

# Attachment and Emotional Memory: Investigating the Source and Extent of Avoidant Memory Impairments

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Attachment avoidance has been associated with impairments in memory for material with emotional, attachment-related themes (e.g., loss). In the present study the author investigated the source and extent of these memory deficits by examining working memory capacity for attachment-related and nonattachment-related material. Avoidance was associated with deficits in working memory for positive and negative attachment-related stimuli. However, avoidance was unrelated to working memory capacity for nonattachment-related stimuli, both emotional and nonemotional. These findings are consistent with the proposal that avoidant individuals defensively limit the processing of potentially distressing information. Attachment anxiety was unrelated to working memory capacity across word type. Implications of the findings for defensive strategies and emotional memory are discussed.

*Keywords:* attachment, emotion, working memory, personality, individual differences

According to attachment theory (Bowlby, 1969/1982), individuals develop *internal working models*, or representations, of the self and relationship partners based on their experiences in close relationships. Embedded in these representations are expectations about the responsiveness of others and strategies for regulating and interpreting attachment-related information (e.g., intimacy and threats to the relationship or to personal safety). The particular expectations that are developed and the specific information-processing strategies that are implemented are thought to depend on the nature of close relationship experiences (Bowlby, 1980).

As such, individual differences in attachment have been proposed to have important influences on attention and memory (e.g., Main, Kaplan, & Cassidy, 1985). Avoidant individuals (i.e., those uncomfortable with closeness and intimacy) are theorized to limit the processing of emotional, attachment-related information, with the goal of preventing attachment-system activation (Bowlby, 1980). Consistent with this idea, there is some evidence that avoidant adults have deficits in long-term memory (LTM) for emotional experiences and information (Edelstein et al., 2005; Fraley, Garner, & Shaver, 2000; Mikulincer & Orbach, 1995).

Yet, relatively little is known about the mechanisms underlying avoidant memory impairments. Although avoidant individuals are thought to limit attention to attachment-related information, this hypothesis has not been directly examined. Additionally, because memory for material varying in attachment relevance has not been compared in previous research, it is unclear whether avoidant memory deficits extend to nonattachment-related information.

The present study was designed to examine the source and extent of avoidant memory deficits by assessing working memory (WM) capacity for attachment-related and nonattachment-related material. WM is an important gateway for long-term retention and retrieval (Baddeley & Logie, 1999); thus, deficits of LTM may result from initial failures to fully process information in WM. Moreover, individual differences in WM capacity are thought to reflect, at least in part, differences in the ability to sustain attention to task-relevant stimuli (Engle, Kane, & Tuholski, 1999). Insofar as avoidant individuals' memory impairments result from disruptions in attention, avoidance should be associated with WM deficits. Further, to the extent that the regulation of attention and memory is specific to attachment-related information, WM deficits should not be observed for other kinds of material. In the following sections, theory and research on attachment and memory are reviewed, followed by a brief discussion of WM.

## Attachment-Related Differences in Memory

Individual differences in adult attachment are generally assessed by the intersection of two relatively independent dimensions: attachment-related avoidance and anxiety. Individuals scoring high on avoidance are characterized by chronic attempts to deactivate or inhibit attachment-system activation (Edelstein & Shaver, 2004; Fraley, Davis, & Shaver, 1998): They minimize expressions of distress (Fraley & Shaver, 1997), dislike physical and emotional intimacy (Brennan, Clark, & Shaver, 1998), and grieve less after a breakup than nonavoidant adults (Fraley et al., 1998). High scores on anxiety, in contrast, appear to reflect "hyperactivation" of the attachment system (Cassidy, 2000): Highly anxious individuals are

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hypervigilant to attachment figures (Mikulincer, Gillath, & Shaver, 2002) and are easily overwhelmed by interpersonal stressors (Mikulincer & Florian, 1998).

Deactivating strategies, in particular, have important implications for attention and memory. Bowlby (1980) proposed that one way to regulate negative affect is to limit attention to material that could result in attachment-system activation, a process he termed *defensive exclusion*. If potentially upsetting information is not fully processed, the attachment system is less likely to become activated, thus preventing rejection and distress. Defensive exclusion of threatening information may, in turn, render such information more difficult to recall.

