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A Body-Related Dot-Probe Task Reveals Distinct Attentional Patterns for Bulimia Nervosa and Anorexia Nervosa

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We investigated body-related attentional biases in eating disorders by testing whether individuals with anorexia nervosa (AN, n = 19) and bulimia nervosa (BN, n = 18) differ from healthy controls (HC, n = 21) in their bias for attending to a photo of their own body (self-photo) relative to a photo of a matched control participant's body (other photo). In a modified dot-probe task, self- and other photos served as cues on the left and the right of the screen. After 1 of 2 time intervals, 1 of the photos was singled out by a surrounding frame, and participants had to saccade toward it. Saccade latency was used as an index of covert attention to the cue photos. In the AN group, saccades were faster when the self-photo was the target than when the other photo was the target. In the BN group, there was a numerically opposite but nonsignificant pattern. Cues did not affect saccade latencies in healthy controls. The bias for self-photos correlated with body dissatisfaction in the AN group. This is the first evidence of an attentional bias for self-photos over other photos in the AN group and for fundamental attentional differences between AN and BN.

Keywords: anorexia nervosa, bulimia nervosa, attentional bias, eye tracking, saccade latencies

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The current study is concerned with attentional biases underlying negative body image in eating disorders (EDs). Dissatisfaction with—and disturbed experiencing of—the own body characterizes patients with anorexia nervosa (AN) and bulimia nervosa (BN), and many authors argue that these factors underlie vulnerability to, and maintenance of, these disorders (Cash & Deagle, 1997; Fairburn, Peveler, Jones, Hope, & Doll, 1993; Fairburn, Stice, et al., 2003; Freeman, Beach, Davis, & Solyom, 1985; Stice, 2002). The pivotal role of these processes in relation to physical appearance has motivated researchers to investigate attentional biases for body-related stimuli.

There are at least two different general approaches to this crucial issue. In one approach, one studies body-related attentional biases in general, assessing how photos of bodies, body parts, or body-related words capture the attention of eating disordered individuals (e.g., Rieger et al., 1998; Shafran, Lee, Cooper, Palmer, & Fairburn, 2007; Smeets, Roefs, van Furth, & Jansen, 2008). Similarly, researchers have presented participants with photos of attractive models to assess how body-related social comparisons affect body dissatisfaction (e.g., Blechert, Nickert, Caffier, & Tuschen-Caffier, 2009; Corning, Krumm, & Smitham, 2006). In contrast to these studies, another approach focuses on attentional processes related to the individuals' own body (Freeman, Touyz, Sara, & Rennie, 1991; Janelle, Hausenblas, Ellis, Coombes, & Duley, 2008; Jansen, Nederkoorn, & Mulkens, 2005). This latter approach is based on the notion that body image disturbance and dissatisfaction result from the way ED patients perceive their own body and that this might be very different from how they perceive general body-related cues.

These two approaches differ not only in their underlying assumptions but also in terms of experimental methodology. Following the first approach of testing for general biases toward body cues, in a number of studies, researchers used dot-probe tasks. Here, two stimuli, the cues, are concurrently presented on the right and the left side of the screen before a dot probe or another type of probe appears at only one cued position. Participants have to report the location of the probe with the respective hand. Reaction times (RTs) are consistently faster when the probe replaces the attended cue than when the probe replaces the unattended cue. Rieger and colleagues (1998) used this task and demonstrated that AN and BN patients responded faster to the probe when it was at the location of a word cue denoting a large body physique, the opposite being true for a word cue denoting a thin physique. Likewise, in a pictorial dot-probe paradigm, Shafran and colleagues (2007) found that relative to body-unrelated stimuli, attention was attracted toward both neutral and negative body shape stimuli as cues (e.g., eyes, noses, elbows, and plumper bodies or body parts, respectively) in ED patients. Thus these studies demonstrated a general attentional bias toward (negative) body-appearance cues in ED. However, they do not answer the question of whether patients processed those stimuli in a self-referential way (i.e., by relating

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the stimuli to their own body) or whether these tasks model how patients attend to environmental body-related stimuli (other peoples' bodies).

In another line of research, it is assumed that the source of body dissatisfaction lies in the way ED patients attend to their own body and that one's own and another's bodies are processed in fundamentally different ways. Extending previous work by Freeman and coworkers (Freeman et al., 1991), Jansen, Nederkoorn, and Mulkens (2005) instructed eating symptomatic and normal control participants to explore photos of their own bodies (termed self-photos in the following) and, on separate trials, other persons' bodies (termed other photos) while continuously measuring their eye movements. Eating symptomatic participants allocated their gaze more toward their own ugly body parts than to their own beautiful body parts. When looking at the other body, the eating symptomatic participants paid most attention to the beautiful parts of that body. Normal controls did exactly the opposite: They focused more on their own beautiful body parts than on their own ugly body parts, whereas they directed their attention more to the ugly parts of another body than to the beautiful parts of these bodies. This study suggests that attentional processing of the own body fundamentally differs from processing of other persons' bodies (similar conclusions were reached by Janelle et al., 2008). However, this approach, with long presentation durations of successive self- and other photos, has several limitations (e.g., presentation order was not counterbalanced in Jansen et al., 2005, fixation probability on different areas was not weighted for size of the body area, and participants' correct self-photo vs. other photo discrimination ability was not ensured) and might be insensitive for attentional biases that occur early during picture processing.

Here, we took a methodological approach that is more in line with the attentional bias literature in which researchers used the well-established dot-probe methodology to investigate early and relatively automatic attention allocation and to address the crucial question of whether ED patients' body image problems are related to (a) biases for any body-related cues (including self- and other photos) or (b) attentional bias for either self-photos or other photos. Similar to Jansen et al. (2005), we used digitized photos of the participants' own body and a comparison persons' body. However, here we presented self- and other concurrently to rule out temporal order effects and to create stimulus competition between these two stimulus classes. No neutral, non–body-related pictures were included because our main question pertains to a competition between self- and other photos for attentional resources. Further, several modifications of the classical dot-probe task were made.

First, in a typical dot-probe task, participants respond to the location of a dot or another type of probe that replaces one of two concurrently presented cues. Here, we used a self-photo on one side and an other photo on the opposite side as cues, but instead of presenting an unrelated probe, we highlighted one of the photos as a target photo: Shortly after the cue presentation, one colored frame (one green, one blue) per photo surrounded the photos, and the target photo was defined by one instructed color (e.g., green). Second, instead of responding with a button press of the respective hand, we instructed participants to make a saccade on the target photo. Participants were trained to saccade not to the cue but to the target, only. Third, we included one short (150 ms) and one long (1,100 ms) time interval between cue (photos) and target (photo surrounded by target color frame) to explore whether biases for one of the photos might differ between early and late attentional phases of attention. This variation was motivated by attentional research in anxiety, suggesting that attention might follow a biphasic pattern (e.g., Koster, Crombez, Verschuere, Van Damme, & Wiersema, 2006; Mogg, Bradley, Miles, & Dixon, 2004) and by findings that earlier and later phases of body-related attention differ (Janelle et al., 2008).

