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Attentional bias to social-evaluative threat in body image dissatisfaction

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Summary of the Major Research Project

Section A aims to investigate whether an attentional bias to social-evaluative threat, theorised to maintain general social anxiety, is also found in individuals with social anxiety about their appearance. The paper presents a systematised review of experimental studies examining attentional biases to social threat across the body image literature. The review included 12 studies examining clinical and non-clinical populations with eating and weight concerns. While findings were mixed, there was some overall evidence of vigilance towards social rejection and avoidance of social acceptance. It is proposed that clinical interventions may benefit from addressing biased processing of social threat, however, future research with different methodologies and within other areas of body image should be conducted.

Section B presents an experimental study examining attentional biases to social-evaluative threat in individuals with a diagnosis of Body Dysmorphic Disorder (BDD). The study implemented the face-in-the-crowd paradigm, which required individuals to find the emotionally incongruent face in a group of faces. Faster detection of an angry face signified a bias towards social rejection. Individuals with a diagnosis of BDD (n=20) were compared to healthy controls (n=20). The study found that both groups had an attentional bias to angry faces, but contrary to predictions, individuals with BDD were no more prone to display this bias than controls. The study did not find evidence for the attentional bias hypothesis, although conclusions were drawn with caution due to methodological limitations. Clinical and research implications are presented.

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Section A

Section Title:

Attentional bias to social-evaluative threat in individuals
with body image dissatisfaction: A review of experimental studies

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Abstract

Background and aims. Theoretical models of social anxiety have proposed that a central mechanism for the maintenance of social anxiety is selective attention to social-evaluative threat. While individuals with body image disturbance experience a heightened degree of social anxiety, as well as fear of being negatively evaluated about their appearance, there is little research devoted to understanding what maintains these interpersonal stressors. This paper reviewed experimental studies investigating selective attention to social threat across the body image literature, with the aim of identifying whether this is a factor involved in the maintenance of body image difficulties.

Methods. A systematic search strategy elicited 12 eligible studies for review. Findings were qualitatively synthesised.

Synthesis and discussion. The identified papers focused predominantly on clinical and non-clinical levels of disordered eating and weight concerns. The review found mixed evidence for selective attention. This may be linked to methodological limitations and differences in the severity and age of the samples recruited. Overall, there was some support for an attentional bias towards socially rejecting cues amongst women with disordered eating and men with muscularity dissatisfaction. There was also evidence of avoidance of positive and accepting emotions. An examination of attentional shifts between early and later stages of processing was inconclusive. Inconsistencies in findings and methodological limitations mean that further empirical testing is required. Potential implications for theoretical models of eating disorders and clinical interventions are discussed.

Key words: Attentional bias; Body image; Eating disorders; Social appearance anxiety; Social anxiety

Introduction

Social anxiety and body image

A consistent link has been reported between social anxiety and a more negative body image. Studies have shown that social anxiety is the most prevalent type of anxiety amongst individuals with eating disorders (Swinbourne et al. 2012), with prevalence ranging from 16%-88% in 'Anorexia Nervosa' (AN) and 17%-68% in 'Bulimia Nervosa' (BN) (Swinbourne & Touyz, 2007). In comparison, the lifetime prevalence of social anxiety in the general population is around 12% (Ruscio et al., 2008). This association has also been found in non-clinical populations with disordered eating (Ciarra & Mathew, 2017). Indeed, a core feature of eating disorders is a constant concern with how the physical self is viewed by others, leading to a persistent strive for approval through controlling size and shape (Striegel-Moore, Silberstein, & Rodin, 1993).

Similarly, it has been reported that between 12%-69% of individuals with a diagnosis of body dysmorphic disorder (BDD) are also socially anxious (Fang & Hofmann, 2010). Social anxiety has been shown to be a prominent feature of BDD, with a high proportion of sufferers experiencing a marked fear of negative evaluation of their appearance by others, aside from self-evaluative appearance concerns (Anson, Veale, & deSilva, 2012). Consequently, they avoid social situations in which their appearance may be subject to scrutiny (Hollander & Aronowitz, 1999). Alternatively, they may endure such situations with great distress and use of safety behaviours such as excessive grooming or camouflaging (Veale, 2004). They may also experience ideas of reference, often believing that others take special notice of, talk about or mock their 'flaw' (Phillips, McElroy, Keck, Pope, & Hudson, 1993).

However, there are different types of social fears. People with body image difficulties may experience a more general form of social anxiety that is unrelated to their appearance and social anxiety that results from their appearance concerns. A more general form of social anxiety involves a high Fear of Negative Evaluation (FNE, Watson & Friend, 1969), referring to the fear that one's *self* will be negatively evaluated. Social Appearance Anxiety (SAA), refers to the fear that one's *appearance* will be negatively evaluated (Hart et al., 2008). An accumulation of correlational studies have shown that SAA is robustly related to symptoms of anorexia and bulimia (Levinson & Rodebaugh, 2012, 2015; Levinson et al., 2013; Dakanalis et al., 2016) and BDD (Anson et al., 2012). A related concept is Appearance-Based Rejection Sensitivity (ABRS), referring to anxious expectations about being rejected based on one's appearance (Park, 2007). As individuals high in ABRS associate physical flaws with rejection, they are more likely to avoid social situations that highlight their appearance (Park & Pinkus, 2009) and support appearance-altering behaviors, such as disordered eating (Park, 2007) and cosmetic surgery (Calogero, Park, Young, & DiRaddo 2010). They are also more likely to experience BDD (Park et al., 2010) and dysfunctional investment in appearance (Cash, Theriault, & Annis, 2004). While general social anxiety and SAA are related, they are different concepts. Individuals who are solely concerned with SAA are not considered to have additional FNE/social anxiety. These concepts are often not separated in the literature, but here they will be examined separately. While SAA has emerged as a significant construct which straddles both the fields of body image and social anxiety, with clear associated psychological distress and difficulties with social functioning, little is understood about what maintains it.

Cognitive models of body image disturbance

As indicated, difficulties such as eating disorders and BDD, are not only associated with body image disturbance, but also interpersonal sensitivity. Despite the emerging evidence on the centrality of interpersonal factors, cognitive models have not comprehensively integrated these. A brief overview of models that have conceptualised interpersonal aspects will be offered.

The cognitive model of BDD developed by Veale and colleagues (Veale et al., 1996; Veale, 2004; Neziroglu, Khemlani-Patel, & Veale, 2008), draws on the social phobia model proposed by Clark and Wells (1995) and Clark (2001). It proposes that individuals with BDD experience themselves as ‘aesthetic objects’, involving excessive self-focused attention on a distorted internal image of how they appear to others and show reduced attention to external social cues. In addition to distorted beliefs about the importance of appearance in terms of self-evaluation, BDD patients, in varying degrees, hold exaggerated beliefs about the importance of other’s evaluation of their appearance. These beliefs lead to frequent social anxiety relating to SAA/ABRS. Veale (2002a, 2002b) observed that for some BDD patients, their appearance preoccupations are almost entirely related to SAA, rather than internal aesthetic standards, whilst for others, the focus is on meeting an internal aesthetic ideal, with minimal concern for social acceptance. Depending on the degree of prominence of social-evaluative appearance concerns, they will show varying levels of safety behaviours and/or avoidance in social contexts.

In eating disorders, Interpersonal theory and Emotion Regulation theory have linked social anxiety and disordered eating. According to Emotion Regulation theory (e.g., Fairburn, Cooper, & Shafran, 2003; Stice, Nemeroff, & Shaw, 1996) disordered eating represents an

unhelpful response employed to reduce heightened emotions (Polivy & Herman, 1993). A heightened FNE may lead to heightened negative affect, whereby individuals use eating and weight restraint to reduce negative emotions. While restrictive eating may reduce negative emotions by allowing a sense of control, binge eating may temporarily numb emotions (Stice, 2002). Similarly, according to Interpersonal theory, disordered eating may be used as a coping mechanism for relational distress (Ansell, Grilo, & White, 2012). It has also been proposed that an individual's preoccupation with weight and shape reflects an underlying attempt to project a positive self-presentation and thus improve self-worth and social acceptance (Striegel-Moore et al., 1993).

While SAA has emerged as an important factor in the literature, little is understood about the psychological processes underpinning it. To prevent and treat body image-related difficulties, like SAA, it is important to examine the ways in which people experience these difficulties, perceive and process information in social contexts, and to consider how this affects their experience of social interactions (Cash & Pruzinsky, 2002). A key line of research in this vein has been pursued within the social anxiety literature, where selective attention to social-evaluative threat is considered a key maintenance factor. Given the suggested overlap between body image and social anxiety, it is considered beneficial to briefly describe how theoretical models of social anxiety have conceptualised selective processing of social information.

Information processing biases in social anxiety and body image

Selective attention is an essential feature of information processing, enabling organisms to allocate further processing resources to specific stimuli, selected from a vast amount of continuously available sensory information, to facilitate potential adaptive responses and

prepare for action (Allport, 1989). Cognitive models concede that selective attention to threat is a critical factor maintaining social phobia. However, there is some debate regarding the specific nature and direction of this bias. In particular, two predominant models make opposite predictions regarding vigilance towards or avoidance of threat. Clark and Wells (1995) and Clark (2001) suggest that upon entering a feared social situation, anxious individuals avoid attending to others in favour of self-focused attention. This might maintain anxiety, since negative expectations about others' reactions are not challenged. In contrast, Rapee and Heimberg (1997), and Heimberg, Brozovich, and Rapee (2010), argue that socially anxious individuals automatically allocate attention towards external indicators of negative evaluation and have difficulty disengaging their attention from these. This could maintain anxiety since the individual would perceive their environment as more threatening and it would increase the likelihood of detecting minor signals of negative feedback, inflating negative self-evaluations of social performance. A 'vigilance-avoidance' model has also been proposed, whereby initial automatic vigilance to negative information is rapidly followed by avoidance, as a strategic attempt to regulate the anxiety provoked through the initial registration of threat (Mogg, Bradley, Miles, & Dixon, 2004). These differences may relate to methodological issues which will be discussed subsequently. Despite discrepancies, all models propose that biased processing of threat leads to an overestimation of social risk, motivating avoidance and reliance on safety behaviours, consequently maintaining anxiety. Recent reviews have conceded that under conditions of social threat, individuals engage in initial vigilance followed by avoidance of threat (Mogg & Bradley, 2018; Chen & Clarke, 2017).

While selective attention to threat is considered a central maintenance mechanism in the social anxiety literature, it has received little attention in the body image literature. In body

image, research has identified attentional biases to food, weight, and appearance (e.g. Fang & Wilhelm, 2015; Brooks, Prince, Stahl, Campbell, & Treasure, 2011; Grocholewska, Kliemb, & Heinrichs, 2011). Social-evaluative biases have remained largely understudied.

Rationale for review

As demonstrated, socially anxious individuals have increased fear of negative evaluation, theorized to be maintained by selective attention to social-evaluative threat, amongst other factors. Similarly, people with body image disturbance have increased fear of appearance evaluation. However, little is known about what maintains this. Given the significant associations between social anxiety, body image disturbance, and SAA, and the common difficulties in social functioning experienced by socially anxious and appearance anxious groups, it seems plausible that those high in SAA might also display selective attention to social-evaluative threat.

Defining worries of SAA/ABRS include a fear that others will find one unattractive or will be rejecting because of one's appearance. However, little is known about what may lead one to feel that way or to maintain these worries. If these worries were indeed combined with a focused attention on negative social evaluation, it seems possible that the result would be an experience of heightened distress and social difficulties, as are known to occur in individuals with high SAA. Selectively attending to negative stimuli may increase one's perception of rejection and by potentially personalizing and linking such feedback to one's appearance, may increase and perpetuate body image disturbance. In turn, such selective attention may make individuals more prone to engage in behaviours to alter their appearance and may encourage social withdrawal. Comprehending the processes through which SAA operates can

illuminate the interpersonal factors maintaining these difficulties and inform interventions by targeting distorted perceptions of one's environment.

Aim and research questions

The review will appraise experimental studies of attention to social-evaluative threat across the body image literature. The focus will be on experimental designs as these can capture more automatic perceptual processes. Experiments using faces as stimuli will be examined, to provide a coherent methodological focus, and because faces are considered to be more ecologically valid social stimuli compared to words or social scenarios (Staugaard, 2010). Facial expressions of anger, contempt and dominance will be examined, as these are considered to signal social threat in the literature. Other emotions, such as sadness and fear do not express direct hostility (Marsh, Kozak, & Ambady, 2007). Expressions of happiness and acceptance will also be reviewed as they can denote social evaluation and may thus be perceived as threatening (Weeks et al., 2008). As research in this area is limited, both clinical and subclinical populations will be included. In addition, as gender differences have been reported, with men having a greater focus on muscle building than thinness, higher exercise rates and lower social reward dependence, harm avoidance and cooperativeness (Núñez-Navarro et al., 2012; Darcy & Lin, 2012), findings will be analysed separately for each gender. Finally, to comprehend whether processing biases are a more enduring feature or improve with recovery, currently affected and recovered individuals will be compared.

The systematic review will therefore investigate:

- (i) Whether individuals with body image concerns display selective attention towards social-evaluative threat, compared to individuals without such concerns.
- (ii) Whether attention to social-evaluative threat varies by gender, type of emotion displayed (rejecting versus accepting), type of body image concern, and stage of recovery.

Method

Literature search strategy

The databases MEDLINE, PsycINFO, and Web of Science were searched from inception to November 2018. Further searches were conducted on Google Scholar and through hand-searching reference lists. Search terms are indicated in Table 1. The criteria applied to identify suitable articles are detailed in Tables 2 and 3.

Table 1: Search terms used

<p><i>attention* OR emotion* regulat* OR emotion* processing OR threat* OR ang* OR disgust* OR rejecti* OR rank OR compassion* OR accept* OR bias*</i></p> <p>AND</p> <p><i>appearance OR body image OR anorexi* OR bulimi* OR binge eating OR eating OR body dysmorph* OR drive for thinness OR physique OR muscle dys* OR muscularity</i></p>

Table 2. Inclusion criteria

Inclusion Criteria
Published in a peer-reviewed journal in English.
Recruited participants on the basis of having clinical or non-clinical levels of body image concerns. Where analogue samples were used, they were divided into high and low groups based on predominance of body image concerns.
Experimental methodology.
Examined attention to socially evaluative emotions (e.g. anger, contempt, disgust, happiness).
Included a comparison group without body image concerns.
Experimental stimuli consisted of photographs of faces depicting socially evaluative emotions.
Sample consisted of only adults, or if participants under the age of 18 were included, these were only part of the sample.

Table 3. Exclusion criteria

Exclusion Criteria
The study examined attention to non-facial stimuli.
Sample consisted solely of participants under the age of 18. These were excluded as emotion processing is still developing during adolescence (Vink, Derks, Hoogendam, Hillegers, & Kahn, 2014).

The search process initially revealed 1188 articles. Articles were screened by title, then by abstract, and then by full text. Twelve articles met criteria and are included in the review.

Figure 1 depicts the selection process.

