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Explicit memory bias for positively valenced body-related cues in women with binge eating disorder

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ABSTRACT

Overweight women with and without binge eating disorder (BED) are characterized by a marked body dissatisfaction, which may in part be due to the negative comments about their weight. Weight-related teasing and discrimination is reported both by healthy overweight women and women with BED, whereas body dissatisfaction is markedly increased among women with BED. Therefore, a memory bias for negatively valenced body-related cues is suspected to occur as a mediating factor in women with BED. In an experimental study, 18 women with BED were compared to 18 overweight healthy female controls (HC) on a free recall task containing four word categories: positively valenced with and without body-related content and negatively valenced with and without body-related content. While both groups showed a bias towards negatively valenced shape-/weight-related words, women with BED retrieved positively valenced shape-/weight-related words significantly less often compared to overweight HC. Findings suggest that it may be the reduced ability to attend to positively valenced shape-/weight-related information, rather than the activation of negative body schemata that differentiates overweight women with BED from overweight women without BED. Results are discussed in the context of cognitive biases in the maintenance of body dissatisfaction.

1. Introduction

The overevaluation of shape and weight and corresponding concerns are core features that characterize both overweight women (Cash, 1995; Eisenberg, Neumark-Sztainer, & Story, 2003; Gleason, Alexander, & Somers, 2000; Grilo, Wilfley, Brownell, & Rodin, 1994) and women with binge eating disorder (BED; Eldredge & Agras, 1996; Hay & Fairburn, 1998; Hilbert & Tuschen-Caffier, 2005; Spitzer et al., 1993; Striegel-Moore, Wilson, Wilfley, Elder, & Brownell, 1998; Telch & Stice, 1998; Wilfley, Schwartz, Spurrell, & Fairburn, 2000; Wilson, Nonas, & Rosenblum, 1993), of whom mostly are overweight and obese (e.g., Cachelin et al., 1999; Striegel-Moore & Franko, 2003). Given the evidence of a systematic discrimination including weight-related teasing of overweight and obese individuals with and without BED (Brownell, Puhl, Schwartz, & Rudd, 2005; Crandall, 1995; Ding & Stillman, 2005; Fairburn et al., 1998; Falkner et al., 1999; Grilo & Masheb, 2001; Maranto & Stenoien, 2000; Neumark-Sztainer et al., 2002; Pingitore, Dugoni, Tindale, & Spring, 1994; Puhl & Brownell, 2001; Strauss & Pollack, 2003), it is comprehensible that these women are marked considerably by shape and weight concerns compared to normal weight individuals. However, there is evidence that overweight women with BED are even more dissatisfied with their body than overweight women without BED. For example, a study conducted by Svaldi, Caffier, Blechert, and Tuschen-Caffier (2009) found women with BED to score almost twice as high on the body shape questionnaire (Cooper, Taylor, Cooper, & Fairburn, 1987) than a healthy overweight control group. Considering the comparable exposure to negative comments about shape and weight, it is still unclear why women with BED are so much more dissatisfied with their body than overweight women without eating disorders.

Cognitive theories about the cause and maintenance of body dissatisfaction have focused on the relevance of cognitive biases. Vitousek and Hollon (1990) suggest that cognitive biases in eating disorders may arise from maladaptive schemata associated with food, shape, weight and self. In line with that, Williamson, Muller, Reas, and Thaw (1999) propose that such cognitive biases of attention, memory, judgment and body-image are responsible for the typical eating, shape and weight concerns eating-disordered patients usually express. Empirical evidence for a memory bias stems from a study conducted by Sebastian, Williamson, and Blouin (1996). The authors compared 30 eating-disordered subjects (AN, BN and eating disorders not otherwise specified [EDNOS]), 30 weight preoccupied controls and 30 healthy controls on a word

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recall memory task including fatness-related, nonfat and neutral words. Results indicate that eating-disordered subjects recalled significantly more fatness-related cues compared to the two control groups. Similarly, Hermans, Pieters, and Eelen (1998) used a recall test to compare patients with AN to healthy controls (HC) using four types of words: AN-related and three types of AN-unrelated words (positively, negatively valenced and neutral). Results revealed that patients with AN recalled significantly more AN-related words than words from the other categories, while there was no such difference in HC.