This task has the following advantages. First, in comparison with standard dot-probe tasks, saccading toward an attended location is more an ecological response than a manual response to a probe, if we want to understand everyday behavior of ED patients (cf. Gibson, 1979). Second, by registering saccade latency (the time from the onset of the target frame to the execution of a saccade of at least 3.3° in the direction of one of the targets), we are able to measure covert attention. Covert attentional shifts precede overt shifts of the eyes (saccades to a certain location) because covert shifts are necessary for selection of the saccade's landing position (e.g., Rizzolatti, Riggio, Dascola, & Umilta, 1987). This is in contrast to studies with overt fixations. Although typically closely related to attention, overt fixations (as in Jansen et al., 2005 and Janelle et al., 2008) do not always correspond with covert attention, and covert attention shifts away from a specific fixated location are common (cf. Becker, Ansorge, & Horstmann, 2009; Deubel & Schneider, 1996; Rizzolatti et al., 1987). In fact, even classical dot-probe tasks claiming to capitalize on covert attentional shifts typically do not assess overt gaze behavior, leaving ambiguity about the precise attentional mechanism. In the present task, however, a covert attentional bias for the self-photo can be safely inferred from faster saccades (shorter latencies) to the self-photos on trials in which the self-photo was defined as target (henceforth called self-target condition), as compared with trials on which the other photo was defined as target (henceforth called other-target condition).

So far, we have discussed attentional biases in relation to AN and BN without acknowledging possible psychopathological differences between them. In fact, most previous attentional research collapsed data across different ED subgroups, although these two groups present with clearly distinct clinical features and different physiques. Therefore, in addition to healthy controls (HC) we recruited about equally sized AN and BN groups to investigate group specific body-related attentional biases with sufficient statistical power.

On the basis of the literature reviewed above, we tested the following hypotheses. If attentional biases in ED patients affect body-related stimuli in general (i.e., including self- and other photos), no difference in saccadic latency was to be expected in any of the conditions because attention should be captured to an equal extent by self- and other photos in all three groups. However, if AN and/or BN patients show an attentional bias for the self-photo, saccade latencies should differ between self-target and other-target trials: If self-photos attract attention and/or other photos are avoided, saccade latencies should be shorter in self-target trials than in other-target trials. If other photos attract attention and/or self-photos are avoided, saccade latencies should be shorter in other-target trials than in self-target trials. The previous literature does not allow any directional hypotheses here, but biases should emerge in the ED patients to a stronger degree than in HC participants, and AN and BN groups might differ in the direction of this bias. In addition, if attention follows a similar biphasic pattern as observed in the anxiety literature, any early attentional bias might reverse its direction with the passage of time (in the 1,100 ms interval).

In addition to the saccade latencies, we collected measures of body (dis)satisfaction ratings for self- and other pictures to explore how this interacts with attentional biases (cf. Jansen et al., 2005). If saccade latencies in the present task reflect a bias for negatively evaluated stimuli then they should be inversely related to dissatisfaction ratings (i.e., the higher the body dissatisfaction with the own body the shorter latencies for self-target trials relative to other-target trials).

To exclude any confounds in this complex task, two control tasks ensured that the three groups performed equally well in a general attentional task (in peripheral cueing) and a self–other photo discrimination task. The latter control task ensured that all participants were equally able and equally fast to identify photos of the self as showing their own body and to discriminate them from the other photos.

Method

Participants

The sample consisted of 21 women diagnosed with AN, 22 women with BN, and 28 non–eating-disordered women for the HC group. Ethical approval of the study (by the German Psychological Society's ethics committee) and written informed consent by the participants were obtained. Participants took part in exchange for 50 Euros (U.S.$75). They were recruited from the community through newspaper announcements, through our website, and from collaborating clinics. All participants had normal or corrected-to-normal vision. Two AN patients, 4 BN patients, and 7 HC participants had to be excluded, reducing the final sample to 18 BN, 19 AN, and 21 HC participants, for one of the following reasons: (a) insufficient quality of eye movement data or of visual acuity, (b) inability to perform one of the tasks, or (c) excessive eye blinks or false responses (for these criteria, see data reduction below).

Additional exclusion criteria were schizophrenia spectrum disorders, bipolar disorder, substance abuse or dependence, neurological disorders (for ED groups), and a lifetime diagnosis of any mental disorder according to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM–IV*; American Psychiatric Association, 1994; for HC). ED participants fulfilled *DSM–IV* diagnostic criteria of either AN or BN as assessed with structured clinical interviews. The Eating Disorder Examination (EDE) was used for the diagnosis of AN and BN (Fairburn & Cooper, 1993; German version: Hilbert, Tuschen-Caffier, & Ohms, 2004), and the Structured Clinical Interview for *DSM–IV* (SCID) was used for all other psychiatric diagnosis (First, Spitzer, Gibbon, & Williams, 1995; German version: Wittchen, Zaudig, & Fydrich, 1997).

The following comorbid disorders were found in the AN and BN groups, respectively: major depression (8/3), dysthymia (2/1), borderline personality disorder (5/1), posttraumatic stress disorder (3/1), social phobia (2/1), obsessive compulsive disorder (2/0), and specific phobia (2/0). Five AN patients were taking selective serotonin reuptake inhibitors; 3 AN patients were taking neuroleptics. Five BN patients reported a history of AN. General ED psychopathology and the behavioral component of body image disturbance was assessed with the German version of the EDE Questionnaire (EDE-Q; Legenbauer et al., 2007), the Body Image Avoidance Questionnaire (BIAQ; Hilbert et al., 2007), and the Body Checking Questionnaires (BCQ). Good internal consistency and test–retest reliability have been demonstrated for these scales (Hilbert, Tuschen-Caffier, Karwautz, Niederhofer, & Munsch, 2007; Legenbauer, Vocks, & Schuett-Stroemel, 2007; Reas, Whisenhunt, Netemeyer, & Williamson, 2002; Rosen, Srebnik, Saltzberg, & Wendt, 1991).

Further, anxiety and depression were assessed with the German versions of the State–Trait Anxiety Inventory (STAI; Laux, Glanzmann, Schaffner, & Spielberger, 1981), and the Beck Depression Inventory (BDI; Hautzinger, Bailer, Worall, & Keller, 1994). As indicated in Table 1, groups did not differ in age, education, and time of testing. The AN participants had the lowest body mass indices (BMI; ratio of weight to squared height in kg/m^2), followed by the HC and the BN participants. Also, the BDI scores were highest in the AN group, followed by the BN and HC group. Both BN and AN participants scored similarly higher than controls on state anxiety and general ED psychopathology, body checking, and body image avoidance.

Materials and Procedure

After a telephone screening, eligible participants were invited to a first session during which the diagnostic interviews were conducted and the photographs were taken. Participants then attended two experimental sessions, approximately 1 week apart, with the present investigation always being scheduled at the first experimental session. Two control tasks preceded the dot-probe task, as described below.

