

Adult attachment and memory of emotional reactions to negative and positive events

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Relations between adult attachment and memory for earlier emotional reactions to negative and positive events were examined. Hypotheses were that avoidance would be associated with underestimating earlier negative affect, whereas anxiety would be associated with overestimating earlier negative affect. Also, both avoidance and anxiety were expected to relate to underestimating earlier positive affect intensity. Participants (119 college students) completed daily report forms three times a day for 4 days on which they described and rated their immediate emotional reactions to events within each time period. Approximately 10 days later, they were asked to estimate their immediate emotional reaction to one negative event and one positive event. Events were coded as interpersonal or non-interpersonal. Contrary to hypotheses, for those lower on avoidance, anxiety related to lower levels of recalled negative affect (i.e., greater underestimation) for negative interpersonal events. As expected, with positive events, anxiety and avoidance related to lower levels of recalled positive emotions. Results suggest that memory processes could be one explanation of how working models operate and are sustained over time.

Memories of earlier emotional experiences can play an important role in shaping future expectations and behaviours. People's memories of their emotional reactions to events may be especially important because an evaluation of one's earlier feelings about a previous experience can be used to make a current decision, even when specific details about the earlier experience have been forgotten (Levine & Safer, 2002; Wirtz, Kruger, Scollon, & Diener, 2003). Although people are often relatively accurate in remembering their earlier emotions (e.g., how they felt in response to a particular event), research also shows that systematic memory biases based on people's personality character-

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istics do occur. For instance, higher anxiety or neuroticism scores have been linked to overestimating the intensity of earlier negative moods (Cutler, Larsen, & Bunce, 1996; Feldman Barrett, 1997), pre-therapy distress (Safer & Keuler, 2002), and anxiety levels before graduate school exams (Keuler & Safer, 1998). In the present study, we examined how one individual difference attribute, adult attachment style, predicts changes in memories of earlier experiences of negative and positive emotions. We expected that memories might be altered over time to be more consistent with an individual's general beliefs about relationships.

Attachment theory offers a framework for understanding how people's beliefs and expectations about relationships develop. Bowlby (1973) conceptualised attachments as universal and important across the life span. The first attachments are formed by children to their parents. Based on interactions with their parents, particularly how parents respond when the children are distressed, children come to develop expectations about themselves and their caregivers. When children are met with responsive, caring parents, the children are likely to develop positive views of themselves and others, and can feel a sense of security in being able to rely on others. By contrast, if they are met with unresponsive or inconsistent parenting, children may develop negative views of themselves or others. Additionally, children may learn to adapt their expressions of emotions and their behaviours based on these early interactions (Cassidy, 1994; Contreras & Kerns, 2000). One type of attachment insecurity, anxious-ambivalent attachment, which arises from inconsistent parenting, is hypothesised to result in children exaggerating their expressions of negative affect to gain comfort or reactions from their caregivers. Another type of insecure attachment, avoidant attachment, which is associated with relatively rejecting caregivers, is hypothesised to result in children minimising their experiences of negative affect and the inhibition of affect expression because caregivers have not attended to earlier signs of distress (Cassidy, 1994). Attachments are also formed to peers in adolescence or adulthood. The research on attachment in adulthood has largely focused on attachment between romantic partners, but there is some consensus that by adolescence, people develop more general attachment representations, which could be operative within different close relationships (e.g., Bartholomew & Horowitz, 1991; Collins & Read, 1994).

In attachment theory, working models (WMs)—attachment-related schemas, scripts, and expectations—are one mechanism of continuity over time (Bowlby, 1973). WMs are thought to influence how individuals encode, interpret, and later recall attachment related information (e.g., Baldwin, 1992; Bowlby, 1973; Beinstein Miller, 1999; Beinstein Miller & Noirot, 1999; Fraley, Garner, & Shaver, 2000). Because people can be motivated to obtain a consistent and coherent view of self (e.g., Swann & Read, 1981), as a result, they may interpret or distort information to be consistent with existing beliefs. Consequently, attachment may affect how social experiences are later remembered. Because

attachment functions to help individuals regulate emotion, attachment may be especially important for understanding how individuals represent and recall their emotional reactions to salient, interpersonal events.

Individual differences in attachment during adulthood were first conceptualised as attachment styles or prototypes that were similar to the categories in parent-child attachment. However, more recent research suggests that two dimensions, anxiety and avoidance about close relationships, can better capture variation in adult attachment (Brennan, Clark, & Shaver, 1998; Fraley & Waller, 1998). Most of the attachment research reviewed here used the categorical approach (i.e., assigning people to particular attachment styles), but these attachment styles can also clearly be mapped on to the anxious and avoidant dimensions. For example, with Hazan and Shaver's (1987) three-category model of secure, ambivalent, and avoidant attachment styles, secure individuals would score low on the anxious and avoidance dimensions, ambivalent individuals score high on the anxious dimension and low on avoidance, and avoidant individuals score high on the avoidance dimension. Similarly, Bartholomew and Horowitz's (1991) four-category model can be described by the two dimensions: secure (low on anxiety and on avoidance); preoccupied (high on anxiety, low on avoidance); dismissing (low on anxiety, high on avoidance); and fearful (high on anxiety, and on avoidance).

Adult attachment and reports of negative affect

In many studies of attachment and emotion, participants have been asked to provide global self-reports regarding the intensity or frequency of their emotions. In general, studies show that, compared to secure attachment, anxious attachment relates to more extreme reports of negative affect, whereas avoidant attachment relates to reports of low negative affect or distress. Pietromonaco and Feldman Barrett (1997) found that preoccupied individuals (those high on anxiety and low on avoidance) scored higher than others on affect intensity and negative emotionality, whereas dismissing individuals (those high on avoidance and low on anxiety) scored lower than other individuals on self-reported general affect intensity. Similarly, Bartholomew and Horowitz (1991) found that dismissing individuals reported less distress than other individuals. Also, Mikulincer and colleagues (Mikulincer, 1998; Mikulincer & Orbach, 1995), who asked college students to recall events from childhood or experiences in relationships with parents or romantic partners, found that anxiously attached individuals have highly accessible memories of intense negative emotional experiences. By contrast, avoidantly attached individuals have less intense or accessible negative memories than others. Overall then, when participants report on their emotional experiences using general, retrospective measures, the findings generally coincide with the prediction that anxiety will be associated with heightened attention to and reporting of emotion, whereas avoidance will be

associated with minimising and reporting less intense negative emotions (Cassidy, 1994).