The transfer of such a theory to BED has its limitations, however. First of all, studies testing memory bias in eating disorders have yielded contradictory results. For example, Hermans et al. (1998) did not find any difference between patients with AN and HC on a word completion task. Similarly, Sebastian et al. (1996) found subjects with various eating disorders to retrieve significantly more fatness-related words than control words, but the authors did not include positively valenced words and did not control for levels of depression. Hence, rather than being the result of an activation of negative self-schemata, the bias for fatness-related stimuli may have been a bias for negative words in general. Second, and more importantly, there is evidence of a bias towards negative body-related words in overweight individuals as well. For example King, Polivy, and Herman (1991) compared restrained and unrestrained eaters, patients with AN and obese women on the words they would retrieve from an essay. Included target words was weight-, food-, and appearance-related information. Results revealed that similar to patients with AN, obese women recalled significantly more weight- and food-related items than other items. Given the comparable experience of stigmatization reported by overweight women with and without BED, the bias towards negative body-related information may thus not be the differentiating factor between overweight women with and without BED. In a study conducted by Agliata, Tantleff-Dunn, and Renk (2007), girls with high body dissatisfaction recalled significantly fewer positively valenced body-related words compared to negatively valenced and neutral words. Hence, the capacity to focus on positive body-related information may be a protective factor against body dissatisfaction. We reasoned that such a skill may be even more important in the face of frequent weight teasing and discrimination.

In light of the research just mentioned, the following hypotheses were stated. First, both women with BED and overweight women without BED are supposed to be characterized by a memory bias towards negatively valenced shape and weight-related cues. Second, compared to overweight women without BED, women with BED are supposed to have a reduced explicit memory recall for positively valenced shape and weight-related cues.

2. Method

2.1. Participants

Eighteen women with BED and 18 overweight healthy female controls were enrolled in the study. The study was approved by the ethics committee of the University of Freiburg. All participants were respondents to newspaper advertisements and announcements looking for “women who suffer from binge attacks”. Additionally, they also included an appeal to overweight women without binge attacks to participate in the study, “as it is only possible to get a deeper insight into the problems of binge attacks when having a comparison to women without such problems”. Prior to the diagnostic session, all participants were given a detailed study description and signed informed consent. The inclusion criterion for our clinical group was the presence of BED; exclusion criteria were the presence of substance abuse or addiction, bipolar disorder, current or past psychosis, schizophrenia, current suicidal ideation, pregnancy or lactation. To be comparable to the clinical group, healthy female controls (HC) were required to have a body mass index ($BMI = weight/height^2$) > 25. They were excluded if they were pregnant, lactating, had evidence of subjective binge eating episodes or had a current or lifetime diagnosis of any mental disorder, as indicated by the *Diagnostic and statistical manual of mental disorders* (DSM-IV-TR; APA, 2000). All diagnoses were determined by means of the Structured Clinical Interview for DSM-IV Axis I (SCID; Spitzer, Williams, Gibbon, & First, 1992; Wittchen, Zaudig, & Fydrich, 1997, German version) and the Eating Disorder Examination (Cooper & Fairburn, 1987; Hilbert & Tuschen-Caffier, 2006, German version).

2.2. Materials

2.2.1. Recall test

Recall test – stimuli: Four word categories were used in the experiment. Category one comprised 10 positively valenced words with body (i.e. shape/weight) related content (positive body-related words; e.g., attractive, gracile), category two comprised 10 positively valenced cues without body-related content (positive control words; e.g., happy, creative); category three included 10 negatively valenced words with body-related content (negative body-related words; e.g., fat, flubby) and category four included 10 negatively valenced cues without body-related content (negative control words; e.g., lazy, egoistic). To control for primacy and recency effects (e.g., Murdock, 1960; Postman & Phillips, 1965), three neutral fillers were presented at the beginning and at the end of the experiment. Target words were randomized within and for each trial with the exception that words of the same category were not presented successively.