Materials for Control Task 2 and the dot-probe task were one digitized photo of the participant's own body (self-photo) and one photo of a control body (other photo, taken from another participant of the same study by the single criterion of a matched BMI). Participants were digitally photographed in a beige, short-sleeve leotard while standing in front of a black background, with standardized ambient light and camera settings from the frontal view. The whole body from the ankles to the neck, but not the head, was visible. After taking the photo, the participant's weight, height, waist, and hip circumference as well as BMI were determined. Other and self-photos were approximately equated for BMI (+ to –1.5 kg/m^2), color, brightness, and contrast. To determine whether the matching on BMI of the self- and other photos was successful, we created and submitted a BMI difference score ($BMI_{self} - BMI_{other}$) to a univariate analysis of variance (ANOVA) for group. Average BMI differences were small (means, standard deviations in the BN, AN, and HC groups, respectively: 0.35, 1.12; −0.41, 1.18; and −0.27, 0.97), and group differences were nonsignificant, $F(2, 55) = 2.57$, $p = .086$. Perceptual differences between self- and other photos (e.g., tattoos, scars) were avoided. Figure 1 depicts stimulus material and exemplifies the trial structure in the Control Task 1 (cueing task, Figure 1A), the Control Task 2 (discrimination task, Figure 1B), and the main task (dot-probe task, Figure 1C).

Control Task 1: Peripheral cueing. Because the dot-probe task capitalizes on the process of attentional capture by peripheral stimuli, this control task ensured that ED patients did not show deficits in their susceptibility to peripheral cueing with neutral (non–body-related) stimuli. In contrast to the Control Task 2 and

Table 1
Means and Standard Deviations of Sample Characteristics

Characteristic	BN *M*	BN *SE*	AN *M*	AN *SE*	HC *M*	HC *SE*	Statistic		Post hoc
Age (years)	26.9	8.35	23.5	4.66	27.1	4.77	2.11	.132	
Education (%)							$\chi^2(4, N = 56) = 7.08$	.13	
Low	5.90		5.60		0.00				
Middle	17.6		33.3		4.80				
High	76.5		61.1		95.2				
Time of testing (%)							$\chi^2(4, N = 56) = 5.57$	.23	
Morning	47.1		22.2		47.6				
Noon	23.5		44.4		14.3				
Afternoon	29.4		33.3		38.1				
Body mass index (kg/m^2)	22.9	3.39	16.5	1.35	20.3	2.12	33.0	<.001	AN < HC < BN
STAI-state form	47.3	22.2	49.9	9.92	33.0	6.18	8.58	<.001	AN = BN > HC
BDI	16.9	8.42	25.9	11.4	2.33	2.65	41.8	<.001	AN > BN > HC
EDE-Q total score	4.05	1.03	3.90	1.43	0.41	0.57	73.69	<.001	AN = BN > HC
EDE-Q restrained	3.28	1.6	3.88	2.02	0.46	0.82	27.93	<.001	AN = BN > HC
EDE-Q eating concerns	3.67	1.33	3.21	1.47	0.11	0.25	57.59	<.001	AN = BN > HC
EDE-Q weight concerns	3.96	1.52	3.73	1.62	0.33	0.53	48.8	<.001	AN = BN > HC
EDE-Q shape concerns	4.72	0.97	4.30	1.44	0.58	0.75	84.5	<.001	AN = BN > HC
BIAQ	18.8	7.74	21.7	7.75	5.24	4.13	34.8	<.001	AN = BN > HC
BCQ	1.83	0.72	1.88	0.87	0.50	0.19	29.1	<.001	AN = BN > HC

Note. Bulimia nervosa (BN) $n = 18$; anorexia nervosa (AN) $n = 19$; healthy controls (HC) $n = 21$. STAI = State-Trait Anxiety Inventory; BDI = Beck Depression Inventory; EDE-Q = Eating Disorder Examination Questionnaire; BIAQ = Body Image Avoidance Questionnaire; BCQ = Body Checking Questionnaire.

the dot-probe task (described below), cues were presented only on one side of the screen on a given trial. Each of 40 trials contained one rectangular frame as a cue, presented 8.5° either right or left of a central fixation cross (frame size similar to photo size in the Control Task 2 and the dot-probe task). After an interval of 150 ms, a filled rectangle (of the size and shape of the cue) was shown as a target. Here, the target's role corresponds to that of the probe, but in keeping with terminology used in the standard paradigms (cf. Posner, 1980), we call the probe a target in the control task because only one cue is presented before this target. The target was either at the cue's position (in cued trials) or at the alternative potential cue position (in uncued or falsely cued trials). The target was green in half the trials and blue in the other half. Participants were instructed to maintain central fixation while pressing the upper key for one of the target colors and the lower key for the other target color,[1] with color-response mappings balanced across participants. A mixed-model ANOVA with the within-participant factor cueing (cued; uncued) and the between-participants factor group (AN, BN, HC) showed a strong cueing effect, $F(1, 50) = 43.7$, $p < .001$, $\eta_p^2 = 43.9\%$, for mean correct RTs (RTs were shorter for cued trials, compared with uncued trials) but the group main effect and the Group × Cueing interaction were not significant (Fs < 2.16, ps $> .125$).[2] The percentage of correct answers was high and not different across groups, as indicated by a univariate ANOVA ($F < 1.00$; see Table 2).Thus, the underlying cueing effect was established, and group differences were excluded. Table 2 displays means and standard deviations of RTs and percentages of correct responses for the control tasks and the dot-probe task.

Control Task 2: Discrimination task. A prerequisite for using self- and other photos as peripheral cues for tests of the body-specificity of the attentional biases in EDs is the participants' ability to correctly discriminate between these nonfoveally presented photos. The discrimination task ensured that different ED groups and healthy controls matched in their precision and speed of discriminating between the photos without fixating on them. Similar to Control Task 1, lateral self- and other photos (body center 5.5°[3] right–left of the fixation cross, bodies subtending a visual angle of 5.5° width × 8.3° height) were presented 150 ms before a blue frame was presented around one photo, and a green frame appeared around the second photo. On each of 40 trials, participants (while maintaining central gaze fixation) had to discriminate between photos by pressing one button (e.g., the upper button) for a self-photo and the other button (e.g., the lower button) for an other photo, with the relevant photo to discriminate being signified by the instructed relevant color frame (between participants either blue or green). Figure 1B exemplifies two trials in

[1] Response devices were aligned vertically (see Figure 1A, right-hand upper response device, left-hand lower response device) to reduce stimulus–response compatibility effects (e.g., Hommel, 1997).

[2] Initial ANOVAs for Control Tasks 1 and 2 had additionally included the between-participants factors color-response mapping (Task 2: self-left/other-right, self-right/other-left, Task 1: green-left/blue-right, green-right/blue-left) and the within-participant factor target side (right, left). In addition, Control Task 2 analysis initially further contained a between-participants factor target frame color (blue, green) and Task 1 analysis contained the within-participant factor target color (blue, green). Because none of these factors interacted significantly with the group factor, and for the sake of simplicity, all these factors were dropped from the main analyses. The same approach was taken for error rates.

[3] Pretesting ($n = 10$) showed that nonfoveal discrimination of the photos was possible at 5.5° but became more difficult with lager visual eccentricities.