However, a different pattern of results has emerged from studies with other methodologies. In addition to having participants report their general, retrospective experiences of emotion, Pietromonaco and Feldman Barrett (1997), and also Tidwell, Reis, and Shaver (1996), used a diary format in which participants reported their immediate emotional reactions to interpersonal interactions across a period of several days. Instead of finding that anxious individuals were markedly high in their reports of negative affect, they found that more anxious (i.e., ambivalent or preoccupied) individuals reported moderate levels of negative emotions, and more avoidant (i.e., avoidant or dismissing) individuals reported consistently higher levels of negative affect (which included ratings of hostility). The latter finding fits with studies showing that avoidant individuals are rated by their peers and teachers as more hostile than other individuals (Kerns & Stevens, 1996; Kobak & Sceery, 1988; Sroufe, 1983).

The discrepant pattern that emerges when comparing findings from diary reports and reports from peers and teachers with those from more global, retrospective self-reports might occur because individuals have biased recall of their earlier emotional reactions (Pietromonaco & Feldman Barrett, 1997). More anxiously attached individuals, who are described as having exaggerated emotional responses (Mikulincer, Shaver, & Pereg, 2003), may overestimate their initial emotional response in that they remember experiences as more negative than they initially reported, because it would allow them to heighten activation of their attachment system whereby their memory of their distress evokes thoughts of their attachment figures. Additionally, the number and accessible nature of their negative memories could play a role in the negative distortion of earlier experiences by triggering associated negative memories or feelings. In contrast, avoidant individuals have been described as defensive about emotional experiences; they show evidence of preemptive defences (i.e., directing attention away from threatening information; Fraley et al., 2000), and after threatening situations, are able to suppress activation of attachment-related thoughts (Fraley & Shaver, 1997) and behaviours (e.g., seeking support from others; Simpson, Rholes, & Nelligan, 1992). Thus, more avoidantly attached individuals may minimise the impact of the negative event by reporting that a threatening situation was not as bad as they initially perceived it, which would lessen activation of the attachment system. Also, avoidant individuals' tendency to suppress distressing emotions could result in their negative memories being less accessible and could blunt how intense they remember their negative experiences.

Findings from two recent studies by Feeney and Cassidy (2003) support the proposition that attachment would be linked to changes over time in memories of emotional experiences. In these studies, adolescents engaged in tasks with their mothers and fathers during which they discussed sources of conflict.

Adolescents' immediate and later perceptions of the interactions were examined. Findings showed that adolescents with more insecure parental attachment representations remembered the interactions with their mothers and fathers as being more negative and less positive than they reported immediately after the interactions. Thus, over the 6 week time interval, adolescents' memories of their interactions with their parents became more consistent with their current attachment to their parents.

Adult attachment and reports of positive affect

In general, associations between attachment and reports of emotions have been studied less often for positive than for negative emotions, but some results support the contention that attachment might be related to how individuals remember positive emotions. When asked to rate the frequency of emotions over the past week, Magai, Distel, and Liker (1995) found that secure, but not insecure, attachment was associated with more frequent positive emotions (i.e., joy and interest). In the diary studies of attachment, in which participants report on their immediate affective response after social interactions, one study also found that secure individuals had higher levels of positive affect (Tidwell et al., 1996) than insecure individuals. However, Pietromonaco and Feldman Barrett (1997) found that across all types of interactions fearful individuals (those who score on both anxiety and avoidance) reported the highest level of positive affect (significantly higher than dismissing individuals), and in high conflict situations preoccupied individuals reported significantly higher positive affect than dismissing and secure individuals. To explain the unexpected findings, the authors proposed that fearful individuals, who hold relatively negative beliefs about other people, may have their negative expectations disconfirmed when interacting with others and may feel a resulting sense of relief and report high positive affect. Another possible explanation of the more intense positive emotions reported on immediate but not retrospective reports could be that, over time, preoccupied and fearful individuals underestimate their earlier experienced positive emotions. In other words, insecure individuals may show a negative bias in that they remember positive events eliciting less intense positive affect than they had initially reported.

The present study

The present study was designed to test directly whether individual differences in attachment are related to systematic memory distortions of earlier emotional reactions to negative and positive life experiences. Using an experience sampling technique, participants reported their initial affective reactions to events three times a day for 4 days. More specifically, participants were asked to choose their "most positive" and "most negative" events that occurred within a specific time frame (morning, afternoon, and evening). Using relatively short

time periods allows the delay between the event and the recording to be minimised. Although participants will still be relying on memory to some degree, Larsen and colleagues (Cutler et al., 1996; Larsen, 1992) recommend this design to uncover discrepancies between global self-reports and daily experiences of emotion. Several days after the daily report period, participants were then asked to estimate their earlier emotional reactions to one negative and one positive event that had occurred during the daily report period.

In most studies referred to earlier, attachment was assessed using categorical measures of attachment. However, in the present study we assessed attachment using scales of anxiety about and avoidance of close relationships because, as previously mentioned, these dimensions were found to better discriminate people on variations in attachment than categorical measures that force individuals into a particular style (Brennan et al., 1998; Fraley & Waller, 1998). An additional problem with categorical measures is that individuals' self-reported attachment styles are somewhat unstable. Prior studies have found that as many as one third of the participants in samples have reported different attachment styles across time, even within short time intervals (e.g., 2 weeks; see Baldwin & Fehr, 1995), whereas multi-item attachment scale measures generally show adequate test-retest reliability (e.g., $> .70$, see Fraley et al., 2000).

