Accepted Manuscript

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PII: S0005-7916(16)30002-7

DOI: 10.1016/j.jbtep.2016.01.002

Reference: BTEP 1200

To appear in: *Journal of Behavior Therapy and Experimental Psychiatry*

Received Date: 13 February 2015

Revised Date: 28 October 2015

Accepted Date: 10 January 2016

Please cite this article as: Ridout, N., Dritschel, B., Matthews, K., Carroll, R.O', Autobiographical memory specificity in response to verbal and pictorial cues in clinical depression, *Journal of Behavior Therapy and Experimental Psychiatry* (2016), doi: 10.1016/j.jbtep.2016.01.002.

Autobiographical memory specificity in response to verbal and pictorial cues in clinical depression

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Abstract

Background: Depressed individuals have been consistently shown to exhibit problems in accessing specific memories of events from their past and instead tend to retrieve categorical summaries of events. The majority of studies examining autobiographical memory changes associated with psychopathology have tended to use word cues, but only one study to date has used images (with PTSD patients). *Objective:* to determine if using images to cue autobiographical memories would reduce the memory specificity deficit exhibited by patients with depression in comparison to healthy controls. *Methods:* Twenty-five clinically depressed patients and twenty-five healthy controls were assessed on two versions of the autobiographical memory test; cued with emotional words and images. *Results:* Depressed patients retrieved significantly fewer specific memories, and a greater number of categorical, than did the controls. Controls retrieved a greater proportion of specific memories to images compared to words, whereas depressed patients retrieved a similar proportion of specific memories to both images and words. *Limitations:* no information about the presence and severity of past trauma was collected. *Conclusions:* results suggest that the overgeneral memory style in depression generalises from verbal to pictorial cues. This is important because retrieval to images may provide a more ecologically valid test of everyday memory experiences than word-cued retrieval.

Key words: overgeneral memory; specificity; depression; Autobiographical Memory Test; imagery

1. Introduction

Autobiographical memory (AM) refers to the recollection of events from one's past. These memories can vary in their level of specificity; specific memories refer to unique events and are sensory in nature (including the emotion associated with the event), whereas general memories are more abstract and conceptual, often referring to categories of events (e.g. we used to go walking on Sundays when I was younger). There is considerable evidence that depression is characterised by a marked deficit in the retrieval of specific autobiographical memories and a tendency to retrieve general categorical memories instead (see Williams et al, 2007 for a review). For example, in studies using the Autobiographical Memory Test (AMT; Williams & Broadbent, 1986), a typical response from a depressed individual when cued with the word "party" might be "I always used to enjoy parties" instead of "I had a great time at Emily's party in February". This tendency to retrieve general descriptions of events or 'categorical' memories is referred to as over-general memory (OGM) and has also been observed in other clinical groups, most notably patients with trauma-related psychopathology (see Moore & Zoellner, 2007 and Williams et al., 2007 for reviews).

Studies using the traditional AMT have tended to use single words or short phrases to cue memories. However, this is likely to be quite different to how individuals access their memories during their everyday life. Schönfeld and Ehlers (2006) proposed that retrieval to image cues may be closer to everyday memory experiences than retrieval to word cues. Indeed, Rasmussen and Berntsen (2014) noted that when individuals access a personal memory they are able to 'see with their minds eye' the context in which the event happened, along with the people and objects that were present. The importance

of visual imagery in the retrieval process was illustrated by Williams, Healy and Ellis (1999), as they reported that highly imageable cues (e.g., library) led to faster and more specific retrieval than did less imageable cues (e.g., boredom). This finding has been replicated in several studies (Anderson, Dewhurst & Nash, 2012; Rasmussen & Berntsen, 2014; Williams et al., 2006). Teasdale and Barnard (1993) proposed that externally viewed and internally generated images are processed by the same cognitive system, which suggests that pictorial cues should confer the same advantage as highly imageable words. In line with this notion, Schönfeld and Ehlers (2006) assessed participants with and without PTSD on two versions of the AMT (cued with words and images) and reported an overall specificity advantage for images over words. However, it should be noted that participants with PTSD still retrieved fewer specific memories than did participants without PTSD, regardless of the nature of the cue. Nevertheless, it would be interesting to establish if OGM in depression generalises to image cues and whether image-cued retrieval could override OGM in patients with depression. Therefore, that was the aim of the current study. We will now consider the processes underlying the retrieval of specific memories, and how these might be impaired in depression, before reflecting on how image cues might aid retrieval of specific memories in depressed participants.

