

The time course of attentional allocation while women high and low in body dissatisfaction view self and model physiques

Christopher M. Janelle*, Heather A. Hausenblas,
Rebecca Ellis, Stephen A. Coombes and Aaron R. Duley

*Department of Applied Physiology and Kinesiology, University of Florida,
College of Health and Human Performance, Gainesville, USA*

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The purpose of this study was to examine trait levels of dissatisfaction with specific bodily regions and attentional characteristics associated with those regions among women high (HBD, $n = 15$) and low (LBD, $n = 14$) in body dissatisfaction. Separate laboratory visits were completed, during which eye movements were recorded as participants viewed slides of self-physiques or model-physiques. Comparisons of search tendencies were made across the entire 5 s of slide presentation, and then within each of the ten 500 ms epochs that comprised the 5 s viewing period. The HBD group made initial fixations to the pelvic region proportionately more than the LBD group, and avoided looking at their own bodies relative to the LBD group. They also viewed the model's legs significantly longer than the LBD group. When considering the time course of attentional allocation, the HBD group preferentially viewed areas typical of dissatisfaction during the latter viewing periods, regardless of whether they were looking at themselves or the model. Results are discussed in the context of an integrated social cognitive view with regard to the formation of a negative body schema that both results from and then perpetuates the negative affective consequences that characterize individuals who are symptomatic for eating disorders.

Keywords: body image; attentional bias; eye movements

Introduction

Theorists have emphasized the need for integrative approaches to investigate the complex interplay among the psychological factors that elicit and maintain body image problems (Cash & Deagle, 1997; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999; Viken, Treat, Nosofsky, McFall, & Palmeri, 2002; Williamson, 1996). At the crux of these integrative approaches is the notion that central psychopathological concerns bias information processing, and these biases often occur automatically and outside of awareness (e.g., Cooper, 1997; Gardner & Bokenkamp, 1996; McManus, Waller, & Chadwick, 1996; Stein & Hedger, 1997). Thus, selective attention to negatively perceived body-related stimuli and distorted interpretations of ambiguous environmental material can result in the progression and maintenance of eating and body-image disturbances, and

*Corresponding author. Email: cjanelle@hhp.ufl.edu

may do so without awareness of its occurrence (Cooper & Fairburn, 1992; Freeman et al., 1991). If these processes occur in an automatic, preconscious manner, measurement methods that bypass self-report can more precisely and comprehensively assess attentional and affective responses (Tucker & Schlundt, 1995).

Body image disturbances are often associated with the altered processing of eating and body-relevant information in protocols using indirect inferential methods such as the Stroop color-word (e.g., Cooper & Fairburn, 1992; Dobson & Dozois, 2004; Green & Rogers, 1993; Lattimore, Thompson, & Halford, 2000), visual probe detection (e.g., Maner et al., 2006; Reiger et al., 1998), and perceptual (e.g., Fuller, Williamson, & Anderson, 1995; Mussap & Salton, 2006; von Hippel, Hawkins, & Narayan, 1994) tasks. However, the underlying mechanisms that predispose individuals to differentially perform these tasks remain unclear. For example, differences in color-word naming (Stroop interference) may be related to information-processing load and response selection complications rather than the emotional content of the word, *per se* (e.g., Hsu & Sobkiewicz, 1991; Huon, 1995; Probst, Vandereycken, Vanderlinden, & Van Coppenolle, 1998).

Analysis of visual search patterns as individuals view their own bodies has provided preliminary evidence of an attentional bias whereby, bodily locations typical of dissatisfaction (i.e., the lower body) are preferentially fixated, with stronger effects evidenced in individuals with eating and weight disturbances (Freeman et al., 1991; Gardner & Morrell, 1991; Gardner, Morell, Watson, & Sandoval, 1990). These findings have recently been replicated and extended by Jansen, Nederkoorn and Mulken (2005), who assessed eye movements across a 30s viewing period. When viewing themselves, eating disorder symptomatic individuals fixated on the 'ugly parts' to a greater extent than self-identified 'beautiful parts'. The findings were reversed when viewing others. Specifically, highly symptomatic individuals were more vigilant of others' beautiful parts and focused less on others' ugly parts.

Contemporary work in the mainstream study of attentional bias has emphasized decomposition of viewing periods into brief time segments to assess orienting and engagement of affective material (Calvo & Avero, 2005). In these protocols, picture exposure periods typically range from 500 to 5000 ms. For example, Hermans, Vansteenwegen and Eelen (1999) recorded eye movements, while spider-anxious and control subjects viewed pictures containing spiders and other material (e.g., flowers). They found that individuals who feared spiders looked significantly more at spiders than at flowers early in the stimulus presentation period, but subsequently their viewing pattern shifted away from the spiders. Control participants generally looked more at spiders than flowers throughout the viewing period. Gaze behaviours away from the spider stimuli were interpreted to represent avoidance behaviours among the spider anxious individuals, fostered by hypersensitivity to the fearful stimuli during early presentation.

