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Memory bias in anorexia nervosa: Evidence from directed forgetting

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Abstract

The aim of this study was to examine memory bias for disorder-relevant information in anorexia nervosa by using the directed forgetting paradigm. Normal controls and patients with anorexia nervosa were given a list consisting of neutral and disorder-relevant words, which they were either asked to remember (R) or forget (F). Memory performance was measured by a free recall and a Yes/No recognition task for all items. There was a directed forgetting effect for both groups; however, the magnitude of the effect (difference between R and F words) was smaller for the patient group due to higher recall of F items. Further analyses showed that this was true only for disorder-relevant but not for neutral items. Our findings support the existence of a strong memory bias for disorder-relevant information in patients with anorexia nervosa, who had difficulty in avoiding the processing of information that they were asked to forget.

Keywords: Memory bias; Anorexia nervosa; Eating disorders; Directed forgetting; Information processing

1. Introduction

Cognitive behavioral theories of eating disorders assign a significant role to cognitive processes in the maintenance of the pathology (Vitousek & Hollon, 1990; Williamson, White, York-Crowe, & Stewart, 2004). These theories argue that patients with eating

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disorders have a self-schema that focuses on different domains (e.g., size, shape, weight, food, etc.). These schema guide information processing and lead attention to weight-relevant stimuli (either internal or external) in the environment, resulting in a bias favoring disorder-related information (Williamson, 1996; Williamson, Muller, Reas, & Thaw, 1999; Williamson et al., 2004). One prediction of cognitive–behavioral models is that such disorder-relevant information would be well attended to and encoded because patients with eating disorders cannot avoid processing such information (i.e., cannot disengage from the stimuli). Since there already is an existing schema, acquisition of and memory for that information would be facilitated. More recent transdiagnostic theoretical approaches (Fairburn, Cooper, & Shafran, 2003) argue for the continuity between eating disorders that are claimed to be categorically different (anorexia nervosa (AN), bulimia nervosa (BN), and EDNOS). This model suggests that there is a core psychopathology common to all these eating disorders and that common mechanisms, including cognitive biases, play a role in the maintenance (Shafran, Lee, Cooper, Palmer, & Fairburn, 2007).

1.1. Attention bias in eating disorders

There are several studies addressing attention biases in eating-related psychopathology, mostly using the emotional Stroop task. This line of research consistently showed that patients with AN and those with BN (e.g., Ben-Tovim & Walker, 1991; Ben-Tovim, Walker, Fok, & Yap, 1989; Cooper, Anastadiades, & Fairburn, 1992; Davidson & Wright, 2002; Green, Corr, & De Silva, 1999) as well as analogue groups such as dieters or high-restraint individuals (Ferraro, Andres, Stromberg, & Kristjanson, 2003; Francis, Stewart, & Hounsell, 1997) have positive attentional biases toward disorder-related material. Similar findings have been reported with the dot-probe paradigm (Reiger et al., 1998; Shafran et al., 2007).

In their review of information processing in eating disorders, Lee and Shafran (2004) observed that (a) an overwhelming majority of studies with patients and analogue groups found a bias for disorder-relevant information, (b) such biases tended to be more consistent for patients than for analogue groups, and (c) larger effects were observed in patients with AN than those with BN. They also noted a relative scarcity of research on memory biases in patients with eating disorders. They were able to locate more than 25 published articles on attention biases, but only six on memory biases, three of which were carried out with analogue samples.

1.2. Memory bias in eating disorders

In the first study on this issue, King, Polivy, and Herman (1991) looked at whether obese and eating disordered individuals showed a memory bias for weight- and food-related information about a person described in an essay. They found that both groups recalled more weight- and food-related information than other items, implying the existence of a memory bias. They also reported a moderate correlation between restraint scores and the frequency of mention of disorder-relevant information in a different task in which the participants were asked to report several types of information (e.g., five types of things they spent most time thinking about). However, the results of this study should be interpreted with some caution because the comparison involved only 6 eating disordered

patients (vs 24 individuals with obesity), and also because data from normal control (NC) participants were not analyzed in comparison to these patient groups.

