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Overgeneral Memory Extends to Pictorial Retrieval Cues and Correlates with Cognitive Features in Posttraumatic Stress Disorder

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Individuals with posttraumatic stress disorder (PTSD) show overgeneral memory (OGM) when retrieving autobiographical memories to word cues. We investigated whether OGM extends to picture cues and whether it is related to PTSD symptoms and cognitions. Trauma survivors with (n = 29) and without (n = 26) PTSD completed the standard Autobiographical Memory Test (AMT) and a novel picture version. Compared to the no-PTSD group, the PTSD group showed OGM in both test versions. Pictures facilitated specific memory retrieval, but this effect was no longer significant when verbal intelligence or depressive symptoms were controlled. OGM correlated with PTSD symptoms and perceived self-change; with intrusive memories, their perceived "nowness," responses to intrusions (thought suppression, rumination, dissociation), and negative interpretations of symptoms.

Keywords: overgeneral memory, Autobiographical Memory Test, posttraumatic stress disorder, intrusive memories, rumination, thought suppression

Researchers and clinicians have observed that people with posttraumatic stress disorder (PTSD) appear "frozen" at the time of the traumatic event (e.g., Herman, 1992), unable to resume their former lives. Trauma is thought to dramatically change people's view of themselves and the world (e.g., Janoff-Bulman, 1992). Patients with PTSD often describe that they have completely changed as a person and that they have difficulty remembering what they used to be like before the traumatic event (e.g., Ehlers, Maercker, & Boos, 2000), and may in extreme cases even be unable to access any personal information (e.g., Markowitsch, 2002). Little is known about the changes in autobiographical memory in PTSD that may account for such profound changes in self-perception.

Autobiographical Memory Disturbance in Depression and PTSD

The present study built on preliminary findings that people with PTSD may have an overgeneral memory bias (OGM) (Harvey, Bryant & Dang, 1998; McNally, Litz, Prassas, Shin, & Weathers, 1994; McNally, Lasko, Macklin & Pitman, 1995), similar to people with depression (Williams & Broadbent, 1986; for reviews see van Vreeswijk & de Wilde, 2004; Williams et al., in press). When asked to retrieve a specific memory from their lives in response to a cue word (e.g., "happy") in an Autobiographical Memory Test (AMT), people with OGM will reply with descriptions that summarize several different events ("always when I visit my friend") instead of retrieving a single, circumscribed event (e.g., "going to my friend's place last Saturday afternoon").

Previous studies on OGM in PTSD are not fully conclusive as it (1) was sometimes not clear whether the study groups had experienced traumatic events of the same severity, and (2) the PTSD and no-PTSD groups sometimes differed on other characteristics that may be linked to OGM, such as comorbid diagnoses of alcohol dependence and major depression (e.g., McNally et al., 1994) or intelligence (McNally et al., 1995). Dunmore and Ehlers (submitted) found that assault survivors with PTSD showed OGM compared to those without PTSD, but also found that differences in education may have in part been responsible for the observed group difference. Thus, it remains as yet unclear how robust the finding of OGM in PTSD is, and what role it may play in the disorder.

Do People with PTSD Show OGM with Sensory Retrieval Cues?

According to hierarchical models of autobiographical memory, access to autobiographical memories is either (1) direct and unintentional, when the individual is in "retrieval mode" and a matching trigger is present (bottom-up process) or (2) through an intentional, generative, and effortful search process (top-down process). In the intentional search (such as in the original AMT with word cues), increasingly specific search-descriptions are created, until a single event from the autobiographical memory base is finally remembered (Conway & Pleydell-Pearce, 2000; Norman & Bo-

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brow, 1979; Brown & Schopflocher, 1998; Williams & Dritschel, 1988). Williams and colleagues (e.g., Williams & Dritschel, 1988) suggested that OGM results from a dysfunctional avoidant retrieval style, which leads to a premature abortion of this memory search. Furthermore, repeated overgeneral retrieval may strengthen the network of general memories, thus enhancing the accessibility of general memories when competing with specific event memories during retrieval ("mnemonic interlock," Williams, 1996).

In everyday life, triggers of autobiographical memories often include sensory cues, and the retrieval will at least partially be a bottom-up (reminding) process. In the AMT, people retrieve more specific memories when responding to imageable cues (Williams, Healy, & Ellis, 1999), and fewer when engaging in abstract verbal processing (Watkins, Teasdale, & Williams, 2000; Watkins & Teasdale, 2001). Thus, sensory cues may lead to more specific memories than verbal retrieval cues. Whether or not the effect of sensory cues overrides OGM in PTSD is unclear.

It would be of interest to study retrieval of autobiographical memories in PTSD in response to sensory retrieval cues. The present study included a novel picture version of the AMT to test the robustness of OGM in PTSD with an alternative methodology. Furthermore, we speculated that pictures may facilitate direct memory retrieval. If OGM in PTSD generalizes to pictorial retrieval cues, this may be a first indication that OGM in PTSD generalizes to memories that are triggered by sensory cues.

Possible Relationships of OGM with Symptoms and Cognitive Features of PTSD

If OGM is in part responsible for the changes in self-perception in PTSD described above, one would expect it to correlate with appraisals of the self and one's future that are characteristic of patients with PTSD. In particular, difficulties in accessing specific memories of one's past may relate to a sense of permanent change (e.g., Ehlers, Maercker, & Boos, 2000). As OGM correlates with poor problem solving (e.g., Evans, Williams, O'Loughlin, & Howells, 1992), one may also expect it to correlate with a sense of foreshortened future (American Psychiatric Association, 1994) or hopelessness.

