded from the analyses (and from all other analyses conducted on the data in this study). The dummy-coded predictors of interest in the regression models were the within-participant variable of the time that the affect was engendered (initial occurrence or at recall) and the between-participant variable of replication (1, 2, or 3). The use of dummy-coding in these analyses allows the data for these variables to be described in terms of means rather than beta-weights.

The effect of replication was statistically significant, $F(2, 330) = 4.46$, $MS_e = 2.08$, $p < .02$. The means indicated that affect was slightly more intense in Replication 2 than in the other replications ($M_{\text{Replication 1}} = 2.03$; $M_{\text{Replication 2}} = 2.25$; $M_{\text{Replication 3}} = 2.07$). However, as expected, affect faded over time such that event-related emotions were rated as less intense when event memories were recalled ($M = 1.74$) than when events originally occurred ($M = 2.44$), $F(1, 2998) = 594.04$, $MS_e = 0.74$, $p < .0001$. Fading affect interacted with replication, $F(2, 2996) = 3.40$, $MS_e = .74$, $p < .04$: Affect faded in all replications, but was smallest in Replication 3 (Replication 1: $M_{\text{Initial intensity}} = 2.43$, $M_{\text{Recall intensity}} = 1.62$; Replication 2: $M_{\text{Initial intensity}} = 2.60$, $M_{\text{Recall intensity}} = 1.90$; Replication 3: $M_{\text{Initial intensity}} = 2.38$, $M_{\text{Recall intensity}} = 1.74$).

Predictors of fading affect. We were particularly interested in whether fading affect was related to event valence and whether this effect was moderated by dysphoria. The dependent measure in the set of analyses exploring these questions was the *decrease* in affective intensity for an event from time of event occurrence to time of event recall. For each participant, a difference score was calculated for both pleasant events (intensity at occurrence–intensity at recall)

and unpleasant events (intensity at recall–intensity at occurrence), such that decreases in intensity yielded positive scores.

This set of regression analyses included dummy-coded terms for each participant and for the between-participants variable of replication. Four additional predictors of interest were also dummy-coded. Dysphoria and gender were simultaneously included as between-participant variables. Initial event valence (unpleasant or pleasant) and initial event extremity (low, moderate, or extreme; corresponding to absolute intensity ratings of 1, 2, and 3, respectively) were derived from the initial pleasantness ratings provided for each event and were dummy-coded within-participant variables. If initial event extremity is responsible for the fading affect bias (or the disruption associated with dysphoria), then the presence of this term in the regression models should eliminate the relation between pleasantness and fading affect. If gender is responsible for the fact that dysphoria disrupts the fading bias, then the inclusion of terms including gender in the regression models should eliminate this interaction.

The finding from past research indicating that the affect for negative events fades more ($M = 1.47$) than the affect for positive events ($M = 0.53$) was robustly replicated, $F(1, 1327) = 166.06$, $MS_e = 1.45$, $p < .0001$. Furthermore, as in Experiment 1, this effect interacted with the level of dysphoria, $F(1, 1304) = 7.70$, $MS_e = 1.43$, $p < .0001$.⁴ As the means in the third column in Table 1 show, increases in dysphoria were generally associated with increased fading of positive affect and reduced fading of negative affect.

Bonferroni-corrected ($\alpha = .01$) follow-up analyses explored whether the fading affect bias significantly emerged at each level of the dysphoria variable. The fading affect bias emerged for those individuals in the lower four dysphoria categories: smallest effect, $F(1, 284) = 22.42$, $MS_e = 1.38$, $p < .0001$, but not for those individuals in the highest dysphoria category: $F(1, 285) = 1.91$, $MS_e = 1.72$, $p > .05$. An examination of the means for the fading affect bias across the dysphoria categories suggested that the magnitude of the fading affect bias was consistent across the lowest three levels of the dysphoria variable ($M = 1.20$, $M = 1.44$, and $M = 1.24$, respectively). Although still significant, substantial shrinkage of the fading affect bias occurred in the marginally dysphoric group ($M = 0.54$), and the effect was even smaller, and not significant, in the dysphoric group ($M = 0.45$). However, it should be noted that the nonsignificance of the bias in the dysphoric group had as much to do with an elevation in the error term for the significance test ($MS_{eDysphoria\ group} = 1.72$; $MS_{eSmallest\ of\ the\ other\ four\ groups} = 1.39$) as it did with a change in the affect ratings associated with the events. Nonetheless, our data suggests that the cutoff for dysphoria (10 and above)

⁴This interaction emerged regardless of whether the BDI score was treated as a continuous variable in the regression or whether it was treated in the traditional binary (dysphoric vs. non-dysphoric) manner.