Importantly, Hermans et al.'s (1999) findings suggest that viewing characteristics of affective stimuli might vary *depending on the time course of analysis*. Without decomposing the viewing period into smaller time bins, attentional maintenance, disengagement, and shifting are concealed in gross averages across broad time periods. The time course of attentional biases remains unspecified in the study of eating disorder symptomatic samples. In addition to this limitation, previous work that has assessed eye movements, body image, and attentional bias is constrained by presentation of stimuli (a) during body size estimation tasks (e.g., Gardner & Morrell, 1991; Gardner et al., 1990); (b) that have involved novel attire (i.e., wearing a black leotard, cf., Freeman et al. 1991); or (c) that

have consisted of various body types and body shapes acquired from a wide range of media sources (cf., Janelle, Hausenblas, Fallon, & Ellis Gardner, 2003).

The purpose of this investigation, therefore, was to assess the time course of natural selective attention associated with specific regions of trait body dissatisfaction among high and low body dissatisfied women, while viewing images of themselves or an aesthetic ideal model. Consistent with previous work (Freeman et al., 1991; Gardner & Morrell, 1991; Gardner et al., 1990; Jansen et al., 2005), analyses of eye movements were predicted to depict search strategies in which highly body dissatisfied (HBD) women would attend more to somatic regions (body parts) of dissatisfaction than would low dissatisfaction (LBD) women when viewing themselves. These tendencies would be broadly evidenced by longer fixation duration toward areas typical of dissatisfaction. Upon fragmentation of the viewing period into 500 ms epochs, we expected early engagement of dissatisfying body parts with later disengagement of these locations among the HBD individuals relative to the LBD participants. This would be evidenced by a greater probability of first fixations to areas of dissatisfaction, as well as greater early maintenance of gaze toward these locations (i.e., during the early attention stages of processing < 1500 ms). Finally, we hypothesized that when viewing the model physique, HBD individuals would focus on those areas of others with which they themselves experience greater dissatisfaction.

Method

Participants

Thirty female Caucasian undergraduate students at a large southeastern university in the United States (M age = 20.10, SD = 2.02) volunteered to participate in this project. Despite all ethnic and racial groups being equally eligible for participation, those who qualified for the study were exclusively Caucasian. The sample size provided adequate power to detect main effects and interactions of interest based on an alpha level of 0.05, with a moderate effect size, and a power of 0.80 (Tran, 1997).

Measures

Eating disorder inventory-2 (EDI-2)

The Body Dissatisfaction, Drive for Thinness, and Bulimia subscales of the EDI-2 were used to assess the attitudinal and behavioral correlates of eating disorders (Garner, 1991). The Body Dissatisfaction subscale measures dissatisfaction with the size and shape of body parts. The Drive for Thinness subscale evaluates excessive concerns regarding weight and dieting. Finally, the Bulimia subscale assesses tendencies to eat large quantities of food in one episode (i.e., binge eating). All of the items are rated on a 6-point Likert scale that ranges from 1 (never) to 6 (always). A high score indicates a greater degree of attitudinal and behavioural correlates of eating disorders. The validity and reliability of the EDI-2 subscales is supported (Garner, 1991) and the internal consistency scores for the Body Dissatisfaction, Drive for Thinness, and Bulimia subscales in this study were 0.81, 0.97, and 0.84, respectively.

Physical appearance state and trait anxiety scale (PASTAS)

As a further measure of dissatisfaction with specific somatic regions, dissatisfaction with body locations was obtained through self-reported level of discontent with various body

parts. The trait form of the PASTAS (Reed, Thompson, Brannick, & Sacco, 1991) measures the extent of dissatisfaction with numerous body areas, including the thighs, buttocks, hips, stomach, legs, and waist, with scores ranging on a 6-point Likert scale from 1 (never) to 6 (always). A higher score indicates a greater level of anxiety, tension, or nervousness about a specific body part.

Body composition

Two measures of body composition were obtained. First, body mass index (BMI) was calculated by direct assessments of weight and height using a Healthometer scale (Chicago, IL). BMI is the ratio of weight to relative height and is calculated by dividing body weight by height squared (kg m^{-2}). BMI is a reliable estimate of obesity. However, there is a SE of 5% when using BMI to estimate body fat percentage (ACSM, 2000).

Second, percent body fat was measured with skinfold calipers using the three-site technique of the triceps, suprailiac, and thigh (Jackson, Pollack, & Ward, 1980). The average of the three skinfolds was converted to an estimate of percent body fat using the generalized skinfold equation (Jackson et al., 1980). Skinfold measurements correlate well with body composition results from hydrostatic weighing (ACSM, 2000). However, assuming proper techniques and formulas are used, there is still a 3.5% margin of error when predicting percent body fat from skinfolds (ACSM, 2000).

