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Selective processing of threatening information: Effects of attachment representation and anxiety disorder on attention and memory

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Abstract
To investigate the effect of the mental representation of attachment on information processing, 28 anxiety disorder outpatients, as diagnosed by the Anxiety Disorders Interview Schedule—Revised, were administered the Adult Attachment Interview and the State–Trait Anxiety Inventory. They also completed an emotional Stroop task with subliminal and supraliminal exposure conditions, a free recall memory task, and a recognition test. All tasks contained threatening, neutral, and positively valenced stimuli. A nonclinical comparison group of 56 participants completed the same measures. Results on the Stroop task showed color-naming interference for threatening words in the supraliminal condition only. Nonclinical participants with insecure attachment representations showed a global response inhibition to the Stroop task. Clinical participants with secure attachment representations showed the largest Stroop interference of the threatening words compared to the other groups. Results on the free recall task showed superior recall of all types of stimuli by participants with secure attachment representations. In the outpatient group, participants with secure attachment representations showed superior recall of threatening words on the free recall task, compared to insecure participants. Results on the recognition task showed no differences between attachment groups. We conclude that secure attachment representations are characterized by open communication about and processing of threatening information, leading to less defensive exclusion of negative material during the attentional stage of information processing and to better recall of threatening information in a later stage. Attachment insecurity, but not the type of insecurity, seems a decisive factor in attention and memory processes.

Mental representations of attachment in adults are thought to regulate cognition and behavior through the selective processing of attachment-relevant information. This notion is basic to recent developments in attachment research but has not yet been investigated extensively (Belsky, Spritz, & Crnic, 1996; Bretherton & Munholland, 1999; Kirsh & Cassidy, 1997; Lynch & Cicchetti, 1991; Main, 1999). Belsky et al. (1996) noted that the concept of attachment representations (or internal working models of attachment) is routinely invoked to explain or predict empirical findings, and there is little empirical evidence to substantiate this latent variable. The study reported in this paper is an attempt to experimentally investigate the impact of attachment representations on the processing of affective information.

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Attachment theory (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1973, 1980, 1984; Bretherton, 1985; Main, Kaplan, & Cassidy, 1985) proposes that mental representations of attachment relationships emerge in childhood experiences with primary caregivers. These mental models enable children to anticipate their caregivers' behavior, to interpret it, and to adapt their own behavior to that of the caregivers. Parents who are not consistently sensitive and responsive toward the child's signals of distress or fear are thought to contribute to the development of an insecure mental representation of attachment. Rejection of attachment, overprotectiveness, and guilt induction are all examples of insensitive and unresponsive caregiving (Bretherton, 1985; de Wolff & van IJzendoorn, 1997). Regardless of whether parents are sensitive and responsive or repeatedly show consistently unresponsive or inconsistently responsive behavior toward a child, the attachment behavioral reaction of the child toward the parents will become so "overlearned" that its rules may be applied automatically and outside awareness (Kirsh & Cassidy, 1997; Main, 1999). The total set of these rules, known as the internal working model or mental representation of attachment, may, once established, become increasingly resistant to change in the course of time, because it functions on an automatic level (Belsky et al., 1996; Rieder & Cicchetti, 1989). This internal working model of attachment is defined as " . . . a set of conscious and/or unconscious rules for the organization of information relevant to attachment and for obtaining or limiting access to . . . information regarding attachment-related experiences, feelings and ideations" (Main et al., 1985, pp. 66–67). Because these representations regulate information processing, expectations, and decision making in affective relationships, they tend to become self-confirming (Belsky et al., 1996; Bretherton & Munholland, 1999; Main et al., 1985). Consequently, mental attachment representations established in childhood are thought to be of considerable influence on future attachment relationships (Waters, Merrick, Treboux, Crowell, & Albersheim, 2000).

In attachment theory, Bowlby combined psychodynamical, ethological, and cognitive aspects of development with an information-processing model of cognition. In the past decades, cognitive psychologists have developed different models to explain the ways in which human beings process specific kinds of information. The idea that incoming information is mentally organized into cognitive representations is widely accepted, even though the exact nature of these mental models is an issue of continuing debate (see Williams, Watts, MacLeod, & Mathews, 1997). Cognitive scientists study the basic rules and mechanisms of cognitive organization. Also, information-processing paradigms have been applied to different clinical disorders, investigating whether specific dysfunctions in information processing accompany specific emotional symptoms or syndromes (for a review, see Mathews & MacLeod, 1994).

Attachment and Cognitive Processing

Mental representations of attachment are thought to direct not only feelings and behavior but also cognitive processes related to attachment, such as attention and memory (Main, 1999; Main et al., 1985). Bowlby (1980) extrapolated on the idea that human beings selectively attend to sensory information to escape from information overload. Due to the filtering of incoming information by the tacit organizational rules of the internal working model, attention is directed toward information that fits the representation. Attachment-related information that, as a result of its (affective) content, does not fit the expectancies is defensively excluded. Consequently, the original representations of attachment are confirmed and ever more rigidly established. The memory system is subject to the same kinds of biases at the levels of encoding and retrieving information. Information that smoothly fits the existing representations is suggested to be easily stored and easily reproduced (see Williams et al., 1997).

On a cognitive level, *secure* or secure–autonomous attachment is reflected by open, nondefensive mental operations regarding attachment-related experiences, as shown in the Adult Attachment Interview (AAI; George,

Kaplan, & Main, 1985; Hesse, 1999; Main, 1990). When interviewed about their childhood memories, secure–autonomous respondents give a balanced view of their past experiences—even when these experiences were negative—and talk about their history in a clear and coherent way. *Dismissing* attachment is revealed in the AAI by a claim for limited access to memories related to attachment. These respondents show restricted feelings regarding attachment experiences and often contradict themselves by presenting a general idealizing view of their attachment figures that cannot be corroborated by positive episodic memories. *Preoccupied* attachment is revealed in the AAI by ambivalence about attachment experiences. These respondents often talk in a very incoherent way about their past and show confusion about or continuing anger with their major attachment figures. There is a fourth classification for an *unresolved* state of mind with respect to loss or trauma; this is coded when respondents show signs of disorganization or disorientation during discussions of potentially traumatic events. The indices for the unresolved attachment category in the AAI are not representative of the overall state of mind with regard to attachment; consequently, individuals classified as unresolved receive a best-fitting alternate classification as secure–autonomous, dismissing, or preoccupied. Dozier and Kobak (1992) showed that the cognitive representational organizations are associated with specific strategies for either deactivation (in the case of dismissing attachment) or hyperactivation (in the case of preoccupied attachment) of the attachment system (see also Main, 1990). A most striking finding is the heightened autonomous physiological arousal their nonclinical respondents showed when using a deactivating strategy, for example, when playing down the importance of negative childhood experiences with separation, rejection, or threat by the parents.