Sebastian, Williamson, and Blouin (1996) compared free recall memory performance for fat-related and fat-unrelated information of patients with eating disorders, individuals with weight preoccupation and NC participants. They found that eating disordered patients but not the other two groups recalled more fat-related than fat-unrelated words. Hermans, Pieters, and Eelen (1998) compared AN patients with nondieting NCs on both explicit and implicit memory tasks and found a bias favoring anorexia-related words in the explicit memory task but not in the implicit memory task. Patients with AN recalled more anorexia-related words than positive, negative and neutral words whereas there was no difference in the recall performance of the nondieting controls. Furthermore, there was no difference between the groups in the implicit memory task, leading the authors to conclude that memory bias in AN patients may be limited to explicit memory. It has to be noted that these findings are based on a relatively small sample of patients and control participants (12 in each group).

Research with analogue groups also found a memory bias for diagnosis-related information. For instance, Israeli and Stewart (2001) compared high- and low-restraint participants on memory for forbidden (high fat) food words and animal words by using an incidental learning paradigm. Although high-restraint participants did not remember more forbidden food words than the low-restraint participants, they remembered more forbidden food words than animal words, providing partial evidence for memory bias. Other studies reported a memory bias in individuals with body dysphoria. In one of these studies, individuals with body dysphoria recalled more fatness words compared to normals (Baker, Williamson, & Sylve, 1995) and in another (Watkins, Martin, Muller, & Day, 1995) high-dysphoria individuals recalled more body-related items than low-dysphoria individuals.

The main purpose of the present study was to provide further data regarding memory bias in AN patients in comparison to NC participants. We employed the directed forgetting procedure, which, to our knowledge, had not been used with individuals diagnosed with eating disorders. It has, however, been used frequently in studies with patients diagnosed with anxiety disorders and posttraumatic stress disorder (e.g., McNally, Metzger, Lasko, Clancy, & Pitman, 1998; Tolin, Hamlin, & Foa, 2002; Wilhelm, McNally, Baer, & Florin, 1996). Directed forgetting provides an especially good test of memory bias because in this procedure individuals are asked to specifically forget some of the information they are presented. There are two methods of directed forgetting: item method and list method. We used the item method, where individual words were followed by an instruction either to remember or to forget that word. There is wide agreement that the directed forgetting in this method is due to selective rehearsal; that is, participants remember more R words than F words because R words receive more rehearsal than F words, which should not be rehearsed once the participants are informed that the word is not going to be on the memory test (Johnson, 1994; MacLeod, 1998). Therefore, item method directed forgetting might provide clues as to how AN patients compared to NC participants process information that needs to be ignored after brief exposure. Therefore, one novel aspect of the present study was the use of the directed forgetting procedure. Moreover, studies on cognitive biases mostly looked at bias for negative information. In their review Lee and Shafran (2004) identified only one study which used positive shape and weight items along with negative ones. We presented our participants with a study list

of words containing neutral words along with positive and negative words that were disorder-relevant (e.g., shape, weight, food).

First, we expected both the AN and the NC groups to show a standard directed forgetting effect (i.e., remember more R words than F words). Second, in line with the cognitive–behavioral models of eating disorders, we expected patients with AN to show a diminished directed forgetting effect, mainly because they would remember more F words compared to NCs, and that this would occur only for disorder-related words but not for neutral ones. Third, on the basis of earlier work with normal participants (Basden, Basden, & Gargano, 1993; MacLeod, 1999), we expected that these findings would hold true in the recognition task as well.

2. Method

2.1. Participants

A total of 46 participants (23 patients diagnosed with AN and 23 NC participants) took part in the study. Patients were individuals referred to the Eating Disorder Unit of the Psychiatry Department at Istanbul University, School of Medicine and were seeking treatment there. All patients were diagnosed with AN according to DSM-IV criteria by a psychiatrist specializing in eating disorders. The primary symptoms of all patients were AN related and patients who showed comorbidity with other disorders were not included in the study. Prior to testing, another psychiatrist also evaluted the patients and confirmed the diagnosis. The NC group consisted of Boğaziçi University students and nonstudent volunteers. None of the NC participants had any history of psychiatric illness. None of them were dieting and all of them scored within the normal range on the Eating Attitudes Test (EAT-40). The BMI scores were based on actual measurements of height and weight for the AN group and on self-report for the NC group.

2.2. Design

A mixed design was employed with Group (AN vs NC) as a between-subjects variable and word type (neutral, positive, and negative) and instructions (remember vs forget) as within-subjects variables.

2.3. Materials

2.3.1. The Eating Attitude Test (EAT-40)

EAT-40 is a self-report questionnaire used to screen abnormal eating behaviors (Garner & Garfinkel, 1979). It consists of 40 statements to which subjects respond on a six-point Likert-type scale (“always”, “very often”, “often”, “sometimes”, “rarely” or “never”). Validity and reliability of the Turkish version of EAT-40 has been demonstrated (Savaşır & Erol, 1989).