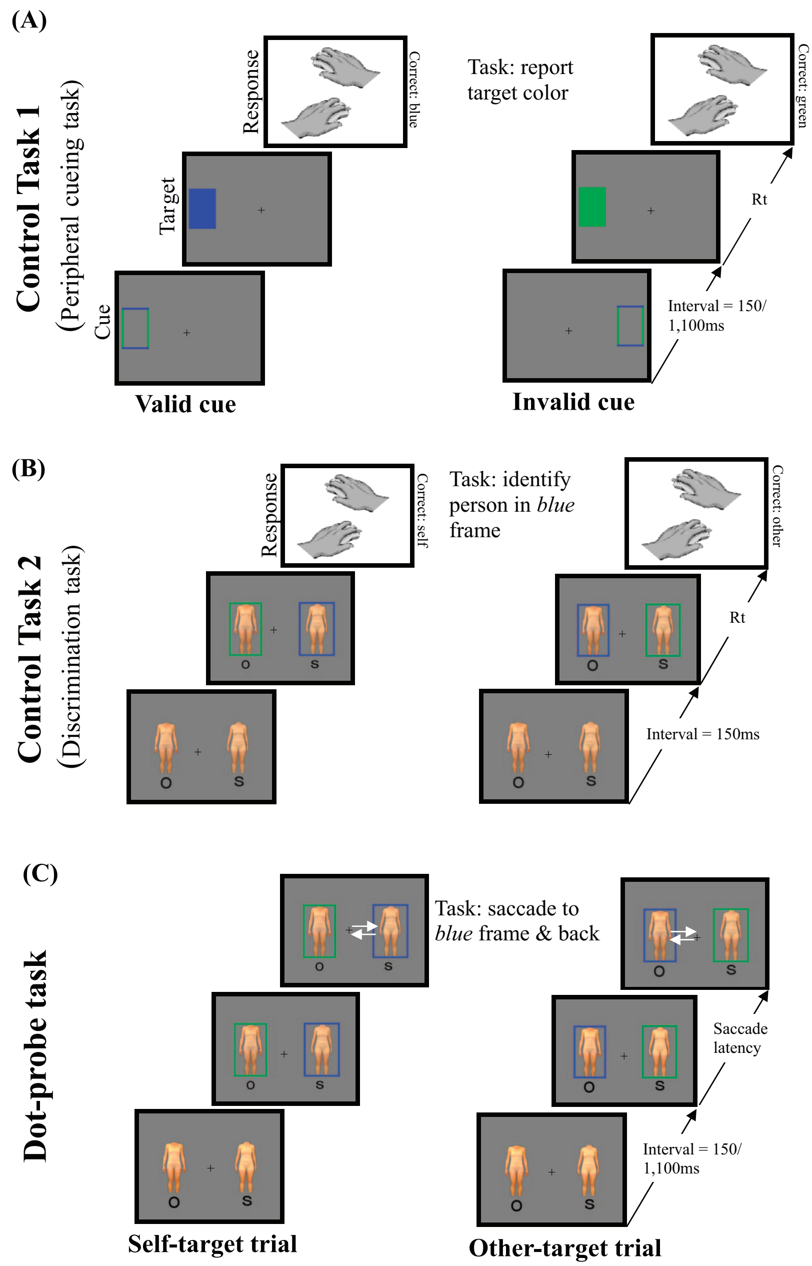

Figure 1. Tasks of the study; for a description, see the text. Arrows depict the sequence of events (time flows from bottom to top). Letters *O* for other photo and *S* for self-photo were not shown during the experiment. Stimuli are not drawn to scale. Rt = reaction time. A color version of this figure is available on the web at http://dx.doi.org/10.1037/a0019531.supp

which the person on the left side (left slide series in Figure 1B) or the person on the right side (right slide series in Figure 1B) had to be identified.[4] Again, positions of the color frames and the photo identities were equally likely left and right, and positions of different photo identities (self; other) and frame colors (blue; green) were uncorrelated. A Target Photo (self, other) × Group ANOVA did not yield main effects or interactions of group (Fs $<$ 1.00) in this task, indicating comparable discrimination abilities between peripheral self- and other photos in all groups. The percentage of correct answers was high and not different across groups, $F(2, 55) = 1.22$, $p = .302$ (see Table 2).

Dot-probe task. After 4 to 8 practice trials, experimental trials for the main dot-experimental probe task started by display-

[4] This task ensured accurate self–other discrimination under conditions that are physically identical to those in the dot-probe task. For parsimony, a lower number of repetitions was used in this control task (40 trials).

Table 2
Means and Standard Errors of RTs and Error Rates in the Control Tasks and the Dot-Probe Task

	BN		AN		HC	
Task	*M*	*SE*	*M*	*SE*	*M*	*SE*
Control Task 1						
Cued trials RT (ms)	678	30.7	733	29.9	652	28.4
Uncued trials RT (ms)	719	30.5	776	29.7	691	28.3
% correct responses	92.8	3.96	93.0	3.85	97.4	3.66
Control Task 2						
Self-target trials RT (ms)	1,439	140	1,791	136	1,684	130
Other-target trials RT (ms)	1,499	134	1,902	130	1,750	124
% correct responses	86.9	3.85	84.2	3.75	92.1	3.56
Dot-probe task[a]						
% correct responses	82.8	2.50	86.5	2.43	86.1	2.32

Note. Bulimia nervosa (BN) $n = 18$; anorexia nervosa (AN) $n = 19$; healthy controls (HC) $n = 21$. RT = reaction time.
[a] For means and standard errors, see Figure 2.

ing one self-photo and one other photo as cues, one right and one left of the central fixation cross. The control tasks had trained participants to maintain their gaze on the central fixation cross during the presentation of peripheral cues. Thus, by the time the dot-probe task began, participants were able to maintain central fixation and, at best, to only covertly (without actual eye movements) attend to (one of) the cues on their left–right visual field if they attended to one of the photos at all. After an interval of 150 ms (short interval) or 1,100 ms (long interval), similar to Control Task 2, green and blue frames surrounded the photos, one of the colors, indicating the target frame (with target color being counterbalanced across participants). Upon frame presentation, (and not before that, see trial exclusion below) participants had to make a saccade to the photo surrounded by the target frame (say blue) as quickly as possible and to return to the central fixation cross thereafter. Positions of the target color frames and the photo identities (self; other) were equally likely left and right, and positions of different photo identities and frame colors (blue; green) were uncorrelated. Thus, the dot-probe task encompassed 80 trials: 2 (self-left, self-right) × 2 (target frame left, target frame right) × 2 (150 ms interval, 1,100 ms interval) × 10 repetitions.

Figure 1C exemplifies two types of trials. In self-target trials (left slide series), an attentional bias for the self-photo cue (marked by an *S* in Figure 1 for illustrative purposes) over the other photo cue would facilitate a saccade in the direction of the self-photo when this photo was later surrounded by the target frame (blue frame). The same attentional bias would lead to a slowing of saccades on other-target trials (right slide series), in which the blue target frame appeared on the other side (surrounding the other photo).

Photo rating procedure. To complement our measures of attentional performance with the participants' evaluation of the photos, we acquired a set of ratings for the photos. For each participant, self- and other photos were presented one by one on the screen in front view, along with a visual analogue scale on which a slider could be moved by clicking the left mouse button or the right mouse button. Ratings of attractiveness (anchors *unattractive* and *attractive*), contentment (*not content* and *content*), and body shape (*fat* and *thin*) were given. Because the attractiveness and contentment scales were highly correlated they were averaged in a satisfaction score (Cronbach's alpha from .907 to .945).