Attention

In the current study, we investigate interference on an emotional Stroop task in clinical and nonclinical adults with secure and insecure attachment representations. In this task, participants are asked to name the color in which words of different emotional value are printed. Response latencies indicate interference of the word content with the primary task: color naming. Reaction times slow down when the word is associated with participants' concerns and thus distracts them from their task. We expect adults with insecure attachment representations to differ in their response latencies from secure–autonomous participants. Because little research has been conducted in this area, we suggest two competing hypotheses. The first hypothesis is that insecure participants show more response interference to threat words than secure–autonomous participants. The insecure participants may show longer response latencies on the threat words, as these are supposed to arouse anxiety, directing attention away from task performance (cf., MacLeod & Hagan, 1992; van den Hout, Tenney, Huygens, Merckelbach, & Kindt, 1995). The alternative hypothesis is that insecure participants may be less inclined to even start processing incoming information of a threatening type, whereas secure–autonomous subjects may be more open to disconcerting information and pay threatening stimuli more attention (Beeghly & Cicchetti, 1994), even though it seems discrepant with their current attachment representation (Lynch & Cicchetti, 1998). Evidence for differential attention processes in individuals with different types of insecure representations is equivocal. Main et al. (1985) and Kirsh and Cassidy (1997), for example, showed that nonclinical insecure–avoidant, as well as insecure–resistant, children looked away from attachment-relevant drawings or family photographs in a stressful context and both groups appeared to avoid arousing painful memories of past experiences with their caregivers. In view of the dearth of empirical studies on adults, we are not in the position to propose specific hypotheses concerning information processing in preoccupied and dismissing adults.

Selectivity in information processing associated with insecure attachment representations may be more pronounced in clinically disordered groups, in particular in anxiety disordered individuals. The theory of internal

working models of attachment shows similarity to Beck's schema model of cognitive processing in psychopathology (Beck, 1976; Beck & Emery, 1985). In Beck's view, cognitive schemata result from experience and guide new information along the processing lines that experience has formed. Biases in information processing result from systematic distortions in cognitive schemata that have been strengthened by perceptual sensitivity and memory biases for information congruent with the schema. For anxiety disorder patients, Beck's model predicts hypervigilance in the processing of threatening information. In a recent review, Williams, Mathews, and MacLeod (1996) showed that in many Stroop studies, anxious participants let the content of the stimuli interfere with their task of naming the color in which the stimulus words were printed, especially when the emotional valence of the stimulus material was threatening and personally relevant. Even at a preattentive level, with stimuli presented subliminally, this attentional bias has been shown to be active (MacLeod & Hagan, 1992; MacLeod & Rutherford, 1992; Mogg, Bradley, Williams, & Mathews, 1993; Mogg, Kentish, & Bradley, 1993; van den Hout et al., 1995). From this experimental research it may be concluded that patients suffering from anxiety disorders are characterized by an (automatic) attentional bias for threat stimuli.

Memory

Beck's model was refined by Williams et al. (1997), who make a distinction between passive–automatic and active–strategic processing of information. They show that these are two independent cognitive processes that may explain dissociations in the performance of anxious and depressed patients on cognitive tasks. Referring to the distinction made by Graf and Mandler (1984), they distinguish two processes that operate on mental representations. *Priming* is a relatively automatic process in which exposure to a stimulus activates an associated schema; *elaboration* is a more strategic process whereby associations between related representations are formed as a result of the activation of one representation. The priming process can be experimentally modeled using the emotional Stroop task. The elaboration process can be experimentally modeled in memory tests.

Memory researchers distinguish explicit memory, which concerns conscious recollection, from implicit memory, which involves nonconscious effects of past experiences on subsequent information processing. Explicit memory depends on the extent to which the activated schema, at the time of encoding, is related to other associated representations that are used as retrieval cues. In a free recall test, explicit memory is activated by specifically asking participants to consciously retrieve previously processed material. Poor memory performance on a free recall test is supposed to indicate poor elaboration of the stimuli offered. Recognition performance is expected to be superior to recall performance, because it is easier to recognize previously processed stimuli than to recall them. Cloitre and Liebowitz (1991) refer to a free recall task as measuring semantic memory whereas a recognition task concerns perceptual memory.

Evidence for a memory bias in anxiety disorders is equivocal and the results even contradict each other (for an overview, see Mineka & Nugent, 1995): few studies have provided empirical evidence for an explicit memory bias in anxiety patients; some studies have reported an implicit memory bias related to clinical anxiety. The studies of memory biases in anxiety disorders are not only inconsistent in their results, but also in the applied paradigms (Eysenck & Mogg, 1992). In view of the controversial findings in anxiety disorder samples, McNally (1994) suggests that researchers concentrate on involuntary explicit memory paradigms to specify the effects of anxiety disorders on memory performance. Involuntary explicit memory is like explicit memory in that it involves conscious recollection, but like implicit memory in that it involves no strategic effort. According to McNally, in anxiety disorder patients threatening information just "pops" into mind without deliberate search, and therefore involuntary explicit memory processes should be studied in these samples.

In the present study, we investigated

whether the inconsistent results of memory research in anxiety-disordered individuals may also be due to differences in the security of their attachment representations. In the current study, memory was assessed by means of a free recall task and a recognition task, both with positive, neutral, and threatening stimuli. We expected to find differences between secure–autonomous and insecure participants with or without anxiety disorder in the processing of threatening information because of regulatory differences in their respective attachment representations (Dozier, Stovall, & Albus, 1999). We hypothesized that insecure individuals with or without anxiety disorder would be less able to remember or recognize threatening stimuli than secure–autonomous subjects, because they tend to defensively exclude such information. Secure participants would be more open to process and discuss negative information (Lynch & Cicchetti, 1998). The alternative hypothesis is that insecure individuals would be more able to remember or recognize threatening information than secure participants because negative information is more congruent with an insecure representational model.

