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Overgeneral Memory in Binge Eating Disorder is Linked to Binge Frequency

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Abstract

Research on memory biases in binge eating disorder (BED) has primarily analyzed the *content* of disorder specific thoughts such as memory for eating, shape and weight related words. By investigating recall of autobiographical memories (AM) in individuals with BED, this study primarily focused on recollection *strategies.* Such strategies include individuals' number of recalled specific and categoric AM on the autobiographical memory test (AMT) and have previously been shown to be implicated in the maintenance of emotional disorders. Thirty women with BED and 24 overweight healthy controls (HC) were compared on the AMT with six positively and six negatively valenced cues. Women with BED retrieved more categoric memories and produced more omissions to positively valenced cues than HC. There was also a significant and positive correlation of categoric memories and binge frequency, suggesting that overgenerality may function as a maintenance factor of eating pathology in BED.

Keywords: Autobiographical memory, overgenerality, binge eating disorder, binge frequency, memory specificity

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Introduction

Autobiographical memory (AM) refers to the recollection of personally experienced past events. As such, AM is fundamental to the conceptualization of the self, to the understanding of one's behaviour and it is closely linked to the ability to pursue one's goals effectively on the background of one's past problem solving (Conway & Pleydell-Pearce, 2000).

One aspect of AM which has closely been linked to psychopathology is overgenerality in the AM test (see Williams et al., 2007 for an extensive review). In this paradigm participants are required to retrieve specific memories of personally experienced events that happened within a single day and that had not occurred regularly (e.g. "I broke my arm in a bike accident") in response to cues of different emotional valence (e.g., happy, sad). Other reports are often referred to as overgeneral memories and include the category of related events (e.g. "Every time I went to a tennis match…"), reports of events of extended

duration (e.g. “My vacation in Spain…”), reports of persons/objects/locations (e.g., “I’m happy about my new bike”), non autobiographical events (e.g., “My uncle fell from the horse”) and omissions.

Empirical studies yield evidence that individuals with bulimia (BN) and anorexia nervosa (AN) are characterized by difficulties in accessing specific autobiographical memories. A study conducted by Laberg and Andersson (2004) compared 18 women remitted from BN to 18 matched women without any history of eating disorders (ED) with the AM test. Results indicate that women with a former diagnosis of BN retrieved significantly fewer specific AM than healthy controls (HC). In a study conducted by Dalgleish et al. (2003), a group of 39 participants with AN retrieved significantly more overgeneral memories than the group of 21 HC. Nandrino, Doba, Lesne, Christophe and Pezard (2006) compared 25 patients with AN to 25 women without previous history of psychiatric, drug abuse or ED. Results indicate that women with AN retrieved significantly more overgeneral memories in response to both positively and negatively valenced cues.

To our knowledge, no study so far has examined AM recall in binge eating disorder (BED). As overgeneral memory recall has been shown to be associated with the delayed recovery from other emotional disorders (see Williams et al., 2007 for an extensive review), to be positively correlated with illness duration in AN (Nandrino et al., 2006) and to persist after symptom remission in BN (Laberg & Andersson, 2004), recall of AM could also be a factor contributing to the maintenance of BED.

Beyond the transdiagnostic aspect of eating disorders (Fairburn, Cooper, & Shafran, 2003), evidence from other areas of research suggests that BED may also be characterized by an overgeneral memory retrieval style. First of all, one of the coping styles closely related to binge eating is avoidance (Paxton & Diggens, 1997; Schwarze, Oliver, & Handal, 2003; Sierra Baigrie & Lemos Giraldez, 2008). Retrieving memories in a less specific way, in turn, can also be considered as a passive avoidance strategy (Hermans et al., 2008). Specific memories primarily involve sensory-perceptual information and may thus produce increases in mood disturbance (Williams et al., 2007). In fact, Raes, Hermans, de Decker, Elen, & Williams. (2003) found that mood decrease was greater in participants with a more specific retrieval style compared to participants with a more overgeneral retrieval style following a frustration inducing performance task. One of the empirically most validated triggers of binge eating is negative affect (Hilbert & Tuschen-Caffier, 2007; Stein et al., 2007). At the same time, BED is characterized by a high incidence of depression (Fairburn et al., 1998) and traumatic experiences (Allison, Grilo, Masheb, & Stunkard, 2007; Grilo & Masheb, 2001; Hilbert & Tuschen-Caffier, 2007). Therefore, an overgeneral retrieval style may alleviate the intensity of negative feelings in women with BED and thereby function as an affect regulation strategy.