Our first hypothesis is that attachment will be associated with how individuals remember their earlier emotions tied to a specific negative and positive event. In particular, for the negative event, anxious attachment is expected to relate to overestimating earlier experienced negative affect, whereas avoidant attachment is expected to relate to underestimating earlier negative affect. Evidence for this hypothesis would be obtained if anxiety is positively related to recalled negative affect after controlling for the initial reaction, and avoidance is negatively related to recalled negative affect after controlling for the initial reaction. For positive affect, our expectation is that individuals who are more secure (i.e., those who score lower on the anxious and avoidant attachment dimensions) will remember earlier positive affect as more intense than they reported on daily reports. Thus, anxiety and avoidance are expected to relate negatively to recalled levels of positive affect, after controlling for initial positive affective reactions.

Furthermore, because a person's attachment-related emotions and behaviour are developed within close relationships, associations between attachment and emotion may be better captured when examining emotional responses to interpersonal interactions (e.g., having a dating relationship end) than to events that do not involve others (e.g., failing a class). We therefore coded events based on whether they directly involved another person (interpersonal) or were more solitary events (non-interpersonal). Our second hypothesis then, is that attachment-emotion associations are more likely to be found for interpersonal than for non-interpersonal experiences.

To test for the presence of memory biases for earlier experienced negative and positive affect (i.e., variation in recalled estimates not explained by earlier reports), we examine recalled levels of negative and positive affect, while taking into account initial reports of their reactions. However, an additional consideration is that participants' current feelings toward the events could influence their recalled estimates of earlier experienced affect. When people estimate emotional reactions for specific events, their current feelings or appraisals about the events relate to how they remember their earlier emotional reactions (Keuler & Safer, 1998; Safer, Levine, & Drapalski, 2002). Therefore, when participants were asked to recall initial emotional reactions, they also were asked how they currently felt about the events so that we could test the effects of attachment on memory while controlling for current feelings about the event.

METHOD

Sample

Participants were 119 undergraduate students enrolled in general psychology classes, who volunteered for the study to get credit in their classes. The sample included 69 females (58%) and 50 males (42%). The age of participants ranged from 18 to 47 years, with a mean age of 20.9 years. The racial distribution of the sample was 79.8% Caucasian, 16.8% African-American, 1.7% Asian-American, 0.8% Latino-American, and .8% who did not specify ethnic background. The original sample consisted of 133 participants, but 14 participants' data were excluded because the data were incomplete or because the participants did not otherwise follow the procedure properly. Participants who completed the study were compared with those who did not on demographic (i.e., gender, age, ethnicity) and attachment (i.e., anxiety and avoidance) variables. One significant difference emerged: The mean anxiety level ($M = 3.48$) for those who completed the study ($N = 133$) was higher than the mean ($M = 2.73$) for those who did not complete the study ($N = 14$), $t(131) = -2.42, p < .05$.

Procedure

The procedure consisted of two lab sessions, and a 4-day period of completing daily report forms. During the first session, participants completed an attachment measure and received instructions and the forms for their daily report period. They then completed daily report forms on their own across four consecutive days. For these 4 days, three times each day they completed reports on which they described their most negative and positive event within each time period, and rated their immediate emotional reaction to each event. The days were divided into three periods: morning (when they get up until 1 p.m.); afternoon (1 p.m.–6 p.m.); and evening (6 p.m. until when they go to bed), and they were asked to complete each form at the end of each time period (i.e., at

1 p.m., 6 p.m., and before going to sleep). Participants were instructed to complete each form within the specified period, and this point was emphasised such that they were told that if they forgot to fill them out within the designated time periods, to not do them at a later point in time or day. Participants' data were retained in the final sample provided that they completed 75% of their reports (9 out of the 12 daily report forms).

Approximately 8–10 days after completing and turning in their daily report forms, participants returned for their second lab session to complete additional questionnaires. Although participants initially were told of the second lab session, they were not told that they would be asked to recall their events or emotional reactions. At the second session, they were asked to estimate their earlier emotional reaction to one negative and one positive event that had occurred across the four days of daily reporting. The negative event that elicited the most negative affect and the positive event that elicited the most positive affect were selected for the memory test. If more than one event evoked the same emotional intensity response, then the event was chosen at random to use for the memory portion. Participants were given a description of a negative and positive event (using the descriptions that participants provided on the daily report forms, reworded in the second person), and were asked to remember that event and how they initially felt when the event occurred. Additionally, they were asked to rate how they currently felt about the two events. One participant was unable to remember his most positive event; thus analyses for the positive event were conducted with 118 participants.

Measures

Attachment. At the first lab session, participants completed the Experiences in Close Relationships Questionnaire, designed by Brennan et al. (1998). The questionnaire assesses two dimensions underlying attachment: anxiety and avoidance of close relationships. The measure consists of 36 items, rated on a 7-point scale, with 18 items corresponding to each dimension. Participants' responses to the items were averaged to obtain scores for each scale. Reliability estimates of the scales were high for the present study ($\alpha = .90$ for anxiety about close relationships; $\alpha = .93$ for avoidance of close relationships), and consistent with reliability estimates from earlier studies.

Affective reactions. On participants' daily report forms they briefly described the most negative and positive event that happened to them within each time period, and rated their immediate emotional reaction to those two events. In both written and verbal instructions given to participants, researchers stressed the point that participants were to report on their immediate emotional reaction by informing them to "record how you felt about the event *immediately* after it occurred. For example, if you describe running into an old friend at

10 a.m. as your most positive event for Friday morning, and you are filling out the form at 1 p.m. on Friday, you should rate how you felt at 10 a.m. after talking to your friend, and NOT how you feel at 1 p.m. as you are filling out the form''.