Hypotheses

In sum, threatening information may be processed differently, depending on clinical status and attachment representation of the participants. We examined the stages of attention to threatening information (on the subliminal and supraliminal levels), and of the recall and recognition of threatening material. The following hypotheses were tested. First, we tested whether insecure individuals showed more attention for threat words in comparison to neutral words in the emotional Stroop task because negative information is more consistent with their representational model or whether the secure–autonomous subjects paid more attention to threatening information because they are less inclined to defensively exclude negative material. Second, we investigated whether the anxiety disorder outpatients were more attentive to threatening words than the nonclinical comparison group because threatening stimuli are more consistent with their anxiety disorder. We also tested whether anxiety disorder participants with insecure attachment representations showed different emotional Stroop interference compared with clinical participants with secure attachment representations. Secure patients may be more open to threatening stimuli that are more salient to them because of their anxiety disorder, and thus show more Stroop interference, or insecure patients may be more attentive to negative material because it is consistent with their state of mind. Third, we tested whether differences in free recall and recognition memory were associated with the security of attachment representations. Anxiety disorder outpatients, as well as nonclinical comparisons with insecure attachment representations, may show impaired memory for threatening words compared to secure–autonomous individuals because they may tend to be less open to negative material and may defensively exclude threatening stimuli.

Method

Participants and procedure

Anxiety disorder group. Twenty-eight individuals voluntarily participated in this study. The sample consisted of 13 men and 15 women with a mean age of 34 years (SD = 11.2, range = 19–67 years). They were all anxiety disorder outpatients referred for treatment to a regional psychiatric hospital. The interviewing and testing took place in the period between the intake procedure and the start of cognitive–behavioral therapy. Participants were tested individually at the hospital. Participation consisted of five 1.5-hr sessions, in which the Anxiety Disorders Interview Schedule—Revised (ADIS-R), the AAI, the Stroop task, two memory tests, a perception task not reported on here, and several questionnaires, among them the State–Trait Anxiety Interview (STAI), were administered. Nineteen of the participants received medication at the time of testing: 9 were using an antidepressant, 4 were using a benzodiazepine, and 6 were using both.

Initially the sample consisted of 32 patients, but data were lost in four instances.

One participant dropped out of the study because of a crisis and thus did not complete the questionnaires, the Stroop task, and the memory tests. Two participants did not understand the instructions for the Stroop task, and made over 25% mistakes, which made their results unfit for further analyses. One participant was color-blind and thus could not perform the Stroop task. Attachment classifications and diagnoses of these four individuals did not differ significantly from those of the other participants, χ^2 (df = 2; n = 32) = 1.93, *ns*; and χ^2 (df = 1; n = 32) = 0.50, *ns*.

Comparison group. In order to get sufficiently large numbers of nonclinical comparisons with insecure attachment representations, about twice as many participants as in the clinical group were included. Fifty-six healthy individuals were recruited from the general population by means of newspaper advertisements. This comparison sample consisted of 14 men and 42 women with a mean age of 38 years (SD = 8.1, range = 25–58 years).

Participants were tested individually at our lab. Participation consisted of two 2.5-hr sessions, 1 week apart. At the first session, the emotional Stroop task plus awareness checks and the AAI were administered. At the second testing, a number of questionnaires were administered, as well as two other tasks not reported in this paper. At the end, participants received Hfl. 50 for their participation.

Initially the comparison sample consisted of 60 participants, but data were lost in four instances. Two of the AAI's were lost due to equipment failure. Two other participants were left out of the analyses because of too much missing data on the Stroop task.

The final sample of 84 participants consisted of 28 anxiety disorder outpatients and 56 nonclinical comparisons. Differences in gender and age distributions between the clinical and comparison group were not associated with the AAI classifications or the Stroop response latencies.

Measures

ADIS-R. The ADIS-R (Dutch version by de Ruiter, Bouman, & Hoogduin, 1993) is a semi-structured interview schedule, which provides a differential diagnosis for the DSM-III-R categories of anxiety disorders, mood disorders, somatoform disorders, and substance abuse. The ADIS-R also globally screens for psychotic episodes. Respondents are questioned about medication use and medical history.

The diagnostic interviews in this study were conducted by three clinical psychology interns who were trained in the use of the ADIS-R and in adjustments of the interview to DSM-IV criteria (American Psychiatric Association, 1994). All participants met DSM-IV criteria for an anxiety disorder as a primary diagnosis (panic disorder with agoraphobia, n = 19; panic disorder without agoraphobia, n = 5; social phobia, n = 2; generalized anxiety disorder, n = 2).[1] All diagnoses were checked afterward against the psychiatric assessments from the outpatient clinic; there were no disagreements.

The STAI Questionnaire. The STAI (Dutch version by van der Ploeg, Defares, & Spielberger, 1979) contains 20 statements about trait anxiety and 20 statements about state anxiety. Participants indicate on a 4-point scale how strongly the statements apply to them. Internal consistency (alpha) in this study was .94 for trait anxiety and .93 for state anxiety for the clinical group and .91 for trait anxiety and .88 for state anxiety for the comparison group. The psychometric qualities of the STAI have been found satisfactory, and the manual provides norm scores. Both clinical participants and comparisons completed the STAI.

In the nonclinical comparison group, the scores on the STAI (trait anxiety: M = 41.4, SD = 4.5; state anxiety: M = 37.5, SD = 7.3) were not significantly different from the normative scores for trait and state anxiety in nonclinical samples. In the clinical group, the

1. Results on all measures and tasks were explored for differences between anxiety disorder patients with and without agoraphobia. Agoraphobics did not differ from nonagoraphobic anxiety patients on any of the variables in this study. This may be due to heterogeneity within diagnostic categories (see Dozier et al., 1999, p. 505).

mean score for state anxiety was 56.2 (*SD* = 10.2). This is slightly higher than the normative scores for psychiatric outpatients (sixth decile). The mean score for trait anxiety was 51.8 (*SD* = 12.9). This is somewhat higher than the normative scores for trait anxiety in outpatient samples (seventh decile).

Compared to the nonclinical group, the anxiety disorder outpatients scored significantly higher on both trait anxiety, t (33.2) = 6.91, $p < .001$, and state anxiety, t (35.6) = 5.02, $p < .001$. In fact, the STAI scores partly mirrored the difference between the clinical and comparison groups. For the total group of clinical and comparison participants, the correlation between the two STAI scales was significant ($r = .58$, $p < .01$, two-tailed).

AAI. The AAI is a semistructured interview with 21 questions and standardized probes. Respondents are asked for descriptions of their childhood relationships, with their parents in general and in specific situations like illness, distress, and separation. Furthermore, they are asked about memories of rejection and threat by the parents and about abuse by and loss of important figures. Respondents are also asked how they think their childhood experiences have influenced their personality and (if relevant) their behavior toward their own children, and they are asked about their current relationship with their parents. The coding system of the AAI does not depend on what respondents say they remember but on how coherently they speak about their experiences. Adult attachment classifications show a reasonable test–retest reliability over 2-month and 12-month periods, and they are independent of IQ, autobiographical memory, verbal ability, social desirability, interviewer, and coder (Bakermans–Kranenburg & van IJzendoorn, 1993; Benoit & Parker, 1994; Sagi et al., 1994).