Target words were taken from a pool of previously evaluated words. Twenty students had rated 225 words on the following dimensions: valency, relation to shape/weight and fluency. Valency was rated on a visual analogue scale which was rated from 1 to 5. Relation to shape/weight as well as fluency were rated on an 8-point Likert-like scale ranging from 1 (not at all) to 8 (very much). Additionally, words were scored for their number of syllables. Using analyses of variance, 10 words which fitted best the respective category were used (e.g., positive body-related words differed from positive control words on the shape and weight dimension, but not on the valence dimension; see Tables 1 and 2 for means, SD and statistics). Further, the four categories did not differ on fluency and number of syllables.

Recall test – procedure: Target words were presented in Presentation (Neurobehavioral Sytems 2007). Participants were shown target words with the instruction to press the number of syllables on the keypad right after the presentation of each word as fast as possible. Following pilot testing of three words, the syllable

Table 1
Means (SD) with regard to the word categories used in the recall test.

	PB ($n = 10$)	PC ($n = 10$)	NB ($n = 10$)	NC ($n = 10$)
Valency	1.74 (0.28)	1.37 (0.22)	3.92 (0.65)	4.33 (0.36)
Shape/weight relation	6.48 (1.04)	1.99 (0.31)	6.72 (0.74)	2.21 (0.73)
Fluency	7.65 (0.38)	7.92 (0.67)	7.72 (0.26)	7.68 (0.22)
Number of syllables	2.00 (0.82)	2.60 (0.84)	2.00 (0.82)	2.90 (0.93)

Note. PB = positively valenced words with body-related content; PC = positive control words; NB = negatively valenced words with body-related content; NC = negative control words; valency was rated on visual analogue scales and scored from 1 to 5; shape/weight relation and fluency were rated on Likert-like scales from 1 (not at all) to 8 (very much).

Table 2
Statistics of word categories.

Dependent variable	Category 1	Category 2	*p* values[a]
Mean valency	PB	PC	0.338
		NB	0.001
		NC	0.001
	PC	PB	0.338
		NB	0.001
		NC	0.001
	NB	PB	0.001
		PC	0.001
		NC	0.199
	NC	PB	0.001
		PC	0.001
		NB	0.199
Mean shape/weight relation	PB	PC	0.001
		NB	1.00
		NC	0.001
	PC	PB	0.001
		NB	0.001
		NC	1.00
	NB	PB	1.00
		PC	0.001
		NC	0.001
	NC	PB	0.001
		PC	1.00
		NB	0.001
Mean fluency	PB	PC	0.119
		NB	1.00
		NC	1.00
	PC	PB	0.119
		NB	0.508
		NC	0.219
	NB	PB	1.00
		PC	0.508
		NC	1.00
	NC	PB	1.00
		PC	0.219
		NB	1.00
Number of syllables	PB	PC	0.793
		NB	1.00
		NC	0.160
	PC	PB	0.793
		NB	0.793
		NC	1.00
	NB	PB	1.00
		PC	0.793
		NC	0.160
	NC	PB	0.160
		PC	1.00
		NB	0.160

Note. PB = positively valenced words with body-related content; PC = positive control words; NB = negatively valenced words with body-related content; NC = negative control words.
[a] Significant at 0.05 level.

task of the 40 words was repeated three times in order to avoid possible floor effects in the recall performance. No mention was made to the participants that they were taking part in a memory test. At the end of the incidental learning phase, they watched a series of landscape pictures for 5 min. Then they were asked to write down as many words as they could remember from the list previously seen. After the free recall task participants were asked whether they had suspected that they were going to be asked to recall the presented words. None of the participants said they had.