Apparatus, Data Acquisition, Data Reduction, and Statistical Analysis

Testing took place in a sound-attenuated windowless chamber partitioned into a testing room and an experimenter room. During the experiment, the experimenter could communicate with the participant by intercom and observe her through an unobtrusive video camera. One Pentium 3 personal computer ran Presentation software (Neurobehavioral Systems; Albany, California) controlling the stimulus presentation and communicating with a second personal computer for data acquisition with a table-mounted 240 Hz Eyelink eye tracker (Sensomotoric Instruments; Berlin, Germany). Photo presentation and real-time eye movements were mirrored to two monitors in the experimenter room, allowing for careful online monitoring of data quality and execution of procedures. The table and chin rest of the eye tracker were individually height-adjusted to ensure a comfortable posture and reduce movement artifacts. Photos were presented on a 17-in. monitor at 80 Hz and 80 cm viewing distance. Prior to each experimental block, the eye tracker was calibrated. During data acquisition, the eye tracker was recalibrated whenever the fixation point was missed (by > 2.2°). Saccade latency was calculated as the time between target presentation and the first horizontal shift exceeding 3.3°. This visual angle was chosen because it reliably separated central fixation from fixation of the less eccentric edge of a photo. In the control and evaluation tasks, manual responses were registered to the nearest millisecond with response devices connected to the computer's parallel port.

Semiautomated offline analysis encompassed trial rejection by the following criteria: false responses, RTs or saccade latencies below 100 ms, and fixation missing the fixation point (by more than +/−2.2°). In the dot-probe task, only trials were also rejected when blinks occurred prior to the saccade or when saccades occurred prior to the target.

Statistical analysis was carried out with the general linear model module of SPSS (Version 15) after we checked the normality of distributions of dependent variables. The alpha level was set to .05. When the sphericity assumption was violated, the Greenhouse–Geisser correction for repeated measures was applied. Nominal *df* values and effect sizes are reported (η_p^2, in percentage).

Results

Dot-Probe Task

Saccade latencies were submitted to a 2 × 2 × 3 mixed-model ANOVA, with the within-participant factors cue photo (self, other) and cue-target interval (150 ms, 1,100 ms) and the between-participants factor group (AN, BN, HC).[5] A significant Cue Photo × Group interaction was found, $F(2, 54) = 3.59$, $p = .034$, $\eta_p^2 = 11.7\%$, indicating different cueing effects in the three groups. Contrary to one of our hypotheses, the factor interval yielded neither a main effect nor any interactions (Fs > 1.95, ps $> .168$). Thus, to simplify the analysis, saccade latencies were averaged across both intervals. The resulting 2 × 3 ANOVA with the sole factors cue photo and group confirmed the Cue Photo × Group interaction,[6] $F(2, 55) = 4.35$, $p = .018$, $\eta_p^2 = 13.7\%$, but no main effects (Fs < 1.29, ps $> .285$), see Figure 2. Separate within-participant *t* tests for each of the groups in turn indicated significantly shorter saccade latencies in the AN group for self-target trials, $t(18) = 2.22$, $p = .039$, compared with other-target trials. Although this effect was numerically reversed in the BN group, the post hoc *t* test did not reach significance, $t(17) = -1.73$, $p = .102$. Healthy participants responded equally fast to self-target and other-target trials, $t(20) = 0.73$, $p = .48$. As shown in Table 3, the percentage of correct saccades toward the target frame was high and was not different across groups, as determined in a univariate ANOVA ($F < 1.00$).

Photo Ratings

Replicating previous studies, within group *t* tests indicated that both BN and AN participants rated their own body as *less satisfying* ($M_{AN} = -5.26$, $SD_{AN} = 4.44$, $M_{BN} = -6.03$, $SD_{BN} = 3.16$) than the other person's body ($M_{AN} = -1.42$, $SD_{AN} = 4.70$, $M_{BN} = -0.67$, $SD_{BN} = 4.82$), $t(16) = 4.20$, $p < .001$,[7] and $t(18) = 2.24$, $p = .038$, respectively, whereas HC participants rated their own body as *more satisfying* ($M_{HC} = 4.26$, $SD_{HC} = 3.48$) than the other person's body ($M_{HC} = 2.28$, $SD_{HC} = 4.07$), $t(20) = 2.81$, $p = .011$. Similarly, although both BN and AN participants rated their own body ($M_{AN} = -1.21$, $SD_{AN} = 5.92$, $M_{BN} = -5.59$, $SD_{BN} = 3.26$) as larger than their BMI-matched comparison person's body ($M_{AN} = 3.05$, $SD_{AN} = 4.06$, $M_{BN} = -0.88$, $SD_{BN} = 3.26$), $t(16) = 6.07$, $p < .001$, and $t(18) = 2.57$, $p = .019$, respectively, there was no difference in the HC group (own body: $M_{HC} = 2.95$, $SD_{HC} = 3.46$, other body: $M_{HC} = 2.48$, $SD_{HC} = 3.23$; $t < 1.00$). Between participants, reflecting actual group differences in BMI, BN patients rated both self- and other bodies as larger than the other two groups (ts > 2.71, ps $< .011$). However, the AN group, despite being underweight rated their own body as larger than healthy participants rated their own body, $t(38) = 2.71$, $p = .009$, although no differences were found between the AN and HC groups on body shape ratings of other bodies ($p > .62$).

Correlations Between Ratings and Saccade Latencies

To aid the interpretation of the cueing effects and to follow up on findings by Jansen et al. (2005) that body dissatisfaction interacts with body-related attention, we calculated Pearson correlations between the saccade latencies and satisfaction ratings separately in each group. As an index of a bias for self-photos, a saccade difference score (ΔSacLat) was computed: ΔSacLat = saccade $\text{latency}_{\text{other-target}}$ – saccade $\text{latency}_{\text{self-target}}$ (collapsed across short and long intervals). Higher scores on this index signify shorter latencies for self-targets relative to other-targets, that is, an attentional bias for self-photos and/or an attentional avoidance of other photos. As listed in Table 3, ΔSacLat correlated negatively with $\text{satisfaction}_{\text{self}}$ in the AN group. No other correlations were significant. Thus, in the AN group *lower* satisfaction ratings for the self-photo were related to faster saccades in self-target trials.

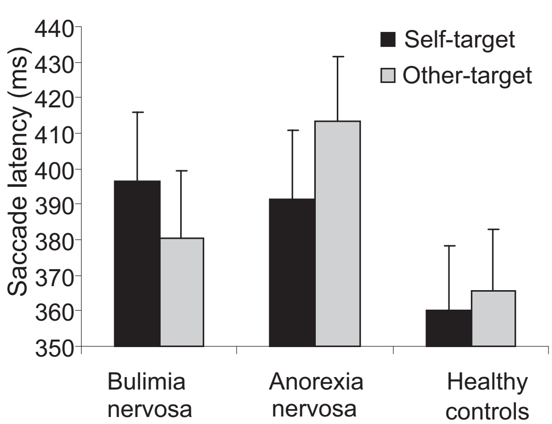

Figure 2. Saccade latencies (with bars depicting means and lines standard errors) in self-target trials (with the participant's own photo at the position of the target frame) and in other-target trials (with photo of a BMI-matched other woman's body at the position of the target frame) as a function of the three groups.