The literature suggests several possible mechanisms of OGM. Several authors have linked OGM to the presence of intrusive memories. Kuyken and Brewin (1995) and Brewin, Reynolds, and Tata (1999) suggested that intrusions and the effort to avoid them might interfere with the understanding and execution of the AMT. They reported significant relationships between OGM and intrusions and avoidance symptoms. However, not all studies have replicated these relationships (e.g., Henderson et al., 2002; Hermans et al., 2004). The absence of an OGM bias in obsessive-compulsive disorder also challenges the hypothesis of a simple relationship between intrusions and OGM (Wilhelm, McNally, Baer, & Florin, 1997).

It is possible that intrusions only interfere with the retrieval of other specific memories if the intrusion reflects a part of a trauma memory that has not been adequately integrated into the autobiographical memory base (see Conway & Pleydell-Pearce, 2000; Ehlers & Clark, 2000). A poorly integrated memory is thought to be disjointed from other autobiographical information (Ehlers, Hackmann, & Michael, 2004). During an intrusive trauma memory, it is difficult for the person to simultaneously access other autobiographical information. If this is the case, an indicator of the poor integration should be related to OGM. In the present study, we used the perceived "nowness" of intrusive memories (the degree to which the content of the memory appears to happens in the here and now rather than in the past) as an indicator of poor integration. "Nowness" of intrusive memories has been found to predict PTSD (Michael, Ehlers, Halligan, & Clark, 2005).

Furthermore, people's responses to intrusions, such as cognitive avoidance strategies, may be related to OGM (e.g. McNally et al., 2006; Raes, Hermans, de Decker, Eelen, & Williams, 2003). In the present study, we investigated the relationship between OGM and three responses to intrusive memories highlighted by Ehlers and Clark (2000) as maintaining factors in PTSD, thought suppression (e.g., Ehlers, Mayou, & Bryant, 1998), rumination (e.g., Ehlers et al., 1998; Murray, Ehlers, & Mayou, 2002), and persistent dissociation (e.g., Halligan, Michael, Clark, & Ehlers, 2003). Interventions aiming at these cognitive avoidance strategies have been shown to influence OGM in past studies (Watkins & Teasdale, 2001; Williams, Teasdale, Segal, & Soulsby, 2000). As negative interpretations of initial PTSD symptoms (e.g., "I am going crazy") are thought to motivate the individual to suppress memories of the traumatic event (Ehlers & Steil, 1995), one may also expect such interpretations to correlate with OGM.

Study Aims

The present study tested the robustness of OGM in PTSD by comparing traumatized people with and without PTSD who reported criterion A events as defined by the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, American Psychiatric Association, 1994) of similar severity; using both the standard word version and a novel picture version of the AMT. We hypothesized that people with PTSD would show OGM in both versions of the AMT (Hypothesis 1). On the basis of Williams et al.'s (1999) findings, we expected that picture cues would lead to more specific memories than word cues (Hypothesis 2). The study further explored the associations between OGM and symptoms and cognitive features of PTSD in trauma survivors.

Method

Participants

Participants were between 18 and 65 years of age and had experienced a traumatic event that met the stressor criterion A of DSM-IV (American Psychiatric Association, 1994). Twenty-three participants had experienced an assault, 21 experienced a motor vehicle accident, 5 experienced another accident, 4 experienced an unexpected death of a relative, and 2 experienced other events. Exclusion criteria were: no memory of the trauma or unconsciousness for more than 15 minutes, head injury, drug abuse or dependence, psychosis, or more than one traumatic event within the last five years. The latter criterion was necessary to unambiguously establish whether a memory preceded or followed the traumatic event and to guarantee that the study groups did not differ in the time between testing and the traumatic event. Participants were recruited via an outpatient specialist clinic for PTSD, victim support charities, local emergency departments, and newspaper advertisements.

Participants in the PTSD group met DSM-IV criteria for PTSD according to the Structured Clinical Interview for DSM-IV (SCID, First, Spitzer, Gibbon, & Williams, 1996) and reported at least moderate symptom

severity (a score of 17 or greater on the Posttraumatic Diagnostic Scale, PDS; Foa, Cashman, Jaycox, & Perry, 1997). The interview was conducted by trained psychologists or research nurses. Interrater reliability of the research team for a diagnosis of PTSD ranged between $\kappa = .95$ ($n = 51$, traumatized outpatients, Ehlers, Clark, Hackmann, McManus, & Fennell, 2005) and $\kappa = .82$ ($n = 56$ trauma survivors, Ehring, Ehlers, & Glucksman, in press). Thirty-seven participants with PTSD were initially recruited for the study. Eight of these were excluded because they fulfilled the criteria for drug abuse ($n = 3$) or psychosis ($n = 1$), scored below 17 on the PDS ($n = 2$), had several traumas in the last five years ($n = 1$), or were too depressed to follow the instructions ($n = 1$). Thus, the PTSD group comprised 29 participants (12 of whom were women). Two participants in this group had comorbid major depression, three had panic disorder (one agoraphobia), one had agoraphobia without panic attacks, one social phobia, four specific phobia, two obsessive-compulsive disorder, one generalized anxiety disorder, one somatization disorder, and one hypochondriasis. Twelve (41.4 %) participants in the PTSD group had at least one comorbid axis 1 diagnosis.

Participants in the no-PTSD group had experienced a criterion A event according to the SCID, but did not meet the diagnostic criteria for PTSD and did not score greater than 13 on the PDS. Thirty-nine volunteers without PTSD were initially recruited for the study. Of these, 13 were excluded because they had been unconscious for more than 15 minutes during the trauma ($n = 1$), met criteria for psychosis ($n = 1$) or drug abuse ($n = 6$), scored 14 or greater on the PDS ($n = 4$) or had experienced more than one traumatic event in the last five years ($n = 1$). Thus, the final no-PTSD group comprised 26 participants (17 women). None of the no-PTSD group met criteria for major depression. One participant had social phobia and another had somatization disorder.