According to hierarchical theories of autobiographical memory (AM) retrieval (e.g. Conway & Pleydell-Pearce, 2000), specific memories can be accessed via two routes. The ‘direct’ route is a ‘bottom up’ process whereby certain (internal or external) triggers automatically lead to spontaneous involuntary retrieval of an event memory. In contrast, the ‘generative’ retrieval route is a ‘top down’ process that involves a strategic

search for a memory that matches current task demands. This process places significant demands on central executive resources (Conway & Pleydell-Pearce, 2000). Involuntary memories are retrieved more rapidly (around two seconds compared to around ten seconds for generative retrieval) and tend to be more specific than voluntary memories (Rasmussen & Berntsen, 2011; Schlagman & Kvavilashvili, 2008; Watson, Berntsen, Kuyken & Watkins, 2013). Depressed individuals exhibit reduced specificity during voluntary retrieval (Sumner, 2012; Williams et al., 2007) but not involuntary (Watson et al., 2013).

Williams and colleagues proposed a comprehensive model (CaR-FA-X) to account for the deficits in memory specificity observed in depression and trauma-related psychopathology (Williams et al., 2007). Capture and rumination (CaR) refers to the disruption of the memory search when resources are captured by ruminative processes (repetitive, negative self-focused thinking) that have been activated by self-referent conceptual information (e.g. depression-relevant word cues). Functional avoidance (FA) is a means of affect regulation whereby the retrieval of specific memories is strategically avoided by the individual in order to avoid the negative consequences of retrieving memories of unpleasant experiences. The final element of the model proposes that depressed and traumatised patients have reduced executive resources that can be utilised during the retrieval process (X). Sumner (2012) conducted an updated review of the literature and concluded that there was support for all elements of the CaR-FA-X model.

Based on Williams et al. (1999) and Schönfeld and Ehlers (2006), it would be expected that participants in the control group of the current study would retrieve a greater number of specific memories to images than words. However, whether image-

based retrieval could override OGM in the depressed patients is unclear. With the CaR-FA-X model in mind, images might aid specificity in depressed patients by reducing the demands on the executive resources during generative retrieval. In line with this proposal, Williams et al. (1999) suggested that visual images provide a rich source of information about an event and thus provide an efficient summary of information that can be used for searching the memory system. Furthermore, Williams et al. (2006) conducted a study using a dual-task paradigm to deplete executive resources and demonstrated that retrieval to highly imageable words was unaffected by performing the concurrent task, whereas specificity to low imageable cues was reduced in the dual task condition. This finding was confirmed by Anderson et al. (2012). Given that executive deficits have been implicated in the OGM exhibited by depressed participants (Dalgleish et al., 2007), then, if image-based retrieval does reduce demands on this system, is likely to be particularly beneficial for depressed individuals' retrieval of voluntary memories.

Another way that pictorial cues might lead to greater memory specificity in depressed participants is via the 'direct' retrieval route, as images may be more likely than words to lead to involuntary retrieval of specific memories. In line with this notion, Anderson et al. (2012) interpreted their findings and those of Williams et al. (1999; 2006) as evidence that image-based mental representations facilitate retrieval via the direct route. Furthermore, Berntsen (1998) noted that involuntary memories are almost invariably triggered by an external visual or auditory cue that relates directly to the central features of the retrieved memory, which also suggests that images might be more likely than words to lead to involuntary retrieval. As evidence suggests that direct retrieval is not affected by depression (Watson et al., 2013), most likely because it does

not require executive resources, then it would be expected that depressed patients would be more specific when cued with images compared to words.

In contrast to the above, based on the functional avoidance component of the CaR-FA-X model, it is plausible that images might actually lead to reduced AM specificity in depression. A recent review by Holmes and Mathews (2010) suggested that, in comparison to words, images may be more likely to lead to direct activation of the emotional systems, which in turn should lead to increased attempts on the part of the participants to control access to specific events in order to regulate their affect and a concomitant increase in categorical retrieval.

1.1. Overview and Predictions

The aim of the current study was to determine if overgeneral memory in depression generalised to retrieval from image cues. We also aimed to determine if images would override the OGM effect in depressed patients. To this end, clinically depressed patients and healthy controls were assessed on two versions of the AMT (cued with words and images). We predicted that (1) depressed patients would retrieve significantly fewer specific memories, and a greater number of categorical, than would healthy controls. (2) Images would lead to enhanced retrieval of specific memories (faster retrieval times and a greater number of specific memories) in comparison to word cues. (3) We expected that controls would exhibit faster and more specific retrieval to images than words. (4) If images reduce demand on executive resources (and/ or facilitated direct access) then depressed individuals should exhibit faster retrieval times and greater specificity to images than words. However, if images lead to greater emotional activation than words,

then depressed individuals should exhibit slower retrieval times and greater OGM to images than words.