In the clinical group, 18 of the AAIs were coded according to the manual (Main & Goldwyn, 1994) by the third author (C.d.R.). Because AAIs of clinical respondents tend to be more difficult to classify, a random set of cases was classified twice independently. Ten of the 18 interviews were independently coded by the first author (I.Z.). Percentage of agreement on these 10 cases was 100% for the three-way classification and 90% ($\kappa = .80$) for the four-way classification. The other 10 AAIs in the clinical group were coded by the first author (I.Z.). Five of these AAIs were also independently coded by the second author (M.v.I.). Across these five interviews, agreement was 100% for the three-category classification and 90% ($\kappa = .55$) for the four-category classification. Disagreements were solved through discussion. The 56 AAIs of the nonclinical participants in this study were coded by the third author (C.d.R.). All coders were reliable with M. Main (Main & Goldwyn, 1994).

Emotional Stroop task. Stimulus words were three sets of 24 words chosen from a list of 2,250 words that had been rated by independent raters as belonging to one of five categories (ter Laak, 1992). For our study, words were selected from the categories labeled *positive*, such as "optimism," "happiness"; *neutral*, such as "practical," "short"; and *threatening*, such as "murder," "fatal." All words had been matched for length (number of letters as well as number of syllables) and for the degree to which the raters had judged the word as typical for the category. The latter judgment is thought to be highly associated with frequency in daily use.

Hardware. The words were presented on a high resolution VGA color monitor that was connected to a 386 microcomputer. The response time was recorded in milliseconds by a voice key (100–3000 Hz) connected to the computer. The experimenter recorded the color named by pushing a button on a response panel.

Software. Before the Stroop words appeared in the center of the screen, a fixation square was presented for 500 ms. The stimuli appeared in 6-mm capital letters in one of four colors (red, yellow, blue, or green). Participants were instructed to ignore the word meaning and name the color as fast as possible. They started out with 18 practice trials, after which all stimulus words were presented twice in the subliminal (masked) and twice in the supraliminal (unmasked) condition, resulting in a total of $72 \times 2 \times 2 = 288$ trials, which

were divided into eight blocks of 36 trials. Words, masking condition, and word color were randomly mixed, with the constraints that each color appeared in 25% of the trials, each word was presented once in each of the colors, both the same color and the same stimulus category could not appear in successive trials, and for each participant, the task was newly randomized.

In the supraliminal condition, the word remained on the screen until the participant named the color. In the subliminal condition, the word was replaced by a mask (a row of ###s) of the same length and in the same color after 14.3 ms (i.e., one visual display unit raster scan). The masking procedure was designed to prevent conscious awareness of the words but not semantic processing (cf., MacLeod & Hagan, 1992; Marcel, 1983).

The Stroop response latencies did not show large skewness (.09–.37) or kurtosis (–.26 to –.90), and outlying values were absent (range, 395–572 ms). As is standard practice in this area of research, reaction times were excluded from the analyses when participants made errors. Excluded participants did not differ significantly from the other subjects on attachment or diagnosis (see the section, "Participants and Procedure"). There were no differences in Stroop results between patients using (different kinds of) medication or no medication at all, $0.75 < t\ (26) < 1.50$, *ns*. There was no significant relation between STAI scores and the response latencies on the Stroop task for any of the word types (correlations of $r = .03$–$.19$, *ns*). Therefore, STAI scores were not included as covariates in the Stroop analyses. Age and gender differences were not significantly associated with response latencies either, and therefore were not included as covariates (see below). Correlations between age and response latencies ranged from $.15 < r < .22$ (*ns*), and *t* tests for gender differences ranged from $.14 < t\ (82) < .49$ (*ns*).

Awareness check. To make sure the participants had been unable to consciously perceive the stimuli in the masked (subliminal) presentation condition, a forced-choice word discrimination task was presented. This task consisted of 96 trials, divided into eight blocks of 12 trials each. After each Stroop block, an awareness block was presented. Half of the time a word was presented for 14.3 ms, whereas during the other half, a random letter string of the same length was presented. Both were immediately followed by a mask of equivalent length. Participants were instructed to decide whether the letter string appearing before the mask was a word, and to indicate their decision by pressing a button on a response box. Participants showed only chance levels of performance on this task, indicating they had not been able to consciously recognize the stimulus words in the masked condition. Therefore, our assumptions about the subliminal presentation were correct.

Memory task. The stimulus set consisted of 12 positively valenced, 12 neutral, and 12 threatening words. These words were different from the stimuli used in the Stroop task. The words were matched for length and number of syllables, and each word in each category was matched with a word in each other category with respect to frequency in daily use (ter Laak, 1992). The words were presented in three blocks, corresponding to the emotional categories (see Watts & Dalgleish, 1991). For each subject, both the order of the blocks and the order of the words within the blocks were randomized. Each word was shown on a computer screen for 1 s, and every 2 s a new word was shown. Participants were instructed to pay close attention to the words, but no suggestion of a memory task was given. After a 30-min distracter task (completing questionnaires), participants did a free recall and a recognition task. For the free recall task, participants were instructed to write down as many words as they could remember from the previous word presentation. When they indicated they had finished, they were encouraged once to try to remember more words. For the forced-choice recognition test, participants were shown all 36 words from the original target word list and 36 filler words, matched for emotional valence, length, and frequency, and again shown in random order. Participants were instructed to decide whether they had seen the word in the word list before by pressing a button on the response box.

Table 1. *Distribution of attachment classifications in the clinical and comparison group* (n = *84*)

	Dismissing	Autonomous	Preoccupied	Unresolved
All participants	23 (21)	48 (45)	13 (11)	0 (7)
Anxiety disorder outpatients (n = 28)	12 (11)	8 (8)	8 (6)	0 (3)
Nonclinical comparisons (n = 56)	11 (10)	40 (37)	5 (5)	0 (4)

Note: Underscored numbers represent the four-way AAI distribution; nonunderscored numbers represent the three-way AAI distribution.

Results

Results are presented in two steps. First, preliminary descriptive analyses focus on the distribution of attachment classifications in the clinical and comparison groups. Further analyses are based on the secure–autonomous and insecure classifications. Second, the hypotheses on differences in attention, free-recall memory, and recognition memory between secure and insecure attachments and between clinical and comparison groups are tested.

Preliminary analyses

In this section, attachment distributions in the anxiety disorder and the comparison groups are compared to meta-analytically derived standard clinical and normal distributions of attachment classifications.