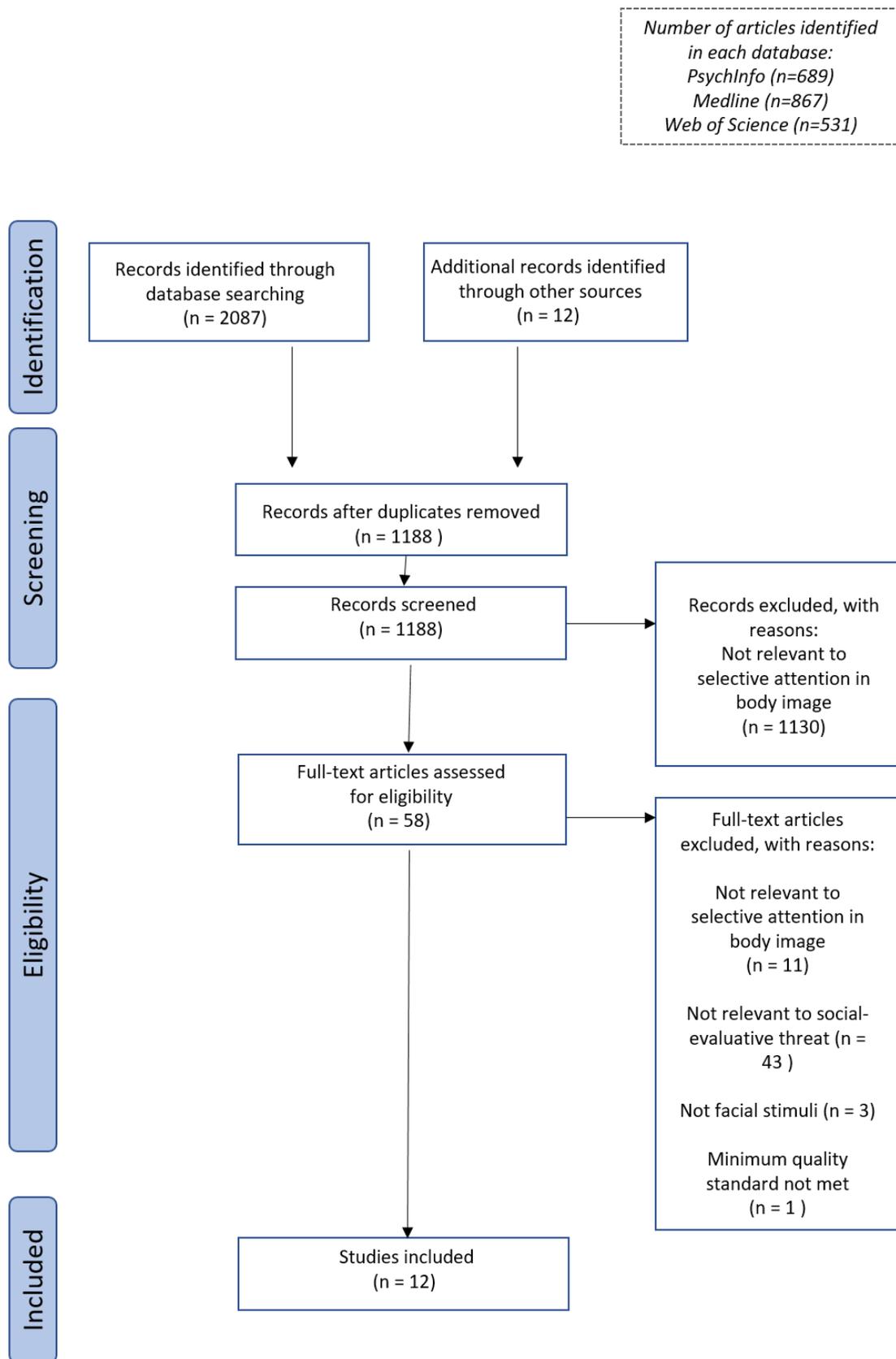


Figure 1: Adapted PRISMA flow diagram (Moher, Liberati, Tetzlaff, Altman, & Group, 2009) depicting the process of literature selection.

Quality appraisal

The quality of the studies was assessed against the Standard Quality Assessment Criteria for Primary Research (Kmet, Lee, & Cook, 2004, Appendix A). This tool was selected as it applies to different methodologies, including the quazi-experimental designs reviewed, it has been validated (Kmet et al., 2004) and it has been commonly used in systematic reviews (e.g. Ashford et al., 2016; Shaw et al., 2009). An overall quality rating was derived, with a possible range of 0-2. In line with the literature (Ghannouchi et al., 2016) quality scores can be interpreted as follows: a score of at least 80% indicates a strong quality study, a score of 60-79% indicates good quality and scores of 50-59% indicate adequate quality. All studies included were found to have percentage scores ranging between 68%-91% indicating at least good methodological quality.

To increase the reliability of the quality assurance process, a second assessor rated quality independently. The intraclass correlation between the assessors was 0.88 suggesting a high degree of inter-rater reliability. Full appraisal information for each paper can be found in Appendix B. Table 4 provides a summary of included papers.

Table 4. Summary of reviewed studies

STUDY	PARTICIPANTS	RELEVANT MEASURES	MAIN FINDINGS	QUALITY RATING
<p>Cserjesi, Vermeulen, Lenard, & Luminet, (2011) (Belgium)</p>	<p>Sample size: 126</p> <p>Gender: women</p> <p>Age of ED group: 21.8 (3.4)</p> <p>Comparison groups: 33 AN, 30 OB and 63 HCs.</p> <p>Recruitment: inpatients at ED clinic. No information on where HCs were recruited from.</p>	<p>Attentional bias: Affective priming task This measures whether exposure to a happy, sad, angry, or neutral schematic facial expression prime, affects reaction times in subsequently categorising a positive or negative word. The principle is that when the affective valence of the prime is congruent to that of the target (positive–positive; negative–negative), a facilitation effect occurs, with faster and more accurate responses, compared to incongruent combinations (positive–negative; negative–positive) where the prime inhibits the subsequent target evaluation.</p> <p>Eating symptomatology: EDI</p> <p>Mood: BDI-II (depression) STAI (anxiety)</p> <p>IQ/Years of education: Years of education</p>	<p>-AN group was significantly more attentive to angry and sad faces (significant differences between inhibition and facilitation effect).</p> <p>-AN group was not attentive to positive expressions (a happy face prime did not influence reaction times for target words).</p> <p>-HCs were more attentive both to angry and happy faces.</p> <p>-OB were not attentive to angry and sad faces. They were more attentive to happy faces.</p>	<p>13/22 (59%)</p>

<p>Harrison, Sullivan, Tchanuria & Treasure (2010a)</p>	<p>Sample size: 190 Gender: female Age of ED group: AN 26.7 (9.82), BN 27.54 (8.82) Comparison groups: 100 with ED (50 AN, 50 BN) and 90 HCs Recruitment: ED group from ED services, university research volunteer database, university email, community posters. Control group from community advertisements, university email, personal contacts.</p>	<p>Attentional bias: Pictorial Emotional Stroop (neutral and angry faces paired with chairs) Eating symptomatology: EDE-Q Mood: DASS-21 (depression, anxiety, stress) OCI (obsessive-compulsive symptoms) DERS (emotion regulation) IQ/Years of education: NART Years of education</p>	<p>-Participants with EDs showed a significantly higher attentional bias to faces in general (both angry and neutral faces) compared to HCs. -Participants with EDs showed specific attentional biases to angry faces over neutral faces compared to HCs. -There were no significant differences between AN and BN. -Attentional bias to faces predicted emotion regulation difficulties.</p>	<p>20/22 (91%)</p>
<p>Harrison, Sullivan, Tchanturia, & Treasure (2010b)</p> <p>(UK)</p> <p>(ANacute and HC groups are the same as in Harrison et al. 2010a)</p>	<p>Sample size: 175 Gender: female Age of ED group: ANacute 26.7 (9.82), ANrecovered 29 (10.62) Comparison groups: 50 ANacute, 35 ANrecovered and 90 HCs Recruitment: ED group from ED services, university research volunteer database, university email, community posters. Control group from university email, community advertisement and personal contacts.</p>	<p>Attentional bias: Pictorial Emotional Stroop (neutral and angry faces paired with chairs) Eating symptomatology: EDE EDE-Q Mood: DASS-21 (depression, anxiety, stress) OCI (obsessive-compulsive symptoms) DERS (emotion regulation) IQ/Years of education: NART</p>	<p>-Both the ANacute and ANrecovered had a significantly higher attentional bias for social (all faces) and social-threat (angry faces) stimuli than HCs. -No significant differences between the ANacute and ANrecovered groups for social and social-threat attentional bias scores. -Attentional biases not significantly associated with depression, anxiety and stress. -Findings remained as reported after depression and anxiety were entered as covariates.</p>	<p>19/22 (86%)</p>

<p>Sharpe Wallis, & Ridout (2015)</p> <p>(UK)</p>	<p>Sample size: 35</p> <p>Gender: female</p> <p>Age of ED group: 21.17 (2.15)</p> <p>Comparison groups: From sample of 52 volunteers, included the highest (n=18) and lowest (n=17) scorers on the EDI</p> <p>Recruitment: non-clinical volunteer sample</p>	<p>Attentional bias: Eye-tracking (24 pairs of neutral-happy or neutral-angry faces)</p> <p>Eating symptomatology: EDI</p> <p>Mood: BDI-II (depression) STAI (anxiety)</p>	<p>-No initial orientation or longer fixations towards angry faces.</p> <p>-High ED group showed attention away from emotional faces during later processing.</p> <p>-High ED group had longer fixations on neutral expressions.</p>	<p>19/22 (86%)</p>
<p>Cardi et al. (2015)</p> <p>(UK)</p>	<p>Sample size: 138</p> <p>Gender: female</p> <p>Age of ED group: AN 28.2 (10); BN 23.4 (5.7)</p> <p>Comparison groups: 65 ED (49AN and 16 BN) and 73 HCs.</p> <p>Recruitment: ED group from university research volunteer database, inpatient units, university email, advertisements at eating disorder website. Control group from community advertisements, university email, personal contacts.</p>	<p>Attentional bias: Dot-Probe task (happy-neutral or sad-neutral)</p> <p>Eating symptomatology: EDE-Q</p> <p>Mood: DASS-21 (depression, anxiety, stress) OSS (social support)</p> <p>Diagnostic screening: SCID-I</p> <p>IQ/Years of education: Years of education</p>	<p>-No significant differences between HC and ED groups.</p> <p>-There was a trend for participants with EDs to have a stronger attentional disengagement from happy faces compared to HCs.</p> <p>-There was also a trend for participants with EDs to have an attentional bias towards sad expressions, whereas HCs disengaged from sad faces.</p> <p>-No differences between AN and BN.</p>	<p>18/22 (82%)</p>

<p>Schneider et al. (2016) (USA)</p>	<p>Sample size: 197 Gender: 97% females Age of ED sample: 26.9 (7.5) Comparison groups: 50 OCD, 30 AN, 43 SAD, and 74 HC Recruitment: Via media notices and referrals from health professionals</p>	<p>Attentional bias: Dot-Probe task (angry-neutral or neutral-neutral) 500ms Eating symptomatology: EDE-Q Mood: LSAS (social anxiety) Y-BOCS (OCD) QIDS (depression) STAI-Trait (anxiety) IQ/Years of education: NAART</p>	<p>-No significant differences in attentional bias between each diagnostic group and the control group. -Attentional bias was not significantly correlated with measures of social anxiety, OCD, depression, anxiety or eating symptomatology.</p>	<p>19/22 (86%)</p>
<p>Cardi, DiMatteo, Cornfield, & Treasure (2012) (UK)</p>	<p>Sample size: 118 Gender: female Age of ED group: 27.3 (10.2) Comparison groups: 46 with current EDs (29 AN, 17 BN), 22 recovered from EDs (13 AN, 9 BN) and 50 HCs Recruitment: ED group from university research volunteer database, university email, advertisements at BEAT website. Control group from community advertisements, university email, personal contacts.</p>	<p>Attentional bias: Dot-probe task (rejecting-neutral or accepting-neutral) 500ms and 1250ms presentations Eating symptomatology: EDE-Q Mood: DASS-21 (depression, anxiety, stress) PBI (Parental Bonding Instrument) CECA (Childhood Experience of Care and Abuse Questionnaire) Pre-morbid IQ: NART Years of education</p>	<p>-ED group showed both an attentional bias towards rejecting faces (at 500ms), and subsequent problems in disengaging their attention from rejecting faces (at 1250ms). They also avoided accepting faces (at 500 and 1250ms) -HCs showed a sustained attentional bias towards accepting faces (at 500 and 1250 ms) and a sustained avoidance of rejecting faces (at 500 and 1250 ms). -EDcurrent and EDrecovered had similar pattern but EDrecovered did not have significant differences from HCs. -No significant differences between AN and BN. -Attentional bias to rejection correlated with anxiety and ‘early adverse experiences’. Early adversity predicted vigilance to rejection.</p>	<p>20/22 (91%)</p>

<p>Goddard and Treasure (2013)</p> <p>(UK)</p>	<p>Sample size: 342</p> <p>Gender: female</p> <p>Age of ED group: 21.8 (5.5)</p> <p>Comparison groups: 65 ED (47 AN; 6 BN; 12 EDNOS) and 52 HC</p> <p>Recruitment: For ED group from ED volunteer database, ED clinics, and posters. Control group from advertisements and emails to university students and snowball sampling.</p>	<p>Attentional bias: Emotional Stroop task (angry-neutral)</p> <p>Eating symptomatology: EDE-Q</p> <p>Mood: DASS-21 (depression, anxiety, stress) STAI (anxiety) LSAS (social anxiety)</p> <p>Pre-morbid IQ: NART Years of education</p>	<p>-ED group did not differ from HC group in their response to social and social-threat stimuli.</p> <p>-No difference when only AN were analysed.</p> <p>-Stroop interference for social-threat stimuli was positively correlated with trait anxiety in ED group.</p> <p>-There was a trend for ED participants on medication (N=27, who had more severe ED history) to have larger interference for social-threat stimuli than nonmedicated ED sample.</p>	<p>20/22 (91%)</p>
<p>Goddard, Carral-Fernandez, Denny, Campbell, & Treasure (2013)</p> <p>(UK)</p>	<p>Sample size:</p> <p>Gender: male</p> <p>Age of ED group: 26.2 (8.2)</p> <p>Comparison groups: 29 with ED (14 AN, 2 BN, 13 EDNOS) and 42 healthy controls</p> <p>Recruitment: ED group from ED services, university research volunteer database. Control group from university advertisements and emails.</p>	<p>Attentional bias: Pictorial Emotional Stroop (neutral and angry faces paired with chairs)</p> <p>Eating symptomatology: EDE-Q</p> <p>Mood: DASS-21 (depression, anxiety, stress) OCI (obsessive-compulsive symptoms) DERS (emotion regulation) FMPS (Perfectionism) CHIRP (Childhood Retrospective Perfectionism Questionnaire)</p> <p>IQ/Years of education: NART</p>	<p>-No significant attentional bias towards social or social threat stimuli in ED group.</p> <p>-Main analyses were re-run including only those who had a diagnosis of AN or those with EDNOS AN and underweight (n=19) but there were no differences in results.</p> <p>-Within the ED group, there were no differences between groups with or without medication indicating that this did not have a confounding effect.</p>	<p>19/22 (86%)</p>

<p>Kanakam, Krug, Raoult, Collier & Treasure (2013)</p> <p>(UK)</p>	<p>Sample size: 112 Gender: female Age of ED group: 38.72 Comparison groups: 50 ED (AN=24; BN=26) (63% were recovered) and 42 HCs Recruitment: Twins registered in the St Thomas UK twin registry who responded to newsletter advertisement and for ED service.</p>	<p>Attentional bias: Pictorial Emotional Stroop (neutral and angry faces paired with chairs) Eating symptomatology: EATATE lifetime diagnostic interview Mood: DASS-21 (depression, anxiety, stress) DERS (emotion regulation) IQ/Years of education: NART</p>	<p>- ED group had greater attentional bias to social stimuli at trend level. - ED group had a significantly greater AB to social threat in comparison to controls. -In the ED group, a greater social attentional bias was positively associated with the duration of bingeing and number of years having been overweight. Also, a social threat attentional bias was associated with longer duration of vomiting and duration of laxative/diuretic use.</p>	<p>17/22 (77%)</p>
<p>Cardi, DiMatteo, Gilbert, & Treasure (2014)</p> <p>(UK)</p>	<p>Sample size: 118 Gender: female Age of ED group: 27.3 (10.2) Comparison groups: 46 with current ED (29 AN, 17 BN), 22 recovered from ED and 50 HCs Recruitment: University eating disorder volunteer database; eating disorder website; Control group by email to university staff and students.</p>	<p>Attentional bias: Dot-Probe task (Social rank stimuli- a neutral face paired with either a dominant or with a submissive face) 500 ms Eating symptomatology: EDE-Q Mood: DASS-21 (depression, anxiety, stress) PFQ-2 (Personal Feelings Questionnaire) OAS (Other as Shamer Scale) SCS (Social Comparison Scale) SBS (Submissive Behavior Scale) Implicit Association Test Diagnostic screening: SCID-I IQ/Years of education: Years of education</p>	<p>EDcurrent group - EDcurrent showed significantly higher vigilance toward rank-related stimuli compared to HCs. -Attentional bias to social rank significantly correlated with unfavourable social comparisons, severity of mood difficulties (DASS) but not eating symptomatology (EDE). -EDcurrent had higher levels of submissive behaviours, external shame, unfavorable social comparisons, and internalized shame than HCs. EDrecovered group - EDrecovered had an intermediate profile between the EDcurrent and HCs. They had a non-significant higher vigilance towards rank-related stimuli compared to the HCs. -EDrecovered also had significantly higher external shame and submissive</p>	<p>20/22 (91%)</p>

			behaviours than HCs.	
			Healthy Controls -HCs showed attentional disengagement from rank-related stimuli and vigilance toward neutral faces.	
Griffiths, Angus, Murray & Touyz (2013) (Australia)	Sample size: 132 Gender: male Age of disordered eating sample: M=18.58; SD=1.37 Comparison groups: one sample Recruitment: undergraduate psychology students	Attentional bias: Dot-probe task; neutral, rejecting, accepting faces Eating symptomatology: EDE-Q Muscularity and body fat dissatisfaction: MBAS	-Participants with higher muscularity dissatisfaction had a stronger attentional bias for rejecting faces. Attentional bias to rejecting faces was a significant unique predictor of muscularity dissatisfaction. -No link between disordered eating and attentional bias.	19/22 (86%)

Key: ED (eating disorder); HC (Healthy control); AN (anorexia nervosa); BN (bulimia nervosa), EDNOS (eating disorder not otherwise specified); OB (obese); BDI-II(Beck depression inventory-II); EDI (Eating Disorder Inventory); STAI (State-trait anxiety inventory); EDE-Q (Eating disorder examination questionnaire); DASS-21 (Depression anxiety scales); OSS (Oslo social support); OCI (The Obsessive Compulsive Inventory Revised); DERS (Difficulties in emotion regulation Scale); NART (National Adult Reading Test); YBOCS (Yale-Brown Obsessive Compulsive Scale); QIDS (Quick Inventory of Depressive Symptomatology); PBI (Parental Bonding Instrument); CECA (Childhood Experience of Care and Abuse Questionnaire); FMPS (Frost Multidimensional Perfectionism Scale); CHIRP (Childhood Retrospective Perfectionism Questionnaire); PFQ-2 (Personal Feelings Questionnaire); OAS (Other as Shamer Scale); SCS (Social Comparison Scale); SBS (Submissive Behaviour Scale); LSAS (Liebowitz Social Anxiety Scale); MBAS (Male Body Attitudes Scale)

Results

Design

All studies employed experimental designs, which, compared to questionnaire-based studies, enable the observation of more automatic processes, reducing self-report bias. All used a 'healthy control' (HC) group, which helps decipher the role of body image on attention. One study (Cserjesi et al., 2011) did not compare the control and body image groups and was thus given a lower rating. Despite the use of experimental designs, methodological flaws and confounding variables make it difficult to establish causality.