2.3.2. Beck Depression Inventory (BDI)

BDI (Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961) is a self-report instrument measuring the severity of depressive symptoms. The Turkish version was shown to be valid and reliable (Hisli, 1988; Tegin, 1987).

2.3.3. The word list

A list of 54 words containing an equal number of (18) neutral, negative, and positive words was constructed. The list was constructed on the basis of earlier work (e.g., Hermans et al., 1998) and on the expert guidance of clinicians on our team. Both negative and positive words were disorder-relevant. Negative words were those that are known to elicit anxiety in individuals with eating psychopathology (e.g., *chocolate*, *heavy*, *breast*). Positive words were related to thinness (e.g., *lettuce*, *tight*, *wrist*). Both positive and negative words included an equal number (6) of body, shape, and food words. The 18 neutral words were matched in terms of frequency with the negative and positive lists. There were an additional four neutral buffer words (two in the beginning and two at the end of the study list) to minimize primacy and recency effects in recall.

2.4. Procedure

All participants were tested individually, AN participants in a testing room in the Istanbul University Medical School, Department of Psychiatry and NC participants in a laboratory at Boğaziçi University. Each testing period consisted of a study session, followed a free recall test and a Yes/No recognition test.

Each participant was seated in front of a computer and informed that this would be a memory task where they will be presented with a list of words and then will be asked to remember as many words from the list as possible. They were also told that each word will be presented for 2 s on the screen followed by an instruction regarding that word; an "RRRRR" would indicate that they would need to remember that word, and an "FFFFF" meant that that word could be forgotten because they would not be asked to remember those words. Each word was presented for 2 s, followed by the instruction to remember or to forget, which remained on the screen for 3 s.

Participants saw a list of 58 words consisting of 54 experimental words and 4 buffer words. Half of the experimental words were followed by an instruction to remember and the other half by an instruction to forget. The buffer words were always followed by an R instruction, and were not included in the statistical analyses. Across participants, each word was followed by an instruction to remember or to forget equally often.

After the study session, participants were given a blank sheet of paper and asked to recall as many of the presented words as possible regardless of the instructions (R vs F) associated with the words. Participants were given 10 min for the free recall task. After the free recall test, a recognition test was given. They were presented with a list of words containing the studied words along with an equal number of unstudied (distractor) words. The distractor words also consisted of neutral, positive and negative words (18 each). Subjects were asked to indicate for each word whether they believed they studied it or not. After the recognition test, they filled out the EAT-40 and the BDI. The presentation of these two tests were counterbalanced across participants. Each experimental session took approximately 30 min.

3. Results

3.1. Background variables

The data regarding age, education, depression level, and eating attitudes are presented in Table 1. The two groups did not differ in terms of age or education. However, the

AN group scored lower than the NC group on the BMI and higher on the EAT-40 and the BDI.

3.2. Recall

First, there was a clear directed forgetting effect for both groups. Both the AN and the NC groups recalled more R words than F words. Mean proportion of recall for R and F words were .44 vs .20 for the AN group and .47 vs .11 for the NC group, $t(22) > 7.25$, $p < .01$ and $t(22) = 9.70$, $p < .01$, respectively. A 2 (group) × 3 (word type) ANOVA on the size of directed forgetting effect (difference between recall of R and F words) showed that there was a main effect of group, $F(1, 44) = 6.50$, $p < .02$, $\eta^2 = .13$: directed forgetting effect was smaller for the AN group (.24) than for the NC group (.36). There was neither a main effect of word type nor an interaction between group and word type.

In order to further investigate the effect of group on the magnitude of the directed forgetting effect, we carried out separate 2 (group) × 3 (word type) mixed design ANOVAs for recall of R and F words. Means and standard deviations for proportion of correct recall are presented in Table 2.

Recall of R words. There was no main effect of group; performance of the AN group (.44) was not different from that of the NC group (.47), $F(1, 44) = 1.10$, $p > .10$, $\eta^2 = .02$. There was a main effect of word type, $F(2, 88) = 3.96$, $p < .05$, $\eta^2 = .08$; pairwise comparisons with Bonferroni corrections showed that negative words (.49) and positive words (.49) were recalled better than neutral words (.39). There was no interaction, $F(2, 88) < 1$.

