

THE IMPACT OF ABUSE EXPOSURE ON MEMORY PROCESSES AND  
ATTENTIONAL BIASES IN A COLLEGE-AGED SAMPLE

BY

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### Abstract

This research assessed whether attentional biases in response to negative stimuli were related to the poor specificity and low levels of emotional language that have previously been observed in stressed individuals. The relations between abuse and assessments of autobiographical memory, working memory, attentional biases, and psychopathology were examined in eighty college students, thirty-four of whom reported past experiences with abuse or domestic violence. Abuse history was unrelated to memory specificity, but recent abuse was related to lower levels of positive emotional language. Depressive symptoms were related to more negative emotional language and overgeneral memories. The analyses also indicated that child abuse exposure was associated with a subliminal bias to attend to abuse-related stimuli. An unconscious bias toward trauma, in turn, predicted *fewer* overgeneral, and more specific, memories. One implication is that poor memory specificity may be due to automatic attentional processes instead of strategic avoidance of potentially negative memory content.

The Impact of Abuse Exposure on Memory  
Processes and Attentional Biases in a College-Aged Sample

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## The Impact of Abuse Exposure on Memory Processes and Attentional Biases in a College-Aged Sample

The links between stress and memory have long been of interest in the psychological literature. Much of the past research on the effect of stress on memory has focused on memory and eyewitness testimony for stressful or traumatic events (Loftus, 1996, 2003). This research has examined issues such as the likelihood of forgetting traumatic events, and whether traumatic experiences are remembered in a different fashion than other life experiences. This research generally suggests that forgetting of traumatic events, such as abuse, is not uncommon and is predicted by factors associated with non-traumatic memory including age, maternal support, the type of exposure to the abuse (e.g. self-directed or witnessed abuse), and whether the individual has been re-exposed to similar experiences (Edelstein *et al.*, 2005; Goodman *et al.*, 2003; Greenhoot, Johnson, & McCloskey, 2005; Greenhoot, McCloskey, & Glisky, 2005). Whereas previous research has focused on memory for the traumatic events themselves, a more recent direction in the literature has been to investigate the effect of traumatic and/or chronic stress on memory functioning in general. The current investigation is designed to examine this issue, focusing specifically on the links between abuse trauma and the functioning of autobiographical memory.

### Trauma and Autobiographical Memory Functioning

A growing literature on trauma and memory functioning has revealed that exposure to trauma, such as physical or sexual abuse, is associated with disturbances

in autobiographical memory. Most of the research on abuse-related memory problems has employed an autobiographical memory assessment, the Autobiographical Memory Test, or AMT (Williams & Broadbent, 1986). In this task, subjects are presented with a number of positive, negative, and neutral cue words, with the number of cue words widely varying across studies, and the participants are instructed to recall a specific autobiographical memory (i.e., a distinct episode from their lives) related to that word. In most studies, subjects are given a restricted amount of time, such as 60 or 90 seconds, in which to generate a memory to each of the cue words. Subjects' memories are coded for their specificity, with the codes being "specific," "overgeneral," or "no memory." A specific code is given to a response that is autobiographical in nature and refers to an event lasting less than 24 hours (e.g. "*I went to the park on my eleventh birthday and picked a bouquet of flowers.*"). Overgeneral memories are those that refer to events that lasted longer than a day or a category of events (e.g. "*I always went to the park when I was younger.*"). A code of "no memory" is given to a response that is not autobiographical in nature or is not a recollection.

Work using the traditional AMT has consistently shown that adults and adolescents with histories of child abuse produce autobiographical memories that are less specific (or more overgeneral) than individuals without abuse exposure (Burnside, Startup, Byatt, Rollinson, & Hill, 2004; de Decker, Hermans, Raes, & Eelen, 2003; Kuyken & Brewin, 1995; Williams & Dritschel, 1988). For instance, fewer specific autobiographical memories on the AMT have been seen in college-

aged individuals reporting a history of childhood sexual abuse than those with no abuse history (Henderson, Hargreaves, Gregory, & Williams, 2002). A recent study by Johnson, Greenhoot, Glisky, and McCloskey (2005) found that exposure to family violence predicted shorter and more overgeneral memories in a sample of adolescents. Therefore, teens who were stressed by family violence recalled memories that were more overgeneral and less detailed. However, not all studies have found the same pattern of low autobiographical memory specificity in traumatized individuals on the AMT. Peeters and colleagues recently found that in depressed adults, childhood abuse actually predicted greater levels of memory specificity on the AMT in response to negative cues (Peeters, Wessel, Merckelbach, & Vermeeren, 2002). Moreover, Orbach *et al.* (2001) found that adolescents who witnessed or were a target of family violence in childhood did not produce more overgeneral memories than the controls. Nevertheless, it was observed by the authors that the adolescents exposed to violence were *more* likely than the controls to provide no response at all (Orbach, Lamb, Sternberg, Williams, & Dawud-Noursi, 2001).

One explanation for the lack of specificity in the narratives of traumatized populations is that overgenerality is a result of emotion regulation or coping processes developed in response to prolonged negative life events. For example, a number of researchers have proposed that the lack of specificity in traumatically stressed individuals may reflect an “avoidant” coping strategy to regulate negative emotions (Raes, Hermans, Williams, & Eelen, 2006; Williams, 1996). Poor specificity may help one cope with negative experiences by allowing an individual to avoid re-

experiencing the negative details and emotions associated with a traumatic event. Consistent with this argument, Hermans *et al.* (2005) found that non-traumatized adolescents with less specific autobiographical memories on an AMT showed higher levels of avoidance and thought suppression, as measured by several coping questionnaires (Hermans, DeFranc, Raes, Williams, & Eelen, 2005). Therefore, this research suggests that lack of specificity may be a form of disengagement from trauma in order to cope with negative affect, although researchers have not yet demonstrated that avoidance accounts for the poor specificity observed in individuals with childhood trauma histories.

Several alternative explanations have been proposed to explain the lack of specificity in the autobiographical memories of traumatized persons. One hypothesis is that these memory disturbances are due to deficits in general working memory or cognitive resources, caused by intrusive thoughts related to traumatic experiences. Intrusive thoughts, and efforts to avoid them, may consume working memory resources, thus making it less likely that specific recollections are produced (Kuyken & Brewin, 1994, 1995). Resource limitations might lead to overgeneral memories because it is presumably more effortful to retrieve a specific memory. Thus, if an individual's resources are constrained, he or she might stop the memory search early, or truncate the memory search, before he or she has retrieved a specific episode.

There is some evidence for the role of intrusive thoughts in accounting for the poor autobiographical memory specificity seen in trauma survivors (McNally, Lasko, Macklin, & Pitman, 1995; Park, Goodyer, & Teasdale, 2002; Wessel, Merckelbach,

& Dekkers, 2002). For example, Wessel *et al.* (2002) found that individuals who had been exposed to the violence of war as children in Indonesia produced fewer specific memories than control subjects, and more “overgenerality” was associated with more frequent intrusive thoughts and attempts to avoid them, as measured by the Impact of Events Scale (IES). However, other research has failed to find a connection between intrusive thoughts and trauma-related autobiographical memory problems (Henderson, Hargreaves, Gregory, & Williams, 2002; Kuyken & Brewin, 1995). More importantly, evidence that cognitive resource limitations (e.g., performance on working memory tasks) explain trauma-related memory problems is slim. Recent work by Filip Raes and colleagues (2006) indicates that overgeneral autobiographical memory is related to poorer working memory abilities in depressed adults (Raes *et al.*, 2006). But only a small number of studies have examined general and working memory and problems on the AMT in traumatized individuals independently of psychopathology, and these studies have found that measures of general memory or cognitive abilities do not account for the observed autobiographical memory deficits (de Decker, Hermans, Raes, & Eelen, 2003; Wessel, Merckelbach, & Dekkers, 2002). Therefore, while relations have been observed between attempted avoidance of intrusive thoughts and overgenerality, at this point these associations do not appear to fully explain the lack of memory specificity in traumatized individuals.

Another hypothesis for lack of specificity in the narratives of persistently stressed individuals centers on the observation that chronic levels of stress can cause a dysregulation in cortisol concentrations (Bremner, 1999; Sapolsky, 1996; Sapolsky,

Krey, & McEwen, 1986). Prolonged exposure to increased levels of cortisol can result in hippocampal atrophy in both humans and animals, particularly in the CA3 pyramidal neurons of the hippocampus (Bremner, 1999, 2003a, 2005; Bremner & Narayan, 1998; Nelson, 2000; Nelson & Carver, 1998). It has been posited that damage to the hippocampus contributes to the observed memory problems in stressed populations, because the hippocampus is involved in the consolidation of memory traces into cohesive, context-rich memories (Nelson, 2000), and the dentate gyrus of the hippocampus is involved in transmitting the consolidated memories to other portions of the cortex (Sapolsky, Krey, & McEwen, 1986). Because of the general role the hippocampus plays in memory formation, hippocampal atrophy should be associated with more general memory and cognitive deficits. While more research is needed on this topic, the current research base seems to indicate that the memory deficits related to specificity and emotionality are related to autobiographical memory functioning and not to more general cognitive processes (de Decker, Hermans, Raes, & Eelen, 2003; Wessel, Merckelbach, & Dekkers, 2002). In conclusion, it seems unlikely that either intrusive thoughts or hippocampal atrophy adeptly account for the lack of specificity and emotional terms in the autobiographical memories of stressed populations. As neither intrusive thoughts nor hippocampal dysfunction seem to fully account for low specificity in stressed persons, this may provide additional indirect evidence for the role of emotion regulation in memory specificity problems exhibited by stressed and/or abused individuals.

## Trauma and the Emotional Content of Recollections

Although most of the research on trauma and memory functioning has focused on the accessibility of memories for specific events, recent research also suggests that the recollections of individuals with and without trauma histories might also differ with respect to their emotional content. Work by Greenhoot, Johnson, and McCloskey (2005) found that adolescents with no history of child abuse used more emotion terms when providing memories in response to the negative cues of “argument” and “punishment” than they did in response to positive or neutral cues. However, teens with a history of prepubescent abuse showed no such increase in emotional language when recalling events related to negative, as opposed to positive or neutral cues. Moreover, their recollections connected to conflict and punishment contained significantly fewer emotion terms than those of adolescents without childhood abuse histories. Similarly, a study of children’s memory narratives for emergency room visits found that children who were more distressed during their ER visits produced narratives with fewer emotional or evaluative remarks than children who had been less distressed (Peterson & Biggs, 1998). Therefore, it appears that high levels of stress may result in personal memories that are devoid of emotional language, particularly those memories that are recalled in response to negative cues, as compared to those of individuals who have not experienced high or chronic stress.

One explanation for the low levels of emotional language in traumatized persons’ narratives attributes this pattern to a desire to avoid the emotions associated with negative past experiences. This argument is highly consistent with the

suggestion that abuse-related memory problems might reflect an avoidant strategy adopted to regulate one's emotions. Specifically, individuals with trauma histories may strategically refrain from thinking and talking about their emotional reactions to past events in order to avoid potentially negative affect. On the other hand, research on the emotional consequences of abuse and domestic violence suggests that repeated exposure to domestic violence or abuse may result in desensitization to such experiences (Carrey, Butter, Persinger, & Bialik, 1995). Thus, the absence of emotion terms in the autobiographical narratives of individuals with abuse histories may reflect a blunting of emotional processing during the events themselves, so that little affective detail is encoded in the first place. In other words, these memory patterns may be due to an automatic, rather than conscious and strategic, form of attentional bias in trauma processing. Indeed, recent models of responses to stress, such as the dual process model developed by Compas and colleagues, suggest that individuals may engage or disengage from stress-related stimuli at both an unconscious, automatic level and a conscious level, and their research provides support for dissociations between these two different levels of responses to stress (Boyer *et al.*, 2006; Glinder, Beckjord, Kaiser, & Compas, 2007).