Discussion

The present study was designed to test whether body-related attentional biases in ED pertain to any body-related stimulus,

[5] An initial ANOVA additionally contained the within-participants factor target side (right, left) and the between-participants factor color-response mapping (blue-right/green-left vs. blue-left/green-right). Neither main effects nor interactions with group reached significance (Fs < 1.00), which is why these factors were dropped from the analysis.

[6] The second analysis included one BN patient that had been excluded from the first ANOVA due to missing values in one of the four cells. Generally, there were no systematic group differences in the number of valid trials per cell (Fs < 1.94, ps $> .154$). Further, because groups differed in comorbid depression, BDI scores were entered as a covariate in this analysis. The Cue Photo × Group interaction was even more pronounced, $F(2, 54) = 4.86$, $p = .011$, $\eta_p^2 = 15.3\%$. In addition, because there were some group differences in the BDI of self- and other photos, these differences were also entered as a covariate. The Cue Photo × Group interaction remained significant, $F(2, 54) = 3.77$, $p = .029$, $\eta_p^2 = 12.2\%$.

[7] Rating scores were lost for one BN patient.

Table 3
Pearson Correlations Between Saccade Latency and Ratings

	BN		AN		HC	
ΔSacLat with	*r*	*p*	*r*	*p*	*r*	*p*
Satisfied self	.188	.471	−.582	.009	.397	.075
Satisfied other	.269	.296	.215	.376	.421	.058
Shape self	.131	.616	.226	.309	.368	.101
Shape other	.060	.809	.208	.393	.454	.039

Note. Bulimia nervosa (BN) $n = 18$; anorexia nervosa (AN) $n = 18$ (one missing value on ratings); healthy controls (HC) $n = 21$. $\Delta\text{SacLat} = \text{saccade latency}_{\text{other-target}} - \text{saccade latency}_{\text{self-target}}$.

including photos of people's own and other peoples bodies (general body-related bias) or whether one of these stimulus types dominates in attentional control (specific bias). We further tested for differences between AN and BN, which have been neglected in previous studies. If ED patients had a general bias to any body-related stimuli, attentional influences of self- and other photos should have canceled each other out and rendered any cueing effects of self- and other nonsignificant. Our results do not support this. In line with different attentional biases for their own body versus another person's body, AN patients' attention was biased for a photo of their own body, whereas BN patients showed a nonsignificant tendency in the other direction. HC participants did not show any attentional bias for their own or another body. Contrary to what could be expected from attentional biases studies in anxiety, we did not find a reversal of the self–other bias from short to long cue-target intervals (i.e., the factor interval did not reach significance). Instead, the AN patients' attentional bias for self-photos pertained to both short and long intervals. In addition to the main findings, exploratory correlation analyses further revealed that the more dissatisfied the AN patients were with their own body, the stronger their attentional bias for it (i.e., the shorter their saccades in self-target trials relative to other-target trials). It is important to note that we obtained these results when self- and other photos were presented concurrently, extending previous work in which researchers had studied self- and other-body-related attention in separate trials and relied on eye-gaze measures in uninstructed, free-viewing tasks (Jansen et al., 2005).

The current results extend findings of previous dot-probe studies indicating that ED patients attend to negative or threatening body-related stimuli (Rieger et al., 1998; Shafran et al., 2007). Our findings specify that if the self–other dimension is taken into account, a bias for self emerges in AN patients. Thus, it seems inadequate to assume that any body-related stimulus biases attention in these patients, but it might be necessary to include stimuli related to the own body to adequately model body-related attention. Without this stimulus class, it might be difficult to specify whether participants process body-related stimuli in a self-referential way (this describes my own body) or whether they consider them environmental-appearance cues (other peoples' bodies). Generally consistent with prior dot-probe and eye-tracking research in EDs (Janelle et al., 2008; Jansen et al., 2005) and anxiety (e.g., Koster et al., 2006; Mogg et al., 2004), an attentional bias emerged for negatively evaluated photos (self-photos rated more negatively than other photos by ED patients) suggesting a nonhedonic, vigilant mode of attentional control. This is consistent with a larger literature on the attentional dominance of negatively evaluated over neutral or positively evaluated stimuli (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Ito, Larsen, Smith, & Cacioppo, 1998; Lipp & Derakshan, 2005; Ohman, Flykt, & Esteves, 2001; Taylor, 1991).

Our findings also extend previous findings of differential scan patterns of self-photos versus other photos in eating symptomatic versus nonsymptomatic individuals (Janelle et al., 2008; Jansen et al., 2005). These studies were restricted to within-body biases because self- and other bodies were serially presented. Here, we found an attentional bias for self-photos when they were concurrently presented with other photos. By doing so we created meaningful stimulus competition and excluded any order effects inherent in successive self–other presentations. Future studies could combine both approaches by presenting self- and other photos concurrently and tracking the specific scan patterns on each of those photos.

Some comments on our present task seem warranted. Our concurrent presentation of self- and other pictures ensured that any attentional control exerted by one stimulus competes with the attentional control exerted by the other stimulus. However, even though this contrast allowed for a valid test of our main research question (general vs. specific body-related bias), it also has important limitations. Any bias detected in this contrast can be considered the net effect of two sources: Both avoidance of other and attraction to self could have resulted in the bias observed in AN patients, and we introduced above that both photos should be salient and therefore contributing to the net bias. Isolating attentional biases for the self from attentional biases for the other would require inclusion of neutral photos (i.e., self-neutral, other-neutral). The difficult question here is which of several possible classes of neutral stimuli to use. In fact, previous studies varied considerably in their choice of neutral stimuli, and it is sometimes difficult to interpret contrasts between body-related stimuli and animals (as used in Shafran et al., 2007) or household objects (e.g., Koster, Crombez, Verschuere, & De Houwer, 2004). These stimulus classes (bodies vs. animals, bodies vs. objects) differ on several dimensions that correlate with attentional control and thus represent confounded factors. For example, facilitated attentional processing has been demonstrated for bodies over other objects (Bartels & Zeki, 2004; Downing, Bray, Rogers, & Childs, 2004) and for animate over inanimate stimuli (e.g., Kirchner & Thorpe, 2006; New, Cosmides, & Tooby, 2007). Further, using just self- and other photos makes it easier to equate these cues on low-level features such as size, color, contrast, position, eccentricity, onset duration, and luminance, all of which are relevant for attentional capture (cf. Itti & Koch, 2001; Parkhurst, Law, & Niebur, 2002). In future studies, one might pair each of the body photos with neutral stimuli in addition to self–other pairs to provide more insight here.

On a further methodological note, our modifications of the dot-probe task might represent an interesting addition to this flexible task. Specifically, saccade latencies tap into covert attention just as manual RTs do, but they allow a clear distinction from overt attention because overt eye movements can be detected and excluded. Further, as indicated above, looking toward an attended location might be more externally valid than manual responses. It is important to note that our task design ensured that we assess task-independent (uninstructed), covert attention allocation because attending to one of the photos did not facilitate task completion (i.e., self was target in 50% of the trial and nontarget in the other 50% of trials). In free viewing tasks, by contrast, demand effects cannot be fully excluded.