Table 1 presents sample and trauma characteristics. The PTSD and no-PTSD groups did not differ significantly (all $p > .05$) in terms of age, gender, ethnic group, education, type of trauma, time since trauma, injuries suffered as result of the trauma, comorbid major depression or type of trauma. However, the PTSD group were significantly more likely than the no PTSD group to have another Axis I disorder, $\chi^2(1, 55) = 8.20$, $p = .004$.

Measures

Posttraumatic Diagnostic Scale (PDS). The PDS (Foa et al., 1997) is a standardized and validated self-report measure of PTSD symptom severity that has been widely used with clinical and nonclinical samples of traumatized individuals. The PDS asks participants to rate how much they were bothered by each of the PTSD symptoms specified in DSM-IV ranging from 0 (*never*) to 3 (*5 times per week or more/very severe/nearly always*). The internal consistency was $\alpha = .95$ in the present sample.

Posttraumatic Cognitions Inventory (PTCI). The PTCI (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999) measures trauma-related thoughts and beliefs that have been shown to discriminate well between traumatized people with and without PTSD. It has been shown to have good internal consistency and retest reliability. For the purposes of the present paper, several a-priori scales from the initial item pool of the PTCI that were of interest with respect to OGM were analyzed. These included (1) permanent change, four items, e.g., "I have permanently changed for the worse", $\alpha = .85$ in the present sample, (2) hopelessness, two items such as "Nothing good can happen to me anymore", $\alpha = .90$; and (3) negative interpretations of symptoms, six items, e.g., "My reactions since the event mean that I am going crazy", $\alpha = .91$.

Intrusions Questionnaire (INT). This questionnaire (Hackmann, Ehlers, Speckens, & Clark, 2004) asks participants to describe the most frequent intrusive memory of their traumatic event and to report how often it occurred in the past week (frequency), and to rate its vividness and "nowness" (i.e., the extent to which it felt as if it was happening now instead of being something from the past), each on a scale from 0, not at all, to 100, very much. The retest-reliability (1-week interval) in a sample of 44 PTSD patients (Speckens, Ehlers, Hackmann, & Clark, 2006) ranged between $r = .61$ and $r = .72$ for the scales, respectively. The correlations

Table 1
Demographic Characteristics of the PTSD and No-PTSD Groups

	PTSD ($n = 29$)	No-PTSD ($n = 26$)	Statistic	p
Age in years M (SD)	40.38 (11.76)	35.23 (12.11)	$t(53) = 1.59$	.116
Sex n (%)				
Female	12 (41.4)	17 (65.4)	$\chi^2(1) = 3.17$	.106
Male	17 (58.6)	9 (34.6)		
Ethnic group n (%)				
Afro-Caribbean	9 (31.0)	2 (7.7)	$FI = 6.24$	.102
Caucasian	17 (58.6)	21 (80.8)		
Education n (%)				
GCSE or below	15 (51.7)	7 (26.9)	$\chi^2(1) = 3.51$	.089
A-levels or degree	14 (48.3)	19 (73.1)		
Trauma n (%)				
Motor vehicle accident	9 (31.0)	12 (46.2)	$FI = 2.92$	.804
Physical assault	11 (37.9)	9 (34.6)		
Sexual assault	2 (6.9)	1 (3.9)		
Unexpected death	4 (13.8)	1 (3.9)		
Accident	2 (6.9)	2 (7.7)		
Other	1 (3.5)	1 (3.9)		
Injuries n (%)				
No injuries	7 (24.2)	12 (46.2)	$\chi^2(2) = 3.48$	.181
Minor injuries	13 (44.8)	10 (38.5)		
Major injuries	9 (31.0)	4 (15.3)		
Time elapsed since trauma n (%)				
< 6 months	4 (13.8)	1 (3.9)	$FI = 2.85$	.453
6 months to 1 year	9 (31.0)	7 (26.9)		
1 year to 2 years	8 (27.6)	6 (23.0)		
2 years to 5 years	8 (27.6)	12 (46.2)		

Note. PTSD = posttraumatic stress disorder; GCSE = a school exam taken at age 16.

between the questionnaire scales and a corresponding Intrusions Interview were: frequency $r = .94$, vividness $r = .70$, "nowness" $r = .84$ (Hackmann et al., 2004).

Response to Intrusions Questionnaire (RIQ). The RIQ (Clohessy & Ehlers, 1999; Murray et al., 2002) measures dysfunctional cognitive strategies in response to intrusive memories, namely thought suppression, six items, e.g., "*I try to push them out of my mind,"* internal consistency in the present sample $\alpha = .92$, and rumination, six items, e.g., "*I dwell on how the event could have been prevented,"* $\alpha = .90$. The scales were developed over a series of studies and have been shown to have good internal consistency and validity in predicting chronic PTSD.

State Dissociation Questionnaire (SDQ). The SDQ (Murray et al., 2002) was used to assess persistent dissociation after the traumatic event. It has been shown to have good internal consistency and to predict PTSD after motor vehicle accidents and assault (Halligan et al., 2003; Murray et al., 2002). The SDQ asks participants to rate how often they had experienced each of a list of 11 items measuring dissociative experiences such as derealization, depersonalization and numbing during the last week. Internal consistency in the present sample was $\alpha = .94$.

Foreshortened future. This was scored as present if participants met the SCID criteria for this symptom.

Mill Hill Vocabulary Scale (MHV). The MHV (Raven, Court, & Raven, 1994) is a standard measure of verbal intelligence and asks participants to detect the correct synonym in a group of words. We administered set A of the multiple-choice version of the senior form.

Trauma interview. An adapted version of the trauma interview used by Dunmore, Clark, and Ehlers (1999, 2001) assessed trauma characteristics.

Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI). The BDI (Beck & Steer, 1987) and BAI (Beck & Steer, 1990) are standard measures of depression and anxiety of established reliability and validity. Internal consistencies were $\alpha = .93$ and $\alpha = .95$, respectively.

Autobiographical Memory Tests (AMT). Two versions of the AMT were given. The word version followed the original version developed by Williams and Broadbent (1986). Both the word and the picture versions were administered via a computer (VAIO Sony laptop), using a program that was specifically developed for the purposes of the study and allowed recording of reaction times (Eckert, 2000).[1] The light in the laboratory was dimmed for better visibility of the pictures. Participants were asked to sit down facing the computer screen. Reaction times and type of memory reported were recorded by the experimenter via a button box and stored on the computer. Answers were also tape-recorded for reliability checks. Each version of the AMT presented six positive and six negative cues, and participants were instructed to recall a specific memory in response to each of these cues. The instruction was the same for both versions, however, for the picture version we added the sentence "The event you remember can be linked to the picture in any way" to facilitate retrieval of a personal memory in response to the concrete stimulus. Positive and negative words/pictures were randomized separately, and then presented in these randomized orders, alternating between positive and negative cues. Three neutral practice cues were given before the test cues in each of the versions. Each picture cue was preceded by a fixation cross to focus the participants' attention to the middle of the screen. Presentation time for pictures was 2.5 seconds. The maximum reaction time allowed to produce a specific memory in response to the cues was 30 seconds. In case the first answer was not specific, the experimenter used the prompts "Can you think of a particular time?" or "Is there a specific event the picture reminds you of?" After completion of both tests, the participant was asked to rate each memory for pleasantness on a scale from –5 (*unpleasant*) to + 5 (*pleasant*). They also reported whether the remembered event happened before the trauma, afterwards or whether it was the traumatic event itself.

For the word version, a word pool of non-trauma related words was created, including the words used by Brittlebank and colleagues (Brittlebank, Scott, Williams, & Ferrier, 1993) and the words from John's word norms for emotionality ratings (John, 1988). These words were rated for imagery using Paivio's scale and instructions (Paivio, Yuille, & Madigan, 1968) and pleasantness by 27 college students and university staff. The appendix shows the instructions and statistics for the chosen words. The final set of six positive and six negative words was matched in terms of emotionality (John, 1988), frequency (Kucera & Francis, 1967), imagery and pleasantness, with positive and negative words being significantly different from each other in terms of their pleasantness. The positive words were *peaceful, relieved, faithful, pleased, glorious, devoted*, the negative words were *stubborn, critical, annoy, bored, grief, ugly*. The 3 neutral practice words were *expert, fashionable, green*. The words were recorded by a female native speaker, piloted for understandability, and were presented as (audible) .wav files.

For the picture version, six positive and six negative pictures were chosen from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1999). The positive pictures were 1910, 2530, 4640, 5910, 5990, and 8490 (e.g., a couple on bicycles, a sunset, a rollercoaster); the negative pictures were 2710, 2900, 9290, 9320, 9417, and 9561 (e.g., a ragged kitten, a crying boy, a dirty toilet). The three practice pictures were 2381, 7002, and 7550 (i.e., a man at work, a woman on a telephone, a towel). Positive and negative pictures were matched for arousal and differed significantly in terms of valence (see Appendix). None of the pictures were trauma-related; thus, none depicted violence, accidents, injuries, hospital scenes, or similar.

Procedure

The two versions of the AMT were presented in two blocks. Order was counterbalanced, stratified by sex. Before the second version began, the instruction was repeated and introduced as follows "Now you are going to do the same task again. Only, instead of seeing a picture you will hear a word (*or vice versa*). Again, please try to think of a specific event, as you have done before." The session continued with the MHV and another memory interview (the results of which will be presented elsewhere). Participants then filled in the questionnaires and completed the SCID. The participants where then debriefed about the purpose of the study and reimbursed for their travel expenses and time (on average £35 for all parts of the study).

Data Analysis

Scoring of the AMT. Following Williams and Broadbent (1986), a memory was defined as specific if it was about "an event lasting a day or less, which occurred at a certain place and time even if the subject could not remember when," as extended, if it was about "an event lasting longer than a day" and as general or categoric, if the memory "reflected repeated activities" or if they were general memories about people or places (Williams & Broadbent, 1986). A second independent rater who was blind to the participants' diagnoses rated a random sample of 10% of the answers. Interrater reliability was $\kappa = .80$. The two main dependent variables were the number of first answers that were specific or general. Pleasantness of the memories was an additional dependent variable.

Statistical analysis. Hypotheses 1 and 2 were tested with two three-way repeated measures ANOVAs with group (PTSD versus no PTSD) as the between-subjects factor and cue type (word vs. picture) and valence (negative vs. positive) as within subject factors, and the number of general memories and the number of specific memories as the dependent variables. An additional three-way ANOVA tested differences in the reported pleasantness of the memories.

If the BDI or MHV correlated with the dependent variable, analyses of covariance (ANCOVA) tested whether group differences or interactions

[1] Latency data were deleted from the paper for brevity and are available from the authors.

remained significant when these variables were statistically controlled. If the effects remained significant, this ruled out that a memory bias was merely explained by differences in depressive symptoms or verbal intelligence. If an ANCOVA is not reported, there was no correlation between the dependent variable and the BDI or MHV.

Pearson correlations were calculated between the number of general first responses in the standard word version and the symptom and cognition measures, and sociodemographic variables. If necessary, variables were log-transformed to normalize distributions. This applied to dissociation, frequency of intrusive memories, and negative interpretation of symptoms. If distributions could not be normalized, Spearman's ρ is reported. Differences between correlation coefficients were tested following Meng, Rosenthal, and Rubin (1992). In addition, an ANOVA tested whether comorbidity influenced OGM in the standard word version within the PTSD group, using comorbidity as the between-subject factor and valence and cue type as within-subject factors. A multiple regression analysis explored whether OGM can be predicted from features of intrusive memories and the individual's response to these memories. The alpha-level was $\alpha = .05$.