Second, recollection of specific autobiographical events is supposed to occur in cyclical processes (Conway & Pleydell-Pearce, 2000) which, in turn, are modulated by the supervisory attentional system (SAS; Burgess & Shallice, 1996). The SAS has access to current self-concepts and its themes, goals, and plans, and evaluates the various accessed memories of each retrieval phase and accordingly inhibits or increases the activation of the memory construction process. Thus, if the system fails, improper search strategies are adopted and the access to specific memories is impaired. There is evidence that such executive skills may be impaired in women with BED (Svaldi, Brand, & Tuschen-Caffier, 2010). With respect to AM recall, a failure by the central executive control in the activation and inhibition of memory components may lead to increased categoric recall (Williams et al., 2007).

Third, AM retrieval is closely linked to the ability to solve one’s problems effectively (Evans, Williams, O'Loughlin, & Howells, 1992; Goddard, Dritschel, & Burton, 1996; Williams et al., 2007). Effective problem solving requires various skills such as general problem orientation, the definition and formulation of the problem, the generation of alternatives, decision making and the implementation of the

selected solution (D'Zurilla & Maydeu-Olivares, 1995). Empirical evidence suggests that women with BED do have impairments at several stages of the problem solving process. For example, compared to HC, they more often make disadvantageous decisions (Svaldi, Brand et al., 2010) and their generated solutions to interpersonal problems are generally less effective (Svaldi, Dorn, & Trentowska, 2010). These difficulties could, in turn, result from BED women's failure to access the relevant information in their autobiographical database.

In sum, while several studies in BED have focused on the role of content specific information processing (Shafran, Lee, Cooper, Palmer, & Fairburn, 2007; Svaldi, Bender, & Tuschen-Caffier, 2010), recall *strategies* of AM have not yet been investigated in BED. As AM recall has been shown to be involved in the maintenance of and recovery from emotional disorders, the knowledge of eventual recollection strategy failures in BED individuals would contribute to a better understanding of the psychopathology of BED. As overgeneral AM recall can be reduced by specific therapeutic approaches (Williams, Teasdale, Segal, & Soulsby, 2000), it may also be important for future treatment considerations in BED. On the basis of this information, the following hypotheses were outlined: First, in light of the avoidant coping style found in BED subjects, we hypothesized that compared to HC they would retrieve fewer specific and more overgeneral memories on the AM test. Second, given the reduced executive functions reported for BED, we also hypothesized that compared to HC, women with BED would be characterized by an increased categoric recall.

Method

Participants

Participants were recruited by means of advertisements in local newspapers, asking for women suffering from binge attacks to participate in a series of experiments in order to get a better understanding of the mechanisms underlying binge episodes. These advertisements also included an appeal for participation to overweight women without eating disturbances, because "it is only possible to get insight into the psychopathology of binge eating disorder when having an appropriate control group". In addition, BED patients were also given the opportunity to participate in eight sessions of group therapy aiming at the reduction of binge attacks. No compensation was given for participation.

Thirty women with BED and a group of 24 healthy female controls (HC) participated in the study. Inclusion criterion for the BED group was the presence of a DSM-IV-TR diagnosis (APA, 2000) of BED. Exclusion criteria were the presence of substance abuse or addiction, bipolar disorder, current or past psychosis, schizophrenia and current suicidal ideation. Because some of the participants also participated also in a study involving body exposure, pregnancy or lactation were included as further exclusion criteria. This was important as the aim of the body exposure experiments was to get insight into the habitual attention allocation to one's body in BED and pregnancy and lactation severely affects body weight and shape (however, no participant had to be excluded for these latter reasons). Additionally, because we wanted to make assertions on the psychopathology of BED and not of weight, our HC group was required to have a Body Mass Index (BMI = weight/height^2) > 25. They were excluded if they qualified for a current or past DSM-IV-TR (APA, 2000) mental disorder, were pregnant or currently lactating. Diagnoses were determined by 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) and participants were informed on their diagnoses after the interview. All participants signed informed consent. The study was approved by the local ethics committee.

(See Table 1 for means, standard deviations and statistics). The two groups did not differ significantly on age, employment status, and monthly income. However, the BED group was characterized by a significantly higher BMI. Thereby, BMI of both the group of women with BED and of HC was comparable to other studies (Allison et al., 2007; Grilo, Masheb, & Wilson, 2001; Striegel-Moore et al., 2005). There were significant between group differences in all other scales measuring overall psychopathology and eating pathology.