Attachment distributions. In the clinical group, 8 participants (29%) were classified as secure–autonomous, 12 (43%) as dismissing, and 8 (29%) as preoccupied. Three respondents (1 dismissing, 2 preoccupied) received a primary classification as unresolved with respect to loss or trauma. The distribution of the AAI classifications is shown in Table 1. The AAI distribution in our patient sample was compared to a standard probability distribution based on clinical samples with adult psychiatric patients (see van IJzendoorn & Bakermans–Kranenburg, 1996). The distributions were compared with Multinom (Kroonenberg, 1998). The three-way AAI distribution (dismissing, secure–autonomous, and preoccupied) differed significantly from the standard probability distribution: there were more secure–autonomous participants in our sample, χ^2 (2) = 8.44, $p < .05$. The four-way AAI distribution (with separate classification of the "unresolved" category) also differed significantly from the standard probability distribution: there were significantly more secure–autonomous participants and fewer unresolved participants in our sample, χ^2 (3) = 33.67, $p < .01$.

Of the 56 nonclinical participants in the comparison group, 40 (71%) were classified secure–autonomous, 11 (20%) dismissing, and 5 (9%) preoccupied. Comparing this distribution to the AAI distributions usually found in nonclinical samples (van IJzendoorn & Bakermans–Kranenburg, 1996), percentages in our sample were not significantly different, χ^2 (2) = 5.88, *ns* (Kroonenberg, 1998). Three secure–autonomous and 1 dismissing respondent were classified as unresolved. The four-way AAI distribution (with separate classification of the "unresolved" category) also did not differ significantly from the standard probability distribution, χ^2 (3) = 5.07, *ns*.

The distributions of attachment classifications in the comparison and clinical groups differed significantly: there were fewer secure–autonomous participants in the clinical group, three-way AAI distribution: χ^2 (2) = 14.33, $p < .01$; four-way AAI distribution: χ^2 (3) = 10.84, $p < .05$ (see Table 1).

In the total group, there were no age or gender differences among the AAI categories, for age: F (2, 81) = 1.31, *ns*; for gender: χ^2 (df = 2; n = 84) = 2.81, *ns*. In the clinical group, there were no differences among the AAI categories on medication use: χ^2 (df = 2; n = 28) = 2.31, *ns*, or clinical diagnosis: χ^2 (df = 2; n = 28) = 2.59, *ns*.

Table 2. *Mean Stroop response latencies (ms) for the three types of stimuli (threatening, neutral, and positive) in two conditions (masked and unmasked) for secure–autonomous and insecure participants in the clinical and comparison groups*

	Autonomous	Insecure
Anxiety disorder patients		
Masked presentation		
Threatening	725 (92)	689 (170)
Neutral	720 (100)	691 (88)
Positive	720 (97)	681 (91)
Unmasked presentation		
Threatening	911 (157)	773 (108)
Neutral	814 (107)	746 (119)
Positive	828 (127)	752 (123)
Nonclinical comparisons		
Masked presentation		
Threatening	701 (85)	772 (130)
Neutral	702 (86)	765 (119)
Positive	701 (88)	767 (121)
Unmasked presentation		
Threatening	792 (115)	869 (170)
Neutral	754 (98)	829 (136)
Positive	759 (106)	840 (137)

Note: Standard deviations are in parentheses.

Analyses of the Stroop response latencies and the memory tasks were performed for two-way (secure–autonomous/insecure), three-way (dismissing/secure–autonomous/preoccupied), and four-way AAI classifications (dismissing/secure–autonomous/preoccupied/unresolved). Basically, the dismissing and preoccupied participants showed similar response patterns, and the forced three-way classifications (Main & Goldwyn, 1994) did not yield different results than the four-way classification (see Zeijlmans van Emmichoven, 2000, for specific data on these comparisons). Because of small cell sizes for the more differentiated AAI classification systems, we decided to present here the results of analyses on the secure versus insecure attachment representations.

Attention, free-recall memory, and recognition memory

In this section, the results of the Stroop (attention) task and the memory tests are presented. We start with showing that the Stroop interference effect exists in the unmasked (supraliminal) but not in the masked (subliminal) condition. Subsequently, we test whether the Stroop effect was stronger in the secure versus insecure groups and was dependent of the (non)clinical status of the participants. Last, the results of the free-recall and recognition memory tests for insecure and secure participants in the clinical and comparison groups are described.

Attention. Mean response latencies on the Stroop task both for the masked (subliminal) and unmasked (supraliminal) condition are presented in Table 2. Repeated-measures analyses of variance (ANOVA) were conducted with attachment classification (secure vs. insecure) and group (clinical vs. comparison) as between-subjects factors and stimulus word type as a within-subject factor for the masked (subliminal) and unmasked (supraliminal) conditions separately. The Stroop effect should lead to a significant difference in response la-

tencies between words with a negative or positive valence, on the one hand, and a neutral valence, on the other hand. Therefore, (repeated) a priori contrasts between the negative and the neutral words and the positive and the neutral words were computed, after testing the significance of the main and interaction effects. The repeated-measures ANOVAs were corrected for unequal numbers of subjects across conditions.

Does the Stroop interference effect of positive or negative versus to neutral word valences exist in the masked (*subliminal*) *and unmasked* (*supraliminal*) *conditions?* Before testing our substantive hypotheses, we tested whether the Stroop tests triggered the expected interference effects. The overall test of within-subjects effects for the *masked* (subliminal) condition resulted in a nonsignificant, F (2, 160) = 0.91, *ns*, for the main effect of word valence. Two-way interactions for word valence by group, F (2, 160) = 0.36, *ns*, and for word valence by attachment, F (2, 160) = 0.16, *ns*, and the three-way interaction among word valence, group, and attachment, F (2, 160) = 0.77, *ns*, failed to reach significance. In the masked (subliminal) condition, response latencies to threat, neutral, and positive words were about the same (M = 722, SE = 12.6; M = 720, SE = 12.1; and M = 717, SE = 12.4; respectively). A (subliminal) Stroop effect for the masked condition was therefore absent.

The overall test of within-subjects effects for the unmasked (supraliminal) condition, however, resulted in a significant main effect for word valence, F (2, 160) = 33.38, $p < .001$. For the unmasked condition, the a priori contrast between threatening and neutral words was significant, F (1, 80) = 41.08, $p < .001$, whereas the contrast between positive and neutral words was not significant, F (1, 80) = 3.10, $p = .08$. In the unmasked (supraliminal) condition, threat words stimulated longer response latencies compared to neutral words (M = 836, SE = 16.6; M = 786, SE = 14.3; respectively). Mean value for positive words was 795, SE = 15.2.

Thus, the emotional Stroop interference effect appeared to be restricted to the threatening words in the unmasked (supraliminal) test condition. The masked (subliminal) condition was therefore not included in further analyses.