Results

Questionnaire Measures

Table 2 presents the results of the psychological questionnaires. As expected, the PTSD group scored higher on all symptom and cognition measures and lower on verbal intelligence than the no-PTSD group.

General and Specific Memories in the AMT

Table 3 shows the results for the two versions of the AMT. The Group × Cue Type × Valence ANOVA for the number of general memories showed a significant group effect (Hypothesis 1), $F(1, 53) = 19.9$, $p < .001$, $\eta^2 = .27$. The PTSD group retrieved more general first memories than the no-PTSD group. There was a significant effect of cue type (Hypothesis 2), $F(1, 53) = 8.90$, $p = .004$, $\eta^2 = .14$. Participants retrieved more general first memories to word than to picture cues. There was also a group × cue type interaction, $F(1, 53) = 4.01$, $p = .05$, $\eta^2 = .07$. Post hoc-analyses showed that the PTSD group retrieved more general memories in response to words than to pictures, whereas there was no difference between the word and picture versions of the AMT in the no-PTSD group. The difference between the PTSD and no-PTSD groups was thus greater in the word version than in the picture version. There were no effects of valence or interactions. Including the BDI as a covariate in an ANCOVA or excluding the two cases with comorbid major depression did not change these effects. When verbal intelligence (MHV) was controlled for by ANCOVA, the main effect for cue and the group × cue type interaction were no longer significant and only the group effect remained significant.

The group × cue type × valence ANOVA for specific memories also showed a significant group effect. The PTSD group retrieved fewer specific memories than the no-PTSD group, $F(1, 53) = 13.71$, $p = .001$, $\eta^2 = .21$. There was a significant effect of cue type, $F(1, 53) = 7.28$, $p = .009$, $\eta^2 = .12$; participants retrieved fewer specific memories to word than to picture cues. There were no effects or interactions with valence. Here again, the group effect remained significant when the MHV and BDI-score were controlled for by ANCOVA, respectively; however, the cue type effect was no longer significant.

Further Analyses of the AMT

The 3-way ANOVA for the pleasantness ratings showed that the PTSD group rated their retrieved memories as more negative than the no-PTSD group, $F(1, 53) = 11.52$, $p < .001$, $\eta^2 = .18$. There was also a main effect of valence, $F(1, 53) = 336.49$, $p < .001$,

Table 2
Symptom and Cognitive Measures for the PTSD and No-PTSD Groups

Measure	PTSD		No-PTSD			
	M	*SD*	*M*	*SD*	*t* (*df*) / *U*	*p*
MHV	18.86	5.30	23.42	5.39	3.16 (53)	.003
PDS Total score	30.21	8.26	4.19	4.09	15.04 (41.90)	< .001
Reexperiencing	9.28	3.07	1.77	1.97	10.91 (48.19)	< .001
Avoidance	11.48	4.40	1.39	1.77	11.04 (34.45)	< .001
Hyperarousal	9.59	3.25	1.04	1.56	12.64 (41.24)	< .001
BDI	20.79	9.71	4.04	3.91	8.55 (37.69)	< .001
BAI	23.45	12.80	5.27	4.33	7.20 (34.98)	< .001
Intrusions						
Frequency	4.92	6.22	1.07	2.09	75.50	< .001
Vividness	75.56	21.90	52.75	32.07	182.00	.007
"Nowness"	60.37	26.82	9.58	12.33	8.85 (37.44)	< .001
Dissociation	10.65	9.00	1.12	2.03	73.50	< .001
Thought suppression	11.35	3.82	4.12	4.19	6.70 (53)	< .001
Rumination	10.38	3.76	1.69	2.07	10.76 (44.52)	< .001
PTCI scales						
Permanent change	16.21	4.84	6.58	3.75	8.17 (53)	< .001
Hopelessness	6.52	3.85	2.88	1.73	156.00	< .001
Negative interpretation of symptoms	16.21	8.69	9.03	5.33	79.00	< .001

Note. PTSD = posttraumatic stress disorder; MHV = Mill Hill Vocabulary Scale; PDS = Posttraumatic Diagnostic Scale; BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; PTCI = Posttraumatic Cognitions Inventory.

Table 3
Means, Standard Deviations, and Mean Percentage on All (6) Answers for Performance in the Word and Picture Versions of the Autobiographical Memory Test

	PTSD (n = 29)						No-PTSD (n = 26)					
	Positive			Negative			Positive			Negative		
	M	*SD*	%	*M*	*SD*	%	*M*	*SD*	%	*M*	*SD*	%
Word												
First answer												
General	2.3	1.4	38	2.4	1.4	39	1.1	1.1	19	0.9	1.0	14
Specific	3.0	1.4	49	3.2	1.5	53	4.1	1.3	69	4.5	1.4	74
Omissions	0.7	0.9	11	0.5	0.6	8	0.6	1.0	10	0.7	1.0	12
Pleasantness	2.5	1.4		−2.4	1.5		2.7	1.4		−1.3	1.5	
Pictures												
First answer												
General	1.7	1.3	29	1.7	1.4	29	0.7	0.6	12	1.0	0.9	17
Specific	3.6	1.5	60	3.6	1.7	60	4.8	1.0	80	4.3	1.5	72
Omissions	0.5	0.8	8	0.6	1.0	11	0.3	0.7	5	0.5	0.9	8
Pleasantness	2.6	1.5		−2.0	1.5		2.5	1.6		−0.3	1.3	

Note. PTSD = posttraumatic stress disorder.