Table 1: Participant Characteristics

	BED *n* = *30*	**HC *n* = *24***	***F*[1]**	***p***
BDI_sum	17.0 (10.21)	3.16 (2.01)	42.59	< .000
BMI	38.0 (8.17)	29.7 (3.86)	21.01	< .000
Age (years)	42.8 (10.11)	37.9 (12.71)	2.52	.118
employment status				
employee	15	9		
self-employed	0	2		
unemployed	5	1		
student	4	8		
housewife	6	3		
other	0	1	X^{2*} = 8.94	.111
monthly income				
0 – 1000 €	8	10		
1000 – 1500 €	6	5		
1500 – 2000 €	5	1		
2000 – 2500 €	5	2		
2500 – 3000 €	2	1		
3000 – 4000 €	1	4		
4000 € and more	1	1	$X^{2\#}$ = 6.13	.409
$EDEQ_{M}$	4.59 (0.86)	2.26 (0.99)	86.40	< .000
$EDEQ_{RE}$	2.79 (1.40)	1.93 (1.00)	6.36	< .015
$EDEQ_{EC}$	3.94 (1.43)	1.33 (0.43)	74.19	< .000
$EDEQ_{WC}$	5.00 (1.04)	2.59 (1.12)	65.37	< .000
$EDEQ_{SC}$	5.63 (0.92)	2.79 (1.36)	81.97	< .000
CTQ_{EA}	12.60 (6.08)	7.71 (2.91)	13.15	< .001
CTQ_{PA}	7.10 (3.53)	5.42 (1.18)	5.00	.030
CTQ_{SA}	7.21 (4.53)	5.17 (0.48)	4.81	.033
CTQ_{EN}	13.86 (6.21)	8.21 (2.70)	17.13	< .000
CTQ_{PN}	8.21 (3.44)	6.08 (1.44)	7.98	.007
TMTA (sec)	26.80 (7.19)	23.65 (7.59)	2.43	.125

Note. BED = group of women with binge eating disorder (BED); HC = healthy controls; BMI = Body Mass Index = weight in kilograms/height in metres^2; BDI = Beck Depression Inventory; EDE-Q = Eating Disorder Examination Questionnaire; $_{M}$ = global score; $_{EC}$ = eating concern subscale; $_{SC}$ = shape concern subscale; $_{WC}$ = weight concern subscale; $_{RE}$ = restraint subscale; CTQ = Childhood Trauma Questionnaire; $_{EA}$ = emotional abuse subscale; $_{PA}$ = physical abuse subscale; $_{SA}$ = sexual abuse subscale; $_{EN}$ = emotional neglect subscale; $_{PN}$ = physical neglect subscale; TMT A = Trail Making Test A; [1] df (2, 53); * df = 5; # df = 6.

With respect to binge frequency, women with BED had a mean of 14.1 (SD = 6.65) binges over the four weeks prior to testing. Consistent with other studies (e.g., Wilfley, Schwartz, Spurrell, & Fairburn, 2000), major depression (63.3%) was the most prevalent comorbid disorder, followed by anxiety disorders

(20%). 30% of women in the BED group had no comordid disorder, 40% had one, 20% two, 3.33% three, 3.33% four and 3.33% six additional comorbid disorders.

Measures

Autobiographical memory test: For the AM test we followed the standard procedure (Williams & Broadbent, 1986) with one variation: consistent with other studies (Mackinger et al., 2004; Mackinger, Pachinger, Leibetseder, & Fartacek, 2000) retrieved memories had to have happened at least two years prior to testing. The time barrier was given to avoid the reminiscence bump (Jansari & Parkin, 1996), a tendency to report very recent events, which in turn are often more specific. In total, participants retrieved memories to six positively (serene, cheerful, comfortable, happy, optimistic, satisfied) and six negatively (sad, down, unhappy, melancholy, depressed, dull) valenced cues. Word stimuli were drawn from a study on word norms (Mackinger, Leibetseder, & Fartacek, 1999). Words were presented in random order, but in alternating valency.

Participants were instructed to recall and speak aloud a specific memory in response to the presented cue within the time frame of one minute; prior to the test, they were given an example of a specific memory. To ensure they had understood the task, they received three practice items.

All responses were tape recorded, typed in detail and scored for level of specificity by two raters as specific, extended, categoric, person/object only, location only, nonautobiographical and omissions. Thereby, one of the raters was blind to all study details, the other one to group membership.

Beck Depression Inventory (BDI; Beck, Steer, & Garbin, 1988; Hautzinger, Bailer, Worall, & Keller, 1994, German version)**:** The BDI is a 21 item self-rating questionnaire that measures severity of depression. Several studies have confirmed the BDI's high internal consistency, reliability and discriminant validity (Richter, Werner, & Bastine, 1994).