Gaze behaviour measurement

An Applied Science Laboratories (ASL; Waltham, MA) 5000 SU eye movement system integrated with the Ascension Technologies Flock of Birds Magnetic Head Tracker (MHT: Model 6DFOB) was used to obtain eye and head movement information. The 5000 SU system is a video based monocular corneal reflection system that measures the point of gaze relative to video images recorded by a headband mounted scene camera. Accuracy of the E5000 system is $\pm 1^\circ$ visual angle, and 1° in both vertical and horizontal fields, with $\pm 0.5^\circ$ precision, respectively. The eye tracking equipment tracks eye movements at a rate of 60 Hz (60 samples per second). Miniaturized optics (scene and eye camera), an illuminator, solid-state sensor, relay lens, and visor are mounted on a headband, with the total weight being 700 g. The ASL system measures the position of two features of the eye, the pupil and the corneal reflex. The corneal reflex is the reflection of a small, helmet mounted light source from the surface of the cornea. By recording both features, the system can accurately measure eye-line-of-gaze. A 40-degree vertical and 50-degree horizontal field of view is present when the head is fixed. However, because the participant is free to move the head, the scene changes with shifts in the participant's gaze. A square, transparent cursor (representing about one degree of visual angle) indicates the participants' point of gaze in the scene and is superimposed on the video image to show the point of gaze. When integrated with the magnetic head tracking system, coordinates acquired using the EYEPOS software permit offline analysis of a variety of eye movement dependent measures, including fixation frequency and duration, as well as search rate (i.e., how quickly the scene is searched).

Slides

The slides included: (a) eight full body pictures of the participants (i.e., self-slides) and eight full body pictures of a female model (i.e., model-slides). The self- and model-slides

consisted of eight different full body views starting with the frontal view and turning at 45° angles. The participants and model were asked to maintain the same facial expression throughout the eight pictures. The model was a 21-year old Caucasian university student whose BMI was 19.75 and body fat percentage was 16.7%, representing a thin physique and aesthetic ideal in the media based on a healthy BMI of 18.5–24.9 and an optimal body fat of 15–25% (ACSM, 2000). To further establish content validity of the model-slides, four graduate students and experts in the field indicated whether or not the model's physique represented the current aesthetic physique of a thin body shape. One hundred percent agreement was established that the model represented the current aesthetic ideal physique.

Procedure

Prescreen

Female undergraduate students ($N = 265$) completed the body dissatisfaction (BD), Drive for Thinness (DT), and Bulimia subscales of the EDI-2, the PASTAS, and demographic questions. Forty-one participants scoring high (upper 33.3%; HBD group) and low (lower 33.3%; LBD group) on the BD subscale were contacted over the phone for study participation. Individuals were contacted beginning with the extreme ends of the terciles (i.e., the highest and lowest scores of the HBD tercile and the LBD tercile, respectively), then working towards the less extreme scores. All were informed that eight photographs of different angles of their body would be taken of them wearing a two piece (separate top and bottom) ensemble of either a bathing suit or high cut shorts and a sports bra during their initial visit. Five LBD and two HBD women who were contacted refused to participate in the study, and one HBD and two LBD women failed to attend their initial visit. Finally, one HBD and one LBD participant withdrew from the study after their initial visit due to scheduling conflicts. Thus, the final sample consisted of 15 HBD and 14 LBD women.

Initial visit

During the initial visit to the laboratory, participants signed the informed consent document approved by the University's Institutional Review Board. The participant's body composition measures and photographs were taken by the third author, who is also a woman. Given that the participants were given a choice as to the type of attire to wear (two-piece swimsuit or shorts and a sports bra), the third author ensured compliance with the constraints of attire. Only high cut (running shorts) and a separate sports bra were permitted thereby ensuring that the amount of exposed skin was generally consistent across subjects. Only the participant and experimenter were present in the room during testing. At the end of the session, the participants were scheduled for follow-up laboratory visits.

Experimental manipulations

On separate laboratory visits, the participants viewed eight slides from one of the two conditions (i.e., self-slides or model-slides). The order of the slide conditions were randomised and counterbalanced across participants and visits to control for potential order effects. The average time between the participants' initial visit and first experimental visit was 21 days (range = 10–31 days). The majority of the participants ($n = 27$) completed

the experimental visits on Monday, Wednesday, or Friday of the same week. The remaining three participants completed their three visits on Monday, Wednesday, and Friday within 2 weeks due to scheduling difficulties.

For each condition, participants were seated comfortably in a chair 122 cm from a large screen (90 cm × 90 cm), outfitted in the eye tracking system, and calibrated for eye movement recording. Once fitted and calibrated, the participants were informed of the procedures for slide viewing. Prior to the slide show, participants were instructed to 'look at the picture on the screen'. They then viewed eight slides that varied depending on the condition. Each of the eight slides was viewed for 5 s, and each was preceded by a preparation slide that contained the words 'get ready to view slide number *n*', and followed by a 15 s black screen. At the conclusion of the slide viewing sessions, the purpose and procedures were explained, participants were debriefed, and they were dismissed. Approximately 3 weeks after completing the study, the participants were mailed monetary compensation worth \$US 45.00.