2. Method

2.1. Participants

Twenty-five psychiatric outpatients (15 females, 10 males) with a diagnosis of a current major depressive episode (ICD-10; World Health Organisation, 1992) and twenty-five never-depressed controls (16 females, 9 males) took part in the study. Patients were recruited from the Affective Disorders Clinic at Ninewells Hospital in Dundee. The control group were a community sample matched for age, sex, educational background (years of full-time education completed) and pre-morbid intelligence. All participants had normal or corrected to normal vision, and all were native English speakers. The patients' clinical status was established by psychiatrist using a semi-structured clinical interview and the severity of symptom burden was estimated using the 17-item Hamilton Rating Scale for Depression (HRSD; Hamilton, 1961). Patients were excluded if they had (a) evidence of psychotic symptoms, (b) received ECT within the last six months, (c) suspected chronic alcohol and/or substance abuse, (d) a suspected neurological disorder (e.g. Korsakoff's), (e) a history of head injury that required hospital treatment, (f) a physical disorder (e.g. Multiple Sclerosis) or pharmacological treatment (e.g. benzodiazepines) that might be considered likely to impair cognitive function (g) a HRSD score of less than 14. This cut-off has been used in a number of previous studies (see Katz, Shaw, Vallis & Kaiser, 1995). The mean HRSD score for the patients in the current study was 20.6 (with a range of 14 – 27). Additional exclusion criteria for the

control group were (a) a history of a psychiatric condition and (b) a Beck Depression Inventory score of greater than 10 on the day of testing.

It should be noted that thirteen of the patients were being treated with selective serotonin reuptake inhibitors (SSRIs), six with tricyclic antidepressants and two with monoamine oxidase inhibitors[1]. However, none were being treated with antipsychotics or mood stabilisers. There was some evidence of co-morbid diagnoses in the patient sample, as two had a secondary diagnosis of social phobia and agoraphobia; two met criteria for panic disorder and agoraphobia, and one had a secondary diagnosis of obsessive-compulsive disorder. Importantly, given the evidence that past experiences of trauma can impair memory specificity in response to word and image cues (Schonfeld & Ehlers, 2006), none of the depressed sample met diagnostic criteria for post-traumatic stress disorder (PTSD).

2.2. *Materials and Measures*

2.2.1. *The Beck Depression Inventory* (BDI; Beck, Ward, Mendelson, Mock, & Erlbaugh, 1961) is a standardised 21-item measure of self-rated depression, which has been shown to be reliable in clinical populations (Cronbach alpha .89; Beck, Steer, Ball & Ranieri, 1996). For each item, participants are asked to indicate the statement (from a choice of four) that best represents their mood during the last week (including the day they were tested). Each item is assigned a score of between zero and three, thus the range of possible total scores is 0-63, with higher scores indicating more severe depression.

[1] The four un-medicated patients were undergoing a 'washout' period prior to changing medication and had until just prior to the test session been treated with SSRIs

2.2.2. Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a reliable measure of depression and anxiety (Cronbach's alpha of .82 and .83; Bjelland, Dahl, Haug & Neckelmann, 2002) that consists of 14-items, seven relating to depression and seven to anxiety. For each item, participants are required to endorse the statement (from a choice of four) that best represents their mood during the last week (including the day of testing). Each item is assigned a score between zero and three depending on the statement chosen, which results in a possible range of scores on each subscale of 0-21, with higher scores indicating more severe depression and anxiety. The HADS was included in the current study to quantify participants' self-rated anxiety symptoms.

2.2.3. *National Adult Reading Task* (NART; Nelson & Williamson, 1991) involves participants reading aloud 50 irregularly spelt words. Errors on this measure were used to estimate the participants' full IQ scores in order to ensure the groups were matched for general intellectual ability. The NART is a widely accepted method of estimating premorbid intelligence and indeed was developed for this purpose (see Spreen & Strauss, 1998). The NART has also been shown to correlate highly (.9) with scores on validated measures of full IQ, such as the WAIS (Crawford et al., 1990). The NART has also been shown to be unaffected by depressive symptoms (e.g. Crawford, Besson, Parker, Sutherland, & Keen, 1987), making it ideal for estimating premorbid IQ in depressed participants.