Participants rated their initial emotional reactions by completing the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). This scale consists of 10 negative emotions (e.g., upset, distressed) and 10 positive emotions (e.g., excited, enthusiastic), which participants rated using 7-point scales (1 = not at all, to 7 = extremely). The original PANAS uses a 5-point Likert scale, but in the present study a 7-point scale was used because of the goal of detecting subtle differences across reports of affect. Scores were averaged to get scales of negative affect (NA) and positive affect (PA). Participants were asked to rate both negative and positive affect for each negative and positive event; however, we only report analyses conducted on negative affect for the negative events and on positive affect for the positive events.

This scale, the PANAS, also was used at the second session both when participants were asked to recall their emotional reactions to the most intense positive and negative events that occurred across the daily report period, and when they were asked to rate how they currently felt about both events. During the second session, the order of the questionnaire administration was standardised, with all participants rating emotions for events in the following manner: 1) recalled estimate of affect for the negative event; 2) current feelings about the negative event; 3) recalled estimate of affect for the positive event; and (4) current feelings about the positive event.

Thus, for each participant, we have three sets of PANAS ratings for their most positive and most negative event: their immediate emotional reaction on the daily report forms; their recalled estimate of their initial emotional reaction at the second session; and how they currently felt about the event at the second session. The negative and positive affect scales demonstrated adequate reliability at each administration, as Cronbach's alphas indicated: Immediate NA, $\alpha = .80$; Recalled NA, $\alpha = .82$; Current NA, $\alpha = .82$; Immediate PA, $\alpha = .82$; Recalled PA, $\alpha = .90$; Current PA, $\alpha = .94$

Coding system for events. Events were later coded based on whether they were interpersonal or non-interpersonal events. An event in which one or more persons were described as being involved in the event was coded as *interpersonal*, whereas an event that was described without explicitly mentioning another person(s) was coded as *non-interpersonal*. Two individuals, blind to participants' other data, coded the events. Also, a subsample ($n = 116$) of the events was coded by both people to assess reliability. The percent agreement in codes was 91.4% ($\kappa = .82$). Discrepancies were discussed and reconciled between the coders. For the negative events, 43 events (36.1%) were coded as interpersonal, and 76 events (63.9%) were coded as non-interpersonal.

For the positive events, 57 (47.9%) were coded as interpersonal, and 62 (52.1%) were coded as non-interpersonal. Also, comparisons were made between the interpersonal and non-interpersonal events to determine if the event type related to attachment (e.g., if people who were higher on anxiety were more likely to have their most intense event be interpersonal than non-interpersonal). However, results of independent samples t-tests showed that anxiety or avoidance attachment scores did not differ by event type (interpersonal vs. non-interpersonal).

RESULTS

In the first section of the results, our preliminary analyses are reported. Specifically, we examined associations among affective reports and conducted repeated-measures ANOVAs to determine whether affective reports change across time and to test for gender differences. Next, we examine correlations between attachment dimensions and affective reports. In the final section, we test our main hypotheses by examining whether attachment dimensions relate to recalled levels of negative and positive affect.

Preliminary analyses

Descriptives. The means, standard deviations, and ranges for each measure are reported in Table 1. A small percentage of subjects reached ceiling ($M = 7.0$) for their immediate report of negative affect ($n = 2$; 1 interpersonal event and 1 non-interpersonal event) or positive affect ($n = 12$; 4 interpersonal events and 8 non-interpersonal events). These participants were not included in regression analyses assessing memory biases due to ceiling effects. Also, difference scores were computed by subtracting immediate affective reports from recalled estimates, so that higher scores reflect greater overestimation of earlier affect. On average, the sample underestimated the intensity of their immediate affective reactions.

To further clarify people's recall of their earlier reactions, we looked at the numbers of participants who underestimated or overestimated or were accurate in estimating their immediate emotional reactions. With negative interpersonal events, 76.7% (33/43) underestimated, 9.3% (6/43) were accurate, and 14% (4/43) overestimated earlier negative affect intensity. With negative non-interpersonal events, 76.3% (58/76) underestimated, 7.9% (6/76) were accurate, and 15.8% (12/76) overestimated earlier negative affect intensity. With positive interpersonal events, 91.2% (52/57) underestimated, 3.5% (2/57) were accurate, and 5.3% (3/57) overestimated earlier positive affect intensity. With positive non-interpersonal events, 79% (49/62) underestimated, 8.1% were accurate, and 12.9% overestimated earlier positive affect intensity.

TABLE 1
Means, (standard deviations), and ranges for attachment and emotion measures
(negative affect for negative event and positive affect for positive event)

	<i>Negative event</i> (<i>N</i> = 119)		<i>Positive event</i> (<i>N</i> = 118)	
	<i>Interpersonal</i> (<i>N</i> = 43)	<i>Non-int.</i> (<i>N</i> = 76)	<i>Interpersonal</i> (<i>N</i> = 57)	<i>Non-int.</i> (<i>N</i> = 61)
Attachment				
Avoidance	2.83 (1.15) 1.00–5.28	2.91 (1.13) 1.11–5.56	2.83 (1.07) 1.00–5.56	2.93 (1.20) 1.06–5.28
Anxiety	3.46 (1.25) 1.17–5.83	3.49 (1.03) 1.61–6.67	3.51 (1.11) 1.28–5.83	3.46 (1.12) 1.17–6.67
Affect				
Immediate	4.52 (1.26) 2.70–7.00	4.69 (1.20) 1.40–7.00	5.57 (1.15) 1.70–7.00	5.66 (1.16) 1.90–7.00
Recall	3.78 (1.27) 1.50–7.00	4.05 (1.29) 1.50–6.60	4.62 (1.48) 1.20–6.50	5.01 (1.26) 1.20–7.00
Current	2.37 (1.41) 1.00–5.60	2.03 (1.06) 1.00–5.70	3.75 (1.66) 1.00–6.40	3.99 (1.78) 1.00–7.00
Difference (Rec. – Imm.)	–0.74 (0.79) –2.60–+1.10	–0.64 (0.81) –3.30–+1.00	–0.95 (0.85) –3.50–+0.60	–0.65 (0.67) –3.00–+0.70

Rec., Recall; Imm., Immediate.