Sample

While the aim was to review studies examining a variety of body image difficulties, ten studies recruited individuals with eating disorders, predominantly AN, and two focused on eating/weight concerns in non-clinical samples. Only one study examined muscularity as an additional area. All studies were conducted in western high-income countries. In addition, there was an underrepresentation of non-White participants, making it difficult to decipher if results generalize to non-White and non-Western populations. Eight studies recruited participants from London clinics and universities, suggesting a bias towards a particular demographic. In addition, volunteers may differ from the general population in terms of distress, agreeableness and interpersonal factors. Two studies recruited men. Mean participant age across studies was early to mid-20's and although eating disorders are most prevalent in females aged 15-40 (Rosenvinge & Göttestam, 2002), findings may not generalise to other ages. Studies had medium to large sample sizes. However, from the studies with the smallest samples, two studies did not report on power (Schneider et al. 2016; Cserjesi et al. 2011), another could only detect large effect sizes (Sharpe et al., 2016) and another only medium effects (Goddart et al., 2013). These studies received a lower rating.

Confounders

A strength of all studies is that they checked for pre-existing group differences. However, one (Cardi et al., 2015) reported that HCs had more years of education but did not control for this, obtaining a lower rating. As some studies recruited from mental health services, it is likely that any interventions received could potentially affect emotional processing. Only Schneier et al. (2016) recruited medication-free participants and only three studies controlled for medication (Cardi et al., 2012; Goddard & Treasure, 2013; Goddard et al., 2013). While medication was not found to have an effect when controlled for, it may still be a confounding variable in other studies, thus studies that considered it were given a higher rating.

Measures

All studies used validated measures and had clearly defined inclusion criteria. The pictorial stimuli used were sourced from validated databases. However, the use of self-report questionnaires increases the risk of bias. To measure attention, four methodologies were used: six studies used the pictorial Stroop task, four the dot-probe task, one a priming task, and one eye-tracking.

The Pictorial Stroop task involves the presentation of a social stimulus (a picture with either an emotional or a neutral expression) paired with a non-social stimulus (e.g. chair). Each picture is framed in a different colour and participants are required to name the colour as quickly as possible. Longer colour-naming latencies are assumed to indicate an attentional bias to that picture, due to the increased resources devoted to process it.

The dot-Probe task involves the presentation of a pair of two facial pictures (e.g. an angry face paired with a neutral face or a neutral face pair). A probe (e.g. dot) appears in the

location of one of the pictures, and participants have to press a key corresponding to the probe as quickly as possible. A quicker response is hypothesized to imply an attentional bias to the picture that was previously in that location.

While the Stroop and dot-probe tasks are the two most widely used measures of attentional bias, there have been some questions regarding their reliability and validity. Regarding the Stroop task, it has been suggested that colour-naming interference may not necessarily reflect increased attention to stimulus content. This is because it is difficult to differentiate the influence of attentional factors from other processes, such as distraction due to emotional arousal. It also cannot differentiate between different attentional processes (e.g. orientation, maintenance, avoidance) (Staugaard, 2010).

Regarding the dot-probe task, the paradigm has been criticised for giving an indirect measure of attention, with biases being inferred from manual reaction times. It has often produced inconsistent results, potentially due to providing a 'snapshot' of attention at specific points in time, and is thus affected by different stimulus presentations (Bradley, Mogg, & Millar, 2000). Presentation durations of 500ms have generally been used to capture initial attention orientation. However, 500ms may be long enough to allow shifts in attention (Rayer, 1998). Therefore, the task does not disentangle whether there is attention towards or away from threat. Overall, relying on reaction-time data alone in determining attentional bias may be unreliable.

Eye-tracking is considered a more direct and ecologically valid method that is more sensitive to attentional shifts (Chen & Clarke, 2017). However, it has been argued that attention can shift in the absence of explicit eye movements, and reaction-time tasks may be capturing such

shifts (Staugaard, 2010). Nevertheless, eye tracking is viewed as the most valid measure and the study that employed this was given the highest methodology score (Sharpe et al., 2016). dot-probe and Pictorial Stroop methodologies were given the same rating.

Analysis

Only Goddard et al. (2013), Goddard and Treasure (2013) and Harrison et al. (2010a, 2010b) commented on whether their data was normally distributed. If data did not meet normality assumptions but parametric tests were used, this increases the likelihood of Type 2 errors.

Rejecting emotions: female participants

Overall, there was mixed evidence regarding selective attention to social rejection. Six out of eight studies found evidence for selective processing. Four of these were of strong quality and two of good quality (Cserjesi et al., 2011; Kanakam et al., 2013). The two studies finding no supporting evidence were of strong quality.

Using a large sample of 100 women with EDs and 90 HCs, Harrison et al. (2010a) implemented the Stroop task, where photographs of either angry or neutral faces, were paired with chairs. They found that the ED group took significantly longer to colour-name social-threat (angry) and social (angry and neutral) photographs, compared to the control group, indicating attentional bias. They also found that an attentional bias to faces independently predicted emotion regulation difficulties and with depression, accounted for 22% of the variance in emotion regulation.

Using the same Stroop task, Kanakam et al. (2013) found that individuals with EDs had a significantly greater attentional bias to anger and a trend towards faces in general, in

comparison to HCs. Greater attentional bias was associated with a longer duration of vomiting and bingeing, laxative/diuretic use and years being overweight. It should be noted that the ED sample included both currently affected and recovered individuals which may have reduced the effect. These two studies indicate that when presented with the option of diverting attention to non-social stimuli, anxious individuals choose to process faces in general rather than avoid them, potentially to decipher social information at early stages of processing.

Cserjesi et al. (2011) compared women with AN, obese individuals and HCs, using an 'Affective Priming' task. They presented a prime consisting of a happy, neutral, sad or angry schematic face, followed by a positive or negative word that needed to be categorized. If the emotional valence of the prime facilitated or inhibited the word categorization, that was an indication of attentional bias to that emotion. The AN group displayed significant facilitation and inhibition for angry but not happy primes, indicating an attentional bias to anger, while the HC group showed an attentional bias for both happy and angry primes. However, as they did not compare the AN and HC groups, it is not known if between-group differences are significant. In addition, schematic faces may have lower ecological validity (Staugaard, 2010). Therefore, this study has been rated as lower quality as it is difficult to draw conclusions from it.

Cardi et al. (2014) used the dot-probe task, to examine attention to social rank, pairing a neutral face with either a dominant or submissive face. Women with EDs showed an attentional bias towards social rank, whereas HCs showed attentional disengagement from social rank and a bias towards neutral faces. Findings from self-report measures also showed higher levels of submissive behaviours, unfavourable social comparisons, external and

internalized shame. An attentional bias to social rank significantly correlated with internalized shame and unfavourable social comparisons. These findings may provide evidence for a greater tendency of people with EDs to perceive others according to power relationships. Unfortunately, the authors did not report whether there were differences in vigilance towards dominant and submissive stimuli.

Cardi et al. (2012) administered the dot-probe with rejecting-neutral or accepting-neutral pairs. They had two stimulus presentation times, displaying photographs for either 500ms or 1250ms, to decipher how participants orient their attention in early and later stages of processing. The ED group showed both a significant early attentional bias towards rejecting faces (500ms) and difficulty disengaging attention from them (1250ms). In contrast, HCs showed a sustained attentional bias towards accepting faces and a sustained disengagement from rejecting faces. They also found that biased attention towards rejection was associated with anxiety and early adverse experiences involving separation from parents, isolation from peers and sexual abuse. In contrast, an attentional bias for acceptance was correlated negatively with anxiety and stress and was not predicted by 'early adversity'. There may therefore be an association between adverse childhood experiences and an attentional bias to rejection. A strength of this study is that they studied attention over two stimulus durations, which to an extent addresses the limitation of the dot-probe design in being unable to disentangle early from later processing. However, the 'early' 500ms presentation may still have allowed participants to shift their attention.

Sharpe et al. (2016) used the strongest-rated methodology of eye-tracking, to study an analogue sample with high and low levels of disordered eating. Participants viewed a series of happy-neutral or angry-neutral faces, while their attention was monitored by an eye-

tracker. They found no differences in initial orientation or fixations, but in terms of later processing they found that the ‘high’ group looked away from emotional faces. Unfortunately, they did not report if there was a difference between the type of emotion they disengaged from. In contrast to the previously reviewed studies that found an initial orientation to rejection, this study found no evidence for such a bias at early stages of processing. In terms of later processing, the emotional avoidance found in this study is contrary to Cardi et al. (2012), who found sustained attention to rejection. Unfortunately, Sharpe et al. do not specify their time frame for ‘later’ processing and thus it is not known if avoidance occurred after the 1250ms used in Cardi et al. Discrepancies with the previous studies could relate to differences between clinical-level difficulties and the analogue sample recruited here. In addition, as the small sample size of 35 participants only enabled the detection of large effect sizes, it is possible that smaller effects were undetected.

Overall, the above studies found evidence for selective processing of social threat. However, there are discrepancies when examining early and later processing. Regarding early processing, five of these found an attentional bias towards rejection and one found no effect. From the two studies that investigated later processing, one found sustained vigilance towards rejection and the other found emotional avoidance. This raises the question of whether there is a bias towards or away from faces and at what stage of processing any attentional shift occurs, which cannot be addressed by these studies due to methodological limitations and sample differences.

Two high-quality studies found no evidence of biased processing. Schneider et al. (2016) compared AN and HC groups on a dot-probe task with angry and neutral faces, finding no significant differences. As they also found no bias in their social anxiety group, contrary to

many studies depicting an effect, this could indicate methodological or sample differences. Although recruitment details are not provided, it is stated that unmedicated individuals were recruited through media notices and professional referrals. This may have led to a self-selecting sample with less severe presentations, in contrast to the clinical samples of the previous studies recruited from specialist eating disorder services. They also had a comparatively smaller AN sample ($n=30$) and did not report on power, which may have led to Type 2 errors.

Goddard and Treasure (2013) used the same Stroop task and recruited from the same sources as Harrison et al. (2010a) but found no evidence of biased processing, apart from a correlation between Stroop interference for anger, anxiety and eating pathology. One reason for the discrepancy could be that participants in the Goddard and Treasure study were younger: 21 vs. 27 years in Harrison et al. (2010), Cardi et al. (2012), Cardi et al. (2014) and 39 years in Kanakam et al. (2013). They also had a shorter eating disorder duration (4 years vs. 9-10 years). In addition, EDE scores, indicating eating severity, were lower than in Harrison et al. (2010). In support of a link between attentional bias and severity/chronicity, there was a trend for medicated participants, with potentially more severe presentations and a longer ED history, to have a greater bias for anger than nonmedicated participants ($p=.081$, large effect size). This might indicate that more sensitive measurements are needed for younger individuals. It is possible that the non-significant results of Sharpe et al. could have been due to having a non-clinical sample. Similarly, the exclusively medication-free sample of Schneider et al. may have had less severe difficulties. However, it is also possible that if medication represses anxiety, a stronger attentional bias should be expected in non-medicated individuals. In summary, the evidence for an attentional bias towards rejection in women with EDs is mixed.

Rejecting emotions: male participants

Two high quality studies recruited men. Goddard et al. (2013) employed the Stroop task to compare men with EDs and HCs. They found no significant effect for social or social threat stimuli. It should be noted that their sample of 29 men with EDs enabled detection of medium effect sizes, with smaller differences being undetected. Griffiths et al. (2013) divided undergraduate men into high and low body satisfaction and disordered eating groups. They used a dot-probe task depicting accepting-neutral or rejecting-neutral faces. They also found no effect for disordered eating. However, they found that men with high muscularity dissatisfaction had a significantly greater attentional bias towards rejecting faces.

These differences may be related to the fact that Goddard et al. used the EDE scale which has poor reliability and validity in men, and conceptualised body dissatisfaction as a unitary construct. Griffiths et al. on the other hand, used the MBAS measure, developed for men, and carried out separate analyses for muscularity and body fat. As they found a significant bias only in muscularity but not body fat-concerned individuals, it might be that different processes drive each element in men. Although it is difficult to draw conclusions based on two studies, it is possible that young men with weight/body fat concerns do not display biased processing, but that men with muscularity dissatisfaction scan their environment for rejecting faces. In addition, as one study used a clinical and the other an analogue sample, results may not be comparable.

Accepting emotions: female participants

Three out of four studies investigating social approval found evidence of selective attention. Cserjesi et al. (2011) found that for participants with AN, happy faces did not prime attention, indicating that they had difficulties in being attentive to positive expressions. In contrast, HCs

were attentive to happy faces. However, the poor ecological validity of schematic faces limits conclusions. In a strong quality study, Cardi et al. (2012) found that the ED group had a sustained attentional disengagement from accepting faces, whereas HCs showed a sustained attentional bias towards accepting faces. Evidence of avoidance of positive faces was also found by Sharpe et al. (2016) who found no initial biases in the processing of happy, angry or neutral faces, but at later stages of strategic processing, their high eating symptomatology group looked away from happy faces and spent longer looking at neutral faces. In contrast, the low ED group had a sustained attentional bias towards happy faces. As this study used an analogue sample, results may not be comparable.

In a strong quality study, Cardi et al. (2015) administered the dot-probe task using happy, sad and neutral faces. They found no significant differences between ED and HC groups. However, there was a trend for the ED group to have a stronger attentional disengagement from happy faces compared to HCs (at 500ms). In addition, participants with EDs had a bias towards sad faces, indicating that they did not avoid all emotions, whereas HCs disengaged from sad stimuli. Overall, there is some indication of avoidance of positive emotions.

Accepting emotions: male participants

Only one study investigated accepting emotions in men. Griffiths et al. (2013), using a dot-probe task with accepting faces, found no significant effects. Again, results may not generalize between clinical and non-clinical groups.

Different types of body image difficulties

As only a narrow range of difficulties were examined, it is not possible to compare selective processing across different areas of concern. Four studies compared participants with a

diagnosis of AN to those with BN, with only one finding differences. Participants with other types of EDs were few, thus no separate analyses were run.

In the study with the largest number of participants with each diagnosis, Harrison et al. (2010a) compared 50 participants with AN and 50 with BN and found no between-group differences. Cardi et al. (2012) found no significant differences between her subsample of 29 women with AN and 17 women with BN. Similarly, Cardi et al. (2015) found no differences when comparing 49 participants with AN and 16 with BN. However, as they do not report on power for subgroup analyses, Type 2 errors are possible. As their non-AN subsamples were too small to run comparisons, Goddard et al. (2013) and Goddard and Treasure (2013) re-run their analyses only for the AN groups and for underweight EDNOS participants, and found no differences to their previous findings, potentially indicating similarity in attentional processes.

The only study that reported differences is by Kanakam et al. (2013). They compared their subsamples of 24 individuals with AN and 26 with BN, and found that the BN subgroup had a more pronounced attentional bias towards anger. However, as they do not report on power or significance levels, it is not possible to draw conclusions. Thus, there is no strong evidence for differences in attention between participants with AN and BN.

Currently affected and recovered individuals

Three studies examined individuals recovered from eating disorders. Harrison et al. (2010b), compared women currently affected to women recovered from AN. Both groups had a significantly higher attentional bias for social and social-threat stimuli compared to HCs, with no significant differences between currently affected and recovered participants.

The other two studies found a similar pattern of attentional bias, with the recovered group displaying biased attention towards threat, however this was not significantly different to HCs. Specifically, Cardi et al. (2014) found that their sample of recovered women showed an increased vigilance towards rank-related stimuli, although differences were not significant compared to HCs, placing them at an intermediate position between acute and never affected individuals. The recovered group was also similar to the acute group in having significantly higher external shame and submissive behaviours compared to HCs. Similarly, Cardi et al. (2012) found a non-significant sustained bias for rejection and sustained avoidance of acceptance in their recovered group, who displayed an intermediate profile between acute AN and HC groups. These non-significant findings may relate to the sample size, as Harrison et al. recruited twice as many participants (50 vs 22). These high-quality studies provide some support for the presence of attentional biases in recovered individuals, although it is not clear if they are ameliorated compared to those currently affected.