2.2.4. *Autobiographical memory Tests*: Participants were assessed on the traditional word-cued autobiographical memory task (AMT) and a modified version incorporating

image cues (AMT-I). During each task, participants were presented with a random sequence of ten cues (5 positive, 5 negative) and were asked to retrieve a specific memory in response to each cue. A specific memory was defined as *"a memory of an event that occurred at a specific time and place, and that lasted less than a day"*. The participants were not confined in terms of the time period from which the memories were to be retrieved or in terms of the personal importance of the memories. However, they were asked to provide a unique memory to each cue. The cues were presented via computer (Apple MacBook running Superlab experiment generation software) and participants were given a maximum of 30 seconds to retrieve an appropriate memory to each cue. The cues remained on screen until the participant responded with a memory or until the time limit expired. The time taken to retrieve each memory was recorded in seconds. Once a participant had retrieved a memory they were asked to provide details about the event (these descriptions were audio-recorded to allow the reliability of specificity coding to be established). If the participant retrieved a memory that did not refer to a specific event then they were prompted with *"Can you give me a specific example – one single event?"*, the timing was restarted, and participants were asked to recommence their memory search. If the resulting memory was specific then the details were recorded and the total time noted (i.e. time to retrieve initial memory plus additional search time). However, if this memory was also overgeneral then the participants were prompted again. This process was repeated until they produced a specific memory or until the time limit (30 seconds in total) expired. Participants were asked to rate the pleasantness of each memory, using a 5-point scale ranging from 1 (extremely unpleasant) to 5 (extremely pleasant).

The word cues used on the AMT were drawn from Williams and Broadbent (1986); the positive word cues were *"Happy", "Interested", "Safe", "Successful", and "Surprised"* and the negative cues were *"Clumsy", "Angry", "Hurt" (emotionally), "Lonely", and "Sorry"*. The image cues used in the AMT-I were drawn from the International Affective Picture System (*IAPS* - Lang, Bradley & Cuthbert, 1997). The positive images (e.g. *a loving couple; teenagers having fun at the beach)* were IAPS images 2360, 2391, 4599, 8120 and 8461. The negative images (e.g. *A couple physically fighting; a crying child)* were 2410, 2700, 2900, 6561 and 9041. Two neutral images (2487, 2880) were included as practice items.

The positive and negative words were matched for their arousal ratings; (means=5.8 and 5.7; standard deviations=1.2 and 1.1 respectively), but differed significantly in their valence ratings (means =7.6 and 2.7; SD=.56 and .81 respectively), $t(5)=9.3$, $p<.01$. Similarly, the images were matched in terms of their arousal ratings (*positive* Mean=4.7, Standard Deviation=0.8; *negative* M=4.5, SD=0.7); $t(8)=0.5$, $p>0.05$, but differed significantly in terms of their valence ratings (*positive* M=7.4, SD=0.3; *negative* M=3.3, SD=0.8); $t(5)=20.6$, $p<0.001$. The words and images were matched in terms of their valence and arousal ratings; $t(9)=.13$, $p>.05$ and $t(9)=1.8$, $p>.05$ respectively.

2.3. *Procedure*

Participants completed both AM tasks in a counterbalanced order and the cues within each task were presented in a new random order for each participant. Prior to each set of cues participants were reminded of the instructions and presented with two practice trials to ensure they understood the task. Once both AM tasks had been completed,

participants rated their recent mood on the 21-item BDI and the HADS. Finally, they were assessed on the NART.

2.4. Data scoring and analysis

The principal variables of interest were the time taken (in seconds) to retrieve a specific memory[2] (including the total time for any multiple attempts on a trial that resulted in a specific memory) and the proportion of specific memories retrieved as a first response to the cues. Memories were scored as specific if they referred to unique events that lasted less than one day (e.g. *"going to see a rock band last weekend"*). In order to obtain a more complete understanding of the participants' memory performance, the proportion of the different types of retrieval errors were also calculated. Memories that referred to particular time periods that lasted longer than a day (e.g. *"my holiday in the south of France two summers ago"*) were coded as extended memories and summaries of repeated events (e.g. *"going for a coffee with friends"*) were coded as categorical memories. Failures to retrieve specific memories to cues within 30 seconds were coded as omissions and responses that simply referred to objects, places or people without a context (e.g. "my dad") were coded as semantic associates. There was a high degree of inter-rater agreement (Kappa =0.85) in the coding of the memories[3]. Retrieval times and the proportion of specific memories were analysed using separate three-way mixed factorial ANOVA, with group (depressed vs. controls) as the between-subjects factor and

[2] Only trials where a specific memory was actually retrieved were included in this analysis

[3] The principal author (NR) coded all memories and a second researcher (BD), blind to participants' group membership, rated all of the memories from a sample of twenty participants (10 patients, 10 controls).

cue type (words vs. images) and valence (positive vs. negative) as the within-subjects factors.

3. **Results**

3.1. Participant characteristics

The two groups were well matched in terms of age, years of education and pre-morbid intellectual ability, all tests $p>.05$. Further, the two groups did not differ in terms of the ratio of males and females; $\chi^2(1)=0.09$, $p>.05$.