Associations among affective reports. Reports of Immediate, Recalled and Current emotions about the events were all moderately to highly correlated indicating a high consistency between earlier and later reports. For negative events, correlations between reports were: Immediate NA and Recalled NA, $r(118) = .80$, $p < .001$; Immediate NA and Current NA, $r(118) = .46$, $p < .001$; and Recalled NA and Current NA, $r(118) = .48$, $p < .001$. For positive events, correlations between reports were: Immediate PA and Recalled PA, $r(117) = .83$, $p < .001$; Immediate PA and Current PA, $r(117) = .65$, $p < .001$; and Recalled PA and Current PA $r(117) = .74$, $p < .001$.

To determine whether participants' affective reports differed by the event type (Interpersonal or Non-interpersonal) or by participants' gender, two repeated-measures ANOVAs were performed. First for the negative event, we used the three negative affective reports (Immediate, Recalled, and Current) as the dependent variables, and the event type and gender as the independent variables. Results showed a significant within-subjects effect for Report, $F(1.62, 334.87) = 206.11$, $p < .001$, and a Report \times Event Type interaction, $F(1.63, 5.27) = 4.19$, $p < .05$. (Degrees of freedom reported were those using the Greenhouse-Geiser adjustment due to the lack of sphericity.) Pairwise comparisons using Bonferroni procedure showed that each mean across reports of NA were significantly

different. Participants' Immediate NA ($M = 4.63$) was higher than their recalled NA estimates ($M = 3.95$) and their current NA at the second session ($M = 2.15$), and also Recalled NA was higher than Current NA. We did not interpret the interaction, which indicates that the magnitude of these differences depended on event type. A significant gender difference emerged as well, $F(1, 20.04) = 6.22$, $p < .05$; women's reports of NA ($M = 3.79$) were significantly higher than men's ($M = 3.29$). As a result, we controlled for gender when testing for the presence of memory biases for negative affect.

For the positive affect reports, a comparable repeated-measure ANOVA was performed. A significant effect of Report was found, $F(1.52, 170.70) = 138.56$, $p < .001$. As with reports of NA, results showed that each report of PA was significantly different. Using Bonferroni's adjustment for multiple pairwise comparisons, participants' Immediate PA ($M = 5.62$) was higher than Recalled PA ($M = 4.82$) and Current PA ($M = 3.87$), and Recalled PA was higher than Current PA. Event type and gender were unrelated to mean levels of PA reports.

Correlations between attachment and scores on the PANAS

The next analyses examined whether attachment dimensions were associated with the immediate, recalled, and current reports of negative and positive affect to determine if our findings were similar to previous studies. As shown in Table 2, scores on PANAS were examined for their relations to anxiety and avoidance, separately by whether events were interpersonal or non-interpersonal. Results showed that for negative affect, anxiety was positively correlated with

TABLE 2
Correlations between attachment and reports of negative and positive affect

	<i>Negative Affect for negative events</i>				<i>Positive Affect for positive events</i>			
	<i>Anxiety</i>		<i>Avoidance</i>		<i>Anxiety</i>		<i>Avoidance</i>	
	<i>Int.</i>	<i>NI</i>	<i>Int.</i>	<i>NI</i>	<i>Int.</i>	<i>NI</i>	<i>Int.</i>	<i>NI</i>
Affective reports								
Immediate	.47***	.29*	.30*	.10	.22	.24	.13	.04
Recalled	.35*	.31**	.31*	.12	.01	.15	-.06	.09
Current	.33*	.03	.17	-.12	.15	.11	.00	.02
Difference (Rec. – Imm.)	-.20	.07	.02	.03	-.27*	-.14	-.28*	.07

Int., Interpersonal events; NI, Non-interpersonal events. For the Negative Affect reported for the negative events, N for interpersonal events = 43, and N for non-interpersonal events = 76. For the Positive Affect reported for the positive events, N for interpersonal events = 57, and N for non-interpersonal events = 61. * $p < .05$; ** $p < .01$; *** $p < .001$.

Immediate NA (reported on daily report forms), Recalled NA (estimates of immediate NA), and Current NA (how participants felt about the event at the second session) for interpersonal events, and with Immediate and Recalled NA for non-interpersonal events. Avoidance also was positively correlated with Immediate and Recalled NA for interpersonal events, but it was unrelated to NA for non-interpersonal events. In contrast, for positive affect, attachment dimensions were unrelated to participants' reports of positive affect with positive events.

More central to this study are analyses examining whether the attachment dimensions are related to changes in memory of affect. The last row of Table 2 also shows correlations of anxiety and avoidance with difference scores assessing degree of overestimation of earlier affect. Contrary to our expectations, attachment was not related to difference scores for reports of negative affect to the negative event. Attachment was, however, related to changes in recall of affect for positive interpersonal events: higher levels of anxiety and avoidance related to greater underestimation of earlier positive affect

Predicting participants' recalled estimates of their earlier affect

To further test the major hypotheses of the study, whether attachment was related to biases in memory of earlier emotional reactions, we conducted a set of hierarchical regression equations to predict recalled estimates of initial levels of negative affect or positive affect. These analyses extended the correlation analyses reported above by allowing us to control for current affect, to test for anxiety by avoidance interactions, and to test whether patterns of associations varied by event type. The latter allowed us to test our hypothesis that findings would be stronger for interpersonal than non-interpersonal events. All continuous predictors were centered because our hypotheses involved testing for interaction effects (Aiken & West, 1991). On the first step in the equations we entered immediate affect scores (their ratings on the daily report forms) to control for initial reactions because we were interested in predicting changes in memories for affective experiences. We also entered current affect scores on the first step because we expected that individuals' current emotional reaction toward the event (i.e., how they felt about the event at time 2, at the same time they were recalling their initial reaction) could influence their memory. Additionally on the first step in the equations, we entered Event Type (Interpersonal vs. Non-interpersonal), and with negative affect only, we controlled for gender. On the second step, the scores on anxious and avoidant scales were entered. On the third step, an interaction term between avoidant and anxious attachment was entered in case interactions of the attachment dimensions rather than main effects emerge, and we entered interaction terms between the attachment dimensions and event type. Finally, on the fourth step, we tested for a three-way

interaction between anxiety, avoidance, and event type. Because initial reactions were controlled for on the first step, a significant effect at Step 2, 3, or 4 would show that attachment predicted the degree of change in affect ratings over time.