Design and analyses

Levels of dissatisfaction with specific body parts

A preliminary multivariate analysis of variance (MANOVA) was conducted to determine differences in levels of dissatisfaction between the HBD and LBD groups with their head, thighs, buttocks, hips, stomach, legs, and waist. Scores from the PASTAS representing these areas served as the dependent measures. This initial analysis was performed to identify those specific areas on which the HBD and LBD groups differed, thereby permitting us to restrict further analyses to more manageable regions of interest determined specifically by known differences in (dis)satisfaction with these particular areas. For the sake of comparative ease and interpretive brevity with regard to PASTAS regions and eye tracking areas of interest labels, the hips/buttocks regions were collapsed to form the 'pelvic' region, the 'thighs' and 'legs' comprised the 'leg' data, and the 'stomach', and 'waist' were combined to form the stomach region.

Gaze behaviour

A wide range of eye movement variables can be recorded from modern day eye tracking systems. Of the numerous options, some are more appropriate for the assessment of initial orienting of attention, while others index the maintenance, or disability to disengage attention. The two primary measures of interest here were first fixation probability and total gaze duration to specific areas across the ten 500 ms viewing epochs. To assess initial orientation of attention, and consistent with other investigations that have used eye movements as an index of initial orienting (e.g., Calvo & Avero, 2005), we calculated the probability of first fixation on the different body locations of interest; namely the head, chest, pelvis, stomach, legs, and off. Although the 'off' region has not been reported in previous investigations of eye movement and attentional bias (fixations off the picture are typically discarded) we felt it important to retain these data, as fixations off the picture could index avoidance gaze strategies (i.e., rather than looking at the picture, one merely looks away from all body locations). First fixation probability was computed as the first location of fixation (at least 100 ms) following a saccade made from the fixation cross located at the centre of the visual display prior to picture onset, as compared to the other possible locations.

The other primary measure of interest was the total gaze duration to specific body locations across the 10 viewing periods. As has been the case in similar investigations of eye movement indices of attentional bias, gaze duration on specific locations provides an index of engagement for the specific time period of interest. In the current project, gaze duration was computed for each of the 10 time periods of interest to assess attentional maintenance on specific areas during those time periods, and was computed as the total duration spent viewing each specific body region across each of the 500 ms viewing epochs. Eye tracking data were collected through eye head integration of the ASL eye tracking system with the Flock of Birds magnetic head tracker, thereby enabling all reduction and analysis of eye movement data to occur offline. After reduction of fixation data and categorization into specific areas of interest, the data were sorted into 500 ms bins through the use of a custom written Labview program.

As mentioned, the number of dependent variables that can be computed from the eye tracking data is virtually limitless. With particular reference to the total gaze duration, we sought to succinctly capture a critical index of information acquisition from the primary somatic areas of interest. Total gaze duration is a composite score that represents the cumulative duration of fixations on a given location. Many other eye movements occur over the course of the viewing period, therefore, that will not be represented in the cumulative fixation duration to each of the locations. These include, but are not limited to saccades, blinks, and in particular, fixations that are outside the coded areas on the slides of interest. As such, it is highly likely (for all practical purposes mandatory) that the entire search duration within the 500 ms bins will not be consumed by fixations to the areas of interest. Additionally, in some cases the fixation duration can exceed the 500 ms bin within which it is counted. This is possible when a fixation is initiated in one of the 500 ms windows, but continues on to another. Any fixations longer than 500 ms mandate this occurrence, but this situation will also occur for fixations that begin in one epoch and last until the next. In these cases, the fixation duration was reported in the epoch during which the fixation was initiated.

Once sorted, the fixation probability¹ and gaze duration measures were statistically analysed using SPSS. First fixation probabilities were analysed with a 2 (Group: HBD, LBD) \times 2 (Physique: model, self) \times 6 (Location: head, chest, stomach, pelvis, legs, and off) mixed model analysis of variance (ANOVA) with repeated measures on the last two factors. Total gaze duration was analysed via a 2 (Group: HBD, LBD) \times 2 (Physique: model, self) \times 6 (Location: head, chest, stomach, pelvis, legs, and off) \times 10 (Period: Each of the 500 ms bins) mixed model ANOVA with repeated measures on the last three factors, for the entire viewing period. If the sphericity assumption was violated, then Greenhouse–Geisser corrected degrees of freedom were used to obtain the critical p -value. In these cases, the adjusted degrees of freedom are reported. Follow-up analyses were conducted using Tukey's HSD procedure and simple effects tests for significant main effects and interactions, respectively. For all analyses, the acceptable probability of a Type I error was set at $p < 0.05$.

Results

Participant characteristics

One-way ANOVAs were undertaken to determine if the HBD and LBD groups differed on measures of BD and demographics (Table 1). No significant group differences were found for age [$F_{(1,27)} = 0.39, p = 0.54$], the Bulimia subscale [$F_{(1,27)} = 2.60, p = 0.12$], percent body

Table 1. Descriptive statistics for the high and low body dissatisfaction groups.