Discussion

This review of experimental studies investigating attentional biases to social-evaluative threat in the body image literature, elicited 12 primary-research studies, predominantly investigating disordered eating. Overall, there is some evidence for an attentional bias towards rejection and avoidance of acceptance, however the evidence is mixed.

Regarding attentional biases in the early stages of processing amongst women, five out of eight studies found an early attentional bias towards rejection or social-rank. Three studies found no evidence of an early attentional orientation towards threat. The two studies that examined later strategic processing found evidence of bias but in opposite directions. One

found that women remained vigilant to rejection at later processing (Cardi et al. 2012), whereas the other (Sharpe et al., 2016) found that high eating disordered women turned away from anger. All four studies that investigated accepting emotions in women, found that women tended to avoid these, although the findings of one study did not reach statistical significance (Cardi et al., 2015). Regarding men, there was no evidence of bias in those with weight concerns but there was bias towards rejection in men with muscularity dissatisfaction. It should be noted that three studies that found no attentional orientation to threat (Sharpe et al., 2016; Schneider et al., 2016; Goddard et al., 2013) may have been underpowered to detect smaller effect sizes. Overall, there was no strong support for differences between women with AN and BN, although the BN samples were small. There was evidence that attentional biases persist in recovered individuals, although in a potentially ameliorated degree.

It is possible that a threat bias is more pronounced in older individuals with more severe difficulties, as the three studies that found no initial orientation to threat had younger and/or potentially less affected participants. In line with this, research has shown that adolescents have fewer set shifting inefficiencies than adults (e.g. Lang, Stahl, Espie, Treasure, & Tchanturia, 2014) and reviews of the social anxiety literature have indicated that attentional bias may depend on severity of social anxiety (Bantin, Stevens, Gerlach & Hermann, 2016). It is however difficult to know if these factors played a role as there were no comparisons based on these characteristics.

While the studies were generally of high quality, with only one (Cserjesi et al. 2011) scoring below the 75% conservative inclusion criterion set by Kmet et al (2004), methodological limitations and the small number of papers make it difficult to draw firm conclusions. As

discussed earlier, some concerns have been raised around the reliability and validity of the Stroop and dot-probe tasks which may have led to inconsistent findings. In addition, while all studies included a HC group, only two included a clinical control group which makes it difficult to decipher if the findings are a feature of a variety of emotional difficulties or linked to the difficulties investigated. In addition, as studies did not include another negative emotion, it is not possible to decipher if participants are biased towards negative emotions in general or socially threatening ones. It should also be noted that it is not possible to ascertain whether individuals with body image concerns attended to faces because of their emotional value, or physical characteristics such as thinness and attractiveness. As studies have shown that attention in individuals with body image concerns is affected by appearance comparisons (Jansen, Nederkoorn, & Mulkens, 2005), this could be a confounder. Another confounder is that none of the studies controlled for social anxiety and thus selective attention might be associated with FNE rather than SAA. In addition, despite the high occurrence of depression (e.g. Godart et al., 2007), anxiety (e.g. Kaye, Bulik, Thornton, Barbarich, & Masters, 2004) and alexithymia (e.g. Nowakowski, McFarlane & Cassin, 2013) within eating disorders, many of the studies failed to assess the impact of these. In light of these inconsistencies, it is clear that future studies should consider the relative contribution of these variables. Finally, because models of social anxiety suggest that information processing biases will be most active during social-evaluative situations (Clark, 2010; Rapee & Heimberg, 1997), the stimuli used in these studies may not have been able to induce a threatening social context, which may have led to the inconsistent results.

Theoretical implications

Overall, the majority of findings are broadly in keeping with the main theoretical models and previous research indicating a tendency for socially anxious individuals to selectively process

social threat. As discussed, there has been some debate as to the direction and nature of selective attention, particularly whether there is attention towards or away from threat. The findings of this review are generally in line with recent meta-analyses of reaction-time and importantly eye-tracking studies (Chen & Clarke, 2017; Mogg & Bradley, 2018; Armstrong & Olatunji, 2012; Bantin et al., 2016), supporting a complex information processing system. These reviews conclude that during a social-evaluative situation, anxious individuals may exhibit an initial orienting bias towards threat, by way of hypervigilant scanning of threatening information. Findings indicating that individuals with eating/muscularity difficulties show initial vigilance towards threat, are in line with these conclusions. In addition, the social bias found in some Stroop studies may indicate that under initial threat, there is a bias towards any social information, rather than preferential attention towards the non-social environment. There was also consensus amongst reviews that following initial vigilance, anxious individuals may seek to strategically avoid emotional stimuli. Such avoidance is likely employed as a safety-seeking strategy to reduce distress and regulate emotion, but may consequently hinder the opportunity for accurate reappraisals of one's environment. The two studies that looked at later strategic processing in the current review found opposing patterns, one finding perseverance of a threat bias and the other avoidance of emotions. Therefore, theoretical implications on later processing cannot be drawn.

The finding that women with disordered eating avoid positive emotions, is in line with contemporary theories of social anxiety proposing a bivalent fear of evaluation, that is, a fear of positive evaluation, in addition to the traditional fear of negative evaluation. This theory suggests that positive social regard may be aversively perceived by socially anxious individuals, as it may signify direct social comparison to others, which in turn, may cause the anxious individual to feel highly conspicuous and put them in greater danger of negative

social evaluation (Weeks & Howell, 2012). In their review, Chen and Clarke (2017) conclude that when positive social gestures are presented, socially anxious individuals may be less likely to orient towards them. This absence of a positivity bias may skew individuals' mental representation of themselves as seen in their social environment, which may in turn exacerbate negative beliefs and other symptoms of social anxiety. In addition, as the present review found evidence for vigilance towards rejection and avoidance of acceptance, different attentional pathways may guide reactions to positive and negative emotions. Fear of positive evaluation is not an aspect that is considered in models of body image and further investigation can reveal if it is a salient factor.

It should be noted that as none of the studies measured social anxiety, the review cannot disentangle whether these attentional biases are part of SAA, FNE or both. Further research that measures social anxiety and SAA separately can inform whether such information processing biases should be included in theoretical models of body image difficulties.

Clinical implications

Due to the small number of studies, inconsistent findings and methodological limitations it is difficult to draw firm clinical suggestions. Some preliminary clinical implications are drawn, although further research is needed to decipher their suitability. It should be noted that the following implications may mainly apply to women with eating concerns and potentially men with muscularity concerns. As other areas of body image were not investigated, wider implications cannot be drawn.

The review indicated some preliminary support that cognitive-behavioural models of eating disorders may need to integrate selective processing of social threat as a maintenance factor.

It could be proposed that when faced with a situation where one's self or physical appearance is under threat of negative evaluation, individuals with disordered eating may process their environment in a selective way. Particularly, they may show an initial vigilance towards social threat, with an attentional bias towards negative others. They may also attend to social cues in general, instead of turning their attention away into their non-social environment. Following this initial vigilance, it is not clear how they might proceed with processing their environment, but there is some indication of strategic processing with either continued vigilance towards rejection or avoidance of emotional others. In addition, they may find positive reactions threatening and avoid them.

These attentional biases, in combination with other emotional processing difficulties, may lead to the persistence of eating disorder symptoms as a maladaptive way of managing interpersonal distress. An attentional bias towards threat may result in detecting threat more frequently and together with potential difficulties in recognizing emotions in others (Oldershaw, Treasure, Hambrook, Tchanturia & Schmidt, 2011), may result in perceiving and remembering social events as more threatening than they actually were, contributing to greater anxiety. A negative memory bias might then increase the likelihood of biased attention toward threat as the person moves into the future. These difficulties, compounded by poor emotion regulation characterized by avoidance and suppression of emotions (Lavender et al., 2015), may lead to reliance on the eating disorder to cope. Eating disorder behaviours may provide a perceived means for emotion regulation and a way to make the self more appealing to others.

Cognitive restructuring may need to focus on interpersonal factors relating to biased expectations that one will be rejected by others and enhance one's ability to attend to and

accept social reward, compassion and warmth. Psychoeducation about attentional biases can help individuals be mindful of overfocusing on rejection and seek a more balanced perception of others. Cognitive restructuring could focus on reducing oversensitivity to power and social rank within social relationships. Behavioural experiments could encourage patients to expose themselves to feared social situations while they maintain a balanced perception of others. Interventions aiming to enhance interpersonal perception and communication, could incorporate work on accepting emotional information, particularly that which is perceived as threatening. In this way, promoting the use of more adaptive perception and emotion regulatory strategies may reduce the need for disordered eating as a way of regulating emotional experiences.

Attentional bias modification (ABM), used in social anxiety to promote disengagement from threat and to promote goal-directed attentional shifts to positive and compassionate others (Mogg, Waters, & Bradley, 2017), could be trialled in eating disorders. Another approach to improve emotional regulation and social engagement is to build a foundation of positive emotions. Positive psychology research has indicated that cultivating one's sense of gratitude and reorienting to the positive aspects of life, may aid the development of more functional positive schemas that may generalize to all aspects of experience, including body image (Wood, Froh, & Geraghty, 2010).

It should be noted however, that given the mixed findings, other factors aside from an attentional bias to threat may account for the increased anxiety in social situations. Factors such as appearance comparisons or other aspects theorised to maintain social anxiety can indicate if these are stronger predictors of SAA and should therefore receive more clinical focus.

Research implications

As research has focused on eating and weight concerns, research on other areas of body image would be of benefit, such as non-clinical levels of appearance dissatisfaction or BDD. Understanding attentional processes in different areas of concern and levels of severity, can help uncover the different factors implicated in both the onset and maintenance of body image difficulties. Prospective longitudinal studies following the same cohort and studies with adolescent samples could help elucidate whether early responses to social-threat predict body image difficulties. Comparisons between non-clinical and clinical groups, might be useful in uncovering factors preceding more severe difficulties and could inform prevention.

It is proposed that further experimental studies could pair dot-probe with eye-tracking, at two time durations, shorter than 500ms and longer than 500ms, to increase the validity of capturing the initial attentional orientation and elucidate shifts between vigilance and avoidance. It is suggested that in addition to the dot-probe, it would be advantageous to employ eye-tracking, as a more direct, naturalistic and ecologically valid method. More naturalistic stimuli such as moving images or videos may enhance ecological validity. Another less used paradigm that has been argued to be more ecologically valid and less affected by shifts in attention (Staugaard, 2010), is ‘face-in-the-crowd’ (Hansen & Hansen, 1988), where participants are asked to identify the incongruent face in an array of faces. In addition, given the research supporting that selective attention may only be observed under conditions of social threat (e.g. Mansell, Clark, Ehlers, & Chen, 1999), future studies could offer a SAA-inducing scenario (e.g. that a photograph will be taken at the end of the experiment).

To minimize confounders, studies should aim to recruit individuals who have not received interventions and to assess and control for other psychological factors such as social anxiety and depression. It would also be advantageous if studies include an additional clinical group to allow comparisons with other areas of distress. Future research should also seek to work with more heterogeneous populations in terms of ethnicity, nationality, age, and gender identity. More research with men, using measures specifically developed for them, would be beneficial. Finally, research could seek to identify moderators of social anxiety-linked attentional bias. Specifically, it would be important to determine the conditions under which social anxiety-linked vigilance or avoidance emerge. For instance, a recent study found that avoidance of emotional stimuli is more likely when social anxiety co-occurs with an avoidant attachment style (Byrow, Broeren, deLissa, & Peters, 2016).

Limitations

As no known studies have systematically reviewed attention to social threat across the body image literature, the main strength of the current study lies in addressing this gap. However, as the studies identified focused on disordered eating, findings may not generalize to other difficulties, particularly as disordered eating involves other factors beyond body image such as emotional dysregulation (Lavender et al., 2015).

The use of tightly controlled laboratory experiments in place of more naturalistic research also presents a limitation. The social stimuli presented during experiments may have lacked relevance to the fear of social evaluation experienced in real life situations and attentional processes may be different to those observed in the lab. However, naturalistic research is also at risk of confounds which cannot be easily identified. For example, if attention is observed in a natural social interaction, the confounding factors (e.g. type of emotion, length of stimuli

presentation) would not be easily identified. In contrast, laboratory studies can control for these. Overall, the use of tightly controlled experimental procedures has clear advantages, yet the lack of generalisability to real-world situations should be taken into consideration when drawing conclusions from this review. It should also be noted that as the majority of studies did not investigate simultaneously attention and avoidance processes, the review has not been able to differentiate between different stages of processing. The included research was carried out in the Western hemisphere and included papers written in English, therefore conclusions may not generalise across different populations.

Conclusion

An attentional bias to social threat is considered a key maintenance factor for social anxiety. While there is a high rate of social anxiety and interpersonal difficulties in individuals with body image disturbance, there is little understanding of what maintains these in appearance-dissatisfied individuals. The review synthesized findings from 12 experimental studies, mainly focusing on disordered eating. Overall, the review found some support for the presence of an attentional bias to social rejection and avoidance of positive emotions. However, the evidence is mixed due to methodological limitations. A need for more research in a wider range of body image areas, implementing more ecologically valid methodologies was identified.

References

- Allport, D. A. (1989). Visual attention. In M. I. Posner (Ed.), *Foundations of cognitive science* (pp. 631–682). Cambridge: MIT Press.
- Ansell, E. B., Grilo, C. M., & White, M. A. (2012). Examining the interpersonal model of binge eating and loss of control over eating in women. *International Journal of Eating Disorders*, 45, 43-50. <https://doi.org/10.1002/eat.20897>
- Anson, M., Veale, D., & de Silva, P. (2012). Social-evaluative versus self-evaluative appearance concerns in Body Dysmorphic Disorder. *Behaviour Research and Therapy*, 50, 753-760. <https://doi.org/10.1016/j.brat.2012.09.003>
- Armstrong, T., & Olatunji, B. O. (2012). Eye tracking of attention in the affective disorders: A meta-analytic review and synthesis. *Clinical Psychology Review*, 32, 704-23. <https://doi.org/10.1016/j.cpr.2012.09.004>
- Ashford, M., Olander, E. K. & Ayers, S. (2016). Computer or web-based interventions for perinatal mental health: A systematic review. *Journal of Affective Disorders*, 197, 134-146. <https://doi.org/10.1016/j.jad.2016.02.057>
- Bantin, T., Stevens, S., Gerlach, A. L., & Hermann, C. (2016). What does the facial dot-probe task tell us about attentional processes in social anxiety? A systematic review. *Journal of Behavioural Therapy and Experimental Psychiatry*, 50, 40-51. <https://doi.org/10.1016/j.jbtep.2015.04.009>

- Bradley, B. P., Mogg, K., & Millar, N. H. (2000). Covert and overt orienting of attention to emotional faces in anxiety. *Cognition and Emotion*, 14, 789-808.
<https://doi.org/10.1080/02699930050156636>
- Brooks, S., Prince, A., Stahl, D., Campbell, I. C., & Treasure, J. (2011). A systematic review and meta-analysis of cognitive bias to food stimuli in people with disordered eating behaviour. *Clinical Psychology Review*, 31, 37-51. <https://doi.org/10.1080/02699930050156636>
- Byrow Y., Broeren S., de Lissa, P., & Peters L. (2016). Anxiety, attachment and attention: The influence of adult attachment style on attentional biases of anxious individuals. *Journal of Experimental Psychopathology*, 7, 110–28. <https://doi.org/10.5127/jep.046714>
- Calogero, R. M., Park, L. E., Rahemtulla, Z. R., & Williams, K. C. D. (2010). Predicting excessive body image concerns among British university students: The unique role of appearance-based rejection sensitivity. *Body Image*, 7, 78-81. <https://doi.org/10.1016/j.bodyim.2009.09.005>
- Cardi, V., Corfield, F., Leppanen, J., Rhind, C., Deriziotis, S., Hadjimichalis, A., ... & Treasure, J. (2015). Emotional processing, recognition, empathy and evoked facial expression in eating disorders: An experimental study to map deficits in social cognition. *PLoS One*, 10, e0133827. <https://doi.org/10.1371/journal.pone.0133827>
- Cardi, V., Di Matteo, R., Gilbert, P., & Treasure, J. (2014). Rank perception and

self-evaluation in eating disorders. *International Journal of Eating Disorders*, 47, 543-552. <https://doi.org/10.1002/eat.22261>.

Cardi, V., Matteo, R. D., Corfield, F., & Treasure, J. (2012). Social reward and rejection sensitivity in eating disorders: An investigation of attentional bias and early experiences. *The World Journal of Biological Psychiatry*, 14, 622-633. <https://doi.org/10.3109/15622975.2012.665479>.