TABLE 1
 Mean initial and current affect intensity ratings and mean change in affect intensity presented for positive and negative events across levels of dysphoria in Experiment 2

<i>Level of dysphoria</i>	<i>Initial affective intensity</i>	<i>Current affective intensity</i>	<i>Change in affective intensity</i>
Positive events			
Low nondysphoric	2.46	2.06	0.40
Moderate nondysphoric	2.39	2.03	0.36
High nondysphoric	2.48	2.19	0.30
Marginally dysphoric	2.53	1.81	0.72
Dysphoric	2.38	1.52	0.86
Negative events			
Low nondysphoric	-2.44	-0.83	1.60
Moderate nondysphoric	-2.56	-0.84	1.72
High nondysphoric	-2.33	-0.79	1.54
Marginally dysphoric	-2.38	-1.11	1.26
Dysphoric	-2.44	-1.13	1.31

published by Beck and Steer (1987) is a reasonable approximation of the point at which the fading affect bias begins to dissipate.

The two-way interaction between dysphoria and initial event valence was qualified by an unexpected interaction with replication, $F(8, 1249) = 6.97$, $MS_e = 1.36$, $p < .0001$. Subsidiary analyses indicated that the Dysphoria \times Initial Event Valence interaction was significant only for replication 2, $F(4, 192) = 16.76$, $MS_e = 1.64$, $p < .0001$. However, inspection of the data indicated that the pattern of the means observed in Table 1 emerged in all three replications. Hence, despite the fact that this pattern was significant only in Replication 2, the diminution of the fading affect bias among those in the marginally dysphoric and dysphoric categories was observed in all three replications.

Other results of the regression analyses indicate that initial event extremity was significantly related to fading affect, $F(2, 1327) = 18.86$, $MS_e = 1.45$, $p < .0001$. Events that were initially rated as emotionally extreme showed more fading ($M = 1.13$) than events that were initially rated as emotionally moderate ($M = 0.99$), or emotionally mild ($M = 0.66$). More importantly, as evidenced by the lack of statistically reliable interactions involving the event extremity variable, the fading affect bias did not depend on event extremity. Furthermore, simultaneous inclusion of the extremity variable with the initial event valence and Initial Event Valence \times Dysphoria interaction in the regression models did not eliminate the relation between those effects and the fading affect bias. Thus, the fading affect bias and its significant interaction with dysphoria cannot be explained by claims that negative events were initially more extreme than

positive events or that dysphorics recalled events of different initial extremity than nondysphorics. This implication is emphasised by the means of the ratings associated with the occurrence of the positive and negative events (Table 1). As Table 1 shows, the overall extremity of the positive and negative items were nearly equal across levels of dysphoria. Furthermore, the means in Table 1 clearly show that both the fading affect bias and the interaction between dysphoria and initial event valence were driven primarily by the ratings of affect associated with the current recall of events, and not with the ratings of affect associated with the original occurrence of events.

The results also show that affective fading was greater among male participants ($M = 1.11$) than among female participants ($M = 0.97$), $F(1, 328) = 4.99$, $MS_e = 2.46$, $p < .03$. This effect was qualified by a Gender \times Dysphoria \times Initial Event Valence interaction, $F(4, 1249) = 2.54$, $MS_e = 1.36$, $p < .04$. The means for this effect are presented in Table 2 and show that fading affect bias was found for both male and female participants. However, the nature of the fading was not constant across gender. For male participants, dysphoria altered the pattern of fading for both positive and negative events. For female participants, dysphoria primarily increased fading for pleasant events but it did not alter fading for unpleasant events. Nonetheless, separate tests of the Dysphoria \times Initial Event Valence interaction for each gender conducted with a Bonferroni adjusted α of .025 indicated that the interaction was significant for both males, $F(4, 480) = 5.89$, $MS_e = 1.69$, $p < .0001$, and females, $F(4, 804) = 4.16$, $MS_e = 1.26$, $p < .01$. Such results argue against the

TABLE 2
The interaction in Experiment 2 between gender, initial event valence, and dysphoria for the fading affect measure

Level of dysphoria	Initial event valence	
	Negative events	Positive events
Female participants		
Low nondysphoric	1.37	0.35
Moderate nondysphoric	1.72	0.24
High nondysphoric	1.38	0.28
Marginally dysphoric	1.33	0.58
Dysphoric	1.35	0.71
Male participants		
Low nondysphoric	1.90	0.45
Moderate nondysphoric	1.72	0.45
High nondysphoric	1.81	0.31
Marginally dysphoric	1.14	0.93
Dysphoric	1.09	1.23

possibility that the disruption of the fading affect bias in dysphorics was due to participant gender.

Discussion

The data from Experiment 2 replicated two of the main findings from Experiment 1. First, the fading affect bias emerged: Across time, the affect associated with negative events faded more than the affect associated with positive events. Second, dysphoria disrupted the fading affect bias. Across time, negative emotions faded less rapidly and positive emotions faded more rapidly for marginally dysphoric and dysphoric participants than for other participants. Although this interaction was not equivalently robust across all three replications of Experiment 2, the pattern of means was consistent across those three replications.