2.2.2. Questionnaires

The following questionnaires were administered: (1) The Dutch Eating Behavior Questionnaire (German version: Grunert, 1989; Van Strien, Frijters, Bergers, & Defares, 1986) is a 30-item self-rating questionnaire that measures various forms of eating behavior on a five response scale for each item ranging from 1 (never) to 5 (very frequently). It consists of three subscales of 10 items each (external eating scale, emotional eating scale and restrained eating scale). The minimum sum score is 30, the maximum sum score is 150. Internal consistency of the three subscales is high ($0.82 \leq$ Cronbach's $\alpha \geq 0.93$; Tuschen-Caffier, Hilbert, & Pook, 2005). In the present sample, internal consistency was $0.91 \leq$ Cronbach's $\alpha \geq 0.96$ (2) The Body Shape Questionnaire (Cooper, Taylor, Cooper, & Fairburn, 1987; Waadt, Laessle, & Pirke, 1992, German version), a 34-item self-report measure that assesses weight and shape concerns over the past four weeks on a six response scale for each item ranging from 1 (never) to 6 (always). The minimum sum score is 34 (no shape and weight concerns), the maximum score 204 (extreme shape and weight concerns). Split-half reliability was shown to be good (Pook & Tuschen-Caffier, 2004; Pook, Tuschen-Caffier, & Stich, 2002). Internal consistency is high (Pook et al., 2002), with Cronbach's $\alpha = 0.97$ in the present sample. (3) The Beck Depression Inventory (BDI; Beck, Steer, & Garbin, 1988; German version: Hautzinger, Bailer, Worall, & Keller, 1994) is a 21-item self-report measure that assesses the severity of depression on a four response scale for each item. The maximum sum score is 63. Scores above eleven indicate mild, of 20–30 moderate and scores of 30 and above severe depression (Beck et al., 1988). Several studies confirmed the BDI's high internal consistency, reliability and discriminant validity (Richter, Werner, & Bastine, 1994). In this sample, internal consistency was Cronbach's $\alpha = 0.88$.

2.3. Procedure

Upon arrival, participants were told that they were going to accomplish a series of experiments involving a speed task. Participants were then seated in front of a 17-inch monitor in a quiet laboratory room. They were told to follow instructions on the monitor. After that, the experimenter left the room and started the experimental procedure ("syllable task"). Thereafter, the experimenter re-entered the laboratory and told participants to relax for the following 5 min by watching landscape pictures on the monitor. Five minutes later, the experimenter entered the room again and told participants to follow instructions which would soon be presented on the monitor. Participants then started with the recall task.

3. Results

3.1. Overall psychopathology

There were no significant group differences on BMI, $F(1,35) = 3.08$, ns (BED: mean [M] = 32.8, standard deviation [SD] = 3.54; HC: M = 30.7, SD = 3.92), and age, $F(1,35) = 0.94$, ns (BED: M = 42.4, SD = 12.3; HC: M = 38.3, SD = 13.1). Congruent with selection criteria for study inclusion and exclusion, groups differed significantly on all questionnaires measuring eating and overall psychopathology (see Table 3 for means [M] and *F* values). Regarding binge attacks, women with BED had a mean of 2.57 (SD = 0.91) binges per week over the six months prior to testing. Comparable to other studies (e.g., Hudson, Hiripi, Pope, & Kessler, 2007; Telch & Stice, 1998; Wilfley et al., 2000; Yanovski, Nelson, Dubbert, & Spitzer, 1993), comorbidity in this group was high: 22.2% had a diagnosis of major depression (MD), 66.7% of past MD, 16.7% of panic disorder with agoraphobia, 11.1% of social phobia, 5.6% of post-traumatic stress disorder, 5.6% of generalized anxiety disorder and 5.6% of somatization disorder. In total, 22.2% had no additional diagnosis, 38.9% had one, 27.8% had two, 5.6% had four, and 5.6% had six additional diagnoses.

Table 3
Participant characteristics.