What are the theoretical and clinical implications of our findings? So far, differences between AN and BN with respect to body-related attention have been neglected. Because there are frequent transitions from AN to BN, transdiagnostic theories have highlighted communalities between these two disorders (Fairburn, Cooper, & Shafran, 2003). In addition, most experimental studies did sample equally sized AN and BN subgroups and thus did not have sufficient statistical power to detect differences between them. The intriguing finding of the present study is that biases in covert attention of AN and BN differed, more separating both ED disorders from one another than each of them from the control group. The reasons for these differences are not obvious, and the following explanations have to remain speculative until further research is conducted and a theory about differences in body-related attention between AN and BN is developed.

Relative to BN, the AN patients' experience of the own body might be more profoundly disturbed. This is explicated in the *DSM–IV* criteria and also partially reflected in the distorted photo ratings in the present study: AN rated their own body as well as the other person's body in a distorted way (i.e., not in line with actual BMIs). Thus, a bias for self-photos in AN but not in BN might be a result of a more profound body image disturbance in the former. There is some evidence that haptic perception, which is considered crucial for body image, is deficient in AN (Grunwald et al., 2001; Grunwald & Weiss, 2005; Grunwald, Weiss, Assmann, & Ettrich, 2004). Brain imaging and neuropsychological research points to deficits in parietal and frontal cortices underlying body image disturbance in AN (e.g., Beato-Fernandez et al., 2009; Tchanturia, Campbell, Morris, & Treasure, 2005; Uher et al., 2005). It has further been suggested that viewing self-images in BN activated neural structures associated with a fear response, whereas AN patients recruit structures related to attention and somatosensoric processing during the same task (Beato-Fernandez et al., 2009). Thus, AN patients, even though dissatisfied with their body, might be more inclined to engage in body checking (cf., Shafran, Fairburn, Robinson, & Lask, 2004) than might BN patients, who realize that their BMIs are above the ones suggested by the current cultural body shape ideal and for whom confrontation with self-photos might be more threatening. More research is clearly needed on the precise differences in how AN and BN patients perceive their own body, for example, by examining how attentional biases change within individuals as they progress from AN to BN.

The following limitations should be noted. First, we cannot draw firm conclusions for the BN group because the relevant statistical test only approached significance. Statistical power could be increased here with (a) a larger BN group, and/or (b) more experimental trials in the dot-probe task. It could also be the case that the BN group is more heterogeneous because some of the patients in this group had a history of AN. Second, due to the inclusion of the control tasks, participants had already been exposed to the photos that might have changed the effects during the saccade task. Future studies could reverse the order of the tasks and administer the dot-probe task before the control tasks. Third, the absence of an effect of cue-target interval might be due to the specific cue-target intervals chosen for this study. In future studies, one might be able to detect a biphasic vigilance-avoidance pattern as described for anxiety by using shorter cue-target intervals (e.g., 100 and 500 ms, Koster et al., 2006).

With these limitations in mind, we draw the following conclusions. The present results do not support a general body-related bias in AN. If self- and other photos compete, a bias for self emerges that could be related to the attentional capture of self, avoidance of other, or a mixture of both. Thus, disturbed body image and body dissatisfaction might be related to a focus on the own body and possibly an avoidance of possible corrective environmental information. Mirror exposure treatments could experiment with exposure not only to the own body but also to other peoples' bodies. Recent evidence shows that attentional biases in ED remit after treatment (Shafran, Lee, Cooper, Palmer, & Fairburn, 2008), and the anxiety literature is now rich with examples of treating attentional biases (e.g., Amir, Beard, Burns, & Bomyea, 2009; Koster, Fox, & MacLeod, 2009). Thus, adding body-related attentional retraining to standard cognitive-behavioral training for body image disturbance might be a fruitful approach.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Amir, N., Beard, C., Burns, M., & Bomyea, J. (2009). Attention modification program in individuals with generalized anxiety disorder. *Journal of Abnormal Psychology, 118,* 28–33.

Bartels, A., & Zeki, S. (2004). Functional brain mapping during free viewing of natural scenes. *Human Brain Mapping, 21,* 75–85.

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5,* 323–370.

Beato-Fernandez, L., Rodriguez-Cano, T., Garcia-Vilches, I., Garcia-Vicente, A., Poblete-Garcia, V., Castrejon, A. S., & Toro, J. (2009). Changes in regional cerebral blood flow after body image exposure in eating disorders. *Psychiatry Research, 171,* 129–137.

Becker, S. I., Ansorge, U., & Horstmann, G. (2009). Can intertrial priming account for the similarity effect in visual search? *Vision Research, 49,* 1738–1756.

Blechert, J., Nickert, T., Caffier, D., & Tuschen-Caffier, B. (2009). Social comparison and its relation to body dissatisfaction in bulimia nervosa: Evidence from eye movements. *Psychosomatic Medicine, 71,* 907–912.

Cash, T. F., & Deagle, E. A. (1997). The nature and extent of body-image disturbances in anorexia nervosa and bulimia nervosa: A meta-analysis. *International Journal of Eating Disorders, 22,* 107–125.

Corning, A. F., Krumm, A. J., & Smitham, L. A. (2006). Differential social comparison processes in women with and without eating disorder symptoms. *Journal of Counseling Psychology, 53,* 338–349.

Deubel, H., & Schneider, W. X. (1996). Saccade target selection and object recognition: Evidence for a common attentional mechanism. *Vision Research, 36,* 1827–1837.

Downing, P. E., Bray, D., Rogers, J., & Childs, C. (2004). Bodies capture attention when nothing is expected. *Cognition, 93,* B27–B38.

Fairburn, C. G., & Cooper, Z. (1993). The eating disorder examination. In C. G. Fairburn & G. T. Wilson (Eds.), *Binge eating: Nature, assessment, treatment* (pp. 317–360). New York, NY: Guilford Press.

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour Research and Therapy, 41,* 509–528.

Fairburn, C. G., Peveler, R. C., Jones, R., Hope, R. A., & Doll, H. A. (1993). Predictors of 12-month outcome in bulimia nervosa and the influence of attitudes to shape and weight. *Journal of Consulting and Clinical Psychology, 61,* 696–698.

Fairburn, C. G., Stice, E., Cooper, Z., Doll, H. A., Norman, P. A., & O'Connor, M. E. (2003). Understanding persistence in bulimia nervosa: A 5-year naturalistic study. *Journal of Consulting and Clinical Psychology, 71,* 103–109.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1995). *Structured clinical interview for DSM–IV axis I disorders.* Washington, DC: American Psychiatric Press.

Freeman, R. J., Beach, B., Davis, R., & Solyom, L. (1985). The prediction of relapse in bulimia nervosa. *Journal of Psychiatric Research, 19,* 349–353.

Freeman, R., Touyz, S., Sara, G., & Rennie, C. (1991). In the eye of the beholder: Processing body shape information in anorexic and bulimic patients. *International Journal of Eating Disorders, 10,* 709–714.

Gibson, J. J. (1979). *The ecological approach to visual perception.* Boston, MA: Houghton Mifflin.

Grunwald, M., Ettrich, C., Assmann, B., Dahne, A., Krause, W., Busse, F., & Gertz, H. J. (2001). Deficits in haptic perception and right parietal theta power changes in patients with anorexia nervosa before and after weight gain. *International Journal of Eating Disorders, 29,* 417–428.