Variable	<i>M</i> (SD)	
	HBD (<i>n</i> = 15)	LBD (<i>n</i> = 14)
Age	19.87 (2.50)	20.33 (1.45)
Body mass index	23.21 (1.53)	21.81 (2.35)
Percent body fat	22.89 (3.91)	21.86 (3.45)
Drive for thinness subscale*	17.13 (2.38)	0.00 (0.00)
Bulimia subscale	2.53 (4.38)	0.66 (0.89)
Body dissatisfaction subscale*	12.13 (5.63)	3.93 (2.63)

Note: * = HBD and LBD participants differed significantly.

Table 2. Descriptive statistics summarizing group differences of dissatisfaction with various somatic locations as indexed by scores on the PASTAS.

PASTAS item	Somatic location	Group	Mean	SD
PASTAS 2	Thighs	LBD	2.29	1.33
		HBD	4.50	1.29
PASTAS 3	Buttocks	LBD	2.29	0.99
		HBD	3.79	1.25
PASTAS 4	Hips	LBD	2.07	1.21
		HBD	3.21	1.25
PASTAS 5	Stomach	LBD	2.21	1.05
		HBD	4.43	1.09
PASTAS 6	Legs	LBD	1.86	1.29
		HBD	4.14	1.61
PASTAS 7	Waist	LBD	1.93	1.21
		HBD	4.43	1.22

Note: HBD and LBD participants differed significantly in all areas.

fat [$F_{(1,27)} = 0.59$, $p = 0.45$], and BMI [$F_{(1,27)} = 3.91$, $p = 0.06$]. The HBD group, however, scored significantly higher on the BD subscale [$F_{(1,27)} = 26.11$, $p < 0.001$] and the Drive for Thinness subscale [$F_{(1,27)} = 773.15$, $p < 0.001$] than the LBD group. Also, the HBD group's DT subscale scores ($M = 17.13$) slightly (but not significantly) exceeded an at-risk range for an eating disorder (range = 14–17; Garner, 1991).

Levels of dissatisfaction with specific body parts

The MANOVA conducted on items selected from the PASTAS yielded significant group differences (*Wilks' Lambda* = 0.149, $F_{(14,6)} = 5.28$, $p < 0.002$). Mean comparisons indicated that the HBD group exhibited significantly greater levels of dissatisfaction than the LBD group with regard to all areas of interest (Table 2).

Probability of first fixation

The probability of first fixation on the various physique locations revealed significant main effects for physique ($F_{(1,27)} = 7.53$, $p < 0.01$, $\eta^2 = 0.21$) and location ($F_{(5,23)} = 182.68$,

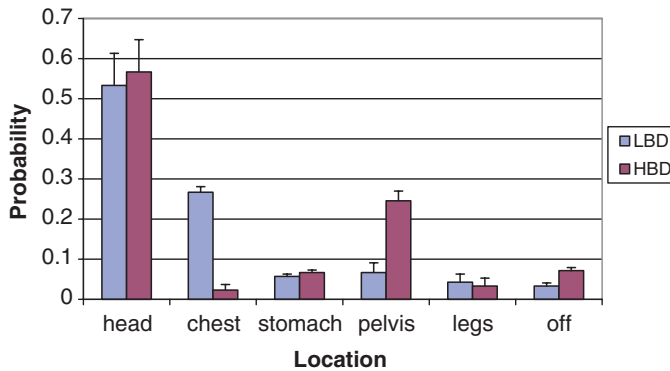


Figure 1. Probability of first fixation to somatic locations of interest among HBD and LBD women.

$p < 0.0001$, $\eta^2 = 0.94$). However, these main effects were superseded by a significant group \times location interaction ($F_{(5,23)} = 3.35$, $p < 0.02$, $\eta^2 = 0.41$). Follow up simple effects tests of the significant interaction indicated that the probability of first fixation was greatest to the head region for both groups. First fixations to the remaining regions were markedly less, but significant differences emerged in the probability of first fixations to the pelvis and chest regions. Specifically, the HBD groups made first fixations to the pelvis region with a higher probability ($M = 0.246$, $SE = 0.024$) relative to the LBD group ($M = 0.067$, $SE = 0.024$), while the inverse was true for the chest region (HBD: $M = 0.023$, $SE = 0.014$; LBD: $M = 0.268$, $SE = 0.014$) (Figure 1).