Measure	BED $n = 18$	HC $n = 18$	F^a	p
	M (SD)	M (SD)		
BDI	16.1 (8.54)	3.00 (2.20)	39.4	<0.000
$DEBQ_{global}$	106 (11.7)	77.8 (19.4)	27.9	<0.000
$DEBQ_{re}$	27.3 (6.57)	27.8 (8.10)	0.42	0.839
$DEBQ_{ee}$	41.3 (5.59)	22.5 (9.92)	46.7	<0.000
$DEBQ_{ex}$	38.1 (7.34)	27.5 (7.12)	17.7	<0.000
BSQ	135 (15.7)	82.7 (33.4)	35.9	<0.000

Note. BED = group of women with binge eating disorder; HC = healthy control group; BDI = Beck Depression Inventory; $DEBQ_{global}$ = Dutch Eating Behavior Questionnaire, global score; $DEBQ_{re}$ = Dutch Eating Behavior Questionnaire, restraint eating subscale; $DEBQ_{ee}$ = Dutch Eating Behavior Questionnaire, emotional eating subscale; $DEBQ_{ex}$ = Dutch Eating Behavior Questionnaire, external eating subscale; BSQ = Body Shape Questionnaire.
[a] df (1, 35).

3.2. Recall task

A 2 (Group) × 2 (Body-Relatedness) × 2 (Valency) repeated measures analysis of variance (ANOVA) revealed a significant main effect for Group, $F(1, 33) = 6.37$, $p = 0.017$, $\eta^2 = 0.876$, a significant main effect for Body-Relatedness, $F(1, 33) = 19.4$, $p < 0.000$, $\eta^2 = 0.370$, a significant interaction of Valency × Group, $F(1, 33) = 4.01$, $p = 0.050$, $\eta^2 = 0.108$ and a significant interaction of Valency × Body-Relatedness, $F(1, 33) = 15.3$, $p < 0.000$, $\eta^2 = 0.317$. To identify the sources of these interactions and to explain our main effects we subsequently conducted separate oneway ANOVAs for each category. Results indicated that groups differed significantly on the retrieved number of positive body-related words, $F(1, 34) = 7.01$, $p = 0.012$, whereby women in the BED group recalled significantly fewer positive body-related words than HC. Moreover, compared to HC, women with BED retrieved significantly fewer positive control words, $F(1, 34) = 4.36$, $p = 0.044$. There were no significant differences with regard to negative body-related words, $F(1, 34) = 1.12$, $p = 0.298$, and negative control words, $F(1, 34) = 0.362$, $p = 0.551$ (see Fig. 1 for M and SD).

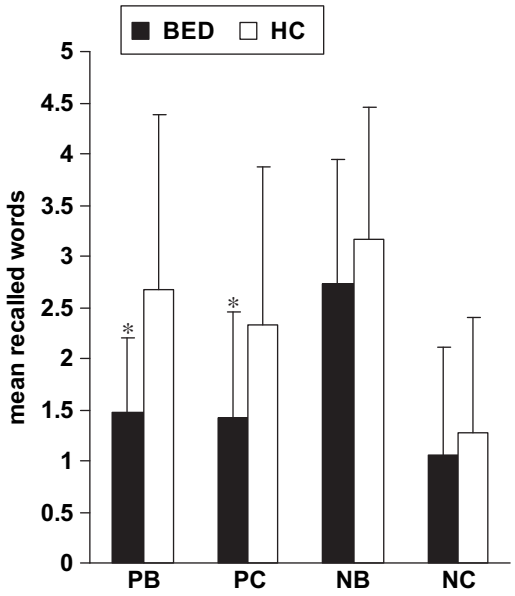

Fig. 1. Mean number of recalled positively valenced words with body-related content (PB), positive control words(PC), negatively valenced words with body-related content (NB) and negative control words (NC). Results are presented separately for the group of women with binge eating disorder (BED) and healthy controls (HC). * = $p < .05$.

On the background of the studies which found attentional and memory biases in anxiety disorders (Clark, 1988; Clark & McManus, 2002; McNally, English, & Lipke, 1993; Rachman, 1997; Rude, Wenzlaff, & Gibbs, 2002; Thorpe & Salkovskis, 1997) and depression (Rude et al., 2002) all analyses were re-computed comparing a subgroup of women with BED without an additional current anxiety or affective disorder (N = 12) to our HC group. The 2 (Group: BED, HC) X 2 (Body-Relatedness) X 2 (Valency) repeated measures ANOVA revealed significant main effect for Group, $F(1, 26) = 4.20$, $p = 0.050$, $\eta^2 = 0.139$, a significant main effect for Body-Relatedness, $F(1, 26) = 10.9$, $p = 0.003$, $\eta^2 = 0.295$, a significant interaction of Valency × Body-Relatedness, $F(1, 26) = 12.9$, $p = 0.001$, $\eta^2 = 0.332$, while the interaction of Valency × Group slightly missed significance, $F(1, 26) = 3.89$, $p = 0.062$, $\eta^2 = 0.128$. An additional oneway ANOVA revealed a significant group difference for positively valenced cues with body-related content, $F(1, 27) = 4.755$, $p = 0.038$. Again, women with BED retrieved significantly fewer positive body-related words than HC. There were no other significant group differences for the other word categories, $Fs < 2.15$, $ps > 0.153$.