Table 1. Mean scores on mood ratings and demographic characteristics of the participants in the depressed and control groups (standard deviations are presented in parentheses)

	Depressed (n=25)	**Controls (n=25)**	**p-value**
Age	42.7 (2.0)	41 (2.1)	NS
Sex	15 F, 10 M	16 F, 9 M	NS
Years of Education	12.6 (0.6)	12.6 (0.6)	NS
IQ (NART)	106 (7.4)	108 (5.8)	NS
BDI	28.9 (1.9)	3.8 (0.6)	<.001
HADS Depression	12.6 (0.7)	1.6 (0.4)	<.001
HADS Anxiety	13.6 (0.7)	4.4 (0.7)	<.001

As expected, patients rated themselves as significantly more depressed on the BDI and HADS depression subscale than did the controls; t(48)=12.6, p<.001 and t(48)=13.6, p<.001 respectively. However, it should be noted that the patients also rated themselves as significantly more anxious than did the controls; t(48)=9.2, p<.001.

3.2. Pleasantness ratings of memories retrieved on the AMT

Given that Young, Erickson and Drevets (2012) found that the emotional valence of retrieved memories on the AMT may be independent of the valence of the retrieval cue we compared the pleasantness ratings of the memories retrieved by the two groups as a function of cue type and cue valence. Memories retrieved to positive cues were rated as significantly more pleasant (M=4.29, SE=.06) than were memories retrieved to negative cues (M=1.7, SE=0.6); F(1, 48)=1155, p<.001; η_p^2=.96[4]. Overall, depressed patients rated their memories as less pleasant (M=2.88, SE=.07) than did the controls (M=3.1, SE=.07); F(1, 48)=5.75, p<.05; η_p^2=.11. However, this pattern did not vary as a function of cue type or valence; all tests F<1, p>.05. Thus, both groups appear to have retrieved positive memories to positive cues and negative memories to negative cues.

3.3. AM retrieval times

Overall, depressed patients were slower to retrieve specific memories (M=9.2 seconds, SD=4.5) than were the controls (M=7.1s, SD=1.9), F(1, 48)=4.2, p<.05 (partial Eta-squared η_p^2=.08). However, this needs to be considered in the light of a significant group x valence interaction (illustrated in Figure 1); F(1, 48)=20.42, p<.001 (η_p^2=.30).

[4] Given the pattern of pleasantness ratings it was deemed appropriate to conduct the analysis of retrieval times and memory specificity using the assigned valence of the cues.

Table 2. Mean retrieval time (seconds) and mean proportion of specific memories retrieved as a function of the type of cue and the valence of the memory retrieved (Standard deviations are presented in parentheses).

		Depressed (N=25)		**Controls (N=25)**	
Cue Type	Valence	RT	Specificity	RT	Specificity
Words	*Positive*	9.7 (5.0)	.52 (.29)	6.7 (2.5)	.75 (.21)
	Negative	8.3 (4.5)	.47 (.28)	8.3 (4.0)	.70 (.21)
Images	*Positive*	9.9 (5.5)	.48 (.28)	5.5 (2.5)	.84 (.15)
	Negative	8.9 (5.5)	.43 (.25)	7.9 (2.5)	.73 (.20)

Inspection of figure 1 reveals that depressed patients were slower to retrieve specific positive memories than were controls; $t(48)=3.4$, $p<.01$, but groups did not differ in their retrieval times for negative memories, $p>.05$. Controls were faster to retrieve positive memories than negative, $t(24)=4.96$, $p<.001$, whereas depressed patients showed a trend for faster retrieval of negative memories; $t(24)=1.7$, $p=.09$. There were no other significant main effects or interactions, all tests $p>.05$.

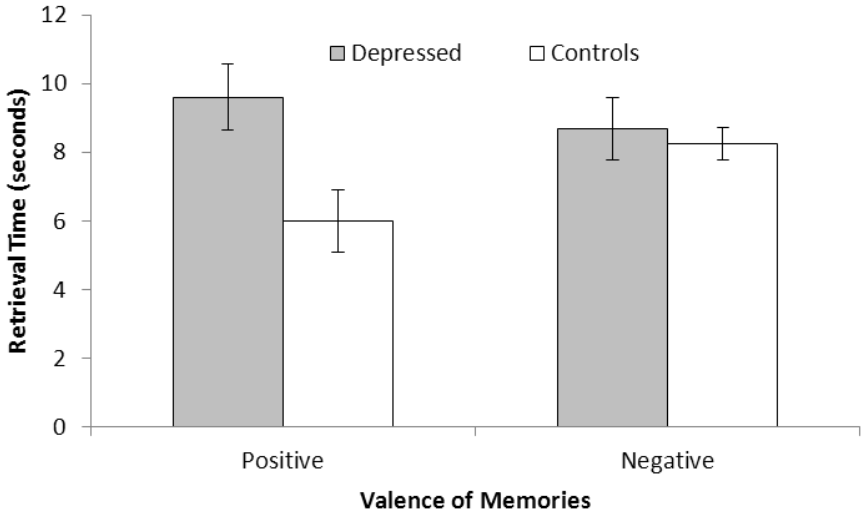

Figure 1. Mean retrieval time (seconds) as a function of participant group and memory valence (error bars show ± standard error of the mean)