An additional explanation for the findings of low emotional language in the narratives of stressed persons is that this is a result of a lack of socialization of emotional disclosure, such that the use of emotional language was not properly "scaffolded" during conversations with parents and other adults. Several studies suggest that parents socialize children's understanding and disclosure of emotions

when they talk with them about past experiences, so that the more parents discuss emotions in conversations with their children, the more likely children are to talk about their own emotional reactions to past events (Adams, Kuebli, Boyle, & Fivush, 1995; Fivush, Berlin, Sales, Washburn, & Cassidy, 2003; Sales, Fivush, & Peterson, 2003). Because the low emotional language in the narratives of abused persons seems to be specific to memories of negative incidents, it seems unlikely that global differences in the socialization of emotional discourse account for the differences observed in emotional language production by individuals with abuse histories. However, it is possible that individuals raised in abusive home situations were not taught how to appraise or express emotions about conflict or negative events in particular.

To summarize, the literature examining the effects of stress on memory functioning indicates that prolonged or traumatic stress is associated with reduced specificity and low emotionality in autobiographical recollections. However, the reasons for these memory problems are unclear. The most widely cited explanations have centered on the role of avoidance of stress-related stimuli in reducing memory specificity or emotionality. It has typically been assumed that such avoidance or disengagement is strategic and adopted as a coping mechanism, but it is also possible that these memory problems reflect a more automatic form of avoidance in response to stress-related information. Therefore, the current study was designed to explore more precisely the role of broader measures of disengagement by examining the links between trauma exposure, memory performance on the AMT, and measures of both

conscious and automatic avoidance in response to trauma-related stimuli in a college sample.

#### Questions of the Current Study

As one goal of our study was to examine the relation between childhood abuse and/or domestic violence experiences and autobiographical memory functioning, college students with abuse histories were recruited to participate and the specificity and emotional content of their autobiographical memories, elicited in an AMT, was compared to that of a control sample of college-aged persons without such histories. To evaluate whether conscious or automatic avoidance of trauma-related (and other potentially negative) stimuli is one of the mechanisms underlying trauma-related memory problems, we also assessed the propensity of individuals in our sample to direct their attention to/from abuse-related stimuli, as compared to neutral stimuli, either consciously or unconsciously. Conscious and unconscious attentional patterns were measured by the Cognitive Attentional Bias Task developed by Compas and colleagues (Boyer *et al.*, 2006). This task assesses automatic and conscious attentional biases using subliminal and supraliminal presentation of trauma-related and neutral words; biases to attend to neutral as opposed to trauma-related words reflect a tendency to avoid or disengage from trauma-related stimuli. If the memory problems associated with trauma reflect either automatic or strategic avoidance, this might have been observed on attentional tasks designed to measure these types of attentional patterns. Specifically, an assessment of whether low levels of memory specificity and emotionality correlate with conscious or automatic disengagement

from negative stimuli would provide information about whether either or both of these memory problems are related to automatic emotion regulation processes or to a controlled coping strategy. In addition, a test of working memory was included, to evaluate the possibility that trauma-related autobiographical memory deficits are explained by more general cognitive dysfunction.

One limitation of the current body of research on trauma-related memory problems is that the potential effect of posttraumatic stress disorder (PTSD) has largely been ignored, even though many studies suggest that individuals with PTSD have problems with memory specificity as well as hippocampal atrophy (Bremner & Narayan, 1998; Sapolsky, 1996). As a result, it is currently unclear whether the memory problems associated with child abuse histories and other traumas are actually attributable to PTSD symptoms or the trauma itself. Thus, the current study extended previous research by including a control measure of PTSD symptoms to determine whether trauma predicts memory and attentional patterns over and above PTSD symptoms.

Another goal of this study was to examine whether memory performance, as well as attentional biases, are related to measures of psychopathology. There is evidence that both poor specificity and low levels of emotional content in autobiographical memories may be maladaptive. A number of researchers have argued that emotional disclosure promotes well-being because it helps individuals find personal relevance and clarity in their experiences (Bauer, Stennes, & Haight, 2003; Fivush, Berlin, Sales, Washburn, & Cassidy, 2003), and because disclosing

emotions may enhance intimacy in one's relationships with others (Adams, Kuebli, Boyle, & Fivush, 1995; Sales, Fivush, & Peterson, 2003). For instance, research by Pennebaker and colleagues has shown that emotional expression in written recollections is linked to physical well-being (Pennebaker, Mayne, & Francis, 1997; Petrie, Booth, & Pennebaker, 1998; Smyth, 1998). In one study, Petrie, Booth, and Pennebaker (1998) found that individuals who were instructed to write about emotional topics while consciously suppressing negative emotion-laden thoughts showed a significant diminishing of CD3 lymphocytes, a marker of immune system functioning, while individuals who were asked to write about emotional topics but not suppress these thoughts had a significant increase in the function of their immune systems.

There is also evidence that problems with memory specificity are associated with psychopathology. For example, it is well-documented that depressed children and adolescents produce more categoric overgeneral memories on the AMT than non-depressed individuals of the same age (Orbach, Lamb, Sternberg, Williams, & Dawud-Noursi, 2001; Park, Goodyer, & Teasdale, 2002). It is important to note that depression does not seem to explain the associations between trauma history and poor memory specificity, because several studies have shown that trauma predicts poor specificity while controlling for depression (de Decker, Hermans, Raes, & Eelen, 2003; Hermans *et al.*, 2004). Williams and others have argued that depression should be viewed as an outcome, rather than an antecedent, of poor memory specificity. Specifically, poor memory specificity may increase one's vulnerability to depression

and relapse because it interferes with social problem solving (Evans, Williams, O'Loughlin, & Howells, 1992; Williams *et al.*, 2006). In support of this argument, depressed individuals who generate less specific memories in response to positive cues show more hopelessness (Williams & Broadbent, 1986) and take longer to recover from their depression (Brittlebank, Scott, Williams, & Ferrier, 1993) than depressed individuals who produce more specific positive memories. Thus, there is reason to believe that both low emotional language and low specificity in autobiographical memory may predict more depressive symptoms.

The literature on emotion regulation and attentional biases suggests that patterns of engaging or disengaging from stress-related stimuli also predict of well-being (Compas & Boyer, 2001). On the one hand, both anxiety and depression have been shown to be related to conscious attentional biases towards negative stimuli (Boyer *et al.*, 2006; Koster, De Raedt, Goeleven, Franck, & Crombez, 2005; MacLeod, Mathews, & Tata, 1986; Vasey, Daleiden, Williams, & Brown, 1995; Waters, Badcock, & Maybery, 2006). Several researchers have argued, however, that in the long term conscious *avoidance* of negative or stress-related stimuli may also lead to poor health or psychopathology. Epping-Jordan and colleagues found that higher levels of conscious avoidance predicted poorer one-year health outcomes in individuals with cancer (Epping-Jordan, Compas, & Howell, 1994). Similarly, Compas *et al.* (2006) found that among women with breast cancer, voluntary avoidance of cancer-related stressors predicted less positive affect and more anxiety and depressive symptoms. Also, Boyer *et al.* (2006) found that children with

recurrent abdominal pain showed a subconscious attentional bias towards pain-related stimuli, and this involuntary engagement was related to more pain, somatic symptoms, and negative affect.

In sum, the current literature suggests that both memory problems and patterns of conscious and automatic engagement or disengagement may be related to well-being. In the current study, to determine whether memory problems and patterns of engagement and disengagement in individuals with and without abuse histories are healthy or maladaptive patterns, measures of memory and attentional biases were related to measures of depressive symptoms and anxiety, while controlling for PTSD symptoms.

To summarize, the goals of this study were (1) to replicate past research findings of lack of specificity and low emotionality in the autobiographical narratives of individuals with abuse histories (compared to those without such histories), (2) to examine whether individuals with abuse histories also differed from controls in the tendency to consciously or unconsciously attend to negative stimuli, (3) to examine the extent to which memory patterns were explained by patterns of conscious or unconscious attentional biases, and (4) to determine whether memory and attentional bias patterns were adaptive or maladaptive as indicated by a measures of depressive symptoms and anxiety.

## Method

### Participants

Participants were recruited through the Introductory Psychology Subject Pool. The pre-screening tool was used to recruit individuals who had been exposed to the highly stressful experiences of physical or sexual abuse, either recently or in childhood, and a control group of individuals who did not have abuse histories. The prescreening questions were adapted from the Conflicts and Tactics Scale (Straus, 1979) to assess childhood and physical abuse exposure. The childhood abuse question asked, *“When you were a child, were you ever exposed to any of the following (mark all that apply): Physical abuse; sexual abuse; witnessing domestic violence in your home?”* The recent physical abuse question asked, *“In the last year, has a relative or romantic partner/spouse done any of the following to you (mark all that apply): Slapped you; Hit you with an object; Kicked or punched you; Burned you; Choked you; Threatened to kill or hurt you?”* Finally, the recent sexual abuse pre-screening question asked, *“In the last year, has an adult done any of the following to you WHEN YOU DID NOT WANT THEM TO (mark all that apply): Made you touch them in a sexual way; Touched you in a sexual way avoiding genital contact; Touched you in a sexual way including the genitals; Had sexual intercourse with you?”*

Three hundred and eighteen individuals with physical and/or sexual abuse exposure were invited to participate in the study. One hundred and sixteen of these individuals reported childhood physical abuse, eighty-three individuals reported

childhood sexual abuse, one hundred and forty-five individuals reported recent physical abuse, and fifty-seven individuals reported recent sexual abuse.<sup>1</sup> Of the persons reporting abuse, one hundred and twenty-eight of them were male. In addition, three-hundred and eighteen individuals who reported no abuse experiences were invited to participate as controls. In the control group, one-hundred and twenty-eight individuals were male. Subjects were only recruited if they were of traditional college-age, ranging from 18 - 23 years old. It should be noted that because participants were recruited from an introductory psychology course subject pool, they were able to select from a large number of studies to obtain course credit. Therefore, only a subset of the individuals who were invited to participate were expected to enroll in the study. Thirty-six of the individuals with abuse histories signed up to participate; fifteen of these individuals were exposed only to child abuse (“CA”), ten individuals had been exposed only to recent abuse (“RA”), and eleven individuals had been exposed to abuse both in childhood and recently (“CA + RA”). Forty-seven of the invited individuals who did not have abuse histories enrolled in the study.

Three subjects were excluded from the analyses; one female subject, who reported both child and recent abuse, was excluded due to procedural errors during the data collection session, a second subject who reported both childhood and recent abuse was excluded because her written report of abuse on the demographic questionnaire failed to corroborate her initial disclosure on the prescreening

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<sup>1</sup> Note: The number of reports of abuse and the total number of subjects is not equal, as eighty-five subjects reported multiple abuse exposures, across both childhood and recently.

questionnaire, and a control subject was excluded because she was unable to finish the experiment.

Therefore, the final sample included 34 individuals; 15 of these individuals were exposed only to child abuse, 10 individuals had been exposed only to recent abuse, and nine individuals had been exposed to abuse both in childhood and recently. The control group included 46 individuals who were similar to those in the abuse group in terms of age and sex but who did not have abuse histories. Course credits were issued to participants in exchange for their successful participation in the study.

#### Procedure

Informed consent was obtained with a written consent form, which outlined the purpose of the study and the rights of the participants, and provided contact information in the event that they had any questions or concerns regarding the study and referral information for counseling services. A copy of the consent form was provided to the participants to take with them. After consent was obtained, the AMT was verbally administered, followed by the Cognitive Attentional Bias Task. The Cognitive Attentional Bias Task was followed by the Working Memory Task. The session was concluded with the completion of several written measures, including a measure of depressive symptoms, a measure of PTSD symptoms, a measure of anxiety symptoms, and a Demographic and Background Questionnaire that included questions about recent and childhood exposure to abuse and domestic violence. At the end of the session, a form was presented to the participants asking if they would

be willing to be contacted about a possible follow-up of this study. If the participants agreed, contact information and a signed consent for future contact were obtained.