Fixation duration

The omnibus ANOVA on fixation duration revealed significant main effects for group ($F_{(1,27)} = 6.72$, $p < 0.02$, $\eta^2 = 0.19$), physique ($F_{(1,27)} = 77.47$, $p < 0.0001$, $\eta^2 = 0.74$), location ($F_{(5,69.93)} = 187.35$, $p < 0.0001$, $\eta^2 = 0.87$), and period ($F_{(9,125.55)} = 89.43$, $p < 0.0001$, $\eta^2 = 0.77$). Additionally, significant group \times period ($F_{(9,69.93)} = 2.28$, $p < 0.02$, $\eta^2 = 0.08$), physique \times location ($F_{(5,70.65)} = 89.03$, $p < 0.0001$, $\eta^2 = 0.77$), physique \times period ($F_{(9,132.66)} = 39.92$, $p < 0.0001$, $\eta^2 = 0.59$), and location \times period ($F_{(45,158.31)} = 32.14$, $p < 0.0001$, $\eta^2 = 0.54$) interactions were revealed. However, these main effects and interactions were superseded by three three-way interactions: a significant group-physique \times location interaction ($F_{(5,130)} = 2.32$, $p < 0.001$, $\eta^2 = 0.08$), a significant physique \times location \times period ($F_{(45,155.12)} = 55.0$, $p < 0.0001$, $\eta^2 = 0.67$) interaction, and a significant group \times location \times period ($F_{(45,158.31)} = 2.11$, $p < 0.05$, $\eta^2 = 0.07$) interaction.

Total viewing time

Of critical interest for comparison with previous work was the significant group-physique \times location interaction, as this interaction pertained to gaze characteristics across the entire viewing period (Figure 2). Simple effects tests revealed that the HBD group viewed all somatic regions of themselves for significantly less time than did the LBD group. They also viewed the model's chest, stomach, and pelvis significantly less than the LBD group. In contrast, the HBD group directed visual gaze significantly more to the leg region of the model as compared to how they viewed themselves as well as how the LBD viewed the legs of themselves and the model. They also gazed longer at the model's head compared to when viewing their own. The opposite was true for the LBD group 500 ms bins.

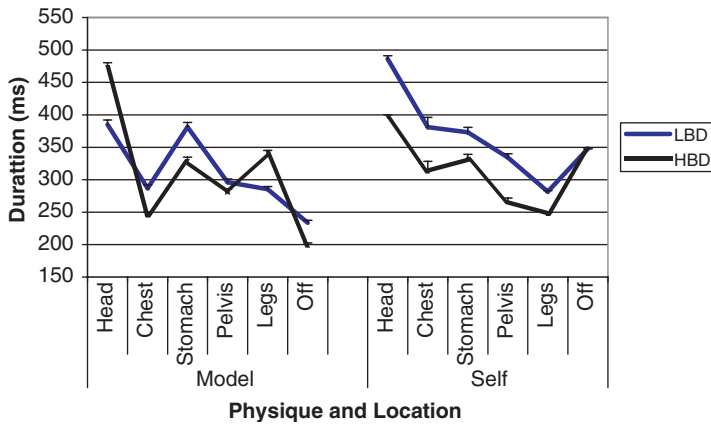


Figure 2. Mean gaze duration to specific somatic locations of the model and self physiques across the entire 5 s viewing period. High body dissatisfied = HBD; low body dissatisfied = LBD.

The Period factor was of critical interest for evaluation of the time course of attentional allocation

Follow-up decomposition of the physique × location × period interaction revealed different search patterns as the model was viewed relative to the self physique slides. Each of the six regions of the Model physique were viewed less compared to viewing patterns of the Self physiques during the following time periods: Head: 1001–1500, 2501 through 3500; Chest: 1501 through 2500, 3501–4000, 4501–5000; Stomach: 0–500, 1501–2000, 3501–4000; Pelvis: 0–500, 3001–3500, 4501–5000; Legs: 0–1500; Off, 0–500, 1501 through 2500, 3001 through 4500). In contrast, the six regions of the self-physiques were viewed less relative to Model slides during the following epochs: Head: 0 through 1000, 2001–2500; Chest: 2501–3000, 4001–4500; Stomach: 1001–1500, 2001 through 3500, 4501–5000; Pelvis: 2501–3000, 4001–4500; Legs: 1501 through 4000, 4501–5000; Off: 2501–3000. All other fixation duration patterns were similarly distributed when viewing the model and physique slides.

As can be seen in Figure 3, follow-up analysis of the group × location × period interaction revealed significant differences primarily with regard to the head and chest locations as a function of the time period of slide presentation. Specifically, the HBD group viewed the following locations significantly less than the LBD group at the following times: Head: 0–500, 1501–2000, 2501–3500; Chest: 501 through 2000; Stomach: 501–1000, 1501 through 2500, 3501–4500 Pelvis: 0–500, 2001–3500, 4501–5000; Legs: 1001–1500, 2001–2500; Off: 0–500, 1001–1500. In contrast, the LBD group viewed the following locations significantly less than the HBD group at the following times: Head: 501–1500, 2001–2500, 4501–5000; Chest: 2001–2500, 3001–3500, 4001–4500; Stomach: 2501–3000; Pelvis: 1001–1500, 3501–4500; Legs: 1501–2000, 3001–4000, 4501–5000; Off: 2501 through 3500. Other fixation duration patterns were similar across time periods and for the respective locations.