In support of this idea, attachment avoidance has been associated with impairments in LTM for emotional, attachment-related information (Edelstein et al., 2005; Fraley et al., 2000; Mikulincer & Orbach, 1995). Mikulincer and Orbach, for instance, found that avoidant participants had more difficulty recalling emotional childhood experiences, particularly those related to sadness and anxiety, than nonavoidant participants. Because the accuracy of these memories was not verified, however, it is unclear whether avoidant participants had more difficulty recalling emotional experiences, had fewer such experiences to recall, or were simply reluctant to discuss emotional topics.

In another study (Fraley et al., 2000), avoidant individuals were less accurate when recalling a story about interpersonal loss. However, avoidance was unrelated to the rate at which story details were forgotten. Insofar as thinking or talking about an experience after encoding facilitates memory, these findings suggest that extent of postencoding elaboration or rehearsal did not differ between avoidant and nonavoidant participants. Fraley et al. thus proposed that avoidant memory impairments reflect encoding or attentional deficits, as opposed to deficits in postencoding elaboration. Of note, however, neither attention to the story nor postencoding elaboration was assessed directly. Rather, the role of these processes was inferred from the rates at which information was forgotten, and comparable forgetting rates could have been obtained if avoidant participants had difficulty *retrieving* information both immediately after encoding and after a delay.

Finally, Edelstein et al. (2005) examined attachment-related differences in LTM for a highly emotional life experience, child sexual abuse. Consistent with previous research, avoidant participants were less accurate in their recall; however, the most pronounced impairments were observed for especially severe incidents. The emotional intensity of the to-be-remembered experience may thus be an important moderator of avoidant individuals' subsequent memory, with highly emotional information being especially poorly recalled. Additionally, in this study, the relation between avoidance and memory was independent of how often participants reported having discussed their experiences with others, again suggesting that postencoding processes cannot account for avoidant memory deficits. As in previous studies, however, attentional processes per se were not assessed, so the possibility remains that avoidant participants differed not in their attention to or encoding of abuse experiences but in how easily those experiences were recalled.

It is also unclear whether avoidant memory impairments are limited to attachment-related (or even emotional) material. Although there is evidence that deficits increase with the emotional intensity of the to-be-remembered experience (Edelstein et al.,

2005), in prior research memory has been assessed only for attachment-related stimuli or experiences, thereby precluding comparison with memory for other types of material. Information less directly related to attachment (even if emotional) should not elicit defensive processing, and thus avoidant individuals' memory for such information should not be impaired.

A less consistent picture has emerged regarding attachment-related anxiety. Theoretically, anxious individuals, who are hypervigilant to attachment figures and concerns, should have *enhanced* memory for attachment-related information; however, this hypothesis has received little empirical support. Although there is some evidence that anxious adults are facilitated in retrieving emotional autobiographical memories (Mikulincer & Orbach, 1995), other findings suggest that anxiety is unrelated to emotional memory (Edelstein et al., 2005; Fraley et al., 2000). Further, research on parent-child attachment suggests that memory may be impaired among anxious children (Kirsh & Cassidy, 1997) and adults (Zeijlmans van Emmichoven, van IJzendoorn, de Ruiter, & Brosschot, 2003). The reasons for these inconsistent findings are not yet clear, but they may reflect the diversity of stimuli, subject populations, or measures of attachment used across studies.

### Working Memory

Working memory is a limited-capacity system involving the control, regulation, and maintenance of information in the service of complex cognition (Miyake & Shah, 1999). Although there is consensus that regulating information in WM involves attentional processes, the precise relation between attention and WM is debated (see Miyake & Shah, 1999). Engle et al. (1999), for instance, argued that WM capacity "is not really about storage or memory per se, but about the capacity for controlled, sustained attention in the face of interference or distraction" (p. 104). Yet, others have found that WM capacity is also limited by factors that are not necessarily attentional, including storage capacity, processing efficiency, or the ability to coordinate processing and storage requirements (e.g., Bayliss, Jerrold, Gunn, & Baddeley, 2003).