### Measures

*Autobiographical Memory Test.* The Autobiographical Memory Test (AMT; Williams, 1986) was presented verbally, using one of two sets of cue words. This task involved presenting five positive, five negative, and five neutral cue words to the participants, one word at a time. Each cue word was printed in black, lowercase letters on a white, unlined 4" x 6" index card, and the participants randomly drew one card at a time to determine the order of cue word presentation. The subjects were given sixty seconds to initiate providing a memory in response to each of the cue words. If subjects did not provide a memory during that time period, the researcher instructed the subjects to chose the next index card and continue with the task in that way. If the subjects did provide a memory, the researcher prompted the subjects to provide more detail by asking, "Is there anything else you would like to tell me about that event?" In contrast to previous research using the AMT, in which subjects are only provided 60 seconds to recount a memory, once the subjects initiated the recounting of a memory in this study, they were given an unlimited amount of time to provide as much information as they chose to reveal about each memory. This was done because it was believed that an unlimited time frame would provide more opportunities for the inclusion of emotional language in the subjects' narratives. The subjects' responses were audio-taped for future transcribing and coding purposes.

The protocol for the AMT, as well as the two sets of cue words, are presented in Appendix A.

*Cognitive Attentional Bias Task.* This task was adapted from an attentional bias tasks used by Compas and colleagues (Boyer *et al.*, 2006) and involves subliminal and supraliminal presentation of trauma-related and neutral word pairs to assess attentional biases in response to the trauma-related stimuli. Thirty-two trauma-related words, each paired with a neutral, frequency- and length-matched household-related word, were used for the test condition. The neutral words in the test condition are all household-related, to control for the possibility of category priming affecting response speeds. Thirty-two length-matched non-categorized neutral filler word pairs were also presented, to control for a possible response bias that might have arisen if the subject developed an expectation for a trauma-related word to be presented at each trial. Thus, the word pairs consisted of trauma-neutral and neutral-neutral sets (32 of each type, 64 total), and these pairs were presented in random order.

For each trial, a fixation mark is presented in the center of the screen for 1 second, followed immediately by one of the 64 word pairs. For half of the word pairs, the presentation was subliminal, with the presentation lasting for 20 ms. For the subliminal trials, the word pair presentation was followed by a pair of length-matched nonsensical letter strings made up of consonants (e.g., GTYHC-SHFTQ), which appeared for the next 1230 ms. The other half of the word pairs were presented supraliminally, with presentation time lasting 1250 ms. For both subliminal and supraliminal trials, after the word pair disappeared a small dot probe immediately

appeared in the same position as either the upper or lower word, and participants were instructed to push one of two keyboard buttons labeled “upper” or “lower” to indicate which word they thought the dot probe replaced. During the presentation of the trauma-neutral pairs, the location (i.e., upper or lower) of the trauma words varied randomly across trials. Moreover, whether a particular word pair was presented subliminally or supraliminally also varied randomly across individuals.

Attentional bias was measured by response time, with higher scores indicated by slower response times. Two attentional bias scores were calculated for each participant, one for subliminally- presented words and one for supraliminally- presented words, based on their response times to the trauma-neutral trials. These scores were calculated by subtracting the average response time for trials in which the trauma-related word is targeted from the average response time for trials in which the neutral word is targeted (e.g.  $RT_{\text{neutral targets}} - RT_{\text{trauma-targets}}$ ). A greater tendency towards avoiding trauma-related stimuli was indicated by longer response times for trauma-target trials and shorter response times for neutral-target trials. Attentional biases away from trauma-related words corresponds with longer response times because the individual is not currently attending to the target stimuli at the time that the dot probe appears; therefore, they have to shift their attention away from the currently attended location to the dot probe, which increases the time to response. Therefore, difference scores significantly greater than 0 reflect greater attentional bias towards trauma-related stimuli, difference scores below 0 reflect attentional bias away (i.e., disengagement) from such stimuli, and scores close to 0 reflect no

attentional bias. The list of word pairs used in this task and the protocol are presented in Appendix B.

*Working Memory Task.* To measure verbal working memory, a widely-used reading span task was administered (Daneman & Carpenter, 1980). This task involves presenting sentences of increasing length to the subject, and requires the subject to read each sentence aloud and remember the last word of each sentence in the order that they read them. A working memory, or reading span, score was calculated based on the highest sentence length level that was correctly remembered. In this sample, the average working memory score across the sample was 3.09 items ( $SD = 0.77$ ); the range was between 1.5 items and 4.5 items remembered. The instructions and scoring protocol for this measure are presented in Appendix C.

*Measure of Depressive Symptoms.* To measure participants' depressive symptoms, the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) was used. Good validity has been observed on this scale when used with Caucasian, Hispanic, and African American adolescents and adults (Roberts, 1992; Roberts, Vernon, & Rhoades, 1989). Cronbach's alphas in this sample ranged from .84 to .87; they have been found to range from .84 to .90 in field studies, and re-test reliability has been found to range from .51 to .67 in two through eight week intervals (Radloff, 1977; Comstock & Helsing, 1976; Weissman, Shlomoskas, Pottenger, Prusoff, & Locke, 1977). This measure asks participants to identify ways that they felt or behaved in the past week (e.g., "In the past week, I felt that everything I did was an effort), and asks them to indicate how often this occurred on a scale of 0 (*none*

*of the time (less than 1 day)) to 3 (most or all of the time (5-7 days)).* An overall depression score was calculated as a continuous variable, with higher scores on the CES-D indicate higher levels of depressive symptoms, and a score of 15 or above seen as an indicator of clinically significant depressive symptoms (see Appendix D for the sample measure). Across the sample, the mean depressive symptomology score was 13.41 ( $SD = 8.08$ ). The range of scores was between 0 and 39, and 33 individuals (41.25%) met the clinical cutoff based on their performance on this measure. Surprisingly, preliminary analyses revealed no significant differences in depressive symptomology based on abuse status.

*Measure of Posttraumatic Stress Disorder.* The UCLA Adolescent PTSD Index (Rodriguez, Steinberg, & Pynoos, 1999) was used to assess Posttraumatic Stress Disorder symptoms. This measure has been found to have good reliability and consistency (Ellis, Lhewa, Charney, & Cabral, 2006; Roussos et al., 2005; Rodriguez, Steinberg, Saltzman, & Pynoos, 2001); for example, Roussos et al. (2005) found Cronbach's alphas in the range of 0.90, while they also found a test-retest reliability for the DSM-IV version of PTSD diagnosis to be 0.84. This measure was used to assess the subjects' levels of PTSD symptoms, based on DSM-IV criteria, by asking each subject to endorse negative events (e.g. "Being in a big earthquake that badly damaged the building you were in") that happened to them, to indicate which of these events bothers them the most now, and how they felt right after the event occurred (e.g. "Were you scared that you would die?"). Some of these questions also ask about abuse exposure, both physical and sexual. The measure then asks them to

indicate how much of the time during the past month they had certain problems (e.g. “I have dreams about what happened or other bad dreams,”) on a scale from 0 (*none*) to 4 (*most*). The questions pertain to the four criteria required for a PTSD diagnoses (experiencing of a traumatic event, re-experiencing symptoms, avoidance symptoms, and increased arousal symptoms). A dichotomous categorical variable of PTSD symptomology was created: those who do not show full PTSD symptoms (they did not experience a traumatic event and/or they met two or fewer of the criteria) and those who are likely to have full PTSD (they experienced at least one traumatic event and met all four criteria). A dichotomous variable is used in the analyses instead of a continuous variable because of the nature of the assessment; the endorsements of various questions are differentially weighted to create subscales, which then result in an overall diagnosis score. In this sample, 17 out of the 34 individuals in the abused group exhibited full PTSD symptoms, while 11 out of the 46 individuals in the control group exhibited full PTSD symptoms. A sample measure and the scoring sheet are included in Appendix E.

*Measure of Anxiety Symptoms.* The Beck Anxiety Inventory (BAI; Beck, Steer, & Brown, 1993) was used to determine subjects’ recent anxiety symptoms. This assessment was designed to measure anxiety symptoms that are unlikely to overlap with depressive symptoms, in order to differentiate between the two types of psychopathology. Cronbach’s alpha for this sample ranged from .89 to .90. The BAI has been shown to have good reliability, with all alphas exceeding 0.82, for Caucasian-American and Latino college students (Contreras, Fernandez, Malcarne,

Ingram, & Vaccarino, 2004). Jolly, Aruffo, Wherry, and Livingston (1993) also found a Cronbach's alpha of .94 in a sample of 180 inpatient adolescents. The scale consists of 21 items, each of which describes a common symptom of anxiety (e.g. "Fear of worst happening"). Subjects were instructed to rate how much they had been bothered by each symptom over the past month on a 4-point scale ranging from 0 ("none at all") to 3 ("severely – it bothered me a lot"). The items are summed to obtain a total score that can range from 0 to 63. Thus, anxiety symptoms were calculated on a continuous scale. A score greater than 36 is indicative of a likely anxiety diagnosis. Across the sample, the mean score was 10.89 ( $SD = 8.52$ ); the range of scores was between 0 and 41 in this study. A sample inventory is provided in Appendix F.

*Demographic and Background Questionnaire.* The Demographic and Background Questionnaire included questions about demographic information (e.g., participant's birth date, gender, GPA) as well as questions about childhood or recent exposure to physical abuse and domestic violence, sexual abuse, and/or emotional abuse. The questions related to abuse were adapted from the Conflict Tactics Scale (Strauss, 1986). The participants were first asked to respond to a global question about whether they had ever been exposed to child physical or sexual abuse, and a second global question asking whether they had been exposed to any kind of recent physical or sexual abuse. These global questions were then followed by specific questions assessing types and frequency of abuse exposure. The questions related to physical abuse, one asking about childhood abuse and another asking about recent

abuse, asked how often subjects had experienced the following physically abusive acts, listed in order of severity: “*slap/spank you;*” “*hit you with an object;*” “*kick/punch you;*” “*burn you;*” “*choke you;*” and “*threaten to hurt/kill you.*”

Similarly, the questions related to sexual abuse, both in childhood and recently, asked how often an individual performed a number of sexually abusive acts towards them, listed in order of severity: “*make you touch them in a sexual way;*” “*touch you in a sexual way avoiding genital contact;*” “*touch you in a sexual way including the genitals;*” and “*have sexual intercourse with you.*” Participants were also asked who the perpetrator was, and how old they were when the abuse occurred. A sample questionnaire is provided in Appendix G.

For both recent and childhood abuse exposure, a severity score (ranging from 0 to 6) was calculated for each participant based on the highest level of abuse reported, with a 0 indicating a report of no abuse, a 1 indicating reports of being pushed, shoved, slapped, or spanked, a 2 indicating reports of being hit with an object, a 3 indicating reports of being kicked or punched, a severity score of 4 indicating reports of being burned, a 5 indicating a report of being choked, and a 6 indicating the highest severity items, which included reports of being threatened with a weapon, or being sexually assaulted in any way.

Although similar questions were used during prescreening as a method of identifying participants for the trauma group, the questions in the Demographic and Background Questionnaire were used to verify their initial disclosures and to gather more information about the frequency and forms of abuse to which they were

exposed. Individuals who reported abuse on the pre-screening tool, but did not report it on the Demographic Questionnaire, were excluded from the sample. As mentioned above, one individual was excluded from the analysis on this basis.

Descriptive data on the demographic characteristics of the sample are presented in Table 1 below. Average child abuse and recent abuse severity rankings are also presented.