The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994; Hilbert, Tuschen-Caffier, Karwautz, Niederhofer, & Munsch, 2007, German version): This self-report questionnaire assesses the presence and severity of eating pathology. It consists of a global score ($EDEQ_M$) and four subscales (restraint scale ($_{RE}$), eating concern scale ($_{EC}$), weight concern scale ($_{WC}$) and shape concern scale ($_{SC}$)) with high internal consistency and stability. Internal consistencies in our study were satisfactory (.68 ≤ Cronbach's $\alpha \leq .95$).

Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998; Gast, Rodewald, Benecke, & Driessen, 2001). This is a self-report questionnaire that assesses types of childhood maltreatment in five subscales on a five-point Likert-type scale anchored from "never true" to "very often true": emotional abuse ($_{EA}$), physical abuse ($_{PA}$), sexual abuse ($_{SA}$), emotional neglect ($_{EN}$) and physical neglect ($_{PN}$). Convergent and discriminative validity as well as reliability (retest reliability, intraclass correlation coefficients r = .076 to .086) are satisfactory (Bernstein & Fink, 1998; Bernstein et al., 2003). Internal consistencies in our study were highly satisfactory (.82 ≤ Cronbach's $\alpha \leq .93$).

The Trail-Making-Test A (TMT; Reitan, 1992). Even though AM retrieval seems to be unrelated to general cognitive deficits, levels of IQ and education (Baddeley, Emslie, & Nimmo-Smith, 1992; Park, Goodyer, & Teasdale, 2002; Wessel, Merckelbach, & Dekkers, 2002), we administered this neuropsychological screening instrument to capture mental tracking (Fernandez & Marcopulos, 2008) and motor speed (Levine, Miller, Becker, Selnes, & Cohen, 2004). It requires subjects to connect as quickly and as correctly as possible 25 encircled numbers in ascending order distributed on a sheet of paper. The instrument was used to ensure that participants have comparable cognitive functioning, as it has proven to be sensitive to various forms of neuro-cognitive deficits and brain injuries (Fernandez &

Marcopulos, 2008; Reitan & Wolfson, 2004). Reported reliability coefficients are around .80 (Spreen & Strauss, 1998).

Procedure

Participants filled out all questionnaires except for the BDI (Beck et al., 1988) on the computer at home two to five days prior to testing. The study took place in a quiet laboratory room. On arrival, participants were told that they were going to accomplish a series of experiments involving motor speed and memory. They were then seated in a comfortable chair in front of a monitor and asked to fill out the BDI (Beck et al., 1988). After that, the research assistant read the AM test instruction, which simultaneously appeared on the monitor. After three practice items, each cue was presented for 60 seconds and the participant had to generate an autobiographical memory (which was tape recorded). After the 12 AM test cues, participants were given the TMT test A (Reitan, 1992). Participants then continued with other experimental procedures. These procedures included eye movement registration (Svaldi, Caffier, & Tuschen-Caffier, in press) in response to body pictures and are unrelated to the present study.

Results

There were no significant group differences on the TMT-A (see Table 1 for *M, SD* and statistics), suggesting that both groups were comparable with regard to motor speed and mental tracking. The raters' agreement with regard to the categorization of the responses to the AM test was excellent with κ = .94. In total there were 407 specific responses (61.6%), 112 omissions (16.9%), 94 extended responses (14.2), 40 categoric responses (6.10%) and 7 person/ object/ location/ non-autobiographical responses (0.77%).

Autobiographical memory test

See Table 2 for *M and SD*. A mixed 2 (Group: BED, HC) × 2 (Valence: positively, negatively) design was used. There were four dependent variables: categoric, extended, omissions, specific. The ANOVA conducted on specific AM recall yielded no significant main effect for Group, $F(1, 52) = 0.83$, $p = .367$, $\eta^2 = .016$, no significant interaction of Group × Valence, $F(1, 52) = 0.01$, $p = .948$, $\eta^2 < .000$, but a significant main effect for Valence, $F(1, 52) = 5.44$, $p = .024$, $\eta^2 = .095$. Thereby, specific recall for positively valenced cues was significantly higher compared to specific recall for negatively valenced cues across groups.

The ANOVA conducted on categoric AM responses revealed a significant main effect for Group, $F(1, 52) = 4.87$, $p = .032$, $\eta^2 = .086$. Thereby, women in the BED group retrieved significantly more categoric memories overall than HC. There was no significant main effect for Valence, $F(1, 52) = 1.01$, $p = .320$, $\eta^2 = .019$, and no significant interaction of Group × Valence, $F(1, 52) = 1.89$, $p = .175$, $\eta^2 = .035$.