The results from Experiment 2 also show that neither initial event extremity nor participant gender can explain the fading affect bias and its interaction with dysphoria. Although initially extreme events showed more fading than less initially extreme events, extremity: (1) was not related to the magnitude of the fading affect bias; (2) did not eliminate the relation between initial event valence and affective fading; and (3) did not eliminate the Initial Event Valence \times Dysphoria interaction. Similarly, although gender did interact with dysphoria and initial event valence to predict fading affect, the fading affect bias was evident in the data from both male and female participants.

Finally, the data in Table 1 clearly show that neither the fading affect bias nor the Dysphoria \times Initial Event Valence interaction were driven by the ratings of initial event affect. Instead, these effects were driven by the ratings of how participants felt about events at recall. These results are inconsistent with the idea that the fading affect bias is caused by a selection bias in which participants recalled negative events that were more extreme than positive events. These findings also suggest that the fading affect bias is not a function of a retrospective memory biases in the recall of affect, a conclusion that also comes from diary studies whose methods eliminate this possibility (Holmes, 1970; Walker et al., 1997).

However, we need to provide a word of caution with respect to the results of Experiment 2. This word of caution comes from a general problem inherent in many within-subject experimental designs. For example, one problem that often arises when using a within-subjects ANOVA involves the assumption of sphericity. The assumption has two components: (1) the population variances of each level of the repeated measures factor are the same; and (2) each pair of levels of the repeated measures variable have identical correlations. If one violates the sphericity assumption (e.g., as evaluated via Mauchly's test) then one applies a correction (often Greenhouse–Geisser or Huynh–Feldt) that lowers the functional alpha level of the statistical test. Unfortunately, to our knowledge,

there is currently no corresponding test that can be applied to within-subject regression models. Thus, it is possible that the functional alpha level for our tests of within-subject main effects and interactions might exceed the nominal .05 level that we routinely employ.

However, for a number of reasons, we would argue that this concern does not substantially alter the conclusions that can be drawn from Experiment 2. First, three of the important results that we obtained in Experiment 2 (affect fades, it fades more for negative than positive events, this fading affect bias is smaller for dysphorics than for nondysphorics) are replications of results that were obtained in research (including Experiment 1) that used other analytic procedures. Second, these three outcomes are highly significant in Experiment 2: The *p*-values for these effects are all less than .0001. Hence, even if the functional alpha level is slightly inflated, considerable alpha-level adjustment would be required to render these effects nonsignificant. Third, these three outcomes emerge even when the data from Experiment 2 are analyzed using ANOVA models, despite the reduction of statistical power that occurs because of participant loss and the shrinkage in the error degrees of freedom produced by the necessary averaging of observations. Hence, the magnitude of the effects and the principles of replication and convergent validity all suggest that the conclusions derived from Experiment 2 accurately reflect the data.

GENERAL DISCUSSION

The data presented in the present article suggest that the fading affect bias is a robust effect that characterises how emotions change over time. Unpleasant emotions fade more than pleasant emotions. However, this bias is disrupted by dysphoria, such that dysphorics show a smaller fading affect bias than nondysphorics. This disruption fits with the results of other research showing that negativity is often characteristic of dysphorics' autobiographical memories (e.g., Beck, 1967; Lyubomirsky et al., 1998; Teasdale, 1983; Williams & Scott, 1988).

However, some might argue that the retrospective recall paradigm used in the experiments reported in the present article leaves open the possibility that these results are at least partially caused by retrospective biases in memory. Other studies show that such distortions do, indeed, occur. For example, Conway and Ross (1984) found retrospective memory distortions when they investigated students' implicit theories of change. At the beginning of their experiment, participants were asked to rate their study skills. Some students were then placed into a bogus study skills improvement course while others were placed on a waiting list. Three weeks later, all students were asked to recall the skill levels they possessed at the time of their initial contact with the experimenters. Students who took the bogus course recalled their initial skill levels as being lower than they had initially reported, a memory distortion that fits with the hypothesis that the bogus course improved their study skills.

Our reply to such claims would cite both prior research and the research reported in the present article. For example, the notion that the fading affect bias is purely the result of a retrospective distortion of memory for the affect associated with event occurrence must claim that distortion is one-sided: The recalled initial intensity of negative emotions should be inflated relative to the initial intensity of positive emotions. Although some research lends credence to this possibility (see Ross & Wilson, 2000), other research does not. For example, Thomas and Diener (1990) found that participants overestimated the initial intensities of *both* positive and negative emotions that were recalled retrospectively. More to the point, in the diary paradigm employed by Holmes (1970) and Walker et al. (1997), people provide ratings of the initial affect associated with an event shortly after the event occurs. A retrospective bias in the affect associated with event recall is, thus, highly unlikely in the diary paradigm, yet the fading affect bias still emerges. This result suggests that the bias cannot be attributed to retrospective biases.