3.4. Memory specificity[5]

Depressed patients retrieved fewer specific memories (M=.47, SD=.21) than did the controls (M=.75, SD=.12); $F(1, 48)=35.6$, $p<.001$ ($\eta_p^2=.43$). Overall, participants retrieved a greater proportion of specific memories to positive (M=.65, SD=.25) than negative cues (M=.58, SD=.24), $F(1,48)=5.0$, $p<.05$ ($\eta_p^2=.10$). Although the group x cue interaction was not significant; $F(1, 48)=3.07$, $p=.08$ ($\eta_p^2=.06$), we chose to conduct follow up analyses given that we had *a priori* predictions concerning this interaction. Depressed patients retrieved a similar proportion of specific memories to words (M=.50, SD=.24) and images (M=.45, SD=.23), $p>.05$. Controls, on the other hand, retrieved a greater number of specific memories to images (M=.78, SD=.16) than to words (M=.72,

[5] As the two groups did not differ on the number of omissions (see section 3.5) the proportion of specific memories was not adjusted for the number of omissions

SD=.13), t(48)=1.7, p=.05 (one-tailed). There were no other significant main effects or interactions, all tests F<1.

3.5. Retrieval errors

Depressed patients recalled a greater proportion of categorical memories[6] (M=.26, SD=.18) than did the controls (M=.06, SD=.05); F(1, 48)=29.6, p<.001 (η_p^2=.38). Overall, participants recalled a fewer positive (M=.13, SD=.16) than negative (M=.19, SD=.21) categorical memories; F(1, 48)=6.1, p<.05 (η_p^2=.11) .

Table 3. Mean proportion of categorical memories retrieved as a function of the type of cue and the valence of the memory retrieved (Standard deviations are presented in parentheses).

Cue	Valence	Depressed (n=25)	Controls (n=25)
Words	*Positive*	.19 (.23)	.07 (0.1)
	Negative	.30 (.31)	.11 (.15)
Images	*Positive*	.25 (.18)	.03 (.06)
	Negative	.32 (.26)	.03 (.09)

The group x cue type interaction was non-significant; F(1, 48)=3.7, p=.059 (η_p^2=.07). Nevertheless, given that we had *a priori* predictions regarding this interaction, we conducted pairwise subsequent comparisons. Depressed participants recalled a similar

[6] The categorical memory data was skewed and this distribution was not improved by square-root or arc-sine transformations. However, analysis of these data using a series of non-parametric tests, with alpha adjusted to 0.01 for multiple comparisons revealed the same pattern of findings; therefore the results of the ANOVA and t-tests are reported in the manuscript.

proportion of categorical memories to words (mean=.25, SD=.24) and images (mean=.28, SD=.18), whereas the controls recalled significantly fewer categorical memories to images (mean=.03, SD=.05) than to words (mean=.09, SD=.09), $t(24)=2.6$, $p<.05$.

As there were relatively few of the other types of retrieval error and as preliminary analysis revealed no differences between conditions (cue type or valence) then these data were collapsed and compared across groups using Mann Whitney tests. Depressed participants and controls retrieved a similar proportion of extended memories (M=.03, SD=.05 and M=.03, SD=.07 respectively); $U(25, 25)=248$, $p>.05$. Similarly, the two groups retrieved a similar number of omissions (Depressed M=.18, SD=.12 and control M=.14, SD=.10 respectively); $U(25, 25)=254$, $p>.05$. However, depressed patients recalled a significantly greater proportion of semantic associates (M=.04, SD=.04) than did the controls (M=.01, SD=.02); $U(25, 25)=223$, $p<.05$.

4. Discussion

The aim of this study was to establish if the deficit in memory specificity observed in depressed patients generalised to pictorial cues. Further, the aim was to determine if image cues would reduce the apparent deficit in memory specificity exhibited by the depressed patients relative to the controls.