η^2 = .86. As to be expected, participants retrieved more unpleasant memories with negative cue words, and more pleasant memories with the positive words. The main effects were qualified by group × valence, $F(1, 53) = 9.36$, $p = .003$, $\eta^2 = .15$, and cue type × valence interactions, $F(1, 53) = 4.27$, $p = .044$, $\eta^2 = .08$. The PTSD group recalled more negative memories with negative cues, whereas the groups recalled equally positive memories with positive cues. Negative words lead to more unpleasant memories than negative pictures, whereas positive words and pictures lead to equally positive memories. The main effects and group × valence interaction remained significant when MHV was controlled for by ANCOVA. When the BDI was controlled for by ANCOVA, the stimulus × valence effect disappeared and the group effect was reduced to a trend at $p = .061$.

A further analysis tested whether there was any group difference in the number of memories that dated from before, during, or after the trauma. In both the word and picture versions of the AMT, the PTSD group recalled more trauma memories during the test than the no-PTSD group; words: $M = .69$, $SD = .97$ versus $M = .08$, $SD = .27$; $U = 232.00$, $p = .002$; pictures: $M = .48$, $SD = .69$ versus $M = .15$, $SD = .37$; $U = 286.00$, $p = .049$, but did not differ in the proportion of memories that dated from before or after the trauma.

Table 3 also shows the omissions (number of cues for which no memory was reported) in the AMT. Omissions were rare. U-tests showed that the PTSD and no-PTSD group did not differ in the number of omissions produced as result of each stimulus type (words, pictures, positive, negative), all $p > .2$. The number of extended memories was even smaller and is therefore not reported here.

Associations Between OGM and Clinical and Cognitive Features of PTSD

Clinical features of PTSD. Participants with PTSD who had comorbid diagnoses did not differ in the number of general first responses in the standard word version, $M = 2.5$, $SD = 1.33$, from those without comorbid diagnoses, $M = 2.18$, $SD = 1.12$, $F(1, 27) = 0.49$, $p = .49$. Interactions of comorbidity with stimulus type and valence were far from significant. The number of general first responses in the standard AMT correlated with the PDS total score, $r = .42$, $p = .001$, as well as with all the subscores for the three PTSD symptom clusters, re-experiencing, $r = .34$, $p = .01$; avoidance, $r = .42$, $p = .002$, hyperarousal, $r = .47$, $p < .001$, and depression (BDI), $r = .29$, $p = .03$, but not anxiety (BAI), $r = .22$, $p = .11$. Correlations between OGM (number of general first responses) and BDI remained unaffected by omitting the two cases with major depression from the analysis ($r = .33$). The correlation between OGM and the PDS tended to be greater than the correlation between OGM and the BDI, $Z = 1.92$, $p = .055$. People with lower verbal intelligence (MHV) and lower education, gave more general answers in the standard AMT, $r = -.30$, $p = .028$ and $r_{pb} = -.36$, $p = .006$, respectively.

Relationship of OGM with demographic variables. The number of general first responses in the standard AMT did not significantly correlate with sex $r_{pb} = -.21$, $p = .119$; ethnic group $r_{pb} = -.19$, $p = .17$ or injury severity, $r_{pb} = .021$, $p = .878$.

Relationship of OGM with changed self-perception. The number of general first responses in the standard AMT correlated with perceived permanent change (PTCI), $r = .36$, $p = .007$, and a sense of foreshortened future, point-biserial correlation $r_{bs} = .32$, $p = .019$. The correlation with hopelessness was not significant, $\rho = .21$, $p = .12$.

Relationship with hypothesized mechanisms of OGM. As shown in Table 4, the number of general first responses in the standard AMT correlated significantly with the frequency, vividness and the perceived "nowness" of intrusive memories, and with responses to these intrusions, rumination, thought suppression, and dissociation. It also correlated with negative interpretations of PTSD symptoms. The Table also shows the intercorrelations between these variables. However, none of the correlations with OGM remained significant when calculated within the PTSD group separately, the only trend was for a correlation with rumination, $r = .33$, $p = .08$.

A multiple regression analysis (see Table 5) explored how much of the variance of OGM (number of general first memories) can be

Table 4
Pearson Correlations Between General First Answers in the Standard Autobiographical Memory Test (AMT) With Characteristics of Intrusive Memories and Response to Intrusions

	Intrusions frequency[a]	Vividness[b]	Nowness	Dissociation[a]	Thought suppression	Rumination	Negative interpretation of symptoms[a]
OGM	.30*	.28*	.50**	.36**	.41**	.53***	.41**
Intrusions frequency		.30*	.51***	.57***	.37**	.60***	.44**
Vividness			.33*	.21	.19	.41**	.35*
Nowness				.67***	.65***	.67***	.56***
Dissociation					.40**	.58***	.57***
Thought suppression						.63***	.53***
Rumination							.75***

Note. OGM = overgeneral memory, number of general first answers.
[a] log-transformed for analysis. [b] Spearman's ρ as distribution could not be normalized.
* $p < .05$. ** $p < .01$. *** $p < .001$.

predicted on the basis of intrusive memories and response to intrusions. To reduce multicollinearity, only the two characteristics of intrusions and two responses to intrusions with the highest correlation, intrusion frequency, "nowness," rumination and thought suppression, were entered in the regression function. Interpretation of symptoms was not entered as it is thought to motivate rumination and thought suppression (Ehlers & Steil, 1995), and was highly correlated with these variables. The four variables explained 37% of the variance of OGM, $R = .61$, $R^2 = .374$, $F(4, 48) = 6.58$, $p < .001$. Rumination was the only variable that explained unique variance, $\beta = 0.453$, $t = 2.49$, $p = .017$.