A 2 × 2 univariate ANOVA conducted on omissions revealed no significant main effect for Group, $F(1, 52) = 2.03$, $p = .161$, $\eta^2 = 0.38$, but a significant main effect for Valence, $F(1, 52) = 4.27$, $p = .044$, $\eta^2 = .76$, whereby omissions were higher for negatively compared to positively valenced cues. There was also a significant interaction of Group × Valence, $F(1, 52) = 6.23$, $p = .016$, $\eta^2 = .107$. Independent *t*-tests revealed that compared to HC, BED women had significantly more omissions in response to positively valenced cues, $t(52) = -2.253$, $p = .028$, while there were no significant group differences for negatively valenced cues, $t(52) = 0.000$, *ns*, and omissions overall, $t(52) = -1.217$, *ns*. No significant group differences were found in other response categories, Fs < .83, ps > .209.

Table 2: Mean number of recalled autobiographical memories

	Specific	Categoric	Extended	Omissions
Overall				
BED	7.10 (2.20)	1.00 (1.27)	1.47 (1.57)	2.33 (1.57)
HC	7.71 (2.71)	0.38 (0.65)	2.04 (1.76)	1.71 (1.65)
BEDMD	7.30 (2.27)	0.90 (1.21)	1.00 (1.30)	2.65 (1.73)
BEDNMD	6.70 (2.11)	1.00 (1.41)	1.40 (1.71)	2.70 (1.83)
Positive				
BED	3.77 (1.41)	0.37 (0.72)	0.67 (0.96)	1.20 (1.03)
HC	4.08 (1.53)	0.21 (0.51)	1.17 (1.17)	0.50 (0.72)
BEDMD	3.90 (1.49)	0.20 (0.52)	0.40 (0.50)	1.50 (1.15)
BEDNMD	3.50 (1.27)	0.60 (0.97)	0.70 (1.06)	1.20 (1.03)
Negative				
BED	3.33 (1.18)	0.63 (0.85)	0.80 (0.96)	1.13 (0.94)
HC	3.63 (1.53)	0.17 (0.38)	0.88 (1.03)	1.21 (1.18)
BEDMD	3.40 (1.23)	0.70 (0.98)	0.60 (1.05)	1.15 (1.04)
BEDNMD	3.20 (1.14)	0.40 (0.52)	0.70 (0.95)	1.70 (1.38)

Note. BED = group of women with binge eating disorder; HC = healthy controls; BEDMD = BED women with a current or past major depression (MD); BEEDNMD = BED women without current or past MD; Specific = number of recalled specific autobiographical memories (AM); Categoric = number of recalled categoric AM; Extended = number of recalled extended AM; Omissions = number of non-responses; positive = positively valenced cues; negative = negatively valenced cues; overall = total number of cues.

The role of depression in the retrieval of AM

As ANCOVA is not designed to control for naturally occurring group differences (Miller & Chapman, 2001) and depressiveness is commonly increased in individuals with BED compared to HC (Grilo, White, & Masheb, 2008, 2009), we did not use BDI as a covariate in our analyses. In a post-hoc analysis, we did, however divide our BED group into two subgroups: one with a current or past history of major depression (BEDMD n = 20), the other without current or past major depression (BEDNOMD n = 10).

The ANOVA conducted on specific AM recall yielded no significant main effect for Group, $F(2, 51) = 0.609$, $p = .548$, $\eta^2 = .023$, no significant interaction of Group × Valence, $F(2, 51) = 0.69$, $p = .933$, $\eta^2 = .003$, but a significant main effect for Valence, $F(1, 51) = 4.17$, $p = .046$, $\eta^2 = .076$. Thereby, specific recall for positively valenced cues was significantly higher compared to specific recall for negatively valenced cues across the three groups.

With regard to categoric recall, there was no significant main effect for group, $F(2, 51) = 2.34$, $p = .102$, $\eta^2 = .086$, and no significant main effect for valence, $F(1, 51) = 0.56$, $p = .457$, $\eta^2 = .011$, but a significant interaction of Group × Valence, $F(2, 51) = 3.66$, $p = .033$, $\eta^2 = .076$. Compared to HC, the BEDNOMD group retrieved significantly more categoric AM overall, $t(32) = -2.050$, $p = .049$, while increased cateoric AM recall in response to positively and negatively valenced cues slightly missed significance, $t(32) = -1.575$, $p = .088$ and $t(32) = -1.844$, $p = .074$, respectively. Similarly, the BEDMD group retrieved significantly more categoric AM overall, $t(42) = 2.148$, $p = .038$ and more categoric AM in response to negatively valenced cues, $t(42) = -2.697$, $p = .010$. No group differences between HC and the the BEDMD group emerged with respect to number of categoric AM in response to positively valenced cues, $t(42) = -.220$, $p = .827$. There were no significant group differences between the two BED groups, ts < .350, ps > .469.