Do secure–autonomous individuals differ from individuals with insecure attachment representations in attention to threatening information? The first substantive hypothesis we tested was whether the emotional Stroop effect in the unmasked (supraliminal) condition differed for participants with insecure attachment representations compared to the secure participants. Because the two-way interaction between word valence and attachment was significant, F (2, 160) = 4.25, $p = .016$, we tested the a priori contrast between threatening and neutral words for the interaction of word valence and attachment security, F (1, 80) = 4.74, $p = .032$. With only two groups available (secure versus insecure participants), this a priori contrast tested our first hypothesis in the most stringent way, so post hoc comparisons were not necessary. The secure participants showed a larger emotional Stroop effect than the insecure participants did. Mean response latencies to the threat, neutral, and positive words of the secure participants in the unmasked condition were 851 (SE = 25.1), 784 (SE = 21.7), and 794 (SE = 22.9), respectively. Mean response latencies for the insecure participants were 821 (SE = 21.7), 788 (SE = 18.8), and 796 (SE = 20.0), respectively.

Thus, secure participants may be more inclined to process information even when it is threatening than insecure participants, who seemed to ignore or avoid the threatening nature of the word stimuli. It should be noted that the difference between the secure and insecure participants was based on a within-subjects repeated-measures ANOVA, and that the Stroop design precluded direct comparisons between group means.

Do the anxiety disorder outpatients experience more emotional Stroop interference for threatening words than the nonclinical comparison group? Second, we addressed the question of whether anxiety-disordered patients were more susceptible to the emotional

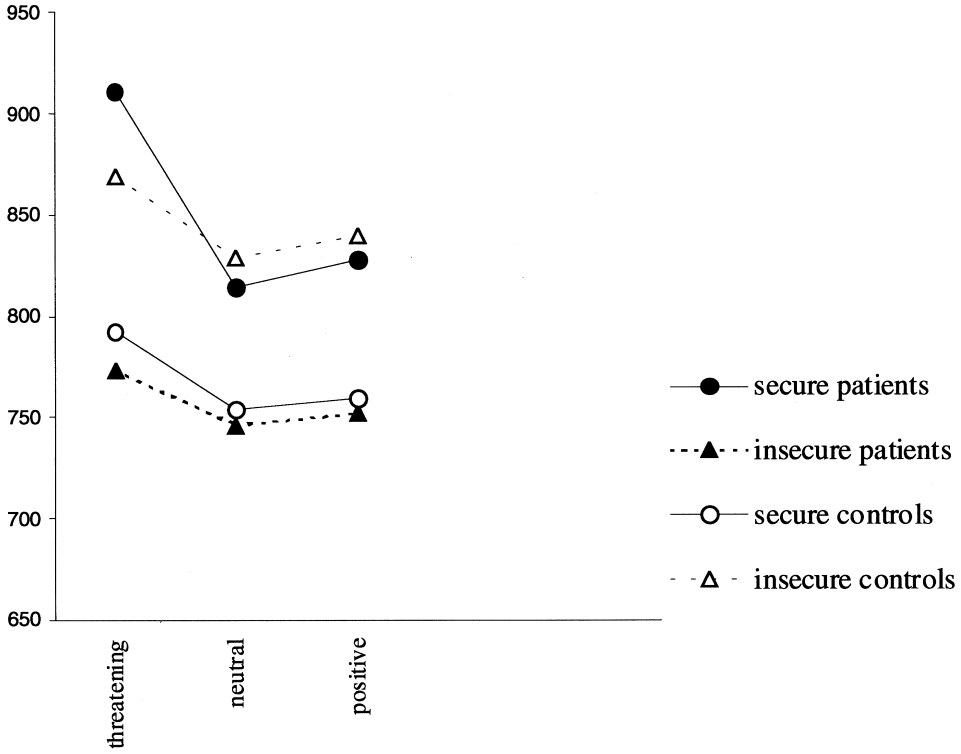

Figure 1. Mean Stroop reaction times (ms) for threatening, neutral, and positive stimuli in the unmasked condition for secure–autonomous and insecure clinical and nonclinical participants.

Stroop effect than the nonclinical comparisons. In the unmasked (supraliminal) condition, the two-way interaction between word valence (threatening vs. neutral) and group (clinical vs. comparisons) was not significant, F (2, 160) = 1.90, p = .15. Therefore, a priori contrasts were not computed. Our hypothesis of a stronger emotional Stroop effect independent of attachment security in the clinical group compared to the nonclinical group was not confirmed.

Do anxiety disorder and nonclinical participants with insecure attachment representations show different emotional Stroop interference compared with (non)clinical participants with secure attachment representations? Third, secure patients may be more open to threatening stimuli that are more salient to them because of their anxiety disorder, and thus show more Stroop interference, or insecure patients may focus more on threatening material because it is consistent with their state of mind. In the unmasked condition, the three-way interaction among word valence (threatening, neutral, or positive), group (clinical vs. comparison), and attachment (secure–autonomous vs. insecure) was significant, F (2, 160) = 4.15, p = .017. The a priori contrast between threatening and neutral words for the three-way interaction, word (threatening vs. neutral) by attachment by group, also appeared to be significant, F (1, 80) = 5.17, p = .026. In Figure 1, this three-way interaction is presented. In general, insecure comparisons showed slower response latencies than the secure comparisons, but compared to their reactions to the neutral stimuli, their responses did not show more interference. In contrast, insecure anxiety disorder outpatients showed faster responses and less threat interference than their secure counterparts. In fact, the secure clinical participants appeared to be most susceptible to the emotional Stroop effect, in that their re-

sponses to the threat words were considerably slower than to the neutral stimuli. Post hoc multiple comparisons (Fisher's least significant difference test) among the four groups (secure patients, insecure patients, secure comparisons, and insecure comparisons) on the difference score of the response latencies for threat versus neutral words confirmed this interpretation. The secure clinical participants were significantly slower in responding to the threat words compared to the neutral words than the other three groups (for each of the three comparisons, $p < .05$), which did not differ significantly from each other (for each of the remaining comparisons, $p > .05$).

Memory: Free recall

Are insecure individuals with or without anxiety disorder less able to remember threatening stimuli than secure–autonomous subjects? The free recall data were analyzed nonparametrically because these data are at an ordinal level. There were no differences in results on the memory tasks between patients using (different kinds of) medication or no medication at all. The average numbers of correctly recalled words are presented in Table 3.