Because both attention and WM are multicomponent processes, neither is likely to be fully encompassed or explained by the other (Baddeley & Logie, 1999). Yet, at the very least, there is a close connection between WM and attention, making WM tasks more suitable for isolating the effects of attention than LTM tasks. In the present study, WM was assessed for attachment-related and nonattachment-related (both emotional and neutral) stimuli. Insofar as successful performance on this WM task necessitates the maintenance of attention to task-relevant stimuli and to the extent that avoidance is associated with limited attention to attachment-related material, avoidant individuals were expected to show WM impairments on the attachment-related task. Avoidance was not expected to predict WM performance for tasks including nonattachment-related stimuli. Given previously inconsistent findings regarding attachment-related anxiety, no predictions were made for the anxiety dimension.

### Method

#### *Participants*

Two hundred fifty-five undergraduate students (63% female) participated in exchange for course credit. Fifty-two percent of participants were

White, 31% were Asian American, 7% were Hispanic, and 10% were of other or mixed ethnicities.

### Materials

**Adult attachment.** The Experiences in Close Relationships Inventory (ECR; Brennan et al., 1998) was used to assess individual differences in adult attachment. The *avoidance* subscale ( $\alpha = .93$ ) reflects comfort with closeness. The *anxiety* subscale ( $\alpha = .92$ ) reflects concern about abandonment. The ECR was completed online, before the experiment, as part of a larger battery of personality measures.<sup>1</sup> The correlation between the subscales was  $.25, p < .01$ .<sup>2</sup>

**Working memory task.** An operation–word span task (La Pointe & Engle, 1990) was used to assess WM capacity. In this task, participants read aloud and verify a simple operation, which is followed by a to-be-remembered word, also read aloud. The objective is to recall the series of words; solving the operations in between each word makes rehearsal more difficult, thereby increasing demands on WM. For example, participants might see the operation “(12/3) + 5 = 9?” requiring a “true” response, followed by the word *dream*. Another operation–word pair would immediately follow. After all pairs have been presented, participants are asked to recall the words, in any order, from the preceding trial.

Participants first completed two practice trials, followed by two trials of three, four, five, and six operation–word pairs. Thus, there were 8 trials in all, and 36 to-be-remembered words. Operations were presented, via computer, for 6 seconds, and words were presented for 1 second. Correct answers to the operations were equally divided between true and false, and all intermediate computations were to be done silently.

Three different tasks were created, including attachment-related, emotional, or neutral words (see Appendix). There were two task versions within each word type, varying in the order of word presentation. Participants were tested individually and were randomly assigned to word-type condition and task version.

**Stimulus words.** Thirty-six words of each type (neutral, emotional, and attachment-related) were chosen from a larger pool of potential words. Emotional valence ratings ranging from 1 (*very negative*) to 5 (*very positive*) were obtained from an independent sample of undergraduate students. Ratings of attachment-relevance ranging from 1 (*not at all attachment-related*) to 5 (*very attachment-related*) were obtained from doctoral-level psychologists or advanced graduate students with extensive backgrounds in attachment theory.

The selected attachment-related words received significantly higher ratings on attachment-relevance,  $M = 4.49; SD = .53$ , compared with the emotional,  $M = 1.41; SD = .60$ , and neutral,  $M = 1.25; SD = .60$ , words,  $F(2, 105) = 356.12, p < .001$ . The mean emotion ratings for the three groups did not significantly differ. (Note that the words were rated on a bipolar scale of emotional valence.) Ratings of emotional intensity (i.e., deviations from the emotionally neutral midpoint of the scale) were higher for the attachment-related words,  $M = 1.31; SD = .43$ , and emotional words,  $M = 1.37; SD = .34$ , than for the neutral words,  $M = .23; SD = .18, F(2, 105) = 132.90, p < .001$ . Attachment-related and emotional words did not significantly differ in emotional intensity.

Across word type, words were comparable in length, number of syllables, frequency, and concreteness. Because the attachment-related and emotional words were necessarily semantically related to one another within word type, neutral words that were similarly related were selected (i.e., from the higher order categories of government and law).