The ANOVA conducted on omissions yielded no significant main effect for Group, $F(2, 51) = 1.400$, $p = .256$, $\eta^2 = .052$, no significant main effect for Valence, $F(1, 51) = 2.36$, $p = .131$, $\eta^2 = .044$, but a significant interaction of Group × Valence, $F(2, 51) = 3.95$, $p = .026$, $\eta^2 = .134$. Whereby, there were no differences between any of the three groups in omissions in response to negatively valenced cues and omissions overall, ts < .550, ps > .316. Compared to HC, the BEDMD group however did have more omissions in response to positively valenced cues, $t(2) = 0.700$, $p = .044$. No other between group differences emerged with regard to omissions in response to positively valenced cues, ts < .001, ps > .277. No significant group differences were found in other response categories, Fs < .83, ps > .442.

The role of BMI on AM retrieval

As BMI is commonly increased in individuals with BED compared to HC (Cachelin et al., 1999; Striegel-Moore & Franko, 2003) and ANCOVA is not designed to control for such naturally occurring group differences (Miller & Chapman, 2001), we did not statistically control for BMI in our analyses. Because number of categoric AM correlated significantly with BMI ($categoric_{total}$: $r = .636$, $p = .001$; $categoric_{positive}$: $r = .475$, $p = .001$; $categoric_{negative}$: $r = .530$, $p = .001$), moderator analyses were conducted following Baron and Kenny (Baron & Kenny, 1986), separately for each of these variables. Thereby, the interaction term of Group x BMI significantly predicted categoric recall overall, b^* > .512, $p = .001$, while Group and BMI did not explain further variance, b^*s < .450, ps > .077. Similarly, the interaction term of Group × BMI significantly predicted categoric recall for negatively valenced cues, b^* > .479, $p = .001$, while Group and BMI did not explain further variance, b^*s < .244, ps > .404. Finally, the interaction term of Group × BMI significantly predicted categoric recall for positively valenced cues, b^* > .329, $p = .015$, while Group and BMI did not explain further variance, b^*s < .132, ps > .263. As no significant correlations were found between BMI and omissions ($omissions_{total}$: $r = –071$, $p = .608$; $omissions_{positive}$: $r = .060$, $p = .664$; $omissions_{negative}$: $r = –167$, $p = .227$), no moderator analyses were conducted on these variables.

Correlations

We found significant positive correlations between number of categoric recalls in response to negatively valenced cues and BDI scores, $EDEQ_M$, $EDEQ_{EC}$, $EDEQ_{WC}$, CTQ_{EA}, CTQ_{PA}, CTQ_{EN} and CTQ_{PN}. Categoric memories overall correlated significantly and positively with $EDEQ_{EC}$, CTQ_{EA}, CTQ_{PA}, CTQ_{EN} and CTQ_{PN}. There were no significant correlations with other response categories (see Table 3).

Because by definition our HC group was free of binge attacks, weekly binge frequency over the past four weeks was correlated with AM variables in the BED group only. Thereby, binge frequency correlated significantly and positively with the number of categoric recalls to positively valenced cues, $r = .433$, $p = .017$, to negatively valenced cues, $r = .372$, $p = .043$ and categoric recalls overall, $r = .498$, $p = .005$. There were no other significant correlations.

Table 3: Significant correlations between autobiographical memory variables and self-report questionnaires

		BDI	$EDEQ_M$	$EDEQ_{EC}$	$EDEQ_{WC}$	CTQ_{EA}	CTQ_{PA}	CTQ_{EN}	CTQ_{PN}
CAT_{SUM}	*r*	.236	.195	.296	.187	.368	.319	.327	.287
	p*	.085	.161	.031	.180	.007	.020	.017	.037
CAT_{NEG}	*r*	.335	.319	.380	.335	.531	.442	.481	.412
	p	.013	.020	.005	.014	.001	.001	.001	.002
CAT_{POS}	*r*	.021	−.048	.048	−.080	−.009	.014	−.018	−.005
	p	.879	.731	.732	.570	.948	.919	.896	.973
$SPEC_{SUM}$	*r*	−.130	−.067	−.090	−.074	−.094	.042	−.026	.013
	p*	.348	.634	.523	.597	.502	.766	.852	.924
$SPEC_{NEG}$	*r*	−.154	−.086	−.136	−.106	−.061	.025	−.008	.017
	p	.266	.542	.332	.451	.664	.859	.954	.903
$SPEC_{POS}$	*r*	−.076	−.030	−.076	−0.23	−0.10	.046	.037	.006
	p	.585	.831	.585	.868	.478	.741	.795	.966

Note: CAT = number of categoric memories; SUM = total number of memories in response to all cues; NEG = number of recalled memories in response to negatively valenced cues; BDI = Beck Depression Inventory; EDEQ = Eating Disorder Examination Questionnaire; $_M$ = global score; $_{EC}$ = eating concern subscale; $_{WC}$ = weight concern subscale; CTQ = Childhood Trauma Questionnaire; $_{EA}$ = emotional abuse subscale; $_{PA}$ = physical abuse subscale; $_{EN}$ = emotional neglect subscale; $_{PN}$ = physical neglect subscale; * $p > .05$.