On the free recall task, secure–autonomous participants recalled more words from all three categories than insecure participants did (positive words: $z = 3.14$, $p < .001$; neutral words, $z = 2.71$, $p < .01$; negative words: $z = 2.66$, $p < .01$). Nonclinical participants recalled more positive words than anxiety disorder patients ($z = 3.19$, $p < .001$). In the clinical sample, Mann–Whitney one-tailed paired analyses (Bonferroni corrected) showed that the insecure patients recalled significantly fewer threatening words than the secure–autonomous patients ($z = -2.16$, $p < .05$). Paired analyses of the word valence categories (Wilcoxon) revealed that all clinical participants recalled more threatening than positive words ($p < .01$). Analyses of the incorrectly recalled words revealed no differences between attachment groups or between the patient and the comparison groups.

In sum, anxiety disorder outpatients with secure attachment representations recalled more threatening stimuli than their insecure counterparts.

Table 3. *Average number of correctly recalled and recognized words for the three types of stimuli* (*threatening, neutral and positive*) *for secure–autonomous and insecure anxiety disorder participants and comparisons*

	Autonomous	Insecure
Anxiety disorder patients		
Recalled		
Threatening	2.1 (0.8)	1.2 (1.1)
Neutral	1.6 (1.7)	1.2 (1.3)
Positive	1.4 (1.1)	0.7 (0.8)
Recognized		
Threatening	9.3 (3.2)	9.4 (1.7)
Neutral	7.3 (2.9)	7.7 (1.7)
Positive	8.6 (2.1)	7.8 (2.5)
Nonclinical comparisons		
Recalled		
Threatening	2.3 (1.6)	1.6 (1.4)
Neutral	1.9 (1.4)	0.9 (0.7)
Positive	2.0 (1.4)	1.3 (1.1)
Recognized		
Threatening	9.2 (1.8)	9.3 (2.0)
Neutral	8.0 (2.4)	7.5 (3.1)
Positive	8.5 (2.0)	8.5 (1.9)

Note: Standard deviations are in parentheses.

Memory: Recognition

Are insecure individuals with or without anxiety disorder less able to recognize threatening stimuli than secure–autonomous individuals? The average numbers of correctly recognized target words are presented in Table 3. Recognition data were analyzed for percentage correctly recognized target words. A repeated-measures ANOVA was conducted with attachment classification and group (clinical vs. comparison) as between-subjects factors and word valence as a within-subject factor. There were no interaction effects among group, attachment classification, and word valence. Also, there were no main effects for group or attachment classification. A main effect for word valence was found, $F(2, 156) = 6.87$, $p < .05$. Post hoc t tests (with Bonferroni correction) were conducted for the dependent variables. The main effect for word valence

was caused by threatening targets being better recognized than neutral targets, t (77) = 2.89, $p < .01$, and threatening targets being better recognized than positive targets, t (77) = 5.21, $p < .001$. In sum, threatening targets were better recognized than neutral or positive targets, but recognition was independent of clinical status and attachment security.

Discussion

We investigated the effect of the mental representation of childhood attachment experiences on information processing in anxiety disorder patients and nonclinical comparisons. In brief, we found the largest emotional Stroop interference for threatening words in anxiety disorder patients with secure attachment representations, who also better recalled threatening words in a free recall task. From their performance on both the Stroop and free recall tasks, we conclude that the patients with secure representations were more focused on, and open to process, threatening words and less defensive than either patients with insecure attachment representations or the nonclinical participants.

Attention in the supraliminal (unmasked) condition

Patients with secure attachment representations, who are sensitized to threat stimuli because of their disorder, may be more open to process information that is consistent with their anxiety disorder schema but inconsistent with their preexisting attachment representation. At the heart of secure attachment representations is the ability to be more open and flexible in face of troubling information (Kirsh & Cassidy, 1997; Main, 1999). Secure representations may lead to more active attention to and more thorough processing of stimuli that are especially salient and threatening because of the aggravating anxiety disorder. Nonclinical participants with secure attachment representations may not be bothered by threatening stimuli because for them the salience of such stimuli is low in the absence of an anxiety disorder. In the stressful context of a Stroop task with threatening words, anxiety disorder respondents with a secure attachment representation may explore, process, and remember material more thoroughly, even when this material is inconsistent with their attachment representation (Kirsh & Cassidy, 1997) but consistent with the preexisting anxiety schema. It should be noted that threatening stimuli may not even, per se, be inconsistent with a secure attachment representation. Lynch and Cicchetti (1998) found that securely related children with a history of maltreatment demonstrate the greatest memory bias for negative mother-referent stimuli. They suggest that secure children may be more open to process and discuss positive, as well as negative, experiences. The open admission of negative experiences and threatening information would, in fact, be congruent rather than incongruent with their secure representational model (Lynch & Cicchetti, 1998, p. 754).

Although insecure patients and secure nonclinical comparisons responded with similarly short response latencies to the Stroop test, the former group recalled fewer threat words than the latter group. For the insecure clinical participants, the short response latencies and inferior recall of threat words are consistent with the idea that the combination of their basic attachment insecurity and their anxiety disorder may lead to cognitive defense in the processing of threatening information. Both insecure–dismissing and insecure–preoccupied adults are known to avoid confrontation with painful experiences in the AAI, but they use different strategies to reach this goal (Main & Goldwyn, 1994). In a stressful separation context, insecure children are inclined to avoid looking at a picture of their parents. Main et al. (1985) argue that these insecure children (with insecure–avoidant as well as insecure–resistant mental representations of attachment) look away in order to avoid arousing painful memories (see also Kirsh and Cassidy, 1997).

In a study on cognitive control functioning of maltreated and comparison children, Rieder and Cicchetti (1989) found that the cognitive organizations used by maltreated children served to insulate them from external information, so that external stimuli were avoided and the memory of such stimuli remained

vague (Rieder & Cicchetti, 1989, p. 389). Using a pictorial curiosity task that tested the tendency to seek variation, Aber and Allen (1987) found little initiative of maltreated children compared to nonmaltreated children in seeking out new information or in mastering new situations, which they approached in a flat and superficial way. The short response latencies during the unmasked (supraliminal) condition and the inferior recall of threat words in the insecure anxiety disorder patients may be the expression of a similar superficial and avoidant way of dealing with the Stroop task. In the current investigation, insecure–dismissing and insecure–preoccupied participants showed similar response patterns in the Stroop and memory tasks (Zeijlmans van Emmichoven, 2000), which suggests that insecurity per se is more critical for information processing than the specific types of insecurity.

The general slowing of color-naming responses that we found in nonclinical participants with insecure attachment representations is usually observed in studies that compare high-anxious and low-anxious individuals on mental load tasks. This general slower response should not be confused with an emotional Stroop interference that is based on the comparison of response latencies to threatening and neutral stimuli within subjects. The general slowing of responses, instead, is often interpreted as response inhibition and a lack of attentional focus. For example, Fox's (1994) findings suggest that high trait anxiety may be associated with a general inability to maintain attentional focus rather than with an automatic attentional bias toward threatening information. Similarly, in their study on affective–cognitive information processing in secure and insecure preschoolers, Kirsh and Cassidy (1997) found some evidence for a general inability of insecure children to focus their attention.