Recalled levels of negative affect for the negative events. For negative affect, variables entered on the first step accounted for 64% of the variance in Recalled NA (see Table 3). Specifically, participants' immediate scores and current NA predicted their recalled scores. Anxiety and avoidance on the second step, and interaction terms on the third step, were not significantly related to recalled NA. However, the interaction term on the fourth step, Anxiety \times Avoidance \times Event Type, was significantly related to Recalled NA and accounted for an additional 2% of the variance. The simple regression lines are plotted in Figures 1 and 2. For interpersonal events, greater anxiety was linked to recalling less intense negative affect (i.e., underestimating Immediate NA to a greater degree) for those who score low in avoidance (similar to the preoccupied attachment style). But for non-interpersonal events, lesser anxiety was linked to recalling less intense negative affect (i.e., greater underestimation) for those who score low in avoidance (similar to the secure attachment type).

For descriptive purposes, and to characterise these interindividual differences in participants' memory of earlier emotional reactions, we examined the percentages of people who underestimated their earlier negative affect compared to the people who were accurate or overestimated their earlier negative affect by splitting the sample on mean levels of the anxious and avoidant attachment dimensions. For those who scored above the mean on anxiety but below the mean on avoidance (similar to the preoccupied attachment style prototype), 90.0% (9/10) underestimated their earlier negative affect to interpersonal events, whereas those who scored below the mean on both anxiety and avoidance (similar to the secure attachment prototype), 66.7% (8/12) underestimated earlier negative affect to interpersonal events. For non-interpersonal events, the pattern was in the opposite direction; for those scoring high on anxiety but low on avoidance (~ preoccupied), 62.5% (10/16) underestimated earlier negative affect, but for those scoring low on both (~ secure), 81.8% (18/22) underestimated earlier negative affect.

Recalled levels of positive affect for the positive event. A parallel set of analyses was done for participants' memory of their positive emotional reaction to the positive event (also shown in Table 3). On the first step, participants' immediate and current levels of positive affect accounted for 74% of the variance in recalled PA. Both higher Immediate PA and higher Current PA predicted recalled scores of higher intensity. When the two attachment dimensions were entered on the second step, these variables accounted for an additional 2% of variance. Specifically, Anxiety related negatively to memory of PA intensity, indicating that people with higher scores on the anxious

TABLE 3
Regression analyses predicting recalled levels of affect^a

	Negative events (N = 117)				Positive events (N = 106)			
	ΔR^2	B	SE B	β	ΔR^2	B	SE B	β
Step 1	.64***				.74***			
Immediate affect		.73	.07	.70***		.73	.08	.60***
Current affect		.16	.07	.16*		.28	.05	.35***
Event type		-.22	.15	-.08		-.27	.14	-.10+
Sex		-.09	.15	-.04				
Step 2	.01				.02+			
Anxiety		.04	.07	.03		-.14	.06	-.11*
Avoidance		.08	.07	.07		-.05	.06	-.05
Step 3	.01				.02+			
Anxiety \times Avoidance		-.01	.06	-.01		-.04	.05	-.04
Anxiety \times Event type		-.24	.14	-.15+		-.18	.12	-.11
Avoidance \times Event type		.02	.14	.01		-.25	.12	-.14*
Step 4	.02**				.00			
Anx. \times Avd. \times Event type		.29	.11	.23**		-.04	.10	-.03

^a While excluding participants whose immediate scores = 7.0. B = unstandardised coefficient; SE B = standard error of B.
+ $p < .06$; * $p < .05$; ** $p < .01$; *** $p < .001$.

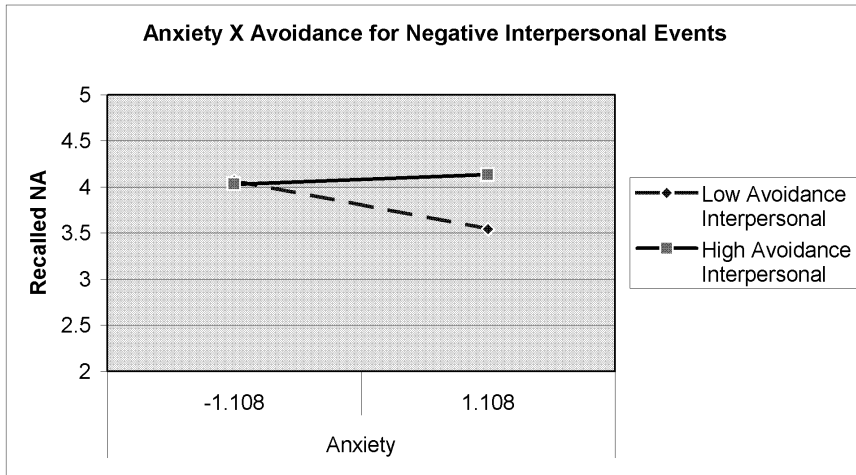


Figure 1. Recalled levels of negative affect for interpersonal events by avoidance and anxiety about close relationships.