Discussion

While former studies on memory biases in eating disorders have primarily focused on the *content* of disorder specific thoughts such as memory biases for eating, shape and weight related words (see Shafran et al., 2007 for an extensive review), the aim of the present study was to test cognitive processes not directly related to the psychopathology of BED. Specifically, we were interested in the investigation of the *strategies* women with BED use to retrieve AM, as recall of AM has shown to function as an important factor in the maintenance of emotional disorders (see Williams et al., 2007 for an extensive review).

In line with studies which demonstrated overgeneral memory retrieval in individuals with AN and BN (Laberg & Andersson, 2004; Nandrino et al., 2006), we hypothesized that individuals with BED would retrieve fewer specific and more categoric AM on the AM test (Williams & Broadbent, 1986) compared to women without BED. Our results yielded a mixed pattern. No significant group results at all were found with respect to specific memories. With respect to categoric memories, women with BED were found to score higher on categoric memories overall and in response to negatively, but not positively valenced cues. In addition compared to HC, women in the BED group had significantly more omissions in response to positively valenced cues, but not to negatively valcend cues and overall omissions.

Reasons for the increased categoric recall in BED may be multifaceted. On the one hand, women with BED may truncate the generative search process earlier due to a failure in the SAS (Burgess & Shallice, 1996), which serves to regulate, monitor, select and verify memory search (Shallice, 1988). There is evidence that such executive skills may be impaired in women with BED (Favaro et al., 2005; Nasser, Gluck, & Geliebter, 2004; Svaldi, Brand et al., 2010). It is of note, that obese women (Nederkoorn, Smulders, Havermans, Roefs, & Jansen, 2006) and obese children (Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006) are also affected by less adequate executive skills. As categoric recall was moderated by the interaction of Group × BMI, future studies should further test the role weight has in BED with regard to recall of AM. It is possible, that the findings are more related to obesity rather than

BED. To fully understand the influence of BMI and fully exclude its role as a possible confounder, replication with highly overweight and normal weight HC would be necessary.

As reports of abuse in women with BED are high (Allison et al., 2007; Grilo & Masheb, 2001), increased categoric recall in women with BED may on the other hand represent an avoidance reaction of negative intrusive imagery such as past binge attacks or other negative experiences and feelings (Conway & Pleydell-Pearce, 2000; Williams et al., 2007). In AN, for example, level of self reported parental abuse was significantly and positively correlated with overgenerality (Dalgleish et al., 2003). Similarly, categoric recall in our study correlated positively with parental abuse and neglect. As specific memories primarily involve sensory-perceptual information, they may produce increases in mood disturbance, which both women with AN and BED may try to avoid. As traumatic experiences are increased in BED women compared to HC (Allison et al., 2007; Grilo & Masheb, 2001), we did not do any mediation analyses (Miller & Chapman, 2001) with traumatic history. Therefore, to better understand the role of traumatic history in the recall of AM, future studies should compare BED women with and BED women without traumatic history with regard to AM recall. However, such samples may be difficult to recruit.

In relation to avoidance theory, one question is why women with BED should avoid memories to positively valenced cues, as yielded by our results. One possibility is that the impaired recall of a memory to a positively valenced cue is due to a mood congruency effect (Bower, 1981), as several studies indicate that depressed mood reduces the availability of mnemonic material with positive valence (Eich, 1995; Williams, Watts, MacLeod, & Mathews, 1997). Alternatively, negative memories are often the result of emotionally discrepant cues (Williams et al., 2007). In line with that, it is possible that positively valenced cues may trigger memories which are even more negative than memories to negatively valenced cues. For example, the word “happy” may trigger the recollection of an intense moment after a movie with the partner in one individual, while another person might avoid this topic at all because it produces painful emotions such as loneliness.