Grunwald, M., & Weiss, T. (2005). Inducing sensory stimulation in treatment of anorexia nervosa. *QJM, 98,* 379–380.

Grunwald, M., Weiss, T., Assmann, B., & Ettrich, C. (2004). Stable asymmetric interhemispheric theta power in patients with anorexia nervosa during haptic perception even after weight gain: A longitudinal study. *Journal of Clinical and Experimental Neuropsychology, 26,* 608–620.

Hautzinger, M., Bailer, M., Worall, H., & Keller, F. (1994). *Beck depression inventory.* Bern, Switzerland: Huber.

Hilbert, A., Tuschen-Caffier, B., Karwautz, A., Niederhofer, H., & Munsch, S. (2007). Eating disorder examination questionnaire: Evaluation der deutschsprachigen Ubersetzung [Eating disorder examination questionnaire: Psychometric properties of the German version]. *Diagnostica, 53,* 144–154.

Hilbert, A., Tuschen-Caffier, B., & Ohms, M. (2004). Eating disorder examination: Deutschsprachige Version des strukturierten Essstorungsinterviews [Eating disorders examination: A German version of the Structured Eating Disorder Interviews]. *Diagnostica, 50,* 98–106.

Hommel, B. (1997). Interaction between stimulus–stimulus congruence and stimulus–response compatibility. *Psychological Research/Psychologische Forschung, 59,* 248–260.

Ito, T. A., Larsen, J. T., Smith, N. K., & Cacioppo, J. T. (1998). Negative information weighs more heavily on the brain: The negativity bias in evaluative categorizations. *Journal of Personality and Social Psychology, 75,* 887–900.

Itti, L., & Koch, C. (2001). Computational modelling of visual attention. *Nature Reviews Neuroscience, 2,* 194–203.

Janelle, C. M., Hausenblas, H. A., Ellis, R., Coombes, S. A., & Duley, A. R. (2008). The time course of attentional allocation while women high and low in body dissatisfaction view self and model physiques. *Psychology and Health, 24,* 351–366.

Jansen, A., Nederkoorn, C., & Mulkens, S. (2005). Selective visual attention for ugly and beautiful body parts in eating disorders. *Behaviour Research and Therapy, 43,* 183–196.

Kirchner, H., & Thorpe, S. J. (2006). Ultra-rapid object detection with saccadic eye movements: Visual processing speed revisited. *Vision Research, 46,* 1762–1776.

Koster, E. H., Crombez, G., Verschuere, B., & De Houwer, J. (2004). Selective attention to threat in the dot probe paradigm: Differentiating vigilance and difficulty to disengage. *Behaviour Research and Therapy, 42,* 1183–1192.

Koster, E. H., Crombez, G., Verschuere, B., Van Damme, S., & Wiersema, J. R. (2006). Components of attentional bias to threat in high trait anxiety: Facilitated engagement, impaired disengagement, and attentional avoidance. *Behaviour Research and Therapy, 44,* 1757–1771.

Koster, E. H., Fox, E., & MacLeod, C. (2009). Introduction to the special section on cognitive bias modification in emotional disorders. *Journal of Abnormal Psychology, 118,* 1–4.

Laux, L., Glanzmann, P., Schaffner, P., & Spielberger, C. D. (1981). *Das State-Trait-Angstinventar (STAI) [State-Trait Anxiety Inventory (STAI)].* Weinheim, Germany: Beltz.

Legenbauer, T., Vocks, S., & Schuett-Stroemel, S. (2007). Validierung einer deutschsprachigen Version des Body Image Avoidance Questionnaire BIAQ [Validation of the German version of the Body Image Avoidance Questionnaire (BIAQ)]. *Diagnostica, 53,* 218–225.

Lipp, O. V., & Derakshan, N. (2005). Attentional bias to pictures of fear-relevant animals in a dot probe task. *Emotion, 5,* 365–369.

Mogg, K., Bradley, B. P., Miles, F., & Dixon, R. (2004). Time course of attentional bias for threat scenes: Testing the vigilance-avoidance hypothesis. *Cognition and Emotion, 18,* 689–700.

New, J., Cosmides, L., & Tooby, J. (2007). Category-specific attention for animals reflects ancestral priorities, not expertise. *Proceedings of the National Academy of Sciences of the United States of America, 104,* 16598–16603.

Ohman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130,* 466–478.

Parkhurst, D., Law, K., & Niebur, E. (2002). Modeling the role of salience in the allocation of overt visual attention. *Vision Research, 42,* 107–123.

Posner, M. I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology, 32,* 3–25.

Reas, D. L., Whisenhunt, B. L., Netemeyer, R., & Williamson, D. A. (2002). Development of the body checking questionnaire: A self-report measure of body checking behaviors. *International Journal of Eating Disorders, 31,* 324–333.

Rieger, E., Schotte, D. E., Touyz, S. W., Beumont, P. J., Griffiths, R., & Russell, J. (1998). Attentional biases in eating disorders: A visual probe detection procedure. *International Journal of Eating Disorders, 23,* 199–205.

Rizzolatti, G., Riggio, L., Dascola, I., & Umilta, C. (1987). Reorienting attention across the horizontal and vertical meridians: Evidence in favor of a premotor theory of attention. *Neuropsychologia, 25,* 31–40.

Rosen, J. C., Srebnik, D., Saltzberg, E., & Wendt, S. (1991). Development of a body image avoidance questionnaire. *Psychological Assessment, 3,* 32–37.

Shafran, R., Fairburn, C. G., Robinson, P., & Lask, B. (2004). Body checking and its avoidance in eating disorders. *International Journal of Eating Disorders, 35,* 93–101.

Shafran, R., Lee, M., Cooper, Z., Palmer, R. L., & Fairburn, C. G. (2007). Attentional bias in eating disorders. *International Journal of Eating Disorders, 40,* 369–380.

Shafran, R., Lee, M., Cooper, Z., Palmer, R. L., & Fairburn, C. G. (2008). Effect of psychological treatment on attentional bias in eating disorders. *International Journal of Eating Disorders, 41,* 348–354.

Smeets, E., Roefs, A., van Furth, E., & Jansen, A. (2008). Attentional bias for body and food in eating disorders: Increased distraction, speeded detection, or both? *Behaviour Research and Therapy, 46,* 229–238.

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin, 128,* 825–848.

Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization-minimization hypothesis. *Psychological Bulletin, 110,* 67–85.

Tchanturia, K., Campbell, I. C., Morris, R., & Treasure, J. (2005). Neuropsychological studies in anorexia nervosa. *International Journal of Eating Disorders, 37,* S72–S76.

Uher, R., Murphy, T., Friederich, H. C., Dalgleish, T., Brammer, M. J., Giampietro, V., . . . Treasure, J. (2005). Functional neuroanatomy of body shape perception in healthy and eating-disordered women. *Biological Psychiatry, 58,* 990–997.

Wittchen, H. U., Zaudig, M., & Fydrich, T. (1997). *Strukturiertes Klinisches Interview für DSM–IV. Achse 1 [Structured clinical interview for DSM–IV Axis 1].* Göttingen, Germany: Hogrefe.

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