Recall of F words. There was a main effect of group; AN group recalled more F words (.20) than the NC group (.11), $F(1, 44) = 7.81$, $p < .01$, $\eta^2 = .15$. There was also a main effect of word type, $F(2, 88) = 39.58$, $p < .01$, $\eta^2 = .47$; both negative (.22) and positive words (.18) were recalled better than the neutral words (.06), but negative and positive words were not different from each other. Most importantly, there was an interaction, $F(2, 88) = 3.10$, $p < .05$, $\eta^2 = .06$; although the groups were not different in their recall of neutral words [$t(44) = 1.46$, $p > .10$], AN group recalled more positive and negative words than the NC group, $t(44) = 2.63$, $p < .05$ and $t(44) = 2.71$, $p < .05$, respectively.

It should also be noted that as corollary analyses, we compared the recall of food, body, and shape items that were included in the study list to increase the representativeness and

Table 1
Means and standard deviations of NC and AN groups on background variables

	AN		NC		*t*	*p*
	M	SD	*M*	SD		
Age	21.62	4.54	19.91	1.65	1.63	= .09
Education	11.90	3.21	11.70	1.22	0.29	> .10
BMI	14.75	2.22	19.39	1.94	7.39	< .01
EAT-40	39.09	19.69	10.26	5.45	6.63	< .01
BDI	18.22	11.08	9.52	6.16	3.29	< .01

Note: BMI: Body Mass Index; EAT-40: Eating Attitudes Test; BDI: Beck Depression Inventory.

Table 2
Proportion of correct recall by the AN and NC groups as a function of instruction (R vs F) and word type (neutral, positive, and negative)

Word type	R words		F words	
	AN	NC	AN	NC
Neutral	.35 (.20)	.44 (.23)	.08 (.07)	.04 (.06)
Positive	.48 (.20)	.49 (.18)	.24 (.12)	.13 (.15)
Negative	.48 (.18)	.49 (.13)	.28 (.13)	.16 (.18)
Overall	.44 (.19)	.47 (.18)	.20 (.10)	.11 (.14)

Table 3
Proportion of "Yes" responses in the recognition test to R, F, and nonstudied items by the AN and NC groups as a function of instruction word type (neutral, positive, and negative)

Word type	R words		F words		Nonstudied words	
	AN	NC	AN	NC	AN	NC
Neutral	.78 (.18)	.85 (.17)	.48 (.23)	.33 (.23)	.21 (.22)	.11 (.10)
Positive	.80 (.14)	.80 (.15)	.63 (.26)	.42 (.21)	.13 (.16)	.04 (.06)
Negative	.76 (.18)	.76 (.16)	.65 (.23)	.48 (.24)	.15 (.15)	.06 (.05)
Overall	.78 (.17)	.80 (.15)	.59 (.24)	.41 (.22)	.17 (.15)	.07 (.06)

the validity of the stimulus material. ANOVAs showed that there was no difference in the recall of these three types of words either for NC or for the AN groups.

In sum, recall data revealed a clear directed forgetting effect for both groups, with a smaller effect for the AN group. This difference in the size of directed forgetting stemmed from the fact that AN group recalled more of the F words than the NC group. An important finding was that this elevated recall F words by the AN group was true for diagnosis-related words but not for neutral words.

3.3. Recognition

Because hit rates (percentage of Yes responses to studied items) is an inadequate measure of recognition performance, we also report false alarms as well as measures of sensitivity and response criterion (bias). Proportion of hit rates to R and F items and overall false alarms are presented in Table 3.

3.3.1. Hit rates

There was a significant directed forgetting effect for both groups (.78 vs .59 for the AN group and .80 vs .41 for the NC group; $ts(22) > 6.24$, $p < .001$). Moreover, the effect was substantially smaller for the AN group (.19) than for the NC group (.39).

Separate 2 (group) × 3 (word type) mixed design ANOVAs were carried out on hit rates for R and F words. The AN group (.78) and the NC group (.80) were not different from

each other, $F<1$. There was also no effect of word type, $F(2, 88) = 2.20$, $p>.10$, $\eta^2 = .05$; hit rates for neutral (.81), positive (.80), and negative (.76) words were not different. There was also no interaction, $F(2, 88) = 1.01$, $p>.10$, $\eta^2 = .02$.