To further confirm the above mentioned results, stepwise regression analyses were computed, with BDI, BMI and group status predicting recall performance, separately for each word category. With respect to the prediction of positive body-related words, BDI scores clearly missed significance, $\beta = -0.158$, $p = 0.333$. Only BMI, $\beta = -0.319$, $p = 0.051$, and group status, $\beta = -0.158$, $p = 0.044$, significantly predicted recall. In total, BDI and BMI explained 27% of the variance, $R^2 = 0.169$, while adding group status increased the explained variance to 27%, $R^2 = 0.269$. With respect to the prediction of positive control words, BDI slightly failed to reach significance, $\beta = -0.281$, $p = 0.060$. BMI strongly predicted recall performance, $\beta = -0.498$, $p = 0.002$, whereas group status clearly missed significance, $\beta = 0.211$, $p = 0.178$. BDI and BMI explained 25% of the variance, $R^2 = 0.248$, while adding group status did not have an increment of variance. There were no significant results for the other two word categories.

Paired T-Tests revealed that women with BED retrieved significantly more negative body-related cues than positive body-related cues, $T = -3.43$, $df = 17$, $p = 0.003$, than positive control words, $T = -4.05$, $df = 17$, $p = 0.001$ and than negative control cues, $T = 4.85$, $df = 17$, $p < 0.001$. No significant differences were found between other categories, $Ts < 1.22$, $ps > 0.124$. Women in the HC retrieved significantly more negative body-related cues than negative control cues, $T = 1.28$, $df = 17$, $p < 0.001$. They also retrieved significantly more positive than negative control cues, $T = 2.70$, $df = 17$, $p = 0.015$ and more positive than negative body-related cues, $T = 3.36$, $df = 17$, $p = 0.004$. There were no significant other pairs, $Ts < 1.82$, $ps > 0.086$ (for M and SD see Figure 1).

3.3. Correlations

There were no significant correlations between the number of recalled words and BSQ scores, $rs < -0.285$, $ps > 0.108$, and number of recalled words and DEBQ scores, $rs < -0.320$, $ps > 0.070$.

4. Discussion

The main aim of the study was to test explicit memory biases for shape and weight-related words of positive and negative valence in comparison to positive and negative control words in women with BED and overweight female HC. Specifically, we thought that both overweight women with and without BED would retrieve more negative than positive body-related cues on a recall task. We also hypothesized that they would retrieve more negative body-related cues than negative and positive control cues. Our hypothesis was

only partially confirmed. Consistent with our prediction, women with BED retrieved significantly more negative body-related words than words from the other three categories. Thus, similar to women with AN and BN (Hermans et al., 1998; Sebastian et al., 1996), women with BED seem to be characterized by an enhanced memory for schema-consistent, i.e. negative body-related information. By contrast, even though overweight HC retrieved significantly more negative body-related cues than negative control cues, they held balance between retrieval of positive and negative cues with shape and weight content.