Discussion

The primary objective of this investigation was to evaluate the degree to which the attentional allocation tendencies if women with high and low levels of BD vary as a

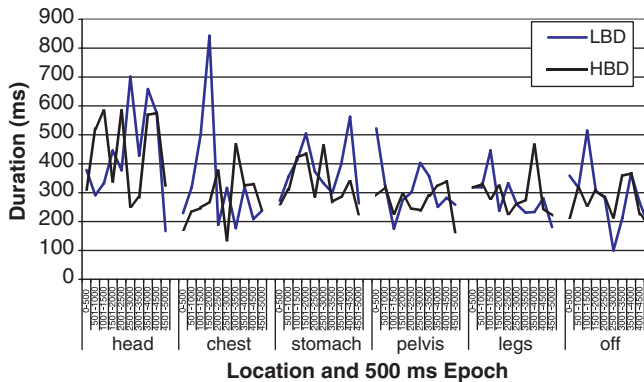


Figure 3. The time course of attentional allocation as indexed by mean gaze duration to somatic locations of interest across the 5 s viewing period decomposed into 500 ms epochs. High body dissatisfied = HBD; low body dissatisfied = LBD.

function of dissatisfaction with specific body parts. Trait BD with specific body parts was assessed and then eye movements were recorded in separate sessions while participants viewed pictures of themselves and an aesthetic ideal model. In addition to general search characteristics, we sought to determine the time course of attentional allocation by recording initial gaze to different body locations, as well as how gaze behaviour varied across half second time periods.

Results revealed that LBD individuals viewed all somatic regions of themselves longer than did the HBD group. Also, though first fixation tendencies were largely similar between the two groups, the HBD group demonstrated a greater propensity to fixate initially on to the lower body; more specifically, the pelvis, as compared to the LBD group. Group differences were also noticed as a function of somatic region and viewing period. The chest and leg locations were predominantly fixated *late* in the viewing period for the HBD individuals, but *earlier* (along with the off region) for the LBD subjects. Also, with the exception of the final 500 ms, the LBD subjects preferentially fixated the stomach more so than the HBD subjects during later viewing periods. Collectively, the pattern of search characteristics was largely disparate for the low *versus* the highly dissatisfied groups as pertaining to which bodily locations were searched during the different time periods. Implications of these findings relative to previous empirical study and contemporary theory follow.

Using a slightly different design and assessing eye movements over an extended viewing period (30 s), Jansen et al. (2005) found that when viewing themselves, eating disorder symptomatic individuals fixated on the 'ugly parts' to a greater extent than self-identified 'beautiful parts'. The findings were reversed when viewing others. The body parts typically deemed ugly by their participants were similar to those that were found to be highly dissatisfying in our sample; particularly the lower body (Cash, Morrow, Hrabosky, & Perry, 2004; Stanford & McCabe, 2002). Like Jansen et al. (2005), significant group differences in gaze behaviour were noticed when viewing the model and self slides. However, in the present study, the greatest disparity in search patterns was noticed in gaze duration to the head and the legs when viewing the model. The HBD group preferentially fixated these regions longer than the LBD group, while the pattern was reversed for the chest and stomach locations. Moreover, the pattern of search characteristics indicates that

those with greater dissatisfaction generally avoided looking at all areas of themselves (HBD = 1900.31 ms, LBD = 2204.39 ms).

One possible explanation for the disparity of our findings compared to Jansen et al. (2005) is that the longer search period they used permits (and may encourage) self-examination, while a brief viewing period such as that used in the current study, mandates a rapid search of the visual display to gather visual input from all possible locations. Jansen et al.'s (2005) findings are consistent with those of Gardner and colleagues (1990, 1991), who found that as eating and weight disordered individuals performed a size estimation task, they looked more to regions typical of dissatisfaction. Freeman et al. (1991) reported similar findings in a study in which subjects wore a black leotard. Arguably, however, both the size estimation task and viewing oneself in novel attire (a leotard) encourage self-examination and evaluation, thereby drawing attention to the figure in a qualitatively different fashion than the natural selective attention shifts that can be assumed to underlie the search strategies noticed herein.

Evaluating viewing tendencies during early and late viewing periods permitted a detailed analysis of attentional capture and maintenance by somatic regions of self and other physiques. The attentional maintenance noticed among HBD individuals at the latter time periods suggests that HBD individuals may have difficulty disengaging attention from somatic locations (particularly those that were most dissatisfying) once fixated upon. Although these results are inconsistent with our hypothesis (albeit tentatively offered given no previous evidence with eating disorder symptomatic individuals), similar findings have also been noticed among highly anxious subjects in alternative visual search tasks (Fox, Russo, Bowles, & Dutton, 2001; Fox, Russo, & Dutton, 2002), with highly anxious participants being unable to disengage from negative or threat cues relative to low anxious counterparts. The issue of initial attentional capture (early attentional bias) *versus* an inability to disengage attention from negatively valenced cues remains an important area of inquiry for researchers interested in affective and related disorders.