Discussion

Overgeneral Memory in PTSD

In line with Hypothesis 1, traumatized people with PTSD produced more general and fewer specific memories in both the original word version and a novel picture version of the Autobiographical Memory Test than those without PTSD. These results replicate and extend the earlier findings of McNally et al. (1994, 1995) and Dunmore and Ehlers (submitted), and support the robustness of OGM in PTSD. The present study is to our knowledge the first to show that trauma survivors with PTSD show OGM in response to picture cues, compared to those without PTSD. The study ruled out a range of alternative interpretations for OGM in PTSD. In contrast to some earlier studies, the study groups were comparable in trauma severity and age of memories retrieved. The pattern of results also made it unlikely that the overgeneral memory retrieval was because if group differences in verbal intelligence, degree of comorbidity, or depression. The results remained the same when the two participants with major depression were excluded. The low rate of major depression in our PTSD sample may reflect the selection criterion of only one discrete traumatic event in the past five years. Furthermore, among the clinic patients, those without depression may have been more likely to volunteer for the study than those with depression. The low comorbidity, however, had the advantage that the study could more unambiguously demonstrate a relationship between PTSD and OGM than previous studies with greater comorbidity. OGM also tended to be more closely correlated with PTSD symptom severity than with depressive symptoms. Furthermore, group differences in OGM remained significant in all ANCOVAs that controlled depression levels statistically. However, it should be noted that depressive symptoms are part of the PTSD symptom cluster, and partialing out depression may be questionable (Miller & Chapman, 2001).

In addition to the overgeneral memory retrieval, the PTSD group also showed a bias to retrieve more unpleasant memories to negative cues. This is in line with earlier findings of mood congruent memory recall (e.g., Williams & Broadbent, 1986) and a previous study comparing assault survivors with and without PTSD (Dunmore & Ehlers, submitted).

OGM was not only related to avoidance and intrusive memories, but also to hyperarousal symptoms. This raises the question of whether the OGM bias in PTSD was because high arousal impeded performance (Eysenck, 1983). However, in previous studies OGM was not associated with anxiety disorders (e.g., Wessel, Meeren, Peeters, Arntz, & Merckelbach, 2001; Wenzel, Jackson, & Holt, 2002; Wilhelm et al., 1997), and in the present study comorbidity (mainly with other anxiety disorders) and the BAI were not significantly related to OGM, making this interpretation unlikely.

Picture Cues as Memory Triggers

In line with Hypothesis 2, participants retrieved fewer general and more specific memories with pictorial retrieval cues than with verbal cues. This finding extends previous results that highly imageable cues facilitate (Williams et al., 1999) and that verbal

Table 5
Summary of Regression Analysis (Enter Method) for Intrusion Characteristics and Response to Intrusions Predicting OGM

Variable	*B*	*SE B*	β
Intrusion frequency	−0.08	1.01	−0.01
Intrusion nowness	0.01	0.01	0.13
Thought suppression	0.04	0.07	0.10
Rumination	0.20	0.08	0.45*

Note. $R^2 = .37$. OGM = overgeneral memory, number of general first answers.
* $p < .05$.

abstract thinking reduces retrieval of specific memories (Watkins et al., 2000, Watkins & Teasdale, 2001). Concrete sensory-perceptual processing may thus reduce OGM. However, in this study, the pictures no longer had an advantage over words for the ease of specific memory retrieval when depressive symptoms and verbal intelligence were controlled for as covariates. Thus, pictorial cues may mainly help overcome difficulties in retrieval that are related to low verbal intelligence or depression.

We had speculated that if OGM in PTSD generalizes to pictorial retrieval cues, this may be an indication that OGM in PTSD generalizes to memories that are triggered by sensory cues. The results offer preliminary support for this interpretation. Further support comes from a recent study that found fewer spontaneous memories in trauma survivors with PTSD than in those without PTSD (Schönfeld & Ehlers, in preparation).

One may argue that it is unclear whether the pictures in this experiment indeed facilitated direct autobiographical memory retrieval. For example, even highly sensory stimuli such as pictures may trigger a top down search unless they are highly personally specific (Conway, personal communication, March 22, 2004). It is also possible that the differences in retrieval rates between words and pictures were because of other differences in the stimulus material. For example, in line with most previous research using the AMT, the words were adjectives, whereas the pictures showed scenes or objects, which are more similar to nouns than to adjectives.

OGM and Changed Self-perception in PTSD

As expected, perceived permanent change and a sense of foreshortened future were associated with OGM. This result is consistent with the hypothesis that OGM may contribute to such changes in self-perception. It is also possible that perceived permanent change may contribute to OGM by motivating the individual to avoid memories that predate the trauma. In line with other studies, we did not find an association between OGM and hopelessness (de Decker et al., 2003; Swales & Williams, 2001). It is possible that a clearer picture would have emerged if we had assessed problem-solving strategies, which may mediate between OGM and hopelessness.

Possible Mechanisms of OGM in PTSD

In line with Williams and Dritschel's (1988) avoidance hypothesis of OGM, the number of general memories in the AMT was related to the severity of avoidance symptoms, and to cognitive strategies that are functionally similar to avoidance in that they are thought to prevent in the emotional processing of trauma memories, thought suppression, persistent dissociation and rumination (Ehlers & Clark, 2000). Rumination contributed unique variance in the multiple regression analysis and was the only variable that showed a trend for a correlation with OGM in the PTSD group. Rumination may be particularly important in explaining OGM (see also Watkins et al., 2000; Watkins & Teasdale, 2001). It is possible that overgeneral retrieval as an abstract remembering style mirrors rumination as an abstract thinking style.