The second issue of our study concerned group differences with regard to the processing of positively valenced shape and weight-related information. Our results revealed that, compared to healthy overweight women, our group of women with BED was found to retrieve significantly fewer positive body-related cues. The lack of balance between the recall of positive and negative body-related cues in women with BED may, in fact, reinforce body dissatisfaction in overweight women with BED. Of course one could argue that overweight women rarely receive positive feedback from others. In this light, it would be unlikely that the lack of a memory bias for positive body-related information explains why overweight women with BED are more dissatisfied with their body than overweight women without BED. On the other hand, body satisfaction does not rely only on feedback concerning one's weight, but it may also include feedback concerning one's general appearance. For example, just like normal weight individuals overweight individuals as well may get positive feedback about the way they dress or their hair is done. Depending on whether they internally accept or decline such a compliment will have an impact on how they perceive themselves. Even more important though may be a person's own body perception. A recent study by Trampe, Stapel, and Siero (2007) showed that body-dissatisfied women compare their body with other women's bodies to a significantly greater extent than body-satisfied women. Depending on *how* they compare, such comparisons may not be problematic. However, Jansen, Nederkoorn, and Mulkens (2005) yield evidence that, compared to healthy controls, eating-disordered participants have a decreased attention towards the body parts they like and an increased attention towards the body parts they dislike when viewing themselves. By contrast, when looking at other BMI matched bodies, eating-disordered women allocate their attention to body parts they like, while controls focus more on those they dislike. In line with a transdiagnostic approach to eating disorders (Fairburn, Cooper, & Shafran, 2003), a similar bias for overweight women with and without BED could be assumed. Moreover, therapeutic approaches that aim at the establishment of such a balance significantly decrease body dissatisfaction in women with extreme shape and weight concerns (Delinsky & Wilson, 2006), with AN and BN (Kaye et al., 2005; Tuschen-Caffier, Pook, & Frank, 2001; Vocks, Legenbauer, Wachter, Wucherer, & Kosfelder, 2007) and obese adolescents (Jansen et al., 2008).

Cognitive theories of emotional disorders suggest that biases in attention and memory are a crucial factor with respect to the maintenance of the psychopathology of a specific disorder (Clark & McManus, 2002; Rachman, 1997; Rude et al., 2002; Thorpe & Salkovskis, 1997; Williamson et al., 1999). Our results yield evidence that it may not only be the enhanced bias for negative body-related cues that may be responsible for the increased BSQ (Cooper et al., 1987) scores we found in women with BED compared to HC. It may, in fact also be the reduced retrieval of positive body-related cues that could add to BED women's stronger body dissatisfaction. In the light of highly prevalent discriminative behavior against overweight individuals (Crandall, 1991; Ding & Stillman, 2005; Harris, Harris, & Bochner, 1982; Puhl & Brownell, 2001) and the high drive for thinness in Western societies (Lake, Staiger, & Glowinski, 2000; Tiggemann & Pickering, 1996), body satisfaction in the overweight may depend on their ability to focus on the environment's positive feedback over one's own body. Overweight women without BED seem to exert this skill better than women with BED. More important, this seems to be independent of the prevalence of a comorbid diagnosis of major depression or an anxiety disorder, as results on recall of positive body-related words remained virtually the same in our subgroup analyses and in our regression analysis.

Even though not hypothesized, women with BED also retrieved significantly fewer positive control words than our HC. As ANCOVA is not designed to control for naturally occurring group differences (Jamieson, 2004; Miller & Chapman, 2001) and depressiveness is commonly increased in individuals with BED compared to HC (Grilo, White, & Masheb, 2008, 2009), we did not statistically control for depression in our primary statistical analysis. We did, however, re-do all analyses with a subgroup of BED women without a comorbid diagnosis of major depression or an anxiety disorder. While results for positive body-related words remained unaltered, the between group difference for positive control words lost significance. The results were additionally confirmed by a stepwise regression analysis, in which we controlled for BDI and BMI scores. While group did not increase the explained variance for recall performance for positive control words, the results indicate that BMI and BDI had a strong predictive quality. On the one hand thus, there seems to have been a mood congruency effect similar to other studies (Blaney, 1986; Bower, 1981; Lloyd & Lishman, 1975). On the other hand, results from the regression analysis also indicate that a higher BMI was associated with weaker recall performance of positive control words. This is in line with other studies which reported a positive association between obesity and depressiveness (Carpenter, Hasin, Allison, & Faith, 2000; McIntyre, Konarski, Wilkins, Soczynska, & Kennedy, 2006; Simon et al., 2006). Thus, weak recall performance of positive information, in turn, may be relevant for the maintenance of negative mood in women with BED. By contrast, group status (BED vs. overweight) seems to be more relevant for recall of positive body-related words as shown by the results of the stepwise regression analysis.