### Results

WM capacity was defined as the number of words correctly recalled across all perfectly recalled trials (i.e., *absolute span*,  $M = 10.97, SD = 7.81, range = 0–36$ ). That is, words were counted only if all of the words from that trial were correctly recalled.

Absolute span size is considered a more sensitive measure of WM capacity than the total number of words recalled (La Pointe & Engle, 1990).<sup>3</sup> Because the distribution of absolute span scores was positively skewed, log-transformed scores were used in subsequent analyses,  $M = 2.98; SD = .37$ . However, for ease of interpretation, untransformed values are presented here. Absolute span scores were unrelated to task version and gender and thus neither is considered further.

The general linear model (GLM) procedure of SAS was used to examine the interaction between word-type condition and avoidance. This analysis included the between-subjects factor of word type (neutral, emotional, and attachment-related), the continuous between-subjects factors of avoidance and anxiety, and the Word Type  $\times$  Avoidance interaction. Results revealed a main effect of word type,  $F(2, 248) = 8.32, p < .01, \eta_p^2 = .06$ : Absolute span scores were significantly higher for the emotional words,  $M = 13.68; SD = 8.50$ , than for the attachment-related words,  $M = 10.76; SD = 7.15$ , and neutral words,  $M = 8.53, SD = 6.94$ .

These effects were qualified by a significant interaction between word type and avoidance,  $F(2, 248) = 3.11, p < .05, \eta_p^2 = .02$ . As predicted, highly avoidant individuals recalled fewer words in the attachment-related versus emotional and neutral conditions. As depicted in Figure 1, avoidance was negatively related to WM performance for attachment-related words,  $\beta = -.23, p < .05$ , but not significantly related to WM performance for emotional or neutral words,  $\beta = .13$  and  $.10$ , respectively,  $ps \geq .27$ . There were no other significant effects. When included in the model, the two- and three-way interactions including anxiety were nonsignificant.

Additional analyses were conducted to examine whether avoidant WM deficits were specific to positive or negative words. Words with average ratings above the midpoint of the emotional valence scale (see Materials section) were classified as positive; words with average ratings below the midpoint were classified as negative. The numbers of positive and negative words correctly recalled from perfect sets were then regressed on avoidance and anxiety, separately for the emotional and attachment-related conditions. Avoidance was negatively associated with memory for both positive,  $\beta = -.22$ , and negative,  $\beta = -.22$ , attachment-related words, both  $ps < .06$ ; memory for positive and negative

<sup>1</sup> Due to a computer error, data for the first 118 participants were converted from a 7-point to a 5-point scale. In an independent sample ( $n = 1,720$ ), avoidance and anxiety scores derived from the 7- and 5-point scales were highly correlated,  $r = .99$  and  $.98$ , for avoidance and anxiety, respectively. None of the results presented here were moderated by this difference in scaling; however, because of mean-level differences, avoidance and anxiety scores were standardized within group for use in subsequent analyses.

<sup>2</sup> Although avoidance and anxiety are typically conceptualized as independent dimensions, it is not uncommon for the two ECR subscales to be positively correlated. This correlation may reflect the large proportion of secure individuals in the present sample (i.e., individuals with low scores on both avoidance and anxiety).

<sup>3</sup> Alternative measures of WM capacity (i.e., the number of words correctly recalled across all trials,  $M = 26.84; SD = 4.31$ , and the span size of the highest set perfectly recalled,  $M = 2.33; SD = 2.00$ ) were also examined. These alternative measures were highly correlated with absolute span size,  $r = .88$  and  $.81$ , respectively, and yielded similar results in the regression analyses.

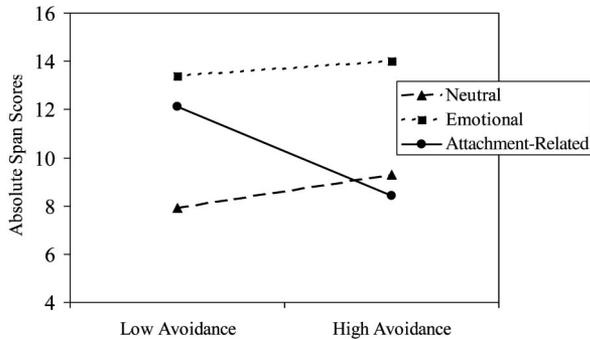


Figure 1. The relation between avoidance and working memory capacity. Regression lines are plotted for each word type.