Kuyken and Brewin (1995) suggested that intrusive memories of the trauma may interfere with the retrieval of other specific memories. In line with this hypothesis, the severity of reexperiencing symptoms and the frequency and vividness of the participants' most important intrusive memories correlated with OGM, and participants with PTSD recalled more trauma memories during the AMT than those without PTSD. Together with the high thought suppression scores in the PTSD group, the latter finding may indicate that considerable effort is involved in suppressing trauma memories, which may contribute to OGM by both, limiting executive functioning and enhancing avoidance tendencies. However, the absolute number of trauma memories during the AMT was small.

The perceived "nowness" of the intrusive memories also correlated with OGM. "Nowness" of trauma memories is thought to be a sign that the trauma has not being adequately elaborated and integrated with other autobiographical memories (Ehlers & Clark, 2000). Trauma memories in PTSD may be so disjointed from other autobiographical memories that the person has problems accessing other memories when remembering the trauma (Ehlers et al., 2004), or may by their disruptiveness reinforce the active inhibition of other autobiographical memories (Conway & Pleydell-Pearce, 2000). It is also possible that OGM is a risk factor for poor integration of the traumatic memory. Finally, there may be a reciprocal relationship.

Limitations

The study had several limitations. First, the study was correlational and does not allow causal conclusions about the direction of the observed associations. Second, we used a computer program for both AMT versions, and the cues in the word version were spoken rather than written words, deviating from the standard procedure. However, the computer version allowed a standardized stimulus presentation and randomization, which can be considered advantages, and the results of the word version replicated previous findings well. Third, the study did not include other control groups such as patients with other anxiety disorders or nontraumatized controls so that we cannot rule out that high arousal or other nonspecific factors correlated with PTSD may have contributed to OGM in the PTSD group, or that traumatized people without PTSD show OGM compared to nontraumatized people.

Fourth, the PTSD and no-PTSD group were not ideally matched in terms of sex, ethnic group and education level, although group differences were not significant. The observed pattern of nonsignificant group differences between participants with and without PTSD resembles the pattern found in epidemiological studies (e.g., Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), and thus probably underscores the generalizability of the results. Furthermore, the pattern of findings (no correlation of OGM with sex and ethnic group, group difference remained significant in ANCOVAs controlling for intelligence) makes it unlikely that these sociodemographic variables explained the group differences in AMT performance.

Fifth, the correlations in the present study remain preliminary as we used a group design with PTSD and no-PTSD groups. However, PDS scores were normally distributed in the sample. No α-correction for multiple correlations was used because of low power. Both methods may have led to an overestimation of the associations between OGM and other measures. It should also be noted that the correlations were no longer significant when analyses were repeated for the PTSD group only. The latter analysis was hampered by low power and a

restricted range of symptoms. A recent study from our laboratory indeed replicated the pattern of findings in a sample of assault survivors that were not selected for diagnostic status (Schönfeld, Ehlers, Böllinghaus & Rief, in press).

Conclusions

In conclusion, the present results support OGM bias in PTSD. The study demonstrated OGM in PTSD with a picture version of the AMT, a condition that possibly facilitates direct memory retrieval, thus underlining the potential relevance of OGM for memory retrieval in the individual's everyday life. The results are in line with the hypothesis that it is not the experience of trauma per se, but rather the response to trauma and dysfunctional coping mechanisms such as rumination and thought suppression that are involved in OGM. OGM correlated with changes in self-perception following the trauma and features of trauma memories that have been shown to be involved in the maintenance of the disorder. Thus, OGM may also play a role in maintaining PTSD. If prospective studies of trauma survivors confirm this hypothesis, treatment strategies that have been found to correct OGM such as mindfulness training (Williams et al., 2000) may play a role in the treatment of PTSD. It would also be of interest to study whether treatment procedures used in effective treatments of PTSD such as "reclaiming your life" assignments (Ehlers & Clark, 2000) change OGM bias.

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Appendix

Instructions for the Word Evaluations

In the following you will find a list of words. You are asked to rate them with respect to two characteristics (imagery and pleasantness).

Imagery. Words differ in their capacity to arouse mental images. You are asked to rate the following words with respect to the ease or difficulty, with which they arouse mental images (i.e., a mental picture, or sound, or other sensory experience). The word "green" would probably arouse an image very easily and therefore would be rated as high imagery (e.g., 6 or 7). Contrary, the word "abstract" would do so with difficulty and therefore would be rated as low imagery (e.g., 1 or 2). Since words tend to make you think of other words as associates, e.g., cat-dog, it is important that you note only the ease of getting a mental image directly related to the word.

Pleasantness. Please rate the same words with respect to their pleasantness. For example, the word "lucky" would probably be very pleasant and therefore be rated as high pleasantness (e.g., 2 or 3), whereas the word "salad" would be neither pleasant nor unpleasant and possibly be rated as 0, and the word "dirty" would be very unpleasant and could therefore be rated as low pleasantness (e.g., −3 or −2).

Please make your judgment by circling the appropriate number and feel free to use the entire range of numbers (1 to 7 and –3 to 3, respectively). There are no right or wrong answers, please just consider your own judgment.

Word set statistics

	Positive		Negative			
Linguistic variable	*M*	*SD*	*M*	*SD*	*t (df)*	*p*
Imagery	3.53	1.07	3.64	0.93	0.71 (26)	.49
Emotionality	4.90	0.30	4.91	0.73	0.04 (10)	.93
Frequency	23.33	9.75	20.33	18.92	−0.35 (10)	.74
Pleasantness	1.86	0.45	−1.72	0.51	−23.74 (26)	<.001

Picture set statistics

	Positive		Negative			
	M	*SD*	*M*	*SD*	*t (df)*	*p*
Arousal	5.11	1.00	4.92	0.35	−0.45 (6.21)	0.67
Valence	7.17	0.57	2.72	0.26	−17.44 (10)	<.001

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