Hit rates for F items showed a main effect of group, $F(1, 44) = 9.17$, $p<.01$, $\eta^2 = .17$; AN group was more likely to give positive recognition judgments to F items (.59) than the NC group (.41). There was also an effect of word type, $F(2, 88) = 14.00$, $p<.01$, $\eta^2 = .24$; positive (.53) and negative (.57) items were more likely to receive positive recognition judgments than the neutral items (.41). Although the difference between the AN and the NC groups seemed larger for positive and negative words than for the neutral words, this apparent interaction was not statistically significant.

We again compared the hit rates for body, shape, and food items for both groups, and the only significant difference was that for the F items AN group was more likely to give positive recognition judgments to body and shape items than to food items, $F(2, 44) = 5.67$, $p<.01$, $\eta^2 = .21$.

Thus, a clear directed forgetting effect was observed in the recognition task as well, with, again, a smaller effect for the AN group. This smaller effect was caused by higher hit rates for F items by the AN group. An important difference with recall was that the size of the directed forgetting did not depend on word type.

3.3.2. False alarms

Overall false alarm rates were compared across groups because separate false alarm rates for R and F items are impossible to calculate. A 2 (group) × 3 (word type) mixed design ANOVA showed that there was a main effect of group; AN group made more false alarms (.17) than the control group (.07), $F(1, 44) = 7.35$, $p<.01$, $\eta^2 = .14$. There was also a main effect of word type, $F(2, 88) = 11.11$, $p<.01$, $\eta^2 = .20$; more false alarms were made to neutral items than to positive and negative items, which were not different from each other. There was no interaction, $F<1$.

3.3.3. Sensitivity

Sensitivity in recognition refers to how well participants can differentiate between studied (old) and nonstudied (new) items. Measures of sensitivity (d' or A') provide estimates of sensitivity (discriminability) independent of individual participants' response criterion. In this study we employed A', the nonparametric counterpart to d', the use of which does not depend on the assumptions of normality and homogeneity of variance (Pollack & Norman, 1964). The A' can range between 0 and 1, with .5 indicating chance level performance. First, both groups showed above chance discrimination (.87 for the NC and .85 for the AN group). Moreover, a 2 (group) × 3 (word type) mixed design ANOVA showed that the two groups were not different from each other in their sensitivity, $F(1, 44) = 1.91$, $p>.10$, $\eta^2 = .04$. There was, however, an effect of word type; A' was larger for positive and negative items (.88 and .87, respectively) than for neutral items (.82); $F(2, 88) = 15.74$, $p<.001$, $\eta^2 = .26$. There was no interaction, $F<1$.

3.3.4. Response bias

B''_D is considered to be the appropriate measure of response bias when A' is used to gauge sensitivity. This value can range between -1 and $+1$, and negative values reflect a liberal criterion whereas positive values reflect a conservative criterion for recognition (Donaldson, 1992, 1996). A 2 (group) × 3 (word type) mixed design ANOVA showed

that the AN group had a less conservative criterion ($B''_D = .367$) than the NC group ($B''_D = .740$), $F(1, 44) = 9.17$, $p < .01$, $\eta^2 = .17$. There was also a significant effect of word type, $F(2, 88) = 3.11$, $p = .05$, $\eta^2 = .07$; the only significant difference was that a less conservative criterion was used for neutral items ($B''_D = .474$) than for positive items ($B''_D = .623$). There was no interaction, $F < 1$.

4. Discussion

To our knowledge, this is the first study that employed a directed forgetting procedure to investigate memory bias in an eating disordered group, and also the first to investigate recognition memory along with recall. To briefly summarize our results: first, we obtained the standard directed forgetting effect in patients with AN as well as NC participants; both groups recalled more of the R items than F items. The important finding here was that the difference between R and F words was substantially smaller for the AN group. Second, we showed that this difference in the magnitude of the directed forgetting stemmed from a memory bias: the AN group recalled more of the disorder-relevant words they were asked to forget than the NC group. Third, although there was a tendency for a similar bias in recognition memory for the F items, it was not significant. Finally, the AN group adopted a less conservative response criterion than the NC group for giving a positive recognition judgment, without any difference in their ability to discriminate old vs new items.