Theoretical implications

Research supports the postulate that social comparison plays a critical role in the development and maintenance of body-image disturbance (Cattarin, Thompson, Thomas, & Williams, 2000; Stormer & Thompson, 1996). Consistent with previous research, BD may moderate social comparison effects (Heinberg & Thompson, 1995; Irving, 2001). When people compare themselves to others who are superior on a dimension (i.e., make an upward comparison) they report increases in negative affect and decreases in self-esteem. In contrast, comparisons with others who are inferior to oneself (i.e., downward comparisons) are associated with increases in self-esteem and positive affect (Major, Testa, & Bylsman, 1991). Individuals with high dissatisfaction maybe more apt to make upward social comparisons than individuals with low dissatisfaction. For the typical well-adjusted individual, avoidance of negative social comparisons provides an ego-protective function, such that threats to self-esteem and negative affective experiences are circumvented. However, the eye tracking patterns noticed herein suggest that individuals with higher levels of BD maintain a preoccupation with stimuli (initial preoccupation with the pelvis and later attentional allocation to the legs of the model) that provoke physique-related dissatisfaction. This postulate is theoretically consistent with the wealth of data (in various forms and divergently interpreted) emerging from studies of attentional biases among individuals with clinical and subclinical anxiety disorders (Bar-Haim, Pergamin,

Bakermans-Kraneburg, & IJzendoorn, in press; Mogg & Bradley, 1998; Matthews & Wells, 1999; Wells & Matthews, 1994, 1996; Williams, Watts, Macleod, & Mathews, 1997).

Our findings are also consistent with the maladaptive tendencies noticed among individuals who have eating body image related disorders. For example, Drobles et al. (2001) found that the psychophysiological and subjective responses of individuals with binge eating tendencies were significantly different from normal eaters when presented with slides containing food content. More specifically, they found that food deprived and binge eater groups showed greater potentiation of the acoustic startle probe (indicative of appetitive response) when viewing food cues, and rated food stimuli as more pleasant than did normal restrained eaters and control participants. As such, Drobles et al. (2001) concluded that these 'subclinical groups interact in unique ways with the relevant environmental cues' (p. 174). Corroborating this assessment, the current results also suggest distinctive responsiveness to environmental cues among individuals with body image problems, in this case being manifested in how they search the environment and obtain information concerning relevant and irrelevant cues.

Future research efforts that involve a more exhaustive assessment of subjective, behavioural, and physiological measures of emotional reactivity and attention should prove useful in delineating the mechanisms that precipitate and then perpetuate BD. Subjectively, a more comprehensive assessment of self-reported affective processing during slide viewing could be obtained by using the state version of the PASTAS and assessing the degree to which attentional characteristics such as those recorded herein vary as a function of state specific affective appraisals of body parts rather than the trait measures of interest in the current project. Additionally, physiological assessment tools such as the acoustic startle probe could be used to assess the valence characteristics of experienced emotion, while viewing physique related material, thereby permitting a more direct evaluation of congruity between reported and objectively acquired affective experiences. Similarly, recording cortical event-related potentials to startle probes would permit more direct assessment of attentional allocation, while viewing content of this nature. Creative empirical approaches might include manipulation of viewed content and elicitation of startle probes based on gaze coordinates (such that a probe could be elicited while one is viewing the head or chest region as opposed to other regions, like the legs or pelvis). In designing such experiments, a finer understanding of the specific content that (a) is visually fixated upon, (b) is attended to, and (c) motivates affective reactions, could be achieved.

Conclusion

In conclusion, continued assessment of attentional biases among eating disordered and body image dissatisfied individuals is critical to the establishment of empirically grounded treatments that are tailored to the experiences of individuals with these problems. As Faunce (2002) recently asserted, 'This area has immense clinical importance, in that selective attention may be one way in which eating disorder symptomatology is maintained' (p. 136). Empirical efforts have indicated that altering patterns of attentional bias through focused intervention can alleviate emotional reactivity when confronted with stressful stimuli and circumstances (e.g., Mathews, Mogg, Kentish, & Eysenck 1995). The mechanisms underlying attentional biases among individuals with clinical and subclinical eating disorder symptoms should continue to be a focal point of scientific inquiry, while researchers and clinicians alike are encouraged to explore the efficacy of

treatments (e.g., exercise; cf., Hausenblas & Fallon, 2006) focused on alleviating the negative consequences of these maladaptive biases.

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Note

1. The combined probability of attending to the six regions of interest is 1.0, thereby violating the assumption of independence among the levels of the independent variables. Though a recognised assumption of ANOVA designs, the analysis remains robust to moderate violations of this assumption. Despite its robustness, the critical value for significance testing in the probability analysis was adjusted to $p < 0.025$ so as to reduce the likelihood of a Type 1 error.

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