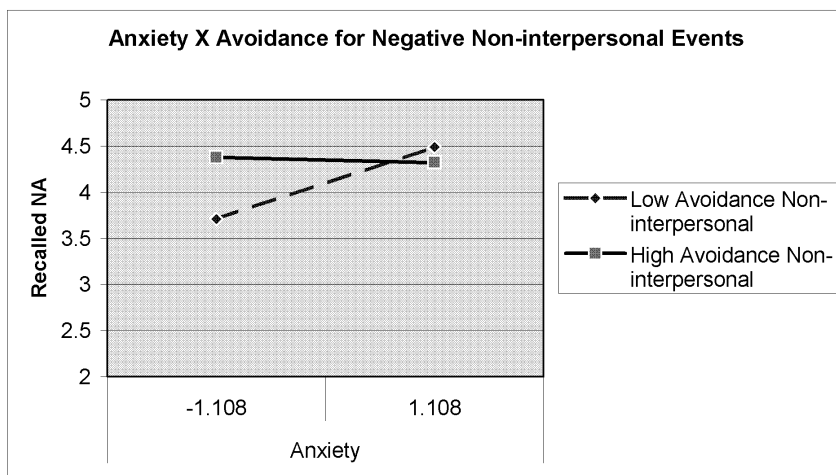


Figure 2. Recalled levels of negative affect for non-interpersonal events by avoidance and anxiety about close relationships.

dimension underestimated earlier experienced positive affect to a greater degree than did those who scored lower on anxiety. On the third step, with an additional 2% of the variance, Avoidance \times Event Type related negatively to recalled PA. On the fourth step, the three-way interaction term was nonsignificant.

In Figure 3, we plotted the Avoidant \times Event Type interaction. Results indicated that avoidance related to recalled PA for interpersonal, $t(97) = -2.16$, $p < .05$, but not for non-interpersonal events, $t(97) = 0.66$, $p = .51$. That is, only with interpersonal events did people who were higher on avoidant attachment underestimate their earlier PA to a greater extent than did those lower on avoidant attachment.

Again, for descriptive purposes, we examined the significant effects that emerged from the regression analyses in terms of the percentages of people who underestimated their earlier positive emotional reactions. For those above the mean on anxiety, 92% (46/50) underestimated their earlier positive affect intensity, but for those below the mean on anxiety, 77.2% (44/57) underestimate their earlier positive affect intensity. For those above the mean on avoidance, 100% (23/23) underestimated earlier positive affect for interpersonal events, and 77.4% (24/31) underestimated earlier positive affect for non-interpersonal events. For those below the mean on avoidance, 83.3% (25/30) underestimated earlier positive affect intensity for interpersonal events, and 78.3% (18/23) underestimated earlier positive affect intensity for non-interpersonal events.

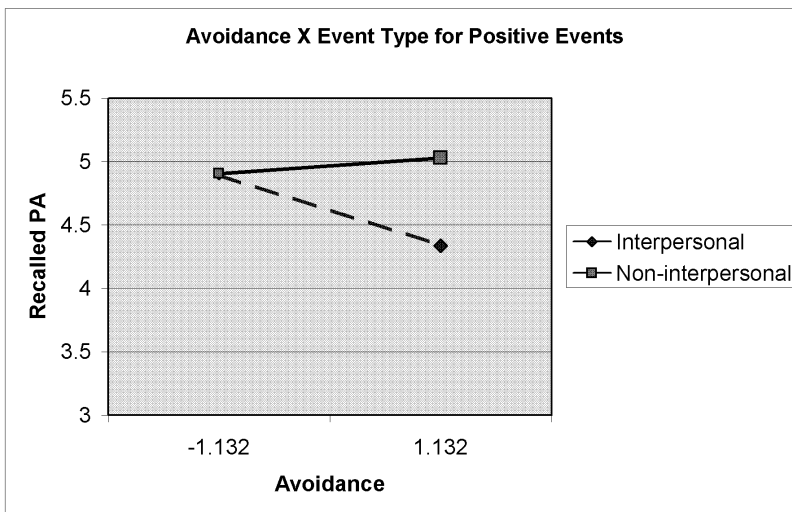


Figure 3. Interaction between avoidance and event type for recalled positive emotional reactions.

DISCUSSION

In the present study, we examined how attachment is related to changes in people's memories of their emotional reactions. When examining participants' recalled estimates of their earlier emotional reactions to events, we also controlled for how they currently felt about the events at the second session. Our results showed that attachment did predict change in memories for earlier affective reactions for both negative and positive events. In general, participants underestimated earlier positive and negative affect, and attachment in some cases moderated this underestimation. We also found that effects differed for interpersonal and non-interpersonal events.

Attachment and biased recall of emotional experience

With negative emotions resulting from negative life events, we had predicted that anxious attachment would be associated with overestimating the intensity of earlier negative emotions whereas avoidant attachment would be associated with underestimating the intensity of earlier negative emotions. We did not find the expected pattern of results, however, and the majority of the participants underestimated their earlier emotional reactions. Nevertheless, a significant three-way interaction was found, showing that contrary to hypotheses, memory of interpersonal events became less negative over time for people who scored higher on anxiety but lower on avoidance (i.e., people characteristic of the preoccupied attachment style). One possible, post hoc explanation of our findings is preoccupied individuals might be motivated to reinterpret negative interpersonal experiences in a more positive way over time because their interpersonal relationships are so important to their sense of worth. Preoccupied individuals are described as having positive views of others (Bartholomew & Horowitz, 1991); thus, this mitigation of their earlier negative reactions may aid in their ability to maintain a positive outlook, despite their intense immediate emotional reactions.

With positive emotions resulting from positive events, attachment also was related to differential recall of initial positive affective reactions. Specifically, a main effect for anxiety showed that more anxious individuals later underestimated how positively they felt about events to a greater degree than less anxious individuals regardless of whether the events were interpersonal or non-interpersonal. For avoidance, a significant interaction with event type emerged, showing that only for interpersonal events, people who are more avoidantly attached underestimated earlier positive affect more than those who are less avoidantly attached. In fact, all participants who scored above the mean on avoidance underestimated earlier positive emotional reactions to interpersonal events, whereas for non-interpersonal

events, the rates of underestimating earlier positive affect were similar across levels of avoidance.