The recall bias in this study concurs with earlier work regarding eating disorders (Hermans et al., 1998; Sebastian et al., 1996). Our findings indicated that patients with AN had difficulty forgetting disorder/schema-related information to which they were briefly exposed to. An important point to note is that this bias was observed for information that they were asked to forget and not for the items they were asked to remember. This finding is especially significant when considered along with the characteristics of the item-method directed forgetting procedure. In this method, each item is presented for a fixed period of time (2 s in this study), immediately followed by a longer presentation (3 s in this study) of the instruction for that item (R or F). There is common agreement in the directed forgetting literature that the difference between R and F items results from selective rehearsal (Johnson, 1994; MacLeod, 1998). In other words, R items are remembered better than F items, because subjects continue to rehearse the R items once the R instruction is given, and stop rehearsing F items once the F instruction is given. Since participants believe that memory for F items will not be tested, the most efficient strategy for the participants is not to further process an item once it is known that it will not be tested. The findings of the present study imply that the AN participants continued to rehearse the F items (especially the disorder-relevant items). It could be suggested that they were unable to disengage from the rehearsal process they initiated when they first saw that item. Another possibility is that the AN participants also stopped or at least diminished rehearsal of F items, once the F instruction appeared. However, they may still remember those disorder-related F items better because of the facilitatory effects of the schema that they have, which is built around ideas of shape, weight etc (Polivy & Herman, 1987; Vitousek & Hollon, 1990; Williamson et al., 2004). Because there may be a well-established schema organized around eating concerns, a "weaker" stimulus (in this case, a stimulus that appears only briefly and that is asked to be forgotten) can still be remembered well. Whether and how these two potential processes can be dissociated awaits further empirical work.

It is somewhat difficult to put the present recognition findings in context due to the absence of relevant literature in eating disorders. On the basis of directed forgetting literature, it was expected that the pattern obtained in recall should have remained relatively stable for recognition. Although a clear directed forgetting was observed for both groups in recognition as well, the apparent memory bias of AN patients for F items did not reach significance. Importantly, our findings suggested that the AN participants were not worse than NC participants in distinguishing between studied and nonstudied items; they simply adopted a less conservative response criterion. Therefore, it is possible that patients with AN show another type of bias such that they set a lower criterion for positive recognition decisions.

Another finding of the present study was that a bias was obtained for both the negative and the positive items, suggesting that disorder-relevance rather than the valence of the items might have been the important factor. Our findings are in line with the conceptualization that such cognitive schemas include both positive and negative information (Foa & Koza, 1986). However, this finding should be interpreted with caution because, in the present study categorization of emotional valence was made by the researchers and not by the participants. The guiding principle used in the categorization was that the negative words were those that relate to aspects of body, food, etc. that the patients would like to avoid, and the positive ones would be the ones they would like to approach or obtain. More specifically, words indicating fatness (e.g., heavy, kilo) or high calories (e.g., ice-cream, bread) were considered to be negative, whereas words indicating thinness (e.g., skinny, light) or low calories (e.g., salad, apple) were considered to be positive. Although there is some overlap between the words used here and in earlier published studies (e.g., Hermans et al., 1998) it has to be acknowledged that a more systematic classification based on expert ratings (e.g., Shafran et al., 2007) or on participants's own ratings would increase the validity of the conclusions regarding emotional valence. A related issue is that inclusion of negative and positive words that are not related to the diagnosis would also be useful in that regard. It should also be noted that when we collapsed the words across emotional valence (thereby having neutral and diagnosis-relevant categories), the main finding of a memory bias remained the same, and we believe that this is one of the most important conclusions of the present study.

Another potential limitation is that the diagnosis of AN was not based on structured clinical interviews. Although this represents a potential problem, the fact that the diagnoses were made by two psychiatrists independently based on the DSM-IV criteria and that the BMI scores of the AN participants were severely and uniformly underweight support for the validity of the diagnosis. Finally, given the possibility that the bias towards threat-related material may be linked to general anxiety rather than the diagnosis per se (Shafran et al., 2007), it would have been desirable to include an anxiety control group. To address the possible role of anxiety we looked at the correlation between anxiety scores (measured by Beck Anxiety Inventory; Steer, Ranieri, Beck, & Clark, 1993) and recall of R and F words; they were not significant ($p > .10$). Thus, at least for the present data, anxiety does not seem to be related to recall.

In sum, we showed that patients diagnosed with AN have difficulty forgetting disorder-relevant information that they were asked to forget, revealing a strong memory bias. Whether that bias extends to recognition memory was less clear and difficult to interpret in the absence of other studies on the topic. There was some indication that patients might have had a more general response bias in recognition. This deserves further empirical

attention. Employing the directed forgetting procedure (both item and list methods) with the full range of eating disorders (Fairburn et al., 2003; Lee & Shafran, 2004; Shafran et al., 2007) is likely to prove useful in determining the boundary conditions of memory bias in eating disorders.

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