Cash, T. F., Thériault, J., & Annis, M. (2004). Body image in an interpersonal context: Adult attachment, fear of intimacy and social anxiety. *Journal of Social and Clinical Psychology*, 23, 89-103. <https://doi.org/10.1521/jscp.23.1.89.26987>

Cash, T. F., & Pruzinsky, T. (2002). *Body image: A handbook of theory, research, and clinical practice*. New York: Guilford Press.

Ciarra, J. L., & Mathew, J. M. (2017). Social anxiety and disordered eating: The influence of stress reactivity and self-esteem. *Eating Behaviours*, 26, 177-181. <https://doi.org/10.1016/j.eatbeh.2017.03.011>

Chen, N. T., & Clarke, P. (2017). Gaze-based assessments of vigilance and avoidance in social anxiety: A review. *Current Psychiatry Reports*, 19, 59. <https://doi.org/10.1007/s11920-017-0808-4>

Clark, D. M. (2001). A cognitive perspective on social phobia. In W. R. Crozier & L. E.

Alden (Eds.), *International handbook of social anxiety: Concepts, research and interventions relating to the self and shyness* (pp. 405–430). Chichester: John Wiley & Sons.

Clark, D. M., & Wells, A. (1995). A Cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, F. R. Schneier, R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69-93). New York: Guilford Press.

Cserjési, R., Vermeulen, N., Lénárd, L., & Luminet, O. (2011). Reduced capacity in automatic processing of facial expression in restrictive anorexia nervosa and obesity. *Psychiatry Research*, 188, 253-257. <https://doi.org/10.1016/j.psychres.2010.12.008>

Dakanalis, A., Clerici, M., Caslini, M., Gaudio, S., Serino, S., Riva G., & Carrà, G. (2016). Predictors of initiation and persistence of recurrent binge eating and inappropriate weight compensatory behaviours in college men. *International Journal of Eating Disorders*, 49, 581-590. <http://doi.org/10.1016/j.ijchp.2016.05.002>

Darcy, A. M., & Lin, I. H.-J. (2012). Are we asking the right questions? A review of assessment of males with eating disorders. *Eating Disorders*, 20, 416–426. <https://doi.org/10.1080/10640266.2012.715521>

Fang, A., & Wilhelm, S. (2015). Clinical features, cognitive biases, and treatment of body dysmorphic disorder. *Annual Review of Clinical Psychology*, 11, 187-212. <https://doi.org/10.1146/annurev-clinpsy-032814-112849>

- Fang, A., & Hofmann, S. G. (2010). Relationship between social anxiety disorder and body dysmorphic disorder. *Clinical Psychology Review*, 30, 1040-1048. <https://doi.org/10.1016/j.cpr.2010.08.001>
- 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. [http://doi.org/10.1016/S0005-7967\(02\)00088-8](http://doi.org/10.1016/S0005-7967(02)00088-8)
- Ghannouchi, I., Speyer, R., Doma, K., Cordier, R., & Verin, E. (2016). Swallowing function and chronic respiratory diseases: Systematic review. *Respiratory Medicine*, 117, 54-64. <https://doi.org/10.1016/j.rmed.2016.05.024>
- Godart, N. T., Perdereau, F., Rein, Z. S., Berthoz, J., Wallier, P., Jeammet, M., & Flament, F. (2007). Comorbidity studies of eating disorders and mood disorders: Critical review of the literature. *Journal of Affective Disorders*, 97, 37-49. <https://doi.org/10.1016/j.jad.2006.06.023>
- Goddard, E., & Treasure, J. (2013). Anxiety and social-emotional processing in eating disorders: Examination of family trios. *Cognitive Therapy and Research*, 37, 890-904. <https://doi.org/10.1007/s10608-013-9535-2>
- Goddard, E., Carral-Fernández, L., Denny, E., Campbell, I. C., & Treasure, J. (2014). Cognitive flexibility, central coherence and social emotional processing in males with an eating disorder. *World Journal of Biological Psychiatry*, 15, 317-326. <https://doi.org/10.3109/15622975.2012.750014>

- Griffiths, S., Angus, D., Murray, S. B., & Touyz, S. (2014). Unique associations between young adult men's emotional functioning and their body dissatisfaction and disordered eating. *Body Image*, 11, 175-178. <https://doi.org/10.1016/j.bodyim.2013.12.002>
- Grochowski, A., Kliem, S., & Heinrichs, N. (2012). Selective attention to imagined facial ugliness is specific to body dysmorphic disorder. *Body Image*, 9, 261-269. <https://doi.org/10.1016/j.bodyim.2012.01.002>
- Hansen, C. H., & Hansen, R. D. (1988). Finding the face in the crowd: An anger superiority effect. *Journal of Personality and Social Psychology*, 54, 917-924. <https://doi.org/10.1037/0022-3514.54.6.917>
- Harrison, A., Sullivan, S., Tchanturia, K., & Treasure, J. (2010a). Emotional functioning in eating disorders: Attentional bias, emotion recognition and emotion regulation. *Psychological Medicine*, 40, 1887-1897. <https://doi.org/10.1017/S0033291710000036>
- Harrison, A., Tchanturia, K., & Treasure, J. (2010b). Attentional bias, emotion recognition, and emotion regulation in anorexia: State or trait? *Biological Psychiatry*, 68, 755-761. <https://doi.org/10.1016/j.biopsych.2010.04.03>
- Hart, T. A., Flora, D. B., Palyo, S. A., Fresco, D. M., Holle, C., & Heimberg, R. G. (2008). Development and examination of the social appearance anxiety scale. *Assessment*, 15, 48-59. <https://doi.org/10.1177/107319110730667>
- Heimberg, R. C., Brozovich, F. A., & Rapee, R. M. (2010). A cognitive behavioural model of

social anxiety disorder: Update and extension. In S. G. Hofmann & P. M. DiBartolo (Eds.), *Social anxiety: Clinical, developmental, and social perspectives* (pp. 395-422). San Diego, CA: Elsevier Academic Press.

Hollander, E., & Aronowitz, B. R. (1999). Comorbid social anxiety and body dysmorphic disorder: Managing the complicated patient. *Journal of Clinical Psychiatry*, 60, 27-31. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/10335677>

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. <https://doi.org/10.1016/j.brat.2004.01.003>

Kanakam, N., Krug, I., Raoult, C., Collier, D., & Treasure, J. (2013). Social and emotional processing as a behavioural endophenotype in eating disorders: A pilot investigation in twins. *European Eating Disorders Review*, 21, 294-307. <https://doi.org/10.1002/erv.2232>

Kaye, W. H., Bulik, C. M., Thornton, L., Barbarich, N., & Masters, K. (2004). Comorbidity of anxiety disorders with anorexia and bulimia nervosa. *American Journal of Psychiatry*, 161, 2215-2221. <https://doi.org/10.1176/appi.ajp.161.12.2215>

Kmet, L. M., Lee, R. C., & Cook, L. S. (2004). *Standard quality assessment criteria for evaluating primary research papers from a variety of fields*. Edmonton: Alberta Heritage Foundation for Medical Research. Retrieved from <http://www.biomedcentral.com/content/supplementary/1471-2393-14-52-s2.pdf>

- Lang, K., Stahl, D., Espie, J., Treasure, J., & Tchanturia, K. (2014). Set shifting in children and adolescents with anorexia nervosa: An exploratory systematic review and meta-analysis. *International Journal of Eating Disorders*, 47, 394-399. <https://doi.org/10.1002/eat.22235>
- Lavender, J. M., Wonderlich, S. A., Engel, S. G., Gordon, K. H., Kaye, W. H., & Mitchell, J. E. (2015). Dimensions of emotion dysregulation in anorexia nervosa and bulimia nervosa: A conceptual review of the empirical literature. *Clinical Psychology Review*, 40, 111-122. <https://doi.org/10.1016/j.cpr.2015.05.010>
- Levinson, C. A., & Rodebaugh, T. L. (2015). Negative social-evaluative fears produce social anxiety, food intake, and body dissatisfaction: evidence of similar mechanisms through different pathways. *Clinical Psychological Science*, 3, 744-757. <https://doi.org/10.1177/2167702614548891>
- Levinson, C. A., Rodebaugh, T. L., White, E. K., Menatti, A. R., Weeks, J. W., Iacovino, J. M., & Warren, C. S. (2013). Social appearance anxiety, perfectionism, and fear of negative evaluation: Distinct or shared risk factors for social anxiety and eating disorders? *Appetite*, 67, 125-33. <https://doi.org/10.1016/j.appet.2013.04.002>
- Levinson, C. A., & Rodebaugh, T. L. (2012). Social anxiety and eating disorder comorbidity: The role of negative social evaluation fears. *Eating Behaviours*, 13, 27-35. <https://doi.org/10.1016/j.eatbeh.2011.11.006>
- Liebowitz, D. A. Hope, & F. R. Schneier (Eds.). *Social phobia: Diagnosis, assessment, and*

treatment. New York: Guilford Press.

Mansell W., Clark, D., M., Ehlers, A. & Chen, Y.-P. (1999). Social anxiety and attention away from emotional faces. *Cognition and Emotion*, 13, 673-690. <https://doi.org/10.1080/026999399379032>

Marsh, A. A., Kozak, M. N., & Ambady, N. (2007). Accurate identification of fear facial expressions predicts prosocial behaviour. *Emotion*, 7, 239-251. <https://doi.org/10.1037/1528-3542.7.2.239>

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, 151, 264-269. Retrieved from: <https://annals.org/aim/fullarticle/744664/preferred-reporting-items-systematic-reviews-meta-analyses-prisma-statement>

Mogg, K., & Bradley, B. P. (2018). Anxiety and threat-related attention: Cognitive-motivational framework and treatment. *Trends in Cognitive Science*, 22, 225-240. <https://doi.org/10.1016/j.tics.2018.01.001>

Mogg, K., Waters, A. M., & Bradley, B. P. (2017). Attention bias modification (ABM): Review of effects of multisession ABM training on anxiety and threat-related attention in high-anxious individuals. *Clinical Psychological Science*, 5, 698–717. <https://doi.org/10.1177/2167702617696359>

- 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. <http://doi.org/10.1080/02699930341000158>
- Neziroglu, F., Khemlani-Patel, S., & Veale, D. (2008). Social learning theory and cognitive behavioural models of body dysmorphic disorder. *Body Image*, 5, 28-38. <https://doi.org/10.1016/j.bodyim.2008.01.002>
- Nowakowski, M. E., McFarlane T., & Cassin, S. (2013). Alexithymia and eating disorders: A critical review of the literature. *Journal of Eating Disorders*, 18, 1-21. <https://doi.org/10.1186/2050-2974-1-21>
- Núñez-Navarro, A., Agüera, Z., Krug, I., Jiménez-Murcia, S., Sánchez, I., Araguz, N...& Fernández-Aranda, F. (2012). Do men with eating disorders differ from women in clinics, psychopathology and personality? *European Eating Disorders Review*, 20, 23-31. <https://doi.org/10.1002/erv.1146>
- Oldershaw, A., Treasure, J., Hambrook, D., Tchanturia, K., & Schmidt, U. (2011). Is anorexia nervosa a version of autism spectrum disorders? *European Eating Disorders Review*, 19, 462-74. <https://doi.org/10.1002/erv.1069>
- Park, L. E., & Pinkus, R. T. (2009). Interpersonal effects of appearance-based rejection sensitivity. *Journal of Research in Personality*, 43, 602-612. <http://doi.org/10.1016/j.jrp.2009.02.003>

- Park, L. E. (2007). Appearance-based rejection sensitivity: Implications for mental and physical health, affect, and motivation. *Personality and Social Psychology Bulletin*, 33, 490-504. <https://doi.org/10.1177/0146167206296301>
- Phillips, K. A., McElroy, S. L., Keck Jr, P. E., Pope Jr, H. G., & Hudson, J. I. (1993). Body dysmorphic disorder: 30 cases of imagined ugliness. *The American Journal of Psychiatry*, 150, 302-308. <https://doi.org/10.1176/ajp.150.2.302>
- Polivy, J., & Herman, C. P. (1993). Etiology of binge eating: Psychological mechanisms. In C. G. Fairburn & G. T. Wilson (Eds.), *Binge eating: Nature, assessment, and treatment* (pp. 173-205). New York: Guilford Press.
- Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioural model of anxiety in social phobia. *Behaviour Research and Therapy*, 35, 741-756. [https://doi.org/10.1016/S0005-7967\(97\)00022-3](https://doi.org/10.1016/S0005-7967(97)00022-3)
- Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin*, 124, 372-422. <http://doi.org/10.1037/0033-2909.124.3.372>
- Ruscio, A. M., Brown, T. A., Chiu, W. T., Sareen, J., Stein, M. B., & Kessler, R. C. (2008). Social fears and social phobia in the USA: Results from the National Comorbidity Survey Replication. *Psychological Medicine*, 38, 15-28. <https://doi.org/10.1017/S0033291707001699>

- Schneier, F. R., Kimeldorf, M. B., Choo, T. H., Steinglass, J. E., Wall, M. M., Fyer, A. J., & Simpson, H. B. (2016). Attention bias in adults with anorexia nervosa, obsessive-compulsive disorder, and social anxiety disorder. *Journal of Psychiatric Research*, 79, 61-69. <https://doi.org/10.1016/j.jpsychires.2016.04.009>
- Sharpe, E., Wallis, D. J., & Ridout, N. (2016). The influence of variations in eating disorder-related symptoms on processing of emotional faces in a non-clinical female sample: An eye-tracking study. *Psychiatry Research*, 240, 321-327. <https://doi.org/10.1016/j.psychres.2016.04.065>
- Shaw, C., McNamara, R., Abrams, K., ...& Williams, K. (2009). Systematic review of respite care in the frail elderly. *Health Technology Assessment*, 13, 1-246. <https://doi.org/10.3310/hta13200>
- Staugaard, S. R. (2010). Threatening faces and social anxiety: A literature review. *Clinical Psychology Review*, 30, 669-690. <http://doi.org/10.1016/j.cpr.2010.05.001>
- Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin*, 128, 825. <http://doi.org/10.1037/0033-2909.128.5.825>
- Stice, E., Nemeroff, C., & Shaw, H. E. (1996). Test of the dual pathway model of bulimia nervosa: Evidence for dietary restraint and affect regulation mechanisms. *Journal of Social and Clinical Psychology*, 15, 340-363. <http://doi.org/10.1521/jscp.1996.15.3.340>

- Striegel-Moore, R. H., Silberstein, L. R., & Rodin, J. (1993). The social self in bulimia nervosa: Public self-consciousness, social anxiety, and perceived fraudulence. *Journal of Abnormal Psychology*, 102, 297-303. <http://doi.org/10.1037/0021-843X.102.2.297>
- Swinbourne, J., Hunt, C., Abbott, M., Russell, J., Clare, T., Touyz S. (2012). The comorbidity between eating disorders and anxiety disorders: Prevalence in an eating disorder sample and anxiety disorder sample. *Australian and New Zealand Journal of Psychiatry*, 46, 118-31. <https://doi.org/10.1177/0004867411432071>
- Swinbourne, J. M., Touyz, S. W. (2007). The co-morbidity of eating disorders and anxiety disorders: A review. *European Eating Disorder Review*, 15, 253-74. <https://doi.org/10.1002/erv.784>
- Veale, D. (2004). Advances in a cognitive behavioural model of body dysmorphic disorder. *Body Image*, 1, 113-125. [https://doi.org/10.1016/S1740-1445\(03\)00009-3](https://doi.org/10.1016/S1740-1445(03)00009-3)
- Veale, D., Gournay, K., Dryden, W., Boocock, A., Shah, F., Willson, R., & Walburn, J. (1996). Body dysmorphic disorder: A cognitive behavioural model and pilot randomised controlled trial. *Behaviour Research and Therapy*, 34, 717-729. [https://doi.org/10.1016/0005-7967\(96\)00025-3](https://doi.org/10.1016/0005-7967(96)00025-3)
- Veale, D. M., & Lambrou, C. (2002a) The importance of aesthetics in body dysmorphic disorder. *CNS Spectrums*, 7, 429–431. <http://doi.org/10.1037/a0022300>
- Veale, D., Ennis, M., & Lambrou, C. (2002b) Possible association of body dysmorphic

disorder with an occupation or education in art and design. *American Journal of Psychiatry*, 159, 1788–1790. <http://doi.org/10.1176/appi.ajp.159.10.1788>

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology*, 33, 448-457. <http://doi.org/10.1037/h0027806>

Weeks, J. W., & Howell, A. N. (2012). The bivalent fear of evaluation model of social anxiety: Further integrating findings on fears of positive and negative evaluation. *Cognitive Behavioural Research and Therapy*, 41, 83-95. <http://doi.org/10.1037/h0027806>

Weeks, J. W., Heimberg, R. G., Rodebaugh, T. L., & Norton, P. J. (2008). Exploring the relationship between fear of positive evaluation and social anxiety. *Journal of Anxiety Disorders*, 22, 386-400. <https://doi.org/10.1016/j.janxdis.2007.04.009>

Wood, A. M., Froh, J. J., & Geraghty, A. W. (2010). Gratitude and well-being: A review and theoretical integration. *Clinical Psychology Review*, 30, 890-905. <https://doi.org/10.1016/j.cpr.2010.03.005>

Section B

Section title:

**Attentional bias to social-evaluative threat in
Body Dysmorphic Disorder**

Word count: 7,998

**For submission to the journal of
Behaviour Research and Therapy**

Abstract

Introduction. An attentional bias to social-evaluative threat is considered a central factor involved in the maintenance of social anxiety. Given the high levels of general and appearance-related social anxiety in individuals with a diagnosis of Body Dysmorphic Disorder (BDD), the study aimed to examine whether an attentional bias to social-evaluative threat would also be observed in individuals with these difficulties. It was hypothesised that individuals with BDD would exhibit a stronger attentional bias to social threat than healthy controls.