Contrary to our expectation that attachment would relate to memories of interpersonal but not non-interpersonal events, we found some evidence that attachment, particularly anxiety, related to distortions of both types of experiences. Nevertheless, the distinction between interpersonal and non-interpersonal events emerged as an important factor to include when investigating how people who vary on attachment remember their earlier emotional experiences. It is noteworthy that the event type did not show main effects to memory biases; only when considered in conjunction with attachment did the type of event matter. Further, the role of the event type emerged despite how global our coding system was, in that we coded events as interpersonal regardless of who else was involved in the event. Some interpersonal events did concern experiences within close relationships (e.g., with a romantic partner, a parent, or close friend); however, other interpersonal events involved people who presumably did not serve as attachment figures to the participants (e.g., a professor, classmates, teammates, acquaintances at a party). Although our sample size did not allow us to examine the possibility, perhaps further distinctions between the type of experience should be examined in relation to attachment, for example by differentiating between interpersonal events with acquaintances compared to interpersonal events involving close relationships partners (i.e., attachment figures).

Working models are thought to explain why attachment is related to social adaptation. The working model construct has been criticised because it is frequently presented as a vague and post hoc explanation for attachment correlates (Hinde, 1988). What is needed is to specify and examine the specific cognitive processes—including memory processes—that may help elucidate the working model construct. Our study, along with Feeney and Cassidy (2003), are the first to show that attachment predicts how memories of people's interpersonal life experiences change over time. Feeney and Cassidy found evidence of change over 6 weeks, whereas we found change over only 10 days. Thus, reconstruction of memories for salient events seems to occur within the first few days after the event. Follow-up studies are needed to identify the specific processes that may account for changes in emotion memories.

Attachment and reports of daily emotions

On the daily reports of immediate emotional reactions, we expected that the pattern of findings would be similar to those from other diary studies. Earlier studies did not show consistent patterns between attachment and reports of daily positive emotions, and in our study the two were not related. We did, however, replicate prior studies' findings for associations between avoidance and diary reports of negative emotions. Specifically, in the earlier studies avoidant or

dismissing individuals were found to report higher levels of negative affect compared to other individuals. In our study, although we assessed attachment using dimensions rather than discrete categories, our results were consistent with earlier studies in that avoidance was associated with more intense negative affect on the immediate reports of affective reactions. Thus, it appears that more avoidant individuals are not able to suppress their initial emotional reactions to negative events; instead their attempts to minimise emotional experience may occur subsequent to the event. However, in Fraley et al.'s (2000) study in which participants listened to an attachment-related interview, their results showed that individuals who were higher on avoidant attachment initially encoded less information about the story, rather than had higher rates of forgetting afterwards compared to less avoidant individuals. Thus, although avoidant individuals can disengage from an attachment-related story, results from our study and others using diary methodologies suggest that more avoidant individuals react with relatively intense negative emotions when the experience is personal (i.e., occurring directly to them).

Although individuals with more anxious attachments tend to report more negative affect on global self-reports of emotion, this has not been found in other diary studies. We were therefore surprised that our results showed that higher anxiety was associated with more intense negative affect on the immediate reports for both interpersonal and non-interpersonal events. One methodological difference between the current and prior diary studies of attachment and emotion may explain the discrepant results. In the earlier studies, participants recorded emotional reactions to interactions lasting 10 minutes or more immediately after the interactions occurred. In the current study, because participants only rated their emotional reactions to events three times a day, longer intervals between the events and their recordings of immediate reactions were typically involved. As Gross (1998) argued, regulation of affect can occur instantaneously as the event is unfolding (e.g., at the encoding stage). Thus, in relation to our findings, more anxious individuals may have already processed the event in a way to heighten emotional responses (e.g., by focusing on the negative implications of the event, or ruminating on the event in the time between the event and reporting their emotional reaction on the daily report forms). Perhaps if we had participants rate their emotions online (i.e. as an event was happening), and then later asked them to recall their earlier emotions, then we might have found evidence that anxiety is not linked to their immediate reactions, and instead linked to later overestimating their earlier negative affect.

Attachment and current feelings about events

Another finding from our study suggests that it may be fruitful to further examine the link between attachment and rumination. In the present study, we also found that anxious attachment was positively correlated with more intense

negative emotions at the second session (Current Affect) when asked about interpersonal events. In other studies, rumination has been shown to relate to relatively intense negative affect being sustained over time (Nolen-Hoeksema, Morrow, & Frederickson, 1993; Thayer, Newman, & McClain, 1994; Wood, Saltzberg, Neale, Stone, & Rachmiel, 1990). The coping strategies that highly anxious individuals tend to rely on, such as rumination (e.g., Mikulincer, 1998), might account for why anxious individuals' negative feelings about interpersonal events tend to persist.

Limitations and future directions

Some limitations of the current study should be noted. First, our study was conducted with a relatively small ($N = 119$) and homogenous sample of undergraduate students. Thus, future studies could be conducted to determine whether results can be generalised to other samples. Additionally, in the current study, we used an approximate 10 day interval between when the events occurred and when participants were asked to recall their earlier emotional reaction, whereas in Feeney and Cassidy's study (2003), they used a 6 week interval. Future research could use different time intervals between participants' events and when they are asked to recall their earlier reactions to determine when attachment-related memory biases emerge. In addition, a longer time interval might result in an increased reliance on existing schemas (e.g., attachment), and a decreased ability to accurately recall how they initially felt.

In summary, this study, like Feeney and Cassidy (2003), shows that attachment predicts changes in memories of emotions for highly salient and negative events. Our study showed that biased memory also occurs for positive emotions with positive events. Relatively few prior studies have examined how attachment relates to positive experiences; however, our results suggest that attachment also may be useful in understanding people's variability in emotional responses to positive, interpersonal experiences. Recent research has begun to consider the specific social information processing mechanisms that may account for attachment correlates. Our study suggests that further elaboration of the working model construct needs to elucidate the role of memory processes.

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