One more issue with regard to categoric AM recall concerns BED women’s higher BDI (Beck et al., 1988) scores. This may suggest that our results may have been mediated by the current severity of depression, especially as several studies have found an increased categoric memory recall in individuals with a current or past MD (Brittlebank, Scott, Williams, & Ferrier, 1993; Kuyken & Dalgleish, 1995; Mackinger et al., 2000; Williams & Broadbent, 1986; Williams & Scott, 1988). Depressiveness is commonly increased in women with a diagnosis of BED (Grilo et al., 2008, 2009) and this was also the case in our sample, which can therefore be considered to be representative. Because ANCOVA is not designed to control for such naturally occurring group differences (Miller & Chapman, 2001) we did not use BDI as a covariate in our analyses. We did, however, divide our BED sample into a group with a current or past MD (BEDMD) and a group without current or past MD (BEDNMD). Overall, our results remained unaffected. Both clinical groups showed an increased categoric recall overall compared to HC; in addition, the BEDMD group also had increased categoric memories in response to negatively valenced cues. Similarly, no significant group differences were found on the number of specific AM. Interestingly though, there were no group differences between HC and the BEDNMD group with regard to omissions, while the BEDMD group produced significantly more omissions to positively valenced cues than HC. Nevertheless, it is important to note that the means and standard deviations in the two clinical groups were quite comparable. Therefore, the null finding between the BEDNMD and the HC group is mostly due to a lack of power because of the very small sample size (n = 10). On the other hand, increasing the sample in both BED groups could show AM recall differences also between the two clinical groups, especially considering other studies which have identified a subgroup of BED individuals (dietary-negative affect subtype; Stice et al., 2001) characterized by higher lifetime rates of major depression and dysthymia (Grilo et al., 2001).

It is important to note that because we did not include a non-BED patient control group, we cannot rule out that our findings are a consequence of factors other than the presence of BED. Therefore, future studies should include a clinical group in addition to a BED group. As current mood has been shown to influence AM recall (Svaldi & Mackinger, 2003), future studies should also assess mood prior to the assessment of AM.

Despite the significant group differences we found on categoric recall and omissions, it should not be belittled that, even though hypothesized, no significant group differences were found on specific AM recall. With respect to AM specificity, Laberg and Andersson (2004) found a main effect for group, but no valency effect. Therefore, increasing the number of words from 12 to 18 cues may have increased the variance in our group. In addition, it is also possible that the null findings result from a lack of power due to the rather small sample size. In sum, though, our data points less to an overgeneral memory bias in BED women – as both groups retrieved equally well specific AM - but, rather to a difference in failure strategy. The selection of failure strategy, in turn, may have consequences for the emotional information processing. For example, specific recall and extended recall did not correlate with overall symptomatology, but categoric recall did.

From a clinical perspective it is important to note that in patients with AN, Nandrino et al. (2006) found overgeneral memory style to be significantly and positively correlated with illness duration. In our group of BED, number of categoric recalls was associated with higher binge frequency and therefore with symptom severity. Considering empirical evidence, a crucial factor in the increased categoric recall in BED women may be rumination. In depressed individuals, rumination has been shown to be related to poor performance on the AM test (Ramponi, Barnard, & Nimmo-Smith, 2004). A study by Raes et al. (2006) showed that rumination moderated the relation between traumatic experiences and AM recall. In laboratory experiments, preventing depressed individuals from ruminating resulted in more specific memory (Watkins & Teasdale, 2001, 2004; Watkins, Teasdale, & Williams, 2000). It is possible that similar mechanisms underlie overgeneral memory retrieval in BED. Rumination has been shown to predict bulimic symptoms and binge eating in adolescents (Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). At the same time, there is evidence that preventing depressed individuals from ruminating reduces categoric recall (Watkins & Teasdale, 2001, 2004; Watkins et al., 2000). Therefore, preventing women with BED from ruminating could reduce their increased categoric recall as well and thereby reduce binge frequency. Mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2002) is a therapeutic approach which aims at reducing ruminating about negative feelings by adapting a more accepting role towards emotions. It has proven to be effective in reducing overgeneral memory retrieval (Williams et al., 2000). It remains open whether - like the reduction of risk for relapse in individuals with recurrent MD - the reduction of overgeneral memory by MBCT leads to a reduction of symptom severity in women with BED.

Finally, it may be worth looking at the content of BED women's recalled memories in the AM test. According to Conway, and Pleydell-Pearce (2000), the self-memory system plays an important role in the retrieval of AM in that an individual's personal goals influence both the encoding and the retrieval of AM. Also, a discrepancy between the perceived and should be self is thought to drive the nature of AM that enter one's awareness. For example, individuals with post traumatic stress disorder (PTSD; Sutherland & Bryant, 2008) report more trauma-related AM than those without PTSD and they have a tendency to report their trauma as a self-defining memory (Sutherland & Bryant, 2005). It would be interesting to see whether BED women also tend to report more eating disorder-related AM than HC. If so, this would have treatment implications because maintenance of an inherently negative self-image may lead to a ceaseless focus on memories such as binge episodes, which in turn are related to increased categoric recall.

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