Methods. 20 individuals (10 men) with a diagnosis of BDD and 20 individuals (8 men) without a mental health diagnosis took the 'face-in-the-crowd task'. This involved detecting an emotionally incongruent face in an array (crowd) of 12 faces. Faster detection of a threatening (angry) face in a crowd of happy or neutral faces, implied an attentional bias to threat. Slower reaction times in angry crowds implied that participants were devoting more attentional resources to processing threat.

Analysis. A number of 2 x 2 ANOVAS were conducted with Group (BDD vs. Control) as between-subject factors and Stimuli Type (threatening vs. non-threatening stimuli) as within-subject factors.

Results. Contrary to predictions, the study found that while both BDD and Control group participants displayed an attentional bias to threat, there were no significant between-group differences.

Discussion. The study did not find support for the attentional bias hypothesis. Clinical and research implications are presented.

Keywords

Attentional bias; Body dysmorphic disorder; Social appearance anxiety; Social anxiety

Introduction

Body dysmorphic disorder (BDD) is characterised by a significant preoccupation with a perceived or minor defect in one's appearance (American Psychiatric Association, 2013). Such preoccupations are commonly centred on the face, usually involving the skin, hair, or nose, although any part of the body can be of concern (Didie, Menard, Stern, & Phillips, 2008). People with these difficulties tend to engage in a number of repetitive behaviours, such as checking mirrors, excessive grooming, comparing to others, camouflaging, and reassurance-seeking. Veale (2004) proposed that one of the principal functions of these strategies is to avoid or minimise perceived scrutiny by others. People with a diagnosis of BDD have high levels of social avoidance and difficulties in academic and occupational functioning (Phillips, Menard, Fay, & Pagano, 2005). In severe cases, they can become housebound due to the fear of being seen (Phillips, McElroy, Keck, & Pope, 1993). High levels of lifetime suicidal ideation (78%) and suicide attempts (28%) have been reported, with 71% of those with a history of suicidal ideation attributing this primarily to BDD and nearly 50% of those attempting suicide attributing their attempt to BDD (Phillips, Coles, Menard, & Weisberg, 2005). Therefore, individuals with high levels of appearance dissatisfaction can experience serious and debilitating psychological and social difficulties.

Social anxiety, defined by Leary and Kowalski (1995) as anxiety due to worries about how one will be perceived by others, has been shown to be a prominent feature of BDD. Surveys have shown that between 12%-68.8% of individuals with a diagnosis of BDD also meet criteria for a diagnosis of social anxiety, making it the most prevalent type of anxiety experienced in BDD (Fang & Hofmann, 2010). However, it should be noted that there are different types of social fears. People with BDD may experience more general social anxiety that is unrelated to their appearance and social anxiety that results from their appearance.

This latter form of anxiety is referred to as Social Appearance Anxiety (SAA). In one of the few studies examining this in BDD, Coles et al. (2006), found that individuals with BDD may experience elevated social anxiety both independent of their appearance and associated to their appearance. Similarly, Anson, Veale and deSilva (2012) found that in addition to holding distorted beliefs about the importance of appearance in terms of self-evaluation, individuals with BDD, in varying degrees, attach elevated levels of importance to other people's evaluation of their appearance. A related concept is Appearance-Based Rejection Sensitivity (ABRS), referring to the tendency to anxiously expect, readily perceive, and overreact to signs of rejection based on one's appearance (Park, 2007). Kellie, Didie, and Phillips (2014) found elevated levels of both personal rejection sensitivity and ABRS in individuals with BDD, with ABRS being particularly elevated. Both types of rejection sensitivity were significantly associated with more severe BDD and depression, but ABRS contributed more unique variance to BDD severity than personal rejection sensitivity. Therefore, while SAA and ABRS are associated with general social anxiety and personal rejection sensitivity respectively, they are not the same constructs. Individuals with BDD who only experience SAA/ABRS are not considered to have social anxiety. In many studies, when they refer to social anxiety, they do not separate general social fears from appearance-related fears, but in this study, they will be examined separately.

Given that high fears of negative evaluation and rejection are experienced both in general social anxiety and in BDD (Fang & Hofmann, 2010), theoretical models of BDD have drawn from social anxiety models. One of the main cognitive models of BDD developed by Veale and colleagues (Veale et al., 1996; Veale, 2004; Neziroglu, Khemlani-Patel, & Veale, 2008) has drawn on the model of social phobia proposed by Clark and Wells (1995) and Clark (2001). This model proposes that when individuals with BDD perceive social situations as

threatening in terms of appearance evaluation, they show increased processing of the self as an 'aesthetic object', leading to intensified self-focused attention on a distorted internal image of how they appear to others, with reduced attention to external cues. Veale (2002a, 2002b) observed that the appearance preoccupations of some individuals with BDD appear to be almost entirely related to concerns about negative evaluation by others, whilst other individuals appear to be entirely focused on meeting an internal aesthetic ideal, with minimal concerns about social acceptance. Depending on the degree of prominence of SAA, they will show varying levels of safety behaviours and/or social avoidance in social contexts. Safety behaviours and avoidance are used to reduce the risk of scrutiny and are considered to be a major maintenance factor in appearance-related preoccupation, through mechanisms similar to those maintaining social phobia. While SAA has been shown to be an important feature of BDD, the available literature consists of prevalence studies and analogue samples, with no research exploring how SAA may be experienced and maintained.

Within the social anxiety literature, a large body of research has found that individuals with social phobia exhibit an attentional bias to social threat. Reviews have conceded that under conditions of threat, socially anxious individuals display an attentional bias towards social rejection at initial stages of processing, and strategic avoidance or difficulties disengaging attention from threat at later stages (Chen & Clarke, 2017; Mogg & Bradley, 2018; Bantini et al., 2016). Although social anxiety models (e.g. Rapee & Heimberg, 1997) highlight the importance of attentional biases to social threat in the maintenance of anxiety, to the author's knowledge, there are no studies exploring this in BDD.

A small number of studies have examined attention in BDD, but none of these have focused on social-evaluative threat. Bulhmann, McNally, Wilhelm and Florin (2002) found that

participants with BDD selectively attended to BDD-related words such as “attractive” or “ugly”. Two studies have investigated attention to faces in BDD, but these have been based on the premise that BDD participants selectively attend to faces due to appearance comparisons, rather than social fears. For example, eye tracking studies have found that participants with BDD selectively attend to the imagined defects in their own face, and to corresponding regions in other people’s faces (Grochowska, Kliemb, & Heinrichs, 2012; Greenberg, Reuman, Hartmann, Kasarskis, & Wilhelm, 2014).

Some studies have examined other types of information processing biases in relation to social threat. Buhlmann, McNally, Etcoff, Tuschen-Caffier & Wilhelm (2004) found that in comparison to controls and individuals with OCD, people with BDD displayed a negative interpretation bias in misidentifying emotional expressions as contemptuous and angry. Buhlmann, Etcoff, and Wilhelm (2006) presented participants with BDD and controls with two questionnaires accompanying facial photographs. One questionnaire included self-referent scenarios (“Imagine that the bank teller is looking at you. What is his facial expression like?”), whereas the other included other-referent scenarios (“Imagine that the bank teller is looking at a friend”), and participants were asked to identify the corresponding emotion. BDD participants misinterpreted more expressions as contemptuous and angry in self-referent scenarios, but not in other-referent scenarios. These studies suggest that individuals with BDD have a tendency to misinterpret others as more negative, particularly in relation to themselves, which may lead to increased anxiety in social situations.

If an attentional bias to social threat maintains anxiety in individuals with social phobia, and if individuals with BDD have high levels of appearance and non-appearance related social anxiety, then is it reasonable to expect that individuals with BDD may also display an attentional bias to social threat. An attentional bias towards rejecting others might lead to an

overestimation of negative reactions, and compounded by a tendency to misinterpret others as rejecting, could partly explain why individuals with BDD feel anxious and avoid social situations. A tendency to personalise such rejection might foster beliefs that others are repelled by one's ugliness and thus contribute to the maintenance of BDD. These biases could be linked to the poor insight and ideas of reference, common in BDD. It would thus be important to decipher if an attentional bias to social threat is also implicated in the maintenance of social appearance anxiety. In addition, while models of BDD highlight the importance of SAA and selective attention, there is limited experimental research testing these aspects. Examining attentional biases to threatening facial expressions might help us understand why BDD patients fear and avoid social situations, contributing to cognitive-behavioural models of BDD and the development of more effective interventions.

The current study therefore, sought to investigate whether there is an attentional bias to social-evaluative threat in BDD. These processes were examined experimentally to allow for the observation of direct processes, reducing social desirability. Facial stimuli were chosen as more ecologically valid social stimuli than words or social scenarios (Lundh & Ost, 1996). Attentional bias has been experimentally examined using the Stroop (Stroop, 1935), and dot-probe tasks (MacLeod, Mathews, & Tata, 1986). However, some concerns have been raised about the reliability and validity of these paradigms. The 'Face-in-the-crowd' paradigm (Hansen & Hansen, 1988), in contrast, has been proposed to be a more ecologically valid measure (Staugaard, 2010; Byrne & Eysenck, 1995). It invites participants to search crowds of emotional and neutral faces for the 'odd one out'. Gilboa-Schechtman, Foa and Amir (1999) used this to compare attention to threatening faces in individuals with social anxiety and controls. In a crowd of neutral or positive faces, faster detection of an angry face was thought to be consistent with vigilance for threat. Alternatively, slower detection of a positive

or neutral face in an angry crowd, was considered to show difficulties in disengaging attention from threat. They found that individuals with a diagnosis of social phobia had significantly quicker detection times for angry targets in neutral crowds, and were more slowed down by angry crowds, compared to controls. The present study replicated this, comparing individuals with a diagnosis of BDD with 'healthy controls'. Anger and disgust were used to signal social disapproval, as these emotions have been shown to have cross-cultural validity (Ekman, 1973).

Aims

1. To examine whether there would be a difference in selective attention to angry and happy or neutral targets in the BDD group compared to the control group.
2. To examine whether the BDD group would allocate more attentional resources to the processing of angry crowds, than to the processing of happy or neutral crowds.
3. To examine whether selective attention to negative expressions is limited to anger or extends to disgust.

Based on the literature outlined above, the study was designed to test the following hypotheses:

1. It was predicted that both groups would detect angry targets faster than non-threat targets (happy or neutral) but that the BDD group would have faster detection times, compared to the Control group. This is based on the attentional bias hypothesis. No specific hypotheses were made regarding whether detection times would be faster in comparison to neutral or happy targets.
2. It was predicted that the BDD group would be slower in responding to angry crowds than to neutral or happy ones, whereas this difference would be less pronounced for Controls.

This is based on the proposal that the BDD group would allocate more attentional resources to the processing of threatening crowds, than to the processing of happy or neutral crowds.

3. It was predicted that both groups would exhibit a stronger attentional bias to anger than to disgust, but that the BDD group would have faster detection times for anger, compared to the Control group. This is based on the theory that anger is more directly related to social harm and rejection than disgust (e.g. Trower & Gilbert, 1989).

Methods

Design

The study consisted of an independent samples quasi-experimental design. The independent variable was Group (BDD or Control). The dependent variable was Target Type (angry, disgust, happy, neutral) and consisted of the Mean Reaction Time (MRT) in seconds for correct responses (see Appendix C for outline of design).

Participants

BDD group:

Inclusion criteria for the BDD group were that participants: (a) had a primary diagnosis of BDD based on the DSM-5 (American Psychiatric Association, 2013); (b) scored over 20 on the BDD-YBOCS (Phillips, Hollander, Rasmussen, & Aronowitz, 1997) which was indicative of moderate to severe levels of BDD; (c) understood English; (d) were aged between 18-60. People outside this range were excluded due to emotion processing differences (Nashiro, Sakaki, Mather, 2012; Vink, Derks, Hoogendam, Hillegers, & Kahn, 2014). Participants were excluded if: (a) there was substance abuse or psychosis (screened through the MINI, Sheelan et al., 1998); (b) their primary concerns involved their weight.

The study included individuals with preoccupations relating to any body part and not just facial concerns, since the purpose was not to measure attention to faces on the basis of attractiveness (which might be affected by the individual's specific concern), but on the basis of their emotional valence. Participants receiving therapy were not excluded, as it was expected that the majority of participants would have undergone therapy.

A non-probabilistic purposive sampling method was used. Participants (30%) were recruited through a national service specializing in the treatment of anxiety. Clinicians identified eligible individuals and shared with them the participant information sheet (Appendix D). If they consented to be contacted, their details were passed to the researcher. Additionally, the trust registry of service users interested in research was used to identify participants (50%), by asking them to opt into the study (Appendix E). Participants were also recruited through BDD support groups organized by a third sector organization (20%).

Control group:

Control group participants were included if they could understand verbal explanations in English and had no current or previous mental health diagnosis (screened through the MINI) or body image disturbance (screened through the BDD-Q, Phillips, Atala & Pope, 1995). Control group participants were also excluded if they scored over the cut-off point of 20 on the SPIN (Connor et al., 2000), indicating social anxiety. The Control group as a whole was matched on age, gender, and years of education with the BDD group.

A non-probabilistic purposive sampling method was used. Students studying at a university in south England were invited to participate in exchange for a prize draw. Participants were also recruited through social media and personal contacts. Based on the study by Gilboa-

Schechtman et al. (2001), for a medium effect size of .3, a sample of 33 participants would be needed. *A priori* power calculations using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) were carried out for between and within factors comparisons. For repeated measures, between-factors ANOVA, based on a medium effect size of .3 for a power of .80 and an alpha of $p = .05$, a sample of 58 participants was required. For a large effect size of .4 for a power of .80 and an alpha of $p = .05$, a minimum sample of 34 was needed. For repeated measures, within-factors ANOVA, based on a medium effect size of .25 for a power of .80 and an alpha of $p = .05$, a sample of 24 was required. For a large effect size of .4 for a power of .80 and an alpha of $p = .05$, a sample of 12 was needed.

The final sample comprised of 20 individuals (10 men) with a diagnosis of BDD, and 20 Controls (8 men). The final Control group was formed following exclusion of 27 participants who scored over 20 on the SPIN and one who scored over the cut-off on the BDD-Q. Participant characteristics are displayed in Table 1. The BDD and Control groups did not differ significantly in terms of age, gender, years of education and estimated IQ, as tested through the TOPF (Psychological Corporation, 2009). The BDD group scored significantly higher than the Control group on anxiety, depression, fear of negative evaluation (FNE), social anxiety and SAA. BDD participants also experienced significantly lower levels of positive appearance evaluation and satisfaction, and higher levels of appearance orientation.

Participants with a diagnosis of BDD had a mean age of 31.4 (SD=6.68), ranging between 19-48 years. At the time of testing, 55% of participants were receiving therapy and 67% were taking medication. All participants had primarily facial/head-related concerns, although they listed some additional secondary bodily concerns. Participants listed between two and six main areas of concern (Table 2). In addition to primary concerns relating to BDD, 30% of

participants also met criteria for depression, 20% for social phobia, 20% for OCD and 15% for generalised anxiety. The mean age of onset of BDD was 14.4 years (SD=4.64), ranging from 9 to 30 years. Except for two participants with intermittent periods of recovery, all others had ongoing BDD concerns. Participants identified a number of triggers for their concerns (Table 3).