4.1. Pleasantness ratings

Before we consider the retrieval time and specificity data we need to consider the participants' ratings of the memories they retrieved in response to the positive and

negative cues. Young et al. (2012) reported that the emotional valence of retrieved memories was not necessarily congruent with the valence of the retrieval cue. In particular, they showed that depressed participants retrieved fewer positive memories in response to positive and neutral cues than did the healthy controls. However, although there was a tendency for our depressed sample to rate their memories as less pleasant than did the controls, the pattern of ratings clearly showed that both groups were retrieving pleasant memories to positive cues and unpleasant memories to negative cues, which is not consistent with the pattern reported by Young et al (2012). Given the congruence between cue valence and memory valence in our study we have analysed the date according to cue valence and will discuss the retrieval time and specificity data accordingly.

4.2. Memory Retrieval Times

Overall the depressed patients were slower to retrieve memories than were controls, which suggests that the patients found it more difficult to access specific memories. However, comparison of the retrieval times in response to positive and negative cues (independent of cue type) revealed that depressed patients were significantly faster to retrieve negative memories than positive. The controls on the other hand exhibited the opposite pattern, as they were faster to retrieve positive memories. Inspection of the data in Figure 1 suggests that depression is associated with a particular problem in accessing positive memories. This pattern has been demonstrated consistently across numerous studies (see Williams et al., 2007). Retrieval times did not vary as a function of cue type, which does not support the prediction (hypothesis 2) that images would facilitate access

to specific memories. Furthermore, the average retrieval times for both groups (depressed = 9 seconds and controls = 7 seconds) was suggestive of generative rather than direct retrieval and this did not vary as a function of cue type, which suggests that images were not more likely than words to lead to involuntary retrieval. The functional avoidance account would have predicted that depressed patients would exhibit slower retrieval times for the negative cues, particularly in the image condition. However, as noted above, depressed patients' retrieval times were faster for negative memories than positive in both word and image conditions, which does not support the functional avoidance account.

4.3. Depression and Memory Specificity

As predicted (hypothesis 1), depressed patients retrieved significantly fewer specific memories and a greater proportion of categorical, than did the controls. This is consistent with the vast majority of studies examining voluntary autobiographical memory retrieval in depressed samples (see Sumner, 2012; Williams et al., 2007). The deficit observed in the current study cannot be explained by differences in education (years of full-time education) or general intelligence (estimated from the NART) as the two groups were matched on these factors. It is notable that the two groups did differ significantly on anxiety. However, due to the strong correlation between depression and anxiety, attempts to partial out the effects of anxiety (e.g. using ANCOVA) would be questionable (Miller & Chapman, 2001). Nevertheless, given that there is very little evidence of impaired autobiographical memory specificity (AMS) in anxiety disorders (see Williams et al., 2007) it is unlikely that the differences in anxiety could explain the observed deficit in memory specificity. Another potential issue is the presence of comorbid diagnoses in five

of the depressed patients; most notably social phobia and obsessive compulsive disorder. However, given that memory specificity has been shown to be unaffected by social phobia (Rapee, McCallum, Melville, Ravenscroft & Rodney, 1994) and obsessive compulsive disorder (Wilhelm, McNally, Baer & Florin, 1997) it is unlikely that the these comorbid conditions could account for the group difference in memory specificity. A factor that might have influenced the findings is the presence of past trauma. The fact that none of the patients met criteria for PTSD argues against this notion, but it is still possible that the depressed patients may have experienced a greater number of traumatic events in their lives than had the controls. As we took no measure of trauma we are unable to firmly discount trauma as a possible factor in the memory deficit observed in the current study. Nevertheless, there is consistent evidence of impaired AMS in depressed patients that is independent of the effects of trauma (e.g. Wessel et al., 2001, see also Sumner, 2012 and Williams et al, 2007).

4.4. Images and Memory Specificity

As expected (hypothesis 2) images led to greater specificity in comparison to word cues. However, this difference was only evident in the control group. This image superiority effect is consistent with the pattern of memory specificity exhibited by healthy participants in response to highly imageable word cues reported by Williams et al. (1999; 2006) and Anderson et al (2012). Similarly, this pattern is comparable to the findings of Schönfeld and Ehlers (2006), although the image superiority effect reported for their control group was somewhat larger (9%) than that exhibited by the controls in the current study (6%).

The prediction (hypothesis 3) that the specificity of AM retrieval in the depressed group would vary as a function of cue type was not supported by the current findings. There was no evidence that images improved AMS in comparison to word cues. This suggests that the over-general memory style in depression generalises from word- to image-cued retrieval. This is important, as image-cued retrieval may be closer to everyday memory experiences than retrieval to word cues. The current data are also consistent with findings in patients with PTSD (Schönfeld and Ehlers, 2006).