Table 1.

Sample Characteristics (SD in parentheses)

<u>Abuse Type</u>	<u>CA</u>	<u>RA</u>	<u>CA + RA</u>	<u>Controls</u>
Age in years	19.13 (0.92)	19.33 (1.50)	19.56 (1.24)	19.28 (0.99)
Ratio Males : Females	7 : 8	4 : 5	3 : 6	27 : 20
Mean CA severity	3.80 (1.93)	2.11 (0.93)	5.56 (0.88)	1.55 (1.00)
<u>Mean RA severity</u>	<u>0.33 (0.72)</u>	<u>5.22 (1.20)</u>	<u>5.56 (0.88)</u>	<u>0.28 (0.65)</u>

Coding of Autobiographical Memories

Autobiographical memories provided on the AMT were coded on the dimensions of specificity, length, and emotional language. For the specificity coding, each memory was coded as specific, overgeneral, or no memory. A specific code was given to a response that was autobiographical in nature and referred to an event lasting less than 24 hours. Overgeneral memories were those that referred to events that lasted longer than a day or a category of events. A code of “no memory” was given to a response that was not autobiographical in nature or was not a recollection. A specificity score was calculated for each subject, indicating the number of specific

memories they recalled in response to the 15 cue words. Similarly, an overgenerality score was also calculated, indicating the number of overgeneral memories they provided in response to the 15 cues. The length of each memory was measured by counting the number of words in each memory, and for each subject the average raw word count across generated memories was calculated.

Because the AMT procedures in this study varied from those used in previous studies, in that subjects were given unlimited time to report autobiographical memories, an additional analysis of the specificity of individuals' initial or "first responses" to each cue was conducted. First-responses were responses provided by subjects after the initial cue word prompt but before any further prompting by the research assistant. Looking only at the first segment of their memories might more closely approximate what the subjects would have provided in the typically-used 60 second window. However, the analyses revealed that the first-response specificity and overgenerality scores were related to abuse and attentional performance in the same ways as the original specificity and overgenerality scores; thus, only the original specificity and overgenerality scores were used for further analyses.

Each memory was also coded for the participants' emotional language; specifically, the numbers of explicit (e.g. *love*) and implicit (e.g. *cry*) negative and positive emotion words were calculated. Positive and negative emotion scores were calculated for each participant as a proportion of emotional words compared to the total raw word count across memories; thus, these scores indicated the density of emotional language used in their recollections. Density scores were calculated to

control for the effect of memory length on the number of emotion terms that were generated. We also coded for several other categories of internal states, including cognitive terms (e.g. “remember”) and sensation terms (“hot”). However, preliminary analyses indicated that there were no significant differences in the amount of internal states language due to abuse histories, attentional biases, or psychopathology; thus, these measures of internal states language were excluded from further analyses.

### Results

Descriptive data on the sample’s performance on the AMT are presented in Table 2. As illustrated by the means, either a specific or overgeneral memory was provided in response to the vast majority of the cue words. Also, subjects were more likely to provide specific memories than overgeneral responses across all cue types ( $t(79) = 7.19, p < 0.0001$ ). Finally, it is apparent from the means that the subjects provided fairly extensive memory narratives on this task, as indicated by the average word counts.

Table 2.

#### Overall Performance on the AMT by Cue Type (*SD* in parentheses)

Cue Type	Positive Cues	Negative Cues	Neutral Cues	All Cues
# Total Mem	4.50 (0.81)	4.33 (0.96)	4.73 (0.57)	13.78 (1.76)
# Specific Mem	3.14 (1.40)	2.86 (1.55)	3.28 (1.22)	9.43 (3.52)
# Overgen Mem	1.36 (1.20)	1.46 (1.40)	1.45 (1.18)	4.35 (3.02)
Mem Length	493.69 (127.41)	500.95 (133.03)	487.06 (111.37)	493.90 (120.53)

To examine the interrelations between the AMT performance variables, correlational analyses were performed and the results are summarized in Table 3. These analyses indicated that the total number of memories produced was positively related to the number of specific memories produced, but was unrelated to the number of overgeneral memories produced. Thus, it was an increase in the number of specific memories, not overgeneral memories, that was related to an increase in total memory production. Furthermore, memory length was also associated with more specificity and greater densities of both positive and negative emotions.

Table 3.

Correlations among Memory Performance Indicators

Memory Measure	1	2	3	4	5	6
1. Total # Mem	---					
2. # Specific Mem	.52****	---				
3. # OG Mem	-.02	-.87****	---			
4. Memory Length	.11	.25*	-.22*	---		
5. Positive Emotions	.13	.16	-.11	.57****	---	
6. Negative Emotions	.33**	.28*	-.13	.59****	.69****	---

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ , \*\*\*\* $p < 0.0001$

Further analyses of autobiographical memory performance examined four major research questions, outlined below. Preliminary analyses indicated that age did not contribute significantly to any of the models, which is not surprising given the

lack of variability in subjects' ages due to our recruiting protocol. Thus, age was not included in the analyses discussed below. Similarly, preliminary models included anxiety, in particular because past work has found a relationship between attentional patterns and anxiety symptoms. However, anxiety symptoms were not related to any of the measures of memory or attentional bias in this study, and were therefore removed from the final models.

Research Question 1: Is a history of trauma, either recent or in childhood, related to performance on the AMT?

The first analytic phase was designed to determine whether the measures of memory performance varied as a function of child abuse and recent abuse history, controlling for gender, memory length, working memory abilities, depressive symptoms, and PTSD. To address this question, separate GLMs were conducted predicting the following measures of performance on the AMT: number of specific memories, number of overgeneral memories, density of positive emotional language, and density of negative emotional language. The number of specific memories and the number of overgeneral memories were both assessed; because some responses were coded as "no memory" due to omissions or the provision of non-autobiographical narratives, overgenerality and specificity scores are not merely inverse of each other, but are distinct outcome measures.

A repeated measures approach was used to test for the effects of cue-type (positive, negative and neutral), a within-subjects variable. The between-subjects predictors in each analysis were child abuse history, recent abuse history, and the

interaction between the two types of abuse. Each model also controlled for any other demographic and control variables identified by the preliminary analyses, and these additional control variables are listed in the descriptions of the individual models themselves. Any interactions with cue type were followed up by examination of univariate analyses.

#### Trauma History and Specific Memory Production

The repeated measures GLM predicting specific memory production included the predictors discussed above, and also included the covariate of working memory because preliminary analyses indicated that working memory scores were correlated with memory specificity scores. The analysis indicated a significant interaction between cue type and recent abuse exposure,  $F(2, 144) = 4.17, p = 0.0174$ . But, the univariate analyses indicated that recent abuse exposure was not a statistically significant predictor of specific memories for any of the three cue types; the interaction between recent abuse exposure and cue type appears to be driven by the variation in the direction of the parameter estimates for recent abuse across the three cue types. The regression coefficient was positive for positive cues, ( $p = 0.1066, \beta = 0.43$ ), but negative for negative cues ( $p = 0.4500, \beta = -0.21$ ) and neutral cues ( $p = 0.3100, \beta = -0.26$ ). There was also a main effect of working memory performance,  $F(1, 72) = 4.88, p = 0.0303, \beta = 0.20$ , which was qualified by a significant interaction between working memory and cue type,  $F(2, 144) = 3.07, p = 0.0493$ . Univariate analyses revealed that individuals with greater working memory capacity produced more specific memories in response to positive cues,  $F(1, 72) = 4.04, p = 0.0483, \beta =$

0.22, and neutral cues,  $F(1, 72) = 9.08, p = 0.0036, \beta = 0.32$ ; however, there were no significant effects of working memory on specific memory in response to negative cues.

There was also a significant main effect of gender on specific memory production,  $F(1, 72) = 7.24, p = 0.0088$ , such that females produced more specific memories than males in response to all cue types ( $\beta_{\text{female}} = 0.47$ ). There were no other significant main effects or interactions in this model.<sup>2</sup>

#### Trauma History and Overgeneral Memory Production

The repeated measures GLM predicting the number of overgeneral memories indicated a significant interaction between recent abuse and cue type,  $F(2, 144) = 4.63, p = 0.0113$ . As with the analyses assessing specific memory production, this significant interaction appears to be attributable to the change across cue types in the direction of the effects of recent abuse, not in the strength in the effects themselves. The parameter estimates associated with recent abuse exposure were positive for negative cues ( $p = 0.0941, \beta = 0.47$ ) and neutral cues ( $p = 0.2010, \beta = 0.35$ ), but negative for positive cues ( $p = 0.1476, \beta = -0.39$ ). There were no other significant interactions involving cue type.

As in the repeated measures model predicting specific memories, there was a main effect of gender,  $F(1, 72) = 8.13, p = 0.0057$ , such that males generated more

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<sup>2</sup> To determine whether the effects on memory specificity were attributable to PTSD and depressive symptoms instead of abuse exposure, supplementary analyses were conducted with psychopathological symptoms removed from the model. However, there were no significant differences in the results when PTSD and depressive symptoms were omitted from the analysis, thus suggesting that psychopathology was not driving these relationships.

overgeneral memories across cues ( $\beta_{\text{female}} = -0.47$ ). Thus, while males generated fewer specific memories, this is because they were generating more overgeneral memories. There was also a main effect of depressive symptoms on overgeneral memory production across cues that did not quite reach significance,  $F(1, 72) = 3.85$ ,  $p = 0.0536$ ; those with more depressive symptoms generated more overgeneral memories across cues ( $\beta = 0.17$ ).<sup>3</sup> Finally, there was a marginally significant main effect of memory length on overgeneral memory production,  $F(1, 72) = 3.65$ ,  $p = 0.0599$ , such that shorter memories were associated with more overgeneral memories ( $\beta = -0.17$ ). There were no other significant main effects.<sup>4</sup>

#### Trauma History and Emotional Language

The last set of models assessed the relation between abuse history and the density of emotional language in the sample's autobiographical memory narratives. The density of positive emotions produced in response to each of the three types of cues and the density of negative emotions produced in the three types of cues were measured as two separate variables. Emotional language density produced by the sample is outlined as a function of cue type in Table 4, below. These values are presented as proportions. As can be observed by the values in Table 4, the overall density of emotional language was quite low.

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<sup>3</sup> Note: When depression is treated as a dichotomized variable based on the clinical cut-off, being above the clinical cut-off for depression is significantly related to more overgeneral memory production ( $F(1, 72) = 5.70$ ,  $p = 0.0196$ ).

<sup>4</sup> To determine whether the effects on overgeneral memory were attributable to PTSD and depressive symptoms instead of abuse exposure, supplementary analyses were conducted with psychopathological symptoms removed from the model. However, as was seen in the supplementary analyses of specificity, there was no difference in the results when PTSD and depressive symptoms were not included in the analysis, thus suggesting that psychopathology was not driving these relationships.

Table 4.

Proportions of Positive and Negative Emotional Language, as a Function of Cue Type

<u>Sample Statistics</u>	Mean	Standard Deviation	<u>Range</u>	
			Minimum	Maximum
Positive Emotions				
All Cues	0.006	0.003	0.001	.015
Positive Cues	0.010	0.005	0.002	.022
Negative Cues	0.004	0.003	0.000	.012
Neutral Cues	0.005	0.003	0.001	.014
% Negative Emotions				
All Cues	0.004	0.002	0.000	.014
Positive Cues	0.002	0.002	0.000	.012
Negative Cues	0.008	0.004	0.000	.022
Neutral Cues	0.002	0.002	0.000	.008

To examine whether there were differences in emotional language based on abuse exposure, two repeated measures were conducted, one predicting positive emotional language density and the second predicting negative emotional language density. There were no significant interactions between cue type and any of the between-subjects predictors in the model. The analyses indicated a main effect of recent abuse,  $F(1, 74) = 4.82, p = 0.0313, \beta = -0.52$ ; individuals with recent abuse histories generated fewer positive emotions across cues. However, there was no

effect of child abuse on positive emotion expression, and there were no other significant interactions or main effects in the model.