emotional words was not significantly related to avoidance,  $\beta$ s < |.05|. Anxiety was unrelated to memory for positive and negative words across word type,  $\beta$ s < |.04|. Results were virtually identical for the total number (i.e., not only from perfect sets) of positive and negative words recalled. The number of operations answered incorrectly was not significantly associated with word type, avoidance, anxiety, or the interactions among these variables.<sup>4</sup>

### Discussion

The goal of the present study was to investigate the source and extent of avoidant memory impairments. Although it has been proposed that the LTM deficits observed among avoidant individuals (e.g., Edelstein et al., 2005; Fraley et al., 2000) result from limited attention to attachment-related information (Bowlby, 1980), in previous research the role of attention was inferred rather than assessed. In addition, previous studies included only attachment-related stimuli and thus memory for material varying in attachment-relevance could not be examined.

In the present study, consistent with previous research on LTM, highly avoidant individuals showed WM decrements for attachment-related stimuli. Avoidance was unrelated to WM performance in the emotional and neutral conditions, however, suggesting that avoidant memory impairments are specific to material with attachment-related themes. Together, these findings are consistent with the idea that avoidant individuals defensively limit the processing of information that could result in attachment-system activation (Bowlby, 1980). Insofar as processing is restricted before information can be fully encoded, subsequent recall of that information is likely to suffer.

Moreover, because the attachment-related and emotional words were matched on emotional valence and intensity, these findings suggest that it is not the emotional nature of the to-be-remembered material per se that impairs memory for avoidant individuals but rather the potentially threatening constructs (e.g., rejection, intimacy) represented by attachment-related stimuli. It is also noteworthy that avoidance was negatively associated with memory for both positive and negative attachment-related words, suggesting that even positive attachment-related constructs (e.g., closeness and affection) may activate defensive processes. Because emotional valence was manipulated within participants, however, it is possible that the similar effects observed across valence represent a carryover effect from negative to positive words (or vice versa).

Fraley et al. (2000) proposed that avoidant individuals' memory impairments result from a preemptive defensive strategy: By limiting the processing of potentially distressing information, avoidant individuals may successfully "short-circuit" many emotional experiences that could otherwise lead to attachment-system activation. Along these lines, Fraley and Shaver (1997) found that avoidant individuals were particularly skilled at suppressing thoughts of separation and that their attempts to do so were associated with decreases in autonomic arousal. Nonavoidant participants, in contrast, had difficulty suppressing such thoughts and experienced heightened autonomic arousal while attempting to do so. These findings suggest that, at least under some circumstances, avoidant individuals may be able to use preemptive defenses to limit distress associated with attachment-system activation.

Alternatively, WM deficits could result from anxiety or distress elicited by attachment-related stimuli. Regulating emotion requires cognitive resources (Richards & Gross, 2000), which could also interfere with WM processes. Indeed, WM performance is reduced after negative mood inductions (Gray, 2001), in anxiety-producing situations (Schmader & Johns, 2003), and among individuals experiencing high levels of life stress (Klein & Boals, 2001). Although avoidant individuals generally do not report attachment-related distress, other indices (e.g., physiological measures, Dozier & Kobak, 1992) suggest that they may nevertheless be experiencing anxiety. Thus, further research using indirect measures may help to disentangle these potential explanations and better elucidate the source of avoidant WM deficits.

In addition, although the deficits observed here implicate attentional processes, WM tasks are not necessarily pure measures of attention. Thus, future research using more direct measures (e.g., dot-probe tasks and eye-tracking devices) may further clarify the mechanisms by which avoidant individuals regulate the processing of attachment-related information. Moreover, because WM tasks are less dependent on explicit *retrieval* processes, the possibility remains that avoidant individuals both limit attention to attachment-related material and also have subsequent difficulty recalling that material. Retrieval processes could be examined by manipulating the conditions under which information is recalled (e.g., by providing cues to facilitate retrieval). However, information that is not attended to is likely to be difficult to retrieve, so it would be important to assess whether initial differences in attention underlie any subsequent differences in retrieval.