The data presented in the present paper reinforces this conclusion in a number of ways. First, our data show that the fading affect bias is driven by the ratings of the affect associated with the *current memory for the event*, not with the affect associated with event occurrence. If retrospective biases were operating, one would expect the initial ratings to drive the fading affect bias. Our data similarly show that disruption in the fading affect bias in dysphorics is caused primarily by the emotions produced by events at the time of recall and *not* by the emotions initially associated with the events. Again, if retrospective biases were operating, one would expect the initial ratings to be more important to the fading affect bias. Finally, our analyses show that affective fading was not caused by other possible memory biases, such as the fact that the negative events recalled were older than the positive events or that the negative events recalled were more intense than the positive events.

One question raised by our results is whether the muted fading affect bias in dysphorics is a consequence of depressed mood or is a consequence of some other element of the dysphoric disposition. The most direct line of attack on this question would be to explore whether temporary mood shifts in nondysphorics are related to a reduction in the fading affect bias. One possibility is to conduct a longitudinal study in which participants are asked to enter emotional events into diaries. Participants' emotional reactions to these memories can later be recorded. The person's mood at recall can also be assessed during these testing sessions, and the extent to which the fading affect bias is maintained across fluctuations in mood can be assessed. One can also envision experiments in which a participant's mood state is systematically altered at recall. There are a variety of mood induction techniques that might be employed (e.g., music, semantic primes). If the fading affect bias is present when an individual is feeling positive, and absent when an individual is feeling negative, a reasonable conclusion would be that the fading affect bias is a consequence of mood at

recall, even in dysphorics. On the other hand, finding that the fading affect bias is relatively invariant across transient mood states would suggest that the fading affect bias is a function of processes related to event memory and that emotional disorders, such as dysphoria, might alter these processes.

If the fading affect bias is a consequence of memory, researchers should be able to determine the cognitive processes that underlie this bias. The identification of an underlying mechanism for the fading affect bias would silence the argument that the bias is simple retrospective distortion. One process that could affect the fading affect bias is the social rehearsal of event memories. After people experience emotional events, they often talk to other individuals about their memory for these events (Taylor, 1991). Talking about events seems to be one of the ways people cope with the emotion associated with the events. Frequent rehearsal of positive events may help to maintain the emotions produced by the original event. Sharing a recent accomplishment may lead to positive feedback from other people, which might reinforce memory for the event's details, including its positive emotion. Conversely, socially sharing negative events might produce responses of empathy and support, which might help to dampen the negative emotions associated with the event. If social sharing does serve to dampen negativity, this consequence might explain why negative events are so often shared with others (Luminent, Bouts, Delie, Manstead, & Rime, 2000).

The speculations about social rehearsal also have implications for dysphoria. In fact, the literature suggests that people suffering from dysphoria and other emotional disorders contemplate their life experiences very differently than other people, and they also may not have the same social support enjoyed by the nondepressed (e.g., Beck, 1967; LePore, 1997; Niles & Beck, 1989; Teasdale, 1983). For instance, depressed people often report instances of negative intrusive thoughts and memories. These intrusive thoughts may reinforce the person's negative affective state and lead to long-term distortions in their autobiographical memory. Such alterations in rehearsal processes may provide a memory-based account for the different patterns of fading affect observed in our dysphoric and nondysphoric participants.

The implications of the fading affect bias for dysphoria (and depression) may be further applied to cognitive therapies, which often attempt to help people cope with emotion by altering the meaning of their life events. For example, the Interactive Cognitive Subsystems (ICS) approach distinguishes between a specific meaning and a more intuitive or holistic level of meaning. According to Teasdale (1993), this holistic level of meaning is important for emotional production. The current results would indicate that meaning is important for emotional regulation as well. If the fading affect bias is evidence of the intuitive emotional experience in nondysphorics, this subsystem is clearly disrupted in dysphorics. Further, if our speculations about the role of event rehearsal hold true, then the social sharing of autobiographical memories may be an important

mechanism by which people can come to terms with life events and put them into proper perspective.

Future research should explore both the conditions under which the fading affect bias occurs and the mechanisms underlying the bias. For now, though, we may take some comfort in the thought that the bad feelings associated with embarrassing acts, with failed relationships, and with broken promises do seem to be substantially dampened with the passage of time. On the other hand, the good feelings produced by personal accomplishments, close relationships, and promises kept are likely to last. Although affective disorders, such as dysphoria, may serve to disrupt this general bias favouring positivity, an optimist who looks at our results might suggest that "life should always be so good".

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