In contrast to the analysis of positive emotions, the repeated measures GLM predicting negative emotions revealed no significant relationships between abuse history and negative emotion production on the AMT. There were no interactions between cue type and the other predictor variables, and the only main effect was of depressive symptoms,  $F(1, 74) = 4.37, p = 0.0401, \beta = 0.19$ ; individuals with more depressive symptoms produced more negative emotions across cues.

Because past work by Greenhoot and colleagues (Greenhoot et al., 2005) has indicated that the effects of abuse on emotional language might be specific to memories related to conflict, supplementary analyses looked at whether abuse predicted emotions only for the cues related to conflict (i.e., argue, conflict, shouting, punishment). In regard to positive emotions, these analyses revealed that there were still a main effect of recent abuse on positive emotional language,  $F(1, 74) = 4.82, p = 0.0313, \beta = -.52$ . There were no other significant relationships in the model predicting positive emotions. In the model predicting negative emotions in response to conflict-related cues, the model was almost identical to the findings when all cues are assessed. There were no significant interactions between cue type and the variables of interest, and the only main effect was again that of depression,  $F(1, 74) = 4.37, p = 0.0401, \beta = 0.19$ . Individuals with more depressive symptoms generated more negative emotions in response to conflict-related cues; these findings mimic the results of the model when all cues are analyzed. Therefore, there were no changes in

the results when only conflict-related cues are assessed compared to analyzing performance on all cues.

Research Question 2: How does trauma relate to attentional biases?

Attentional bias scores in response to conscious and subconscious stimuli are presented below, in Table 5. Negative scores indicate disengagement from trauma-related words, while positive scores indicate attentional biases towards trauma-related stimuli. As can be seen, on average there are no attentional biases; in other words, the mean subliminal and supraliminal attentional bias scores did not significantly differ from 0. However, there is considerable variation in these response patterns, with some subjects showing trends of engagement while others showed trends of disengagement.

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Table 5.

Attentional Bias Response Times

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<u>Sample Statistics</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Range</u>	
			<u>Minimum</u>	<u>Maximum</u>
Difference Scores				
Subliminal	1.45	89.13	-168.88	317.38
Supraliminal	0.97	90.83	-418.38	317.50

---

Preliminary analyses focused on determining whether there were relations between subliminal and supraliminal attentional biases. Correlational analyses indicated there was no significant relationship between subliminal and supraliminal

biases ( $r = -.149$ ,  $p = 0.1873$ ), thus indicating that these biases are independent performance measures.

#### Trauma and Attentional Biases

Two repeated measures GLMs were used to assess whether there were differences in these attentional bias scores based on abuse history, with one GLM predicting subliminal attentional biases and another predicting supraliminal attentional biases. Each GLM included the between-subject predictor variables of child abuse, recent abuse, and working memory capacity. Working memory was controlled for in these GLMs because these scores were correlated with attentional bias scores in preliminary analyses. The interaction between child abuse and recent abuse was initially included in these analyses, but this interaction was not significant and was therefore removed from the final analyses.

The GLM predicting subliminal attentional bias revealed a significant effect of child abuse exposure,  $F(1,76) = 5.31$ ,  $p = 0.0240$ ,  $\beta = 0.57$ , such that individuals with a history of child abuse showed a greater subliminal or unconscious bias towards the trauma-related words than those individuals without a history of child abuse (see Figure 1). T-tests within these two groups were conducted to determine whether subliminal attentional bias patterns in either group significantly differed from zero. The individuals with no abuse exposure did not exhibit a significant subliminal attentional bias,  $t(56) = 0.96$ ,  $p = 0.3427$ . However, the individuals with child abuse exposure exhibited a significant subliminal attentional bias,  $t(24) = -2.69$ ,  $p = 0.0132$ , towards the trauma-related stimuli. Also, the GLM predicting subliminal attentional

biases revealed that there were no effects of recent abuse history or working memory capacity.

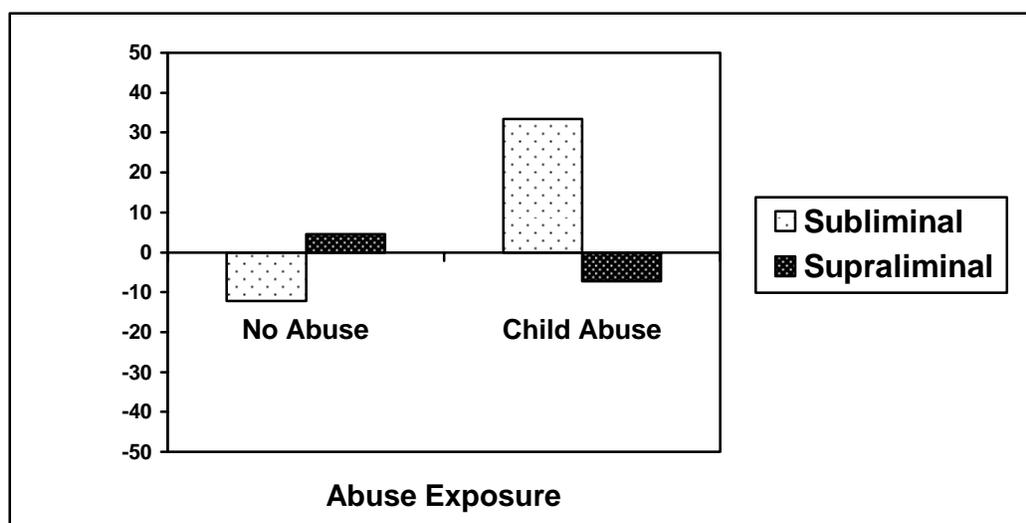


Figure 1. Subliminal and supraliminal attentional biases in individuals without child abuse exposure ( $n = 56$ ) and with child abuse exposure ( $n = 24$ ).

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Furthermore, using t-tests to determine whether there were any significant attentional biases based on child abuse exposure for the supraliminal condition, these analyses revealed that neither individuals with child abuse exposure nor individuals with no child abuse exposure, showed any significant conscious attentional biases, .

Research Question 3: Does unconscious or conscious attentional patterns explain trauma-related memory patterns?

Repeated measures GLMs were used to determine whether attentional bias patterns predicted performance on the Autobiographical Memory Test above and beyond the models conducted to assess Research Question 1. Thus, the models

conducted to assess Research Question 1 were each tested a second time with attentional bias scores included as additional between-subject predictors. Initial analyses included both the interaction between child and recent abuse, as well as the interaction between the two attentional bias scores. However, as both of these interactions were non-significant predictors of all memory measures, they were removed from further analyses. Significant interactions involving cue type were followed up by examination of the univariate tests predicting responses to each type of cue.

#### Specific Memories and Attentional Bias Patterns

The repeated measures GLM of the number of specific memories indicated that when attentional biases were added to the model, there were no significant interactions between cue type and attentional patterns. However, there was a marginally significant main effect of subliminal attentional bias across cues,  $F(1, 70) = 3.44, p = 0.0677$ ; individuals who were more subliminally engaged, or biased towards trauma-related words, generated more specific memories across cues ( $\beta = 0.17$ ). There was no effect of supraliminal attentional biases on specific memory production.

The rest of the significant relationships in this model mirror the results of the analyses conducted for Research Question 1. There was still a significant interaction between cue type and recent abuse exposure,  $F(2, 140) = 3.85, p = 0.0235$ ; again, this interaction appears to be driven by the change in the direction of the effects. The parameter estimates for positive cues was positive ( $p = 0.0949, \beta = 0.44$ ), while the

parameter estimates for negative cues ( $p = 0.4869$ ,  $\beta = -0.19$ ) and neutral cues ( $p = 0.3965$ ,  $\beta = -0.22$ ) were in the opposite direction. There was also a marginally significant main effect of working memory on the number of specific memories that were produced,  $F(1, 70) = 3.66$ ,  $p = 0.0600$ ; however, this main effect was qualified by a marginally significant interaction between working memory and cue type,  $F(2, 140) = 2.98$ ,  $p = 0.0544$ . The univariate analyses indicate the same patterns as was observed in the analyses of Research Question 1: Individuals with greater working memory capacities produced more specific memories in response to positive cues,  $F(1, 70) = 2.80$ ,  $p = 0.0988$ ,  $\beta = 0.18$ , and, in particular, neutral cues,  $F(1, 70) = 7.94$ ,  $p = 0.0063$ ,  $\beta = 0.30$ , but working memory abilities did not predict specific memory production in response to negative cues. There were no other significant interactions with cue type. As reported in response to Research Question 1, females produced more specific memories than males,  $F(1, 70) = 5.98$ ,  $p = 0.0170$ ,  $\beta = 0.42$ . Finally, longer memory length was also associated with more specific memories across cues,  $F(1, 70) = 4.37$ ,  $p = 0.0402$ ,  $\beta = 0.20$ . There were no other significant main effects or interactions.

#### Overgeneral Memories and Attentional Bias Patterns

The repeated measures GLM predicting overgeneral memories was conducted to determine whether attentional biases were related to overgeneral memory production, and whether including these measures in the model altered any of the effects found in the analyses for Research Question 1. The analyses indicated that there was a significant main effect of subconscious attentional patterns on

overgeneral memory production,  $F(1, 70) = 4.27, p = 0.0426$ ; the across-cue regression coefficient indicated that more subliminal attention away from trauma-related stimuli, or disengagement, was related to more overgeneral memory production ( $\beta = -0.18$ ). In contrast, conscious attentional patterns were not significant predictors of overgeneral memory production.

The other relationships in the model were almost identical to those observed in the first research question. There was still a significant interaction between cue type and recent abuse,  $F(2, 140) = 4.21, p = 0.0168$ . However, the univariate analyses indicated that recent abuse exposure was not a statistically significant predictor of overgeneral memories for any cue type; the interaction between recent abuse exposure and cue type appears to be mostly driven by the variation between cue types in the direction of the parameter estimates for recent abuse predicting overgeneral memories in response to negative cues ( $\beta = 0.43, p = 0.1242$ ), positive cues ( $\beta = -0.41, p = 0.1355$ ), and neutral cues ( $\beta = 0.29, p = 0.2830$ ). The analysis revealed no other significant effects of cue type or interactions between cue type and the other predictor variables.

As in the analyses that were conducted to answer the first research question, males generated more overgeneral memories than females,  $F(1, 70) = 7.12, p = 0.0095, \beta = -0.44$ , across cues and there was also still a significant main effect of memory length on overgeneral memory production,  $F(1, 70) = 5.37, p = 0.0235, \beta = -0.21$ . Finally, the effect of depressive symptoms on overgeneral memory production remained,  $F(1, 70) = 4.05, p = 0.0481$ ; individuals with more depressive symptoms

generated more overgeneral memories across cues ( $\beta = 0.17$ ). There were no other significant effects.

#### Emotional Language and Attentional Bias Patterns

When attentional bias measures are added to the model predicting positive emotional language, it does not significantly impact the model. In fact, the results were almost identical to the model that did not include the attentional difference scores, analyzed under Research Question 1, and subjects' performance on the Cognitive Attentional Bias Task did not relate to emotional language production. The repeated measures GLM predicting positive emotions revealed no significant effects of cue type or interactions between cue type and the other predictor variables. There was still a significant main effect of recent abuse on positive emotional language across cues,  $F(1, 72) = 5.09, p = 0.0271$ ; individuals with recent abuse histories used fewer positive emotions across cues ( $\beta = -0.54$ ). Attentional bias patterns and child abuse history were not significantly related to positive emotion generation, and there were other significant relationships in this analysis.