<sup>4</sup> The attachment-related words differ from the other two word types both in their relevance to attachment and, more generally, in their relevance to interpersonal relationships. Thus, avoidant individuals' memory deficits could reflect the interpersonal nature of the attachment-related stimuli, as opposed to their attachment relevance. Although attachment relevance and interpersonal relevance are highly related ( $r = .80$  in the present study), there are several interpersonal words in the emotional and neutral conditions that are not directly related to attachment. If interpersonal relevance underlies avoidant memory deficits, avoidance should be negatively associated with memory for these words. However, avoidance was not significantly related to memory for highly interpersonal words (i.e., those words rated above the midpoint of a 5-point scale of interpersonal relevance),  $\beta = .08$  and  $-.06$ , for emotional and neutral words, respectively. Thus, to the extent that attachment relevance and interpersonal relevance can be differentiated, these data suggest that avoidant individuals are not less attentive to interpersonal information per se.

Across word type, attachment anxiety was unrelated to WM. Given that similar null findings were reported in other studies (Edelstein et al., 2005; Fraley et al., 2000), perhaps attachment-related stimuli are relevant for individuals both high and low on anxiety. It is also possible that anxious individuals are hypervigilant to attachment-related information, but are also (or as a result) preoccupied with their own emotional reactions or overwhelmed by other distracting thoughts (Mikulincer & Florian, 1998), which could impair WM. Thus, anxious individuals may not benefit from the potentially memory-enhancing effects of hypervigilance (see MacLeod & Mathews, 2004, for a similar discussion regarding general anxiety).

More generally, the present findings illustrate the potential of individual differences to moderate the influence of emotion on WM. Although few researchers have directly examined WM for emotional stimuli, extant research (e.g., Kensinger & Corkin, 2003; Perlstein, Elbert, & Stenger, 2002) has indicated little evidence for the facilitative effect of emotion typically found in studies of LTM (e.g., Canli, Zhao, Desmond, Glover, & Gabrieli, 1999). These findings have led to speculation that emotion may differentially influence WM versus LTM processes; however, prior studies relied on within-participant manipulations of emotion, which could obscure emotion-related differences in WM. Assessments of individual differences may also help reveal the conditions under which emotion facilitates (or hinders) WM. In the present study, avoidance predicted WM for attachment-related words; however, other individual differences (e.g., extroversion or neuroticism) may be relevant for emotional material more generally (e.g., Larsen & Ketelaar, 1991).

### Conclusions

In conclusion, the present findings extend previous research by demonstrating that avoidant individuals' memory deficits may be specific to attachment-related material and that these deficits may result from the defensive regulation of attention. WM impairments were observed for both positive and negative attachment-related stimuli, suggesting that both kinds of material may activate avoidant defenses. Finally, the present findings highlight the importance of individual differences as moderators of the influence of emotion on WM.

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## Appendix

### Word Lists

Neutral		Emotional		Attachment-Related	
Account	Lobby	Award	Ideal	Adore	Hug
Agent	Local	Beauty	Justice	Afraid	Ignore
Banner	Mayor	Blood	Mistake	Alone	Leave
Border	Oath	Broken	Nasty	Anger	Lonely
Budget	Pardon	Cancer	Parade	Avoid	Loss
Bureau	Permit	Clever	Peace	Betray	Loving
Client	Pledge	Crash	Poison	Caring	Near
Custom	Rank	Curse	Roach	Comfort	Need
Debate	Region	Damage	Rodent	Contact	Protect
Domain	Royal	Devil	Sin	Cuddle	Punish
Elect	Senate	Dirty	Snake	Danger	Reject
Empire	Service	Evil	Spirit	Depend	Rely
Frontier	Speech	Glory	Ulcer	Despair	Safe
Gavel	Symbol	Gossip	Wealth	Divorce	Sorrow
Government	Trial	Greed	Wicked	Embrace	Stress
Invest	Union	Gross	Win	Failure	Touch
License	Verdict	Heaven	Wisdom	Fear	Trust
Loan	Vote	Honor	Wrong	Grief	Warm

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