The image superiority effect in the control group is consistent with the proposal that images would facilitate direct access to specific memories, given that involuntary memories tend to be more specific than voluntary (Rasmussen & Berntsen, 2011; Schlagman & Kvavilashvili, 2008; Watson Berntsen, Kuyken & Watkins, 2013). However, the lack of an image superiority effect in the depressed patients is not consistent this proposal, as depression is not thought to impair specificity of involuntary memories (Watson et al, 2013). Finally, as noted above, retrieval times were not faster for images compared to words. Taken together the data do not suggest that images facilitated involuntary retrieval.

The image superiority effect in the control group is consistent with the proposal that images may have reduced the executive demands of generative retrieval by providing useful summaries of information about events that could be used to search for candidate memories. However, if images had reduced demand on executive resources it should have been particularly helpful for the depressed patients, given the evidence of executive dysfunction in depression (Dalgleish et al, 2007), and yet there was no evidence that images improved the AMS of depressed patients in comparison to words.

One possible explanation for the lack of a clear image superiority effect relates to differences in the presentation of the cues across the different studies. In Schönfeld and Ehlers (2006) the pictorial cues were presented for 2.5 seconds and the word cues were presented briefly (via a recorded auditory track). Similarly, in Williams et al. (1999) the cues were only presented for a relatively short duration (read aloud by the experimenter) and in Anderson et al (2012) cues were presented for 5 seconds. Therefore, in all of these studies, as part of the retrieval process participants would have to have held the cue in working memory, whilst searching for a suitable event to meet the task demands. Under these circumstances it is clear how reducing demands on the executive could have facilitated retrieval. However, in the current study the words and images remained on screen throughout the entire retrieval process (i.e. up to 30 seconds). It is therefore likely that this reduced the demands of the task on working memory and consequently may have masked differences between the cue types in terms of specificity of retrieval. It is plausible that, had the images and words only been presented for a limited time, the images would have conferred an even greater retrieval advantage for the controls and an image superiority effect may have emerged for the patients.

There is no evidence that images lead to greater categorical retrieval in the depressed patients. Taken together with the findings that depressed patients produced faster retrieval times to negative than positive cues, this provides no support for the notion that negative images might encourage functional avoidance in the depressed patients due to the greater emotional activation associated with images (Holmes & Mathews, 2010). This is perhaps not surprising given that words and images were matched for valence and arousal ratings.

4.5. Methodological issues

In addition to the methodological issues considered in the sections above, it is appropriate to reflect on the potential influence of some of the changes to the AMT that were made in the current study and whether they are likely to have influenced the results. In the current study we allowed a total retrieval time of 30 seconds for each cue, this is in contrast to many of the earlier studies using the AMT that used 60 seconds (See Williams et al., 2007). Nevertheless, it should be noted that other published studies have used a 30 second retrieval period (e.g. Gibbs & Rude, 2004; Schönfeld & Ehlers, 2006). Allowing a longer retrieval time might have increased the likelihood that depressed participants would have eventually accessed a specific memory. However, there is no reason to expect that it would have altered the specificity of their first response, therefore this change to the procedure cannot explain the current findings. Traditionally, the positive and negative cues are presented in an alternating pattern, whereas, in line with other studies (e.g. Gibbs & Rude, 2004), we presented our cues in a fully randomised order. The advantage of the alternating method is that it prevents blocking together of positive and negative cues, but the advantage of full randomisation is that it minimises order effects. As with the change to the duration of the retrieval period, it is unclear how this change could account for the findings of our study.

4.6. Conclusions

In contrast to the control group, depressed patients did not exhibit greater memory specificity to image cues compared to words. Thus, our results demonstrate that the overgeneral memory style in depression generalises from words to images. This is

important because image-cued retrieval may more closely resemble everyday memory experiences than retrieval to word cues, and thus may represent a more ecologically valid test of the hypothesis. There was no evidence that images facilitated involuntary retrieval, but images may have reduced the executive demands of the generative retrieval process. Given the finding that depressed patients exhibited impaired AMS to image cues, a potentially important avenue of research would be to establish if recently developed methods of improving AM retrieval to word cues in depressed patients, such as Memory Specificity Training (MeST; Raes et al, 2009), could be adapted to improve the specificity of image-cued retrieval in depressed patients.

Conflicts of Interest

None of the authors have any conflicts of interest to report.

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Highlights

- Depressed patients retrieved fewer specific memories than did healthy controls
- Memory specificity deficit in depressed patients generalised from words to image cues
- Controls retrieved a greater number of specific memories to images than words
- No evidence that image cues facilitated retrieval of involuntary memories
- No evidence that image cues led to greater activation of emotion than words