The repeated measures GLM of negative emotional language indicated no significant effect of cue type or interactions between cue type and the other predictor variables. There was still a significant main effect of depressive symptoms,  $F(1, 72) = 4.77, p = 0.0322$ , such that individuals with more depressive symptoms used more negative emotions across cues ( $\beta = 0.21$ ). There were no other significant effects.

To summarize the findings thus far, the analyses for Research Question 3 showed that the inclusion of attentional bias patterns did not change many of the

relationships that were observed in the analyses conducted for Research Question 1. Moreover, only subliminal biases were related to memory performance; subconscious disengagement away from trauma-related stimuli was related to more overgenerality and less specificity. The only effects of abuse on memory performance had to do with emotional language usage, such that individuals with recent abuse used less positive emotional language. There were also differences in subliminal attentional patterns according to abuse exposure, with child abuse victims exhibiting a significant subconscious bias toward the processing of trauma-related stimuli.

While the first three research questions examined whether abuse and attentional patterns were related to autobiographical memory functioning, the final research question had to do with determining whether these variables were related to psychopathological outcomes, in an attempt to assess how these variables may contribute to mental health. These analyses focused on depressive symptoms as the measure of psychopathology, because preliminary analyses revealed that anxiety symptoms were not related to any of the variables of interest in this study (i.e., memory, attentional bias, or abuse history). Although depressive symptoms were used as a control variable in the analyses of Research Questions 1, 2, and 3, these symptoms are used as an outcome variable in these analyses based on theoretical premises, as discussed in the Introduction.

Research Question 4: Are memory problems and measures of disengagement associated with psychopathology?

Because of sample-size related limitations to the number of predictors that could be included in any model, two GLMs predicting depressive symptoms were used to answer this research question: one predicting depressive symptoms from memory performance (i.e. number of specific memories, number of overgeneral memories, positive emotional language density, and negative emotional language density), and the second model predicting depressive symptoms from attentional measures (i.e. subliminal attentional biases, supraliminal attentional biases, and the interaction between the two attentional biases). Both GLMs included the between-subjects predictor variables of child abuse, recent abuse, the interaction between child abuse and recent abuse, memory length, gender, and PTSD symptoms. Preliminary analyses indicated that the interaction between child abuse and recent abuse was not significant for either model; therefore, this interaction was removed from the final models.

#### Memory Performance, Abuse, and Depression

The GLM predicting depressive symptoms from memory performance and abuse status revealed significant effects of positive emotional language,  $F(1, 70) = 4.46, p = 0.0383, \beta = -0.37$ , and negative emotional language,  $F(1, 70) = 4.09, p = 0.0470, \beta = 0.36$ . Therefore, individuals who used more negative emotional language and less positive emotional language in their narratives exhibited more depressive

symptoms. However, there were no effects of abuse on depressive symptoms, and there were no other significant effects in the model.

#### Attentional Biases, Abuse, and Depression

The GLM predicting depression from attentional biases and abuse status revealed a marginally significant main effect of supraliminal attentional biases,  $F(1, 72) = 3.82, p = 0.0546, \beta = 0.24$ ; however, this main effect was qualified by a marginally significant two-way interaction between subliminal and supraliminal attentional bias patterns,  $F(1, 72) = 3.17, p = 0.0792, \beta = 0.16$ . To explore the nature of this interaction, the parameter estimates from this model were used to plot estimated CESD scores corresponding with high and low supraliminal attentional bias scores (i.e., conscious engagement and disengagement) and high and low subliminal attentional bias scores (i.e., unconscious engagement and disengagement). These estimated scores are shown in Figure 2.

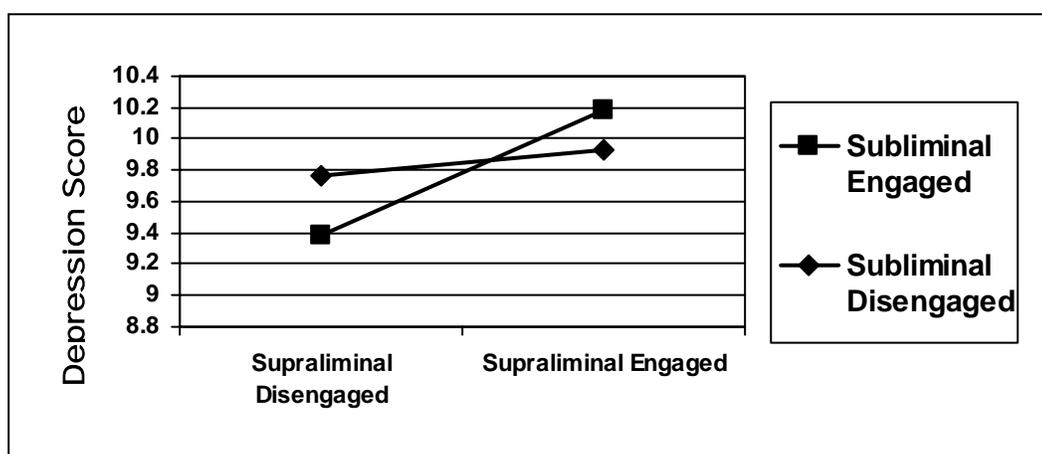


Figure 2. Estimated depressive symptoms scores based on attentional biases.

As illustrated in the figure above, the highest level of depressive symptoms was observed when individuals were attentionally biased towards trauma at both the conscious and subconscious level. Conversely, the lowest number of depressive symptoms is observed in individuals who are subconsciously engaged with trauma while consciously disengaging from trauma. Overall, it appears that conscious engagement is related to more depressive symptom compared to conscious disengagement. However, subconscious engagement seems to intensify these patterns. There were no other significant effects in the model.

### Discussion

Overall, this study provides some further insight into the relationships between memory specificity, attentional biases, and depression in an abused population. Firstly, we were interested in whether we were able to replicate past findings of the relationships between abuse, memory specificity, and emotional language. It was predicted that poorer specificity and lower emotional language density (positive and negative) would be observed in the recollections of individuals exposed to abuse. The results indicated that the only dimension of autobiographical memory that was related to abuse was positive emotional language. Specifically, recent abuse was related to less positive emotional language, but was unrelated to negative emotional language. This is discrepant with other work which has shown more global effects of abuse on emotional language content (Peterson & Biggs, 1998; Greenhoot, Johnson, & McCloskey, 2005).

Because of the fact that these differences in emotional language based on abuse exposure are observed only for positive emotions, it is unlikely to be an indication of avoidant processes used to control negative affect. If avoidant mechanisms were indeed the underlying reason for emotional language deficits in abused persons, then one would expect deficits in both positive and negative emotional language densities, or in negative emotional language alone, which was not observed in our sample. However, there are several alternative explanations for the relationship between recent abuse and low levels of positive emotional language. It is feasible that this pattern is an effect of mood congruency on the affective qualities of recall, such that recently abused persons may have been in a less-positive mood at the time of the assessment. Consistent with this claim is the finding that increased levels of current depressive symptoms were associated with more negative emotional language. As the CES-D is a measure of current and recent depressive symptoms, it is not surprising that individuals with higher levels of recent depressive symptoms produced more negative emotions, as would be expected if these results are attributable to mood-congruency effects.

A related potential explanation for lower positive emotional language usage in recently abused persons' narratives is simply that they may have had fewer positive recent experiences than other individuals, and therefore recalled fewer such experiences in response to the fifteen cue words, compared to individuals without recent abuse histories. Similarly, even if there were not differences in the number of positive events that were remembered, these subjects' appraisals of their experiences

may have been less positive than others' experiences, and therefore consisted of less positive emotional content.

Finally, it is possible these results differed from past findings because of the nature of the autobiographical memory task that was used. In the current study, subjects were allowed an unlimited amount of time on the AMT to provide their autobiographical narratives. Conversely, the traditional AMT imposes a 60-second time limit for each cue. Thus, it is possible that abused individuals may be initially less emotional in their narratives, or have fewer immediately-accessible emotions connected to their memories than other individuals. But with an unlimited time period, they could have become more emotional throughout the recounting of their memories, thus hiding potential differences between the groups' negative emotional language usage.

Similarly, the differences in the AMT protocol used in our study may also account for the fact that we did not observe differences in memory specificity. In particular, we did not find that individuals with abuse exposure were more overgeneral, or less specific, in their autobiographical memories when compared to individuals without abuse experience, a finding that has been repeatedly observed in the literature when the traditional AMT is employed (Burnside, Startup, Byatt, Rollinson, & Hill, 2004; de Decker, Hermans, Raes, & Eelen, 2003; Kuyken & Brewin, 1995; Williams & Dritschel, 1988). Although we also assessed the first memories that subjects provided before any additional interviewer prompts were given, in an attempt to approximate what might have been produced in the traditional

procedure, subjects still had an unlimited amount of time to produce that first response. The fact that subjects in our study were not under the traditional time pressure during memory recall may create important differences in the context of recall between our protocol and the traditional AMT. Thus, it is unlikely that our analysis of subjects' first responses fully captured their memories in the same way that the traditional AMT protocol may have done. These patterns suggest that abuse-related specificity problems could be limited to certain contexts, such as when restrictions are placed upon recall conditions. For example, it is posited by Williams *et al.* (2007) that when individuals engage in a memory search, they may truncate the memory search early and remain at the overgeneral level of their memory. Williams and others hypothesize that traumatized individuals truncate their memories because the more specific memory might elicit painful emotional information upon which they could then ruminate. If the differences in specificity that are normally observed in abused populations are indeed due to the fact that they have difficulty accessing specific memories and instead truncate their memory search at the overgeneral level, then the unlimited time window for memory generation may have masked differences in their memory function. The abused individuals may have initially reacted by truncating their search; however, with the lack of time pressure, along with the prompt from the interviewer to provide more information, they may have been able to overcome this tendency and recall a specific memory.

If the differences between memory performance in our study and previous studies using the traditional AMT are attributable to differences in protocol, then our

study challenges the generalizability of the finding of low specificity in traumatized persons. Furthermore, this author would argue that a 60-second time limit for the recall of an autobiographical memory is quite artificial; the provision of an unrestricted context seems to much more closely resemble the day-to-day production of autobiographical memories. Thus, future work should investigate the conditions under which memory specificity may be affected by abuse experience, and to what extent the relationships between abuse and memory specificity extend beyond the traditional AMT protocol.

However, while it is possible that the lack of differences memory specificity are attributable to differences in AMT procedures, another explanation that might account for the lack of differences in abuse-related memory specificity is that these memory dysfunctions are not attributable merely to abuse experience itself. Instead, it is possible that overgeneral memory production is due to a combination of trauma or abuse exposure and other factors, such as broader emotion regulation tendencies or cognitive factors such as attentional biases and working memory capacity. In other words, abuse may result in memory problems only when experienced in combination with these other types of vulnerabilities (Moore & Zoellner, 2007). Some of the patterns observed in this study, however, argue against this hypothesis; specifically, the interactions between working memory performance and type of abuse status were not significant in the prediction of memory specificity, nor were the interactions between types of abuse exposure and attentional biases. Nevertheless, there could still be other personal characteristics or experiences that combine with abuse

exposure to increase memory problems. Thus, future work should further explore this hypothesis.

While we did not find evidence for the interaction between attentional mechanisms and abuse contributing to memory specificity, we did find that subliminal attentional patterns were associated with abuse histories in our sample, such that individuals with child abuse were subconsciously biased towards trauma-related words. This subconscious attentional engagement with trauma in abused persons is suggestive of a hypersensitivity to trauma. There is evidence in the literature on abuse and domestic violence that it can result in hypersensitive physiological reactions (Saltzman, Holden, & Holahan, 2005; Koopman, Carrion, Butler, Sudhakar, Palmer, & Steiner, 2004). Thus, it would be interesting to know whether subconscious attentional engagement is also associated with hypersensitive physiological reactions to trauma-related stimuli, as this type of responding could contribute to an attentional bias towards trauma. Thus, future work should investigate how attentional patterns and physiological measures may relate to abuse status and possibly contribute to memory performance.