Absence of subliminal processing

The masked (subliminal) condition did not provoke an emotional Stroop interference at all, in that the participants responded on average with similar latencies to the threat words compared to the neutral or positive words. The stimulus onset asynchrony was put at a level that other studies (e.g., Bradley, Mogg, Millar, & White, 1995; Mogg, Bradley, & Williams, 1995; Mogg, Bradley, et al., 1993; Mogg, Kentish, et al., 1993) have reported to allow cognitive processing without conscious awareness. Results from the awareness checks indicated that participants indeed were unaware of the presence of stimulus words in the subliminal/masked condition.

However, finding no differences between response latencies to threat words and neutral or positive words in the subliminal condition leaves us to guess whether the word content was processed and simply did not interfere or whether nothing was processed at all. This question can be resolved by using individually determined masking thresholds (see Merikle, 1992) instead of so-called objective thresholds (see Holender, 1986). In view of the ongoing debate about perceptual thresholds (see, e.g., Greenwald, Klinger, & Schuh, 1995), we will not enter the discussion on adequate thresholds in subliminal conditions here. However, for some of our participants, the masking may have been too fast, preventing a differential effect in the subliminal condition. A second point is that we randomly mixed the stimuli from the different word categories, which may have decreased the impact of the words. Richards, French, Johnson, Naparstek, and Williams (1992) report that individuals high in trait anxiety take longer to identify the color of anxiety-related words compared to neutral words when presented in a blocked manner, but not after a randomly mixed presentation.

An additional explanation for the absence of a specific Stroop interference in insecure nonclinical participants (who were slow to respond but did not show different latencies to threat and other words) may be the fact that the stimuli we offered were threatening but did not specifically concern attachment-related information. It has been shown in patient samples that both the relevance of stimuli to the cognitive schema and the negativity of the material influence the degree of Stroop interference (Williams et al., 1996). We investigated this potential alternative explana-

tion in a follow-up study of 42 nonclinical respondents, using attachment-specific stimuli (see Zeijlmans van Emmichoven, 2000, for a complete report). We constructed a new set of emotional Stroop stimuli to investigate attachment-related selective information processing in the areas of separation (de Ruiter & van IJzendoorn, 1992) and negative social evaluation (de Ruiter & Garssen, 1989; Pollard & Cox, 1988). These areas are thought to be of specific importance to insecure individuals, even when their insecurity has not (yet) led to clinical diagnoses, causing attention to be directed to these stimuli and consequently interfering with task performance. In this experiment, insecure attachment was again associated with longer response latencies across all stimulus word types. Apparently, the attachment-related threatening stimuli did not differentiate any better between insecure and secure–autonomous individuals than the physically threatening words (Zeijlmans van Emmichoven, 2000).

Memory

On the free recall task, insecure (dismissing and preoccupied) participants showed inferior recall for threatening words compared to secure–autonomous participants. For the insecure-dismissing group, this fits the hypothesis that these individuals elaborate threatening information less well, as is also suggested by the AAI, where they tend to show poor memory (Main & Goldwyn, 1994). It has been shown that insecure–dismissing individuals perform well on autobiographical memory tests as long as the stimuli concern neutral experiences (Bakermans–Kranenburg & van IJzendoorn, 1993; Sagi et al., 1994). Insecure–preoccupied respondents may be expected to show superior recall for threatening material, in line with their preoccupation with negative attachment experiences in the AAI. Nevertheless, they too recalled significantly fewer threatening words than secure participants did. We suggest that both insecure–dismissing and insecure–preoccupied groups react defensively at this level of information processing (Main et al., 1985; Kirsh & Cassidy, 1997), contrary to the AAI, on which they are discriminated on the basis of their overt verbal strategy.

Overall, all clinical participants recalled significantly more threatening than positive stimulus words, which provides support for the idea that an activated threat schema produces a memory bias (Eysenck & Mogg, 1992). This is also consistent with studies that showed that anxiety disorder patients show superior recall of threat words compared to nonthreatening information (Becker, Rinck, & Margraf, 1994; Cloitre & Liebowitz, 1991; Cloitre, Shear, Cancienne, & Zeitlin, 1994). The occurrence of semantic intrusions of threatening material in the free recall task in all clinical participants possibly indicates a general response bias in anxiety-disordered patients, independent of attachment status (see Mogg & Mathews, 1990). The threat schema may be activated by the memory induction and result in general selective memory for threatening material.

Sample characteristics and recommendations for future studies

Compared to other clinical samples, our sample included more secure and fewer unresolved participants. Although our clinical sample consisted of outpatients, their symptomatology was severe. The overrepresentation of secure attachments and underrepresentation of unresolved loss or trauma can, therefore, not be explained on the basis of a more lenient diagnosis. Another explanation may be the recruitment procedure of self-selection: because participation in this study was voluntary, it is possible that secure individuals are more willing and unresolved individuals are less willing to expose themselves to intensive interviewing and testing. In studies in which the research protocol is part of the diagnosis and treatment of (in)patients, the attachment distribution may better reflect the distribution in the population of psychiatric patients. In a future study, the generalizability of the outcomes should receive careful attention, starting in the stage of participant recruitment.

Co-occurrence of anxiety and depression could not be completely controlled for in this

study. By using the ADIS-R for diagnosing, depression as a primary diagnosis was ruled out. However, this does not mean that the anxiety disorder patients did not experience any depressive symptoms, as it is a well-established fact that the comorbidity of anxiety and depressive symptoms is high. The Williams et al. (1997) model for selective information processing predicts explicit differences in the nature of cognitive biases in anxiety and depression. In a future study of the effect of attachment insecurity on information processing in clinical disorders, this should be accounted for by using more specific diagnostic instruments that allow control of the level of symptomatology.

Furthermore, we recommend that future investigations into attachment-related information processing compare different kinds of threatening material (general, disorder specific, and attachment specific) and refine experimental conditions with individually determined thresholds for preattentive information processing. Last, it will be interesting to compare information processing and response selection tasks to investigate similarities and differences in the nature of the insecure mental representations of attachment.

In sum, we found provisional evidence for one of the most basic assumptions of attachment theory: that the mental representation of childhood attachment experiences influences information processing, in particular attention and memory. Insecure (dismissing and preoccupied) nonclinical participants show an undifferentiated response inhibition suggesting a general inability to maintain attentional focus. In anxiety disorder patients, secure attachment representations facilitate a more focused and open processing of threatening information.

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