Table 1. Characteristics of participants and statistical tests of group differences

	BDD N (%) / Mean (SD)	Control N (%) / Mean (SD)	t/ χ^2
Age (years)	31.4 (6.68)	27.35 (7.99)	ns
Gender			ns
Male	10 (50%)	8 (40%)	
Female	10 (50%)	12 (60%)	
Ethnicity			
White	17	17	
Black	1	1	
Asian	1	2	
Other	1	0	
Years of education	14.5 (2.9)	14.6 (2.8)	ns
TOPF	109.67 (6.85)	111.91 (8.71)	ns
Current treatment			
None	3 (16%) ^a		
Medication	10 (67%) ^b		
Talking therapy or support groups	11 (55%)		
Number of therapy courses received			
0	1 (5%)		
1	3 (15%)		
2	4 (20%)		
3	4 (20%)		
4	3 (15%)		
5	3 (15%)		
10	2 (10%)		
Total number of sessions received			
0	1 (5%)		
6-20	4 (20%)		
20-40	6 (30%)		
40-60	6 (30%)		
60-100	3 (15%)		
MINI Depression	6 (30%)		
MINI Social Phobia	4 (20%)		
MINI OCD	4 (20%)		
MINI Generalised Anxiety	3 (15%)		
MINI Anorexia Nervosa	1 (5%)		
MINI Bipolar	1 (5%)		
BFNE	49.2 (8.1)	29.45 (8.99)	7.3***
SPIN	33.95 (16.77)	13.35(5.54)	5.22***
SAAS	66.13 (10.29)	26.21 (7.16)	10.74***
HADS Total	23.05 (7.91)	9.25 (4.73)	6.57***
HADS Depression	9.11 (4.68)	2.95 (2.26)	5.2***
HADS Anxiety	13.95 (4.06)	6.03 (3.23)	6.53***
MBSRQ-AS Appearance evaluation	1.97 (.72)	3.39 (.52)	-7.14***
MBSRQ-AS Appearance orientation	4.05 (.73)	3.26 (.74)	3.41**
MBSRQ-AS Body areas satisfaction	2.01 (.51)	3.56 (.55)	-9.22***
BDD-YBOCS Total	32.2 (6.31)		

**significant at $p \leq .01$

***significant at $p \leq .001$

^aData on medication was not available for one participant not receiving therapy.

^bData on medication was available for 15 out of 20 participants.

Table 2. Main areas of appearance concern amongst BDD group participants

Area of concern	N (%)
Skin	11 (55%)
Teeth	9 (45%)
Hair	8 (40%)
Nose	8 (40%)
Shape/ size/ proportion of face	5 (25%)
Lips/ mouth	4 (20%)
General sense of unattractiveness	4 (20%)
Chin	3 (15%)
Eyes	3 (15%)
Eye-brows	1 (5%)
Weight/ muscularity	10 (50%)
Arms/ hands/ legs/ feet	5 (25%)
Torso	5 (25%)
Body proportion	3 (15%)
Height	1 (5%)

Table 3. Aspects identified as triggering the onset of BDD

Trigger	N (%)
Criticism about appearance	8 (40%)
Comparisons/competitiveness with peers/family/media	5 (25%)
Accident incurring perceived or actual defect on appearance	5 (25%)
High aesthetic standards and perfectionism	3 (15%)
Being overweight	3 (15%)
Acne	2 (10%)
Sexual abuse	2 (10%)
Feeling unwanted or different to others	2 (10%)
Bereavement	1 (5%)
Cosmetic surgery	1 (5%)
Domestic violence	1 (5%)

Materials

Questionnaires administered to all participants:

Demographic questionnaire (Appendix F).

Test of Premorbid Functioning-UK Version (TOPF UK) (Psychological Corporation, 2009). The TOPF (Appendix G) requires participants to read aloud a list of 70 nonphonetic words. A greater number of incorrect pronunciations relates to an increasingly lower estimated IQ score. Raw scores are converted to age-corrected standard scores, with a mean of 100 and a standard deviation of 15. The TOPF was administered to check for any pre-existing differences between groups in terms of cognitive ability. The TOPF has a very high degree of reliability ($r=.96-.99$), test-retest reliability ($r=.89-.95$) and concurrent validity ($r=.70$) with the WAIS-IV Full Scale IQ (Holdnack & Drozdick, 2009).

MINI International Neuropsychiatric Interview version 7.0.2 for DSM-5 (Sheelan et al, 1998). This short interview screens for psychiatric diagnoses and is fully structured to allow administration by non-specialized interviewers (Appendix H). The MINI was used to screen participants based on the exclusion criteria, and to obtain further information on the possible influence of additional diagnoses on the dependent variables. The MINI has similar validity and reliability with longer interviews. Kappa values for most diagnoses in relation to the Structured Clinical Interview for the DSM (SCID) are 0.75 or above (Sheelan et al., 1997) and 0.70 or above in relation to the Composite International Diagnostic Interview (CIDI) (Lecrubier et al., 1997), indicating good levels of diagnostic agreement. Good levels of sensitivity and specificity have been indicated, in addition to high inter-rater ($r=0.88-1$) and test-retest reliability ($r=0.76-0.9$) (Lecrubier et al., 1997).

The Brief Fear of Negative Evaluation Scale (BFNE) (Leary, 1983). This questionnaire (Appendix I) examines the fear of negative evaluation. It consists of 12 items describing fearful cognitions which are rated by participants on a 5-point scale ranging from

1 (Not at all characteristic of me) to 5 (Extremely characteristic of me). Total scores range from 12-60, with higher scores indicating greater fear. Norms have been established in undergraduate students ($M=35.7$, $SD=8.1$). Participants were instructed to complete the measure considering only fears of personal and not appearance evaluation, to separate social anxiety from appearance anxiety. Social anxiety was investigated because the experiment was originally designed to measure attention to social cues in socially anxious individuals, and therefore it was possible that responses were influenced by social anxiety rather than appearance anxiety. This measure was therefore used to establish social anxiety levels in each group. The scale has good test-retest reliability ($r=.75$) and internal consistency ($\alpha=.90-.91$) (Leary, 1983). Cronbach's α in the present study was excellent ($\alpha=.95$).

The Social Phobia Inventory (SPIN) (Connor et al., 2000). This 17-item self-report questionnaire (Appendix J) measures social anxiety and produces scores between 0-68. Higher scores indicate greater levels of social anxiety. Each item is measured on a 5-point scale, ranging from 0 (not at all) to 4 (extremely). Scores greater than 20 indicate social anxiety. As with the BFNE, participants were instructed to complete the measure separately to appearance concerns. The measure was administered to exclude controls with social anxiety. The scale has good convergent and discriminant validity, excellent internal consistency ($\alpha=.95$) and good test-retest reliability ($r=.86$) (Connor, 2000). Cronbach's α in the current sample was .95.

Social Appearance Anxiety Scale (SAAS) (Hart et al.2008). This 16-item self-report questionnaire measures social appearance anxiety (Appendix K). Total scores range between 16-80. Norms have not been established. This measure was administered to establish the degree of social appearance anxiety in each group and to ensure groups differed sufficiently on this aspect. It has good test-retest reliability, internal consistency, factor

validity, incremental validity and divergent validity in undergraduate samples (Hart et al, 2008; Levinson & Rosenbaugh, 2011). Cronbach's α was .99 in the present sample.

Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983). This 14-item self-report scale, measures anxiety and depression over the past week (Appendix L). The anxiety and depression subscales each have a severity score ranging from 0-21. Clinical norms are: non-cases (0–7), borderline cases (8–10), and definite cases (11–21). The measure was added to establish levels of anxiety and depression in the control and clinical groups. The scales have good internal consistency (HADS-Anxiety: α =.83; HADS-Depression: α =.82) and medium to strong correlations with other measures of anxiety and depression (Bjelland, Dahl, Haug, & Neckelmann, 2002). In the present sample, Cronbach's α for HADS-Anxiety was .9, for HADS-Depression 0.89 and for HADS-Total 0.93.

The Multidimensional Body-Self Relations Questionnaire– Appearance Scales (MBSRQ-AS) (Cash, 2000). This self-report measure (Appendix M) comprises of separate subscales assessing appearance-related aspects of body image. The following subscales were included: (1) Appearance Evaluation (AE) measuring feelings of physical attractiveness and satisfaction with one's looks. It has seven items and a score range between 7-35, with higher scores indicating more appearance satisfaction; (2) Appearance Orientation (AO), measuring investment in one's appearance. It has 12 items and a score range between 12-60, with higher scores indicating greater investment and importance placed on appearance; (3) Body Areas Satisfaction Scale (BASS) measuring satisfaction with discrete aspects of one's appearance. It has nine items and a score range between 9-45, with higher scores indicating greater body satisfaction. AE and AO are scored on a 5-point Agree-Disagree scale and BASS on a 5-point Satisfied-Dissatisfied scale. Scales cannot be combined into a single score. Norms for men are: M=3.49 (SD=.83) for AE, M=3.60 (SD=.68) for AO and M=3.50 (SD=.63) for BASS. Norms for women are: M=3.36 (SD=.87) for AE, M=3.91 (SD=.60) for AO and M=3.23

(SD=.74) for BASS (Cash, 2000). The MBSRQ-AS was included to allow for a continuous measure of body image across all participants. These subscales have good internal consistency and test-retest reliability (Cash, 2000). Reliability scores in the present sample were excellent (0.89 for AE, 0.87 for AO and 0.9 for BASS).

Additional measures for the Control group:

Body Dysmorphic Disorder Questionnaire (BDD-Q) (Phillips et al., 1995). This is a five-question screening tool derived from the DSM-IV diagnostic criteria for BDD, used to exclude control group participants based on presence of body image disturbance (Appendix N). A score of four or more is considered a positive BDD-screening. The BDD-Q has shown good concurrent validity, with sensitivity of 94% and specificity of 90%, in a community sample (Brohede, Wingren, Wijma, & Wijma, 2013), and equivalent levels in clinical samples (Phillips et al., 1995; Grant et al., 2001).

Additional measures for the BDD group:

Yale-Brown Obsessive Compulsive Scale for Body Dysmorphic Disorder (BDD-YBOCS) (Phillips et al., 1997). This 12-item semi-structured interview assesses severity and impairment associated with BDD during the past week (Appendix O). Scores range from 0-48, with higher scores indicating greater severity. This measure was administered to screen for BDD severity in relation to the inclusion criteria. A score of ≥ 20 was used as a cut-off, following other studies. This interview was not administered to controls, as it assumes that the responder experiences significant appearance preoccupation. The BDD-YBOCS has shown high test-retest reliability ($r=0.88$) and internal consistency ($\alpha=0.80$) (Phillips et al., 1997). Cronbach's α in the present study was 0.93.

Experimental stimuli

The experimental task was created and run using PsychoPy on a 15-inch laptop. Colour facial photographs of two individuals (one male and one female), in four emotional expressions (angry, happy, disgust, and neutral), were used as targets. The faces were taken from the Karolinska Institute facial database (Lundqvist, Flykt, & Öhman, 1998) and were selected on the basis of the highest inter-rater agreement regarding the emotion depicted (Goeleven, De Raedt, Leyman, & Verschuere, 2008). As the photographs showed the same two individuals, variations in attractiveness were prevented. Such variations could have been confounders, if participants attended to faces on the basis of attractiveness. Studies have shown that emotion identification is greater amongst people of the same ethnicity (Elfenbein & Ambady, 2003), and as a predominantly White demographic were expected, photographs were chosen on this basis. Static rather than dynamic emotions were used as the literature presents conflicting results, with some studies indicating that facial motion improves recognition (Ambadar, Schooler, & Cohn, 2005), while others find no differences (Kätsyri, Saalasti, Tiippana, von Wendt, & Sams, 2008). Thus, for simplicity of design and in line with previous research, static images were chosen.

The experiment involved 576 trials, where photographs of a male or female actor were presented on a computer screen. In each trial, 12 photographs of the same individual were displayed simultaneously, creating a 'crowd'. Each crowd was presented for 72 consecutive trials, in eight blocks. Each crowd depicted one of four emotions: angry, disgust, happy, or neutral. Within each block, in half the trials, one of the faces displayed a different emotion (Target) (Appendix P). Each Target was randomly placed in one of 12 possible positions. In the other half trials, all the photographs were the same, thus there was no Target (36 No-Target trials) (Appendix P). Therefore, half the trials contained a discrepant target face and

half did not. The order of the eight crowds was randomized for each participant. Participants had to identify whether the faces were all the same or if one face was different, as quickly and accurately as possible by pressing either the corresponding 'Same' or 'Different' key. Reaction times (seconds) and accuracy of responses were recorded by the computer. Images were displayed until the participant pressed the key. A bullseye was displayed for 500ms between trials.

Procedure

To assess eligibility, control group participants initially completed the SPIN and BDD-Q online and had to answer 'no' to the question 'Do you currently have or have you ever had any mental health problems?'. Each participant was assessed in one meeting lasting approximately 1 hour and 15 minutes, held at the specialist anxiety service, or at the premises of two private hospitals or at a confidential room in the participant's local library. Initially, participants read the information sheet, and signed the consent form (Appendix Q). All participants were then interviewed through the MINI. The Control group was additionally screened through the BDD-YBOCS, before proceeding with the experiment. Participants were seated with their eyes positioned 80cm from the laptop monitor and levelled with the screen. They were read the following instructions (also given in written form): "In this task, you will see twelve faces on the screen. At times, ALL twelve faces are going to be IDENTICAL. At other times one of the faces will be DIFFERENT. Your task is to make a judgement about the presence or absence of a different face amongst those 12 faces, as QUICKLY and as ACCURATELY as you possibly can by pressing either the SAME (all the faces are the same) or DIFFERENT key (one of the faces stands out) on the keyboard". Participants were asked to keep their fingers on the computer keys throughout the task and were encouraged to take breaks between blocks. Initially, participants were given six practice

trials to ensure that they comprehended the task. The experimenter remained in the room with the participant. Upon completion of the experiment, the BFNE, SPIN, HADS, MBSRQ, demographic questionnaires, and TOPF were completed. At the end, participants were debriefed. BDD group participants were given a £10 shopping coupon and Control group participants were offered the opportunity to enter a prize draw.

Ethical Considerations

Ethical approval was granted by the National Research Ethics Committee (Appendices R, T) and the NHS Health Research Authority (Appendices S, U). Research governance approval was obtained from the Research and Development department of the recruiting trust (Appendix V). Approval to advertise to support groups was obtained by the organisation's communications department and the support group facilitator, via email. The researcher informed the primary supervisor of all appointments and followed 'lone worker' procedures to ensure personal safety. Service confidentiality and risk procedures were followed.

Analysis

Data was analysed using IBM SPSS version 24. Trials involving pressing incorrect keys or extreme reaction times (i.e. shorter than 333ms or longer than 2 standard deviations above the participant's overall reaction time) were eliminated. Excluded responses constituted less than 5% of the trials, and they were not affected by stimulus type ($p > .05$). Following Gilboa-Schechtman et al. (1999), reaction times were computed only for correct responses separately for each individual, each target type and each crowd type.

Each variable was checked for assumptions of normality separately for the BDD and Control groups through inspection of histograms and Q-Q plots, as well as the Shapiro-Wilks

normality test. These indicated that for the majority of variables, there were no serious violations of the assumption of normality (Appendix W). Thus, following Gilboa-Schechtman et al. (1999), parametric tests were chosen.

Preliminary analyses were conducted with stimulus gender and block order as between-subjects factors. As no significant effects were detected ($p > .05$), these factors were omitted from further analyses. Several 2x2 mixed ANOVAs were conducted, with Group (BDD or Control) as between-subject factors and Stimuli Type (angry vs. non-threatening) as within-subject factors. The effect of Group was analysed in relation to both the detection of angry *Targets* and the processing of angry *Crowds* (vs. non-threat targets and crowds).

To investigate Hypothesis 1 regarding the effect of BDD on reaction speed for detection of angry targets in non-threat crowds, the following 2x2 ANOVAs were conducted:

1. (Target: Angry vs. Happy, in Neutral crowds) X (Group: BDD vs. Control)
2. (Target: Angry vs. Neutral, in Happy crowds) X (Group: BDD vs. Control)

To investigate Hypothesis 2 regarding the effect of BDD on processing speed of angry (vs. non-threat) crowds, the following 2x2 ANOVAs were conducted:

1. (No-Target Crowd: Angry vs. Neutral) X (Group: BDD vs Control)
2. (No-Target Crowd: Angry vs. Happy) X (Group: BDD vs Control)
3. (Crowd: Neutral Target in Angry crowd vs. Neutral Target in Happy crowd) X (Group: BDD vs Control)
4. (Crowd: Happy Target in Angry crowd vs. Happy Target in Neutral crowd) X (Group: BDD vs Control)

To investigate Hypothesis 3 regarding whether attentional bias for anger is stronger than to disgust, the following 2x2 ANOVAs were conducted:

1. (Target: Angry vs. Disgust, in Neutral crowds) X (Group: BDD vs. Control)
2. (Target: Angry vs. Disgust, in Happy crowds) X (Group: BDD vs. Control)
3. (No-Target Crowd: Angry vs. Disgust) X (Group: BDD vs Control)

Results

Descriptive statistics

Table 4 presents MRTs for BDD and Control participants as a function of both type of target and type of crowd.