Although child abuse predicted greater subconscious attentional engagement with trauma words, this attentional bias, in turn, was actually related to greater memory specificity and less overgeneral memory production. This pattern is surprising because of the previously established links between child abuse and poor memory specificity. Of course, in this study there was no direct link between child abuse history and measures of memory specificity. The association between

subconscious engagement and memory specificity suggests that lack of specificity in autobiographical narratives may reflect an automatic avoidance of negative stimuli, as opposed to a conscious, strategic attempt at regulating negative affect as has been frequently proposed in the literature (Raes, Hermans, Williams, & Eelen, 2006; Williams, 1996). Thus, future work should further explore the relationships between attentional biases and memory performance.

Furthermore, it would be interesting to know whether attentional bias patterns actually related to measures of emotion-regulation processes in an abused population. Several of the studies that have found links between conscious disengagement and psychopathology have used self report measures of emotion regulation such as the Responses to Stress Questionnaire (e.g., Compas *et al.*, 2006). Compas and his colleagues suggest that performance on the CABT is an indication of the more global voluntary and involuntary emotion regulation processes assessed on the self-report measure, but only recently has the relationship between experimental measures of attentional biases and self-report measures of emotion regulation been examined jointly (Glinder, Beckjord, Kaiser, & Compas, 2007). Glinder *et al.* (2007) found that conscious attention towards cancer-related words in a population of breast-cancer patients was related self-reported higher levels of engagement coping, thus suggesting that self-report and experimental measures are assessing similar processes. Nonetheless, more work is needed to explore whether attentional biases are related to more global coping behaviors in other populations.

Along with the examination of attention's possible role in memory functioning, another goal of this study was to determine whether memory deficits were specific to autobiographical memory or whether these deficits were related to more general cognitive dysfunction. Although working memory function was related to memory specificity, the fact that we did not find differences in memory specificity based on abuse history limits our abilities to evaluate the role of working memory in abuse-related memory problems. Thus, it is still unclear whether working memory may account for these trends observed in prior studies.

Additionally, we were interested in examining the relationship between abuse, attentional biases, and depressive symptoms, to determine whether memory or attentional mechanisms predicted psychopathological outcomes. In terms of emotional language, we found that a dearth of positive emotional language in one's narratives was related to poorer outcomes, which is consistent with past arguments in the literature that emotional disclosure is an adaptive pattern (Pennebaker, Mayne, & Francis, 1997; Petrie, Booth, & Pennebaker, 1998; Smyth, 1998). However, because emotional language and depressive symptoms were measured concurrently, it is not clear whether depressive symptoms create a mood congruency effect, resulting in less positive emotional language, or if a lack of positive emotional content in one's memories causes an individual to be more vulnerable to depression.

In terms of attentional biases and depressive symptoms, we found that conscious engagement with trauma-related stimuli was related to higher depressive symptoms, particularly when coupled with subconscious engagement, whereas

conscious avoidance coupled with subconscious engagement was related to lower depressive symptoms. This finding is discrepant from the predicted pattern outlined by Epping-Jordan, Compas, & Howell (1994) and others, which argues that both conscious engagement and subconscious disengagement should be related to better long-term outcomes. However, it is possible that the difference in findings is attributable to the time frame of the outcome that was assessed. In the current study, attentional biases and psychopathology were measured concurrently, and it may be that in the short-term, consciously avoiding traumatic stimuli is a beneficial pattern for mental health, in that it does prevent the re-activation of negative emotional responses. Thus, conscious disengagement may actually decrease depressive symptoms in the short term. However, over a longer period of time, this conscious avoidance could become maladaptive, because of the inability to use past experiences during problem-solving or social interactions. Therefore, it would be interesting to examine the relationship between current attentional bias patterns and future mental health function in a longitudinal study.

Finally, our study also sought to extend the literature by accounting for PTSD symptomology in memory functioning, as past work has indicated relationships between memory function and PTSD symptoms, but this research has not thoroughly accounted for the possible effects of PTSD on memory performance. In our study, we did not find abuse-related differences in memory specificity when we controlled for PTSD, and were therefore unable to examine PTSD's potential role in producing abuse-related memory deficits. However, it should also be noted that we did not

observe significant abuse-related effects on memory specificity even when PTSD was not included in the model. Therefore, future work is still needed to investigate whether trauma-related memory patterns could be due to trauma-related psychopathology rather than the trauma itself.

On a final note, it was interesting that memory specificity, but *not* emotional language production, was found to be related to attentional bias patterns. These discrepant patterns suggest that differential mechanism may underlie memory and emotional language production in an abused sample. Thus, future work should further examine the role of attentional biases in both of these arenas.

### Conclusions

One major contribution of this study is that reduced autobiographical memory specificity may not be due to a conscious emotion regulation strategy to blunt negative affect, as has been suggested repeatedly in the literature. Instead, this work suggests that overgeneral memory production may be attributable to more automatic emotion regulation processes. Secondly, our results suggest that the prevalence of trauma-related memory problems may be dependent on the task context, and future work should examine the generalizability of abuse-related memory dysfunctions beyond the traditional AMT protocol. Finally, this study adds to the mounting evidence that emotion expression in one's personal recollections is related to psychological well-being.

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## Appendix A: Autobiographical Memory Task

The instructions for this assessment are as follows: *“For each cue word, you have one minute to describe a memory of an event that happened to you which the word reminds you of. The event could have happened recently (yesterday, last week) or a long time ago. It might be an important event, or a trivial event. The memory you recall should be of a specific event. Please be sure to tell me your approximate age at the time of the event.”* The participant should then be provided with examples of appropriate and inappropriate responses before the task begins.

*“So, an example of a specific event in response to the word playing could be, ‘One time when I was about 8 years old, I was playing baseball at the park. My friend Jane hit the ball so hard it went across the street. A kid named Bobby ran after the ball and almost got hit by a car’*

*An example of a response to the word playing that is not specific enough is: ‘When I was a kid, we always used to play baseball at the park. Or, my friend always hit the ball across the street.’*

Next, present the set of 15 cards to the participant face-down and ask him or her to select one. Read the word on the card and ask the participant to generate a specific memory related to that word. The participant should be given sixty seconds in which to begin describing the memory. If they do not provide a memory in response to the cue after sixty seconds, ask the participant to pick the next card and repeat the above procedures. If the subject does provide a memory to the cue word, allow the participant unlimited time to provide their memory. After the subject has stopped recounting their memory, prompt them with, “Is there anything else you would like to tell me about that event?” Again, allow the participant an unlimited amount of time to provide their memory. A maximum of one prompt will be provided for each cue word.

When the subject has finished telling you about their memory, ask the participant to pick the next card and repeat above procedures.

The cue words are as follows:

Set 1 Negative Cues:

1. stress
2. argue
3. punishment
4. conflict
5. frustrate

Set 1 Positive Cues:

1. peace

2. comfort
3. humor
4. joy
5. wedding

Set 1 Neutral Cues:

1. tape
2. shoes
3. fish
4. sidewalk
5. journal

Set 2 Negative Cues:

1. shouting
2. burden
3. anxiety
4. criticism
5. tears

Set 2 Positive cues:

1. friendship
2. ease
3. smile
4. gentle
5. party

Set 2 Neutral cues:

1. light
2. statue
3. street
4. music
5. water

## Appendix B: Instructions and Words Used in the Cognitive Attentional Bias Task

Using E-Prime, 32 trauma-related-neutral and 32 neutral-neutral word pairs will be presented in the center of a computer screen, 3 cm apart from each other, and all words will be lowercase. The subject will sit 60 cm from the screen. Before the task, the subject will be instructed as follows: *You are going to participate in a test of attention. Sixty-four sets of word-pairs will appear on the computer screen in front of you. Before each trial, a plus sign will appear on the screen, and you should look at the plus sign between each trial. When the plus sign disappears from the screen, it will be replaced with a set of words. Some words will remain on the screen for a long time, and some will disappear very quickly, followed by a string of consonants. After the pair of words disappears from the screen, a dot will appear in the location where one of the two words was. When the dot appears, push the keyboard button that corresponds with the location of the dot. For example, if the word “cat” appeared in the upper portion of the screen, and the dot replaces the word “cat,” then you would push the button labeled “cat.” We’ll do four practice sets before we begin. Do you have any questions before we begin the practice sets?*

The researcher will then lead the participants through the practice sets. Once the subject has correctly performed the practice sets, the researcher will say: *Okay, do you have any questions before we begin the experiment?* Once the subject states that they don’t have any questions about the test, they will begin the experiment. The word pairs are as follows:

## A. Practice set word-pairs:

1. ours-make
2. plan-book
3. wire-milk
4. reading-lighter

## B. Abuse-related/neutral word pairs:

1. Lonesome-bungalow
2. Stitches–stairway
3. Coward-garage
4. Bullied-bathtub
5. Knife-chest
6. Teased-washer
7. Deserted-linoleum
8. Disliked-bookcase
9. Argue-phone
10. Alone-table
11. Shame-plant
12. Unbearable-belongings
13. Pain-door
14. Suffer-gutter
15. Injure-hammer
16. Puncture-backyard
17. Bloody-Mirror
18. Gash-iron
19. Wound-quilt
20. Emergency-fireplace
21. Cheat-chair
22. Hurt-yard
23. Slap-rugs
24. Burn-lamp
25. Bleed-dryer
26. Ache-gate
27. Stab-rake
28. Bruise-faucet
29. Kill-lamp
30. Stupid-rocker
31. Rape-fork
32. Unpopular-furniture

## C. Neutral-Neutral Word pairs:

1. Foreseen-blinding
2. Remnants-softness

3. Romans-peered
4. Saffron-monocle
5. Sheep-trail
6. Tokens-birdie
7. Supplies-mangrove
8. Locality-imagines
9. Verse-sites
10. Human-early
11. Sixty-noise
12. Administer-circulated
13. Fast-days
14. Bottle-chords
15. Tracts-sketch
16. Blurring-rosewood
17. Nights-finish
18. Chic-spot
19. Towns-pasta
20. Classical-predicted
21. Brace-chief
22. Vast-worn
23. Dial-feat
24. Cave-jean
25. Gloss-blots
26. Airs-Heat
27. Pall-Info
28. Extras-bistro
29. Draw-rank
30. Reduce-paling
31. Toys-guys
32. Scholarly-estimated

### Appendix C: Working Memory Task

The subject will read a series of sentences (one sentence per page) followed by a blank page. When the blank page appears, the subject is to repeat the last word of each sentence in the set in the order that they appeared. There will be three practice sets (of two sentences each) before the actual test. The actual test will begin with new sets of two sentences. There are three sets at each level (three sets of 2, 3, 4, 5, 6, and 7 sentences). The subject reads all three sets at each level of increasing length until two out of three sets at a given level are failed.

**Instructions:** *I want you to read each sentence aloud. When you see a blank page you are to recall the last word of each sentence that you just read in the order that you read them. The number of sentences you will read at any one time-so the number of words you will have to remember-will increase during the course of the test. First we will start out with two sentences at a time-so you need to try to recall 2 words.*

At this point, begin with the practice trials. Let the subject read the first sentence aloud. As soon as the subject has finished reading the sentence aloud, s/he should be instructed to immediately turn the page to the next sentence and then read it aloud. This procedure will continue until a blank page appears. At this time, the last word of each sentence should be recalled in the correct order. Mark the answer sheet for each word in the set that is recalled. Then continue with the next set repeating the procedure above. Have the subject read all three sets at a given level. The test is terminated only after a subject fails two out of three sets at a given level. The subject's score is equal to the highest level where two out of three sets are passed, with an additional .5 if the subject passes one of the three sets at the next level.