A possible objection to the study concerns the ecological validity of the stimuli used. Contrary to most studies assessing memory bias in eating disorders, we added the categories of positive and negative valence in addition to the use of cues with and without shape and weight content. However, a computer task is far removed from daily reality and may not give enough insight into how the information processing found in the actual test may operate in participants' everyday lives. The replication of our results using pictures, essays or real "world situations" (Watkins, Martin, Muller, & Day, 1995) may certainly add to the ecological validity of the presented results.

Another shortcoming concerns the fact that, by using a very explicit measure of memory recall it is unclear whether our participants related the used stimuli to themselves. If they did so, it may still be other reasons than a memory bias which could be responsible for the yielded results. Because of their stronger body dissatisfaction and the accompanying feelings of shame, BED participants could have in fact memorized positive body-related cues but may have decided not to write them down because they felt that the stimuli used really did not apply to their own body. This would mean that positive body-related information is less self-relevant for women with BED than HC. Only a design which manipulates self-reference, for example by putting half of the participants in front of a mirror, could ultimately clear this issue. If lack of self-reference of positive body-related words was the reason for our results, information processing theories would argue that schema inconsistent information is more likely to be rejected than schema-consistent information. In this context, therefore, we

would again assume that the reason for BED women's found bias – whether they decided not to write down the positive body-related words or they had forgotten them – would be related to the activation of negative body schema. Nevertheless, correlations between the number of recalled positive body-related words and overall body dissatisfaction (BSQ scores) were small to medium but not significant. As body dissatisfaction (BSQ) and eating pathology (DEBQ) are commonly increased in BED women compared to overweight HC and ANCOVA is not designed for naturally occurring differences, we did not statistically control for these factors in our analyses (Jamieson, 2004; Miller & Chapman, 2001). The lack of the significant correlation could, on the one hand, be a consequence of the small sample size. It may, however, also oppugn the assumption that the memory bias found is the major mechanism that leads to increased body dissatisfaction. Overall, recall may influence other factors which increase body dissatisfaction. Such a factor could be self-esteem, for example. Alternatively, body dissatisfaction – due to negative body schemata – may influence factors such as self-esteem, which in turn reduce recall performance. Longitudinal studies which consider perception and information processing before and after the development of body dissatisfaction could give more insight into the causality of these processes. Additionally, comparing BED women with high and low body satisfaction on such a memory test could clear its role in the memory bias found. However, recruitment of such a sample is quite difficult.

In addition, even though participants were presented each cue three times in order to avoid floor effects, recall scores across word categories were relatively low for both groups. It is difficult to draw comparisons to other studies which assessed memory biases in eating disorders. Recall scores in the study conducted by Sebastian et al. (1996) were considerably higher both for the eating-disordered groups and the control group. However, in this study participants were presented fewer words (three categories of 10 words each), words were presented longer (10 sec) and word learning was embedded in an imagery task, in which participants were instructed to imagine themselves in a past, present or future scene that involved themselves and the presented word. By contrast, King et al. (1991) presented their subjects with a one-page description of the physical appearance and behavior of a target person which they could read once. In total, the essay contained 16 items of information and mean recall scores of their study were lower compared to our scores. Russo, Fox, Lynn, and Nguyen-Van-Tam (2001) adopted a similar design to ours with high and low anxious students. As their results are quiet comparable to our ones, the fairly low recall scores of our groups do not seem to be a marker of psychopathology.

Last but not least, our results do not give any direction of causality. It is still not clear, whether women with BED retrieved fewer positive body-related cues than controls because they were more dissatisfied with their body or vice versa. However, such knowledge is important for clinical improvement. For example, the experimental manipulation of the bias found (e.g., increase/decrease the selective attention of positive body-related cues) could give more insight into the contribution of such biases in the maintenance of body dissatisfaction in BED.

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