**IMPORTANT NOTE:** If all of the words in the set are recalled, but in the wrong order, mark the set OO (Out of Order).

#### Practice Sentences

Set 1:      room            house

Set 2:      bill            sirens

Set 3:      tornadoes    loyal

#### Level 2

Set 1:      note            stranded

Set 2:      silent        trouble

Set 3:      hundreds    puckered

**Level 3**

Set 1:  coat  attendance  yesterday

Set 2:  first  strange  purse

Set 3:  fast  baseball  careful

**Level 4**

Set 1:  guilty  daughter  idea  hunt

Set 2:  truth  nickered  ice  bill

Set 3:  hours  free  building  crying

**Level 5**

Set 1:  busy  silently  allowance  wilted  questions

Set 2:  ball  dress  road  before  dizzy

Set 3:  truth  arrived  lunch  night  car

**Level 6**

Set 1:  magazine  cancelled  room  danger  shelter  
 failed

Set 2:  offer  events  off  jobs  testimony  
 appointed

Set 3:  increases  speech  last  school  television  
 bottom

**Level 7**

Set 1:  restaurant  experience  football  anthem  package  
 bike  cave

Set 2:  decision  question  older  below  cold  
 vacation  angry

Set 3:  mad  program  earnest  land  phone  
 thumped  jobs

## Appendix D: CES-D

Below is a list of the ways you might have felt or behaved. Please tell me how often you have felt this way *during the past week*.

	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I did not feel like eating; my appetite was poor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I felt that I could not shake off the blues even with help from my family or friends.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I felt I was just as good as other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I had trouble keeping my mind on what I was doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I felt depressed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I felt that everything I did was an effort.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I felt hopeful about the future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I thought my life had been a failure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I felt fearful.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. My sleep was restless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I was happy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I talked less than usual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. I felt lonely.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. People were unfriendly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- |                                    |                          |                          |                          |                          |
|------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 16. I enjoyed life.                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17. I had crying spells.           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18. I felt sad.                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19. I felt that people dislike me. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20. I could not get "going."       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Appendix E: PTSD Measure

Below is a list of VERY SCARY, DANGEROUS OR VIOLENT things that sometimes happen to people. These are times where someone was HURT VERY BADLY OR KILLED, or could have been. Some people have had these experiences, some people have not had these experiences. Please be honest in answering if the violent thing happened to you, or if it did not happen to you.

<b>FOR EACH QUESTION:</b>	<b>Check "Yes" if this HAPPENED TO YOU Check "No" if it DID NOT HAPPEN TO YOU</b>	
1) Being in a big earthquake that badly damaged the building you were in.	Yes [ ]	No [ ]
2) Being in another kind of <b>disaster</b> , like a fire, tornado, flood or hurricane.	Yes [ ]	No [ ]
3) Being in a bad <b>accident</b> , like a <b>very serious</b> car accident.	Yes [ ]	No [ ]
4) Being in place where a <b>war</b> was going on around you.	Yes [ ]	No [ ]
5) Being <b>hit, punched, or kicked very hard</b> at home. ( <b>DO NOT INCLUDE</b> ordinary fights between brothers & sisters).	Yes [ ]	No [ ]
6) Seeing a family member being <b>hit, punched or kicked very hard</b> at home. ( <b>DO NOT INCLUDE</b> ordinary fights between brothers & sisters).	Yes [ ]	No [ ]
7) Being <b>beaten up, shot at or threatened to be hurt badly</b> in your town.	Yes [ ]	No [ ]
8) Seeing someone in your town being <b>beaten up, shot at or killed</b> .	Yes [ ]	No [ ]
9) Seeing a <b>dead body</b> in your town (do not include funerals).	Yes [ ]	No [ ]
10) Having anyone touch your <b>private sexual body parts</b> when you did not want them to.	Yes [ ]	No [ ]
11) Hearing about the <b>violent death or serious injury</b> of a loved one.	Yes [ ]	No [ ]
12) Having <b>painful and scary medical treatment in a hospital</b> when you were very sick or badly injured.	Yes [ ]	No [ ]
13) <b>OTHER</b> than the situations described above, has <b>ANYTHING ELSE</b> ever happened to you that was <b>REALLY SCARY, DANGEROUS OR VIOLENT?</b>	Yes [ ]	No [ ]
14)		
a) If you answered "YES" to only <b>ONE</b> thing in the above list of questions #1 to #13, place the number of that thing (#1 to #13) in this blank. # _____		
b) If you answered "YES" to <b>MORE THAN ONE THING</b> , place the number of the thing that <b>BOTHERS YOU THE MOST NOW</b> in this blank. # _____		
c) About how long ago did this bad thing (your answer to [a] or [b]) happen to you? _____		
d) Please write what happened: _____ _____		



4 <sub>D2</sub> I feel grouchy, angry or mad.					
5 <sub>B2</sub> I have dreams about what happened or other bad dreams.	0	1	2	3	4
6 <sub>B3</sub> I feel like I am back at the time when the bad thing happened, living through it again.	0	1	2	3	4
7 <sub>C4</sub> I feel like staying by myself and not being with my friends.	0	1	2	3	4

<b>HOW MUCH OF THE TIME DURING THE PAST MONTH</b>	<b>None</b>	<b>Little</b>	<b>Some</b>	<b>Much</b>	<b>Most</b>
8 <sub>C5</sub> I feel alone inside and not close to other people.	0	1	2	3	4
9 <sub>C1</sub> I try not to talk about, think about, or have feelings about what happened.	0	1	2	3	4
10 <sub>C6</sub> I have trouble feeling happiness or love.	0	1	2	3	4
11 <sub>C6</sub> I have trouble feeling sadness or anger.	0	1	2	3	4
12 <sub>D5</sub> I feel jumpy or startle easily, like when I hear a loud noise or when something surprises me.	0	1	2	3	4
13 <sub>D1</sub> I have trouble going to sleep or I wake up often during the night.	0	1	2	3	4
14 <sub>AF</sub> I think that some part of what happened is my fault.	0	1	2	3	4
15 <sub>C3</sub> I have trouble remembering important parts of what happened.	0	1	2	3	4
16 <sub>D3</sub> I have trouble concentrating or paying attention.	0	1	2	3	4
17 <sub>C2</sub> I try to stay away from people, places, or things that make me remember what happened.	0	1	2	3	4
18 <sub>B5</sub> When something reminds me of what happened, I have strong feelings in my body, like my heart beats fast, my head aches, or my stomach	0	1	2	3	4

aches.					
19 <sub>C7</sub> I think that I will not live a long life.	0	1	2	3	4
20 <sub>D2</sub> I have arguments or physical fights.	0	1	2	3	4
21 <sub>C7</sub> I feel pessimistic or negative about my future.	0	1	2	3	4
22 <sub>AF</sub> I am afraid that the bad thing will happen again.	0	1	2	3	4

### FREQUENCY RATING SHEET

HOW OFTEN OR HOW MUCH OF THE TIME DURING THE PAST MONTH  
DOES THE PROBLEM HAPPEN?

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NEVER	TWO TIMES A MONTH	1-2 TIMES A WEEK	2-3 TIMES EACH WEEK	ALMOST EVERY DAY																																																																																																																																																																																																																		



## Appendix F: BAI

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by that symptom during the past month, including today, by circling the number in the corresponding space in the column next to each symptom.

	Not At All	Mildly but it didn't bother me much.	Moderately - it wasn't pleasant at times	Severely – it bothered me a lot
Numbness or tingling	0	1	2	3
Feeling hot	0	1	2	3
Wobbliness in legs	0	1	2	3
Unable to relax	0	1	2	3
Fear of worst happening	0	1	2	3
Dizzy or lightheaded	0	1	2	3
Heart pounding/racing	0	1	2	3
Unsteady	0	1	2	3
Terrified or afraid	0	1	2	3
Nervous	0	1	2	3
Feeling of choking	0	1	2	3
Hands trembling	0	1	2	3
Shaky / unsteady	0	1	2	3
Fear of losing control	0	1	2	3
Difficulty in breathing	0	1	2	3
Fear of dying	0	1	2	3
Scared	0	1	2	3
Indigestion	0	1	2	3
Faint / lightheaded	0	1	2	3
Face flushed	0	1	2	3
Hot/cold sweats	0	1	2	3
<b>Column Sum</b>				

**Scoring** - Sum each column. Then sum the column totals to achieve a grand score. Write that score here \_\_\_\_\_ .



(11) When you were a child, how often did an adult:

	<b>How often?</b>	<b>Indicate age or age range when each occurred below:</b>
Push/grab/shove you?	_____	_____
Slap/spank you?	_____	_____
Hit you with an object?	_____	_____
Kick/punch you?	_____	_____
Burn you?	_____	_____
Choke you?	_____	_____
Threaten to hurt/kill you?	_____	_____
	0 = never	
	1 = once	
	2 = twice	
	3 = 3-5 times	
	4 = 6-10 times	
	5 = 11-20 times	
	6 = more than 20 times	

(12) When you were a child, how often did an adult:

	<b>How often?</b>	<b>Indicate age or age range when each occurred below:</b>
Sexually expose themselves to you?	_____	_____
Watch you bathing/dressing in a sexual way?	_____	_____
Make you touch them in a sexual way?	_____	_____
Touch you in a sexual way avoiding genital contact?	_____	_____
Touch you in a sexual way including the genitals?	_____	_____
Have sexual intercourse with you?	_____	_____
	0 = never	
	1 = once	
	2 = twice	
	3 = 3-5 times	
	4 = 6-10 times	
	5 = 11-20 times	
	6 = more than 20 times	

(13) In the recent past (since childhood), have you been the victim of abuse or assault?

Yes No

If yes, circle all that apply: Sexual abuse/assault  
Physical abuse/assault

(14) In the recent past (since childhood), how often did another adult:

	<b>How often?</b>	<b>Who?</b>
Push/grab/shove you?	_____	_____
Slap you?	_____	_____
Hit you with an object?	_____	_____
Kick/punch you?	_____	_____
Burn you?	_____	_____
Choke you?	_____	_____
Threaten to hurt/kill you?	_____	_____

0 = never  
 1 = once  
 2 = twice  
 3 = 3-5 times  
 4 = 6-10 times  
 5 = 11-20 times  
 6 = more than 20 times

1 = Romantic partner/spouse  
 2 = Relative (not spouse)  
 3 = Friend/acquaintance  
 4 = Stranger  
 5 = Other

(15) In the recent past (since childhood), how often did another adult do the following **when you did not want them to:**

	<b>How often?</b>	<b>Who?</b>
Sexually expose themselves to you?	_____	_____
Watch you bathing/dressing without your permission?	_____	_____
Make you touch them in a sexual way?	_____	_____
Touch you in a sexual way avoiding genital contact?	_____	_____
Touch you in a sexual way including the genitals?	_____	_____
Have sexual intercourse with you?	_____	_____

0 = never  
 1 = once  
 2 = twice  
 3 = 3-5 times  
 4 = 6-10 times  
 5 = 11-20 times  
 6 = >20 times

1 = Romantic partner/spouse  
 2 = Relative (not spouse)  
 3 = Friend/acquaintance  
 4 = Stranger  
 5 = Other

## Appendix H: Follow-Up Contact Authorization Form

Participant ID: \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Email: \_\_\_\_\_

Phone: \_\_\_\_\_

Alternate Phone Number: \_\_\_\_\_

Sign here if it is OK for us to contact you about additional follow-up studies. This does not make you obligated to participate in additional follow-up studies, it allows us to contact you to see if you are interested.

\_\_\_\_\_

Signature

\_\_\_\_\_

Date

What would be the best way to contact you in the future?

\_\_\_\_\_