Table 4. Means and standard deviations of detection times (seconds) as a function of type of crowd and type of target for BDD and Control groups

Type of Crowd								
Type of Target	Neutral		Angry		Disgust		Happy	
	BDD	Control	BDD	Control	BDD	Control	BDD	Control
Neutral	<i>1.75(.54)</i>	<i>1.63(.39)</i>	1.45(.25)	1.32(.23)	1.43(.22)	1.42(.21)	1.56(.23)	1.54(.2)
Angry	.91(.15)	.88(.13)	2.63(.79)	2.75(.77)	1.86(.35)	1.93(.39)	1.58(.29)	1.5(.27)
Disgust	1.01(.21)	.98(.16)	2.01(.38)	1.86(.35)	2.58(.69)	2.84(.9)	1.57(.32)	1.56(.25)
Happy	1.06(.22)	1.01(.2)	1.72(.36)	1.66(.33)	1.66(.25)	1.69(.29)	2.45(.63)	2.64(.84)

Note: Italicised numbers indicate no-target trials

Hypothesis 1: Target detection analyses

This series of analyses examines the first hypothesis that angry targets would be detected faster than happy and neutral targets in non-threat crowds by all participants, but that for the BDD group this difference would be more pronounced than for the control group. To examine whether the BDD group would detect angry targets faster than happy targets in neutral crowds compared to Controls, a 2 (Target: Angry vs. Happy) X 2 (Group: BDD vs. Control) ANOVA was conducted. There was no main effect of Group on detection speed $F(1, 38)=.59, p>.05$. There was a main effect of Target, with both groups detecting angry targets faster than happy targets, $F(1, 38)=57.89, p<.001$. However there was no significant interaction between Group and Target, $F(1, 38)=.39, p>.05, r=.01$.

To examine whether the BDD group would detect angry targets faster than neutral targets in happy crowds compared to Controls, a 2 (Target: Angry vs. Neutral) X 2 (Group: BDD vs. Control) ANOVA was conducted. There was no main effect of Group [$F(1, 38)=.425, n.s.$], with both groups displaying equivalent reaction times. There was also no main effect of Target, $F(1, 38)=.09, n.s.$ — that is, participants were equally fast detecting angry and neutral targets in a happy crowd. Contrary to the hypothesis, no significant interaction was observed, $F(1, 38) =.77, p>.05, r=.14$.

Therefore, the first hypothesis stating that the BDD group would detect angry faces faster than the Control group was not supported.

Hypothesis 2: Crowd distraction analyses

This series of analyses examines the second hypothesis that the BDD group would be more slowed down in their responses in angry crowds (when many angry faces are presented

together), than in their responses to neutral or happy crowds. This hypothesis was tested for No-Target trials (fully angry vs. fully happy or neutral crowds), as well as trials where participants were expected to detect a non-threat target (either happy or neutral) in an angry crowd (vs. neutral or happy crowds).

a. No-Target trials

First, a 2 (Crowd: Angry vs. Neutral) X 2 (Group: BDD vs Control) ANOVA was conducted to test whether the BDD group would be more slowed down in trials displaying fully angry crowds as compared to fully neutral crowds, whereas this difference would be less pronounced for Control participants. No significant main effect for Group was found [$F(1, 38)=.00$, n.s.]. Findings revealed a main effect of Crowd, $F(1, 38)=133.89$, $p<.001$, such that both groups had slower reaction times to angry crowds in comparison to neutral crowds. Contrary to predictions, there was no Crowd X Group interaction, $F(1, 38)=1.92$, $p>.05$, $r=.22$.

Second, a 2 (Crowd: Angry vs. Happy) X 2 (Group: BDD vs Control) ANOVA was conducted to test whether BDD participants would be slower in their responses to fully angry crowds compared to fully happy crowds, whereas this effect would be weaker for Controls. There were no significant differences between Groups [$F(1, 38)=.46$, n.s.]. There was a main effect for Crowd, with slower reactions for angry than happy crowds [Target: $F(1, 38)=4.8$, $p=.03$]. Contrary to predictions, there was no Crowd X Group interaction, $F(1, 38)=.31$, $p>.05$, $r=.09$.

Therefore, participants were slowed down by angry crowds in comparison to neutral and happy crowds, but this slower reaction was equivalent for BDD and Control participants.

b. *Target trials (detection of non-threat targets in angry vs. non-threat crowds)*

Target trials were analysed to check whether reaction times for detection of neutral faces in angry crowds was slower than in happy crowds, and whether this difference was more pronounced for BDD versus Control participants. A 2 (Crowd: Neutral in Angry Crowd vs. Neutral in Happy Crowd) X 2 (Group: BDD vs Control) ANOVA was conducted. There was no main effect of Group [$F(1, 38)=1.2$, n.s.]. Findings revealed a main effect of Crowd, $F(1, 38)=29.14$, $p<.001$, such that both groups detected neutral faces faster in happy crowds than in angry crowds. Contrary to predictions, no significant Group X Crowd interaction was detected [$F(1, 38)=2.94$, $p=.094$, $r=.27$].

Next, reaction times for detection of happy faces in angry crowds was compared to the detection of happy faces in neutral crowds. A 2 (Crowd: Happy in Angry Crowd vs. Happy in Neutral Crowd) X 2 (Group: BDD vs Control) ANOVA was conducted. There was no effect for Group [$F(1, 38)=.57$, n.s.]. Findings revealed a main effect of Crowd, $F(1, 38)=148.05$, $p<.001$, such that both groups were slower in detecting happy faces in angry crowds than in neutral crowds. No significant Group X Crowd interaction was detected [$F(1, 38)=.00$, n.s.].

Therefore, participants were slowed down by a ‘gathering’ of angry faces when trying to detect a non-threat target, but this effect did not differ significantly between groups.

Hypothesis 3: Comparisons between Anger and Disgust

These analyses aimed to investigate whether the BDD group would have a stronger attentional bias for anger than disgust, as anger is conceptualised to be more socially threatening. This hypothesis was investigated by comparing how fast each group could detect

angry vs. disgust faces in non-threat crowds, as well as comparison of reaction times in fully angry vs. fully disgusted crowds.

To examine whether the BDD group could find angry or disgust faces quicker than controls, a 2 (Target: Angry vs. Disgust) X 2 (Group: BDD vs. Control) ANOVA was conducted in neutral crowds. There was no main effect of Group on detection speed [$F(1,38)=.36$, n.s.]. There was a main effect of Target, with both groups detecting angry targets faster than disgust targets, $F(1,38)=44.49$, $p<.001$. However, there was no significant interaction between Group and Target [$F(1,38)=.00$, n.s.].

Similarly, a 2 (Target: Angry vs. Disgust) X 2 (Group: BDD vs Control) ANOVA was conducted in happy crowds. There was also no significant effect of Group [$F(1, 38)=.22$, n.s] or Target [$F(1, 38)=1.07$, n.s.]. Again, there was no significant interaction between Group and Target [$F(1, 38)=1.84$, $p=.18$, $r=.22$].

Finally, a 2 (No target Crowd: Angry vs. Disgust) X 2 (Group: BDD vs Control) ANOVA was conducted to test whether BDD participants would be slower in their responses to fully angry crowds compared to fully disgusted crowds, whereas this effect would be weaker for Control participants. There was no main effect of Group [$F(1, 38)=.6$, n.s.]. There was also no Crowd effect such that both groups reacted equally to both angry and disgusted crowds [$F(1, 38)=.08$, n.s.]. There was no Crowd X Group interaction, $F(1, 38)=1.9$, $p=.18$, $r=.05$.

Discussion

In order to investigate whether an attentional bias to social-evaluative threat is involved in the maintenance of BDD, the present study executed an independent samples quasi-experimental design comparing 20 individuals with a diagnosis of BDD to 20 individuals without a mental health diagnosis. Findings did not provide support for the attentional bias hypothesis. In relation to the first hypothesis, while both the BDD and Control groups detected angry faces faster than happy faces in neutral crowds, reaction times did not differ between groups. In relation to the second hypothesis, while both the BDD and Control groups were slowed down by angry in comparison to happy and neutral crowds, there were no significant between-group differences. The BDD group therefore did not seem to require additional attentional resources for the processing of threatening crowds in comparison to Controls. In relation to the third hypothesis, both groups detected angry targets faster than disgust targets only in neutral crowds but not in happy crowds, and were more slowed down by fully angry compared to fully disgusted crowds. This provides partial support for the hypothesis that anger is more directly related to social harm than disgust (e.g. Trower & Gilbert, 1989), although this bias was no more pronounced in the BDD than in the Control group.

These findings are not in line with those of Gilboa-Schechtman et al. (1999), who found that individuals with social phobia, in comparison to controls, had a greater attentional bias for angry than happy faces in a crowd of neutral faces, slower reactions to angry compared to neutral crowds and a greater attentional bias for anger than disgust. Although there are some discrepancies in the anxiety literature, the present results also deviate from recent reviews which conclude that socially anxious individuals display a stronger orientation bias to anger and rejection (Chen & Clarke, 2017; Mogg & Bradley, 2018; Bantini et al., 2016). In the body image literature, the only available research has been conducted with individuals with

disordered eating. Studies have elicited mixed results, with some indication a greater bias to social rejection (e.g. Harrison et al., 2010), and some not finding significant differences to controls (e.g. Cardi et al., 2015).

A number of reasons can be considered for these discrepancies. First, it may be that an attentional bias to social threat is more pronounced in socially anxious individuals, but not in individuals with predominantly appearance concerns. As this has not been examined before in appearance dissatisfied individuals, it is not possible to compare results. It may be that individuals with high SAA attend to faces in terms of appearance comparisons but not in terms of social acceptance. To illuminate this issue, it might have been useful to compare individuals with low and high general social anxiety in both the BDD group, and the control group. However, a larger sample size would be needed. Second, it is possible that the low ecological validity of the experimental situation was not able to induce sufficient levels of social threat. Chen and Clarke (2017) and Mansell et al. (1999) have conceded that an attentional bias may only be noted under conditions of social threat. They propose that when no threat of rejection is present, anxious and non-anxious individuals present with the same attentional patterns. In relation to this, as the experimenter remained in the room whilst participants completed the task, responses may have been affected. Third, the ‘face-in-the-crowd’ task may have limited reliability as a method of measuring attention. This task, along with the Pictorial Stroop and the dot-probe paradigms, is an indirect measure of attention, where bias is inferred by manual reaction times. Therefore, responses may not be directly indicative of initial attentional orientation (Staugaard, 2010) and nuances in attention may not be captured. Fourth, although the BDD group scored within the medium to severe range on the BDD-YBOCS and social anxiety measures, it is possible that individuals with less severe social anxiety and appearance concerns volunteered to take part, with potentially lower levels

of biased perception. In addition, as 84% of participants were receiving therapy and/or medication, and had also attended a number of previous interventions, this may have ameliorated attentional biases. Finally, as this study used different stimuli to Gilboa-Schechtman et al., it could be that confounding variables related to the stimuli affected results. It could also be that, instead of anger and disgust, other more complex emotions such as contempt and compassion, are more relevant. Buhlmann et al. (2016) found that individuals with BDD had an emotion recognition bias for contempt. They suggest that contempt is a particularly salient emotion in BDD, as although it is related to other negative expressions such as anger and disgust, it differs from these because it includes elements of condescension and superiority toward another person and might foster beliefs that others are repelled by one's 'ugliness'.

Importantly, the present study replicated previous research by Anson et al. (2012), Coles (2006) and Kellie et al. (2014), finding that in addition to self-evaluative concerns relating to appearance, social-evaluative appearance concerns are also a central feature of BDD, as indicated by the high SAAS scores. In addition, a strong fear of personal evaluation was indicated through the high BFNE and SPIN scores. As participants were asked to complete the BFNE and SPIN separate to appearance concerns, the study has been able to separate the two components. The presence of both general social and appearance concerns lends support to models of BDD such as that by Veale et al. (2004) that emphasize interpersonal aspects as maintaining factors, alongside self-evaluative concerns relating to a high internal aesthetic standard.

Limitations

The sample size was calculated based on a large effect size and thus the sample may have been too small to detect smaller effects. It is thus possible that there are between-group differences that the current study was not able to identify. Care should be taken in generalising findings given the small sample size, disproportionate recruitment from the South-East of England, and specialist service setting. Although the sample demographic suggests that it is broadly representative in terms of gender (Buhlmann et al., 2010), there may be an overrepresentation of young White participants. In addition, even though participants were encouraged to complete the BFNE and SPIN separate to appearance, it is not possible to ascertain the degree of social anxiety relating to appearance and non-appearance concerns.

Clinical implications

As no significant difference in attentional bias was found between the BDD and Control groups, this might indicate that different factors maintain anxiety about appearance and general social anxiety. Cognitive models of BDD might thus need to differentiate the pathways through which they conceptualise the maintenance of these two types of anxiety. For example, research has shown that in social situations, individuals with BDD make excessive appearance comparisons, feeling markedly more anxious and less satisfied with their appearance after comparing (Anson, Veale, & Miles, 2015). They also pay attention to others' faces in order to compare with their own areas of concern (Grocholewska et al. 2012; Greenberg et al., 2014). These patterns could maintain SAA through sustained preoccupation with appearance, over and above anxiety about being accepted. Therefore, interventions may need to focus on other factors that might maintain anxiety in social situations such as appearance comparisons, rather than an attentional bias to threat, potentially making

interventions applied in social anxiety such as Attentional Bias Modification, less relevant. It should however be noted, that due to the small sample and methodological limitations, these implications are drawn with caution.

In addition, the present findings also suggest that individuals with BDD have high levels of both general social anxiety and appearance-related social anxiety. Both these types of anxiety may be important elements that need to be incorporated in BDD models and interventions as they may maintain BDD, alongside personal-evaluation concerns. Restructuring maladaptive beliefs around the fear of being rejected by others based on one's appearance and/or one's personal qualities may be a useful component of cognitive therapy for body dysmorphic concerns. It may also be important for exposure hierarchies to incorporate situations that are avoided due to fear of personal and appearance-based rejection.

Research implications

Given the limited research on the maintenance of SAA, a greater understanding of the underlying mechanisms will be important in the development of successful treatments. To the authors' knowledge, this is the first study to examine attention to emotions. While it demonstrated high levels of social anxiety and SAA, it did not illuminate what may be maintaining these. Further research is therefore required. Future studies could investigate attentional bias to social threat with more direct methodologies such as eye-tracking and with larger samples. Other areas of research proposed to maintain social phobia could also be investigated in BDD, such as a bias in overestimating the proportion of people that are observing oneself (Bolt, Elhers, & Clark, 2014).

Recruiting from more geographically and ethnically diverse populations would enhance the generalisability of findings. Comparisons could be made between men and women, as well as

individuals with different gender identities and sexual preferences, as some subsections of the population may be more vulnerable to fears of social rejection. Preference should be given to individuals on waiting lists and those who have not received interventions.

To increase ecological validity, stress levels could be manipulated experimentally. Following Mansell et al. (1999), participants could be given an anxiety-inducing prompt such as being told that they would give a speech or have their photograph taken, which could decipher if increased anxiety affects bias levels.

Conclusions

Both individuals with a diagnosis of BDD and Controls displayed an attentional bias to anger. However, contrary to predictions, individuals with BDD did not display a stronger bias compared to controls. This may indicate that individuals with BDD do not attend to faces on the basis of social-evaluative threat, although firm conclusions cannot be drawn due to methodological limitations. The study confirmed previous findings that individuals with BDD have high levels of both social and social appearance anxiety. A need for more research on factors implicated in the maintenance of SAA is identified.

References

- Ambadar, Z., Schooler, J. W., & Cohn, J. F. (2005). Deciphering the enigmatic face: The importance of facial dynamics in interpreting subtle facial expressions. *Psychological Science*, 16, 403-410. <https://doi.org/10.1111/j.0956-7976.2005.01548.x>
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington: American Psychiatric Publishing.
- Anson, M., Veale, D. & Miles, S. (2015) Appearance comparison in individuals with body dysmorphic disorder and controls. *Body Image*, 15, 132-140. <https://doi.org/10.1016/j.bodyim.2015.08.003>
- Anson, M., Veale, D., & de Silva, P. (2012). Social-evaluative versus self-evaluative appearance concerns in Body Dysmorphic Disorder. *Behaviour Research and Therapy*, 50, 753-760. <https://doi.org/10.1016/j.brat.2012.09.003>
- Bantin, T., Stevens, S., Gerlach, A., L., & Hermann, C. (2016). What does the facial dot-probe task tell us about attentional processes in social anxiety? A systematic review. *Journal of Behavioural Therapy and Experimental Psychiatry*, 50, 40-51. <https://doi.org/10.1016/j.jbtep.2015.04.009>
- Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research*, 52, 69-77. [https://doi.org/10.1016/S0022-3999\(01\)00296-3](https://doi.org/10.1016/S0022-3999(01)00296-3)

- Bolt, O. C., Ehlers, A., & Clark, D. M. (2014). Faces in a crowd: High socially anxious individuals estimate that more people are looking at them than low socially anxious individuals. *PloS One*, 9, e106400. <https://doi.org/10.1371/journal.pone.0106400>
- Buhlmann, U., Etcoff, N. L., & Wilhelm, S. (2006). Emotion recognition bias for contempt and anger in body dysmorphic disorder. *Journal of Psychiatric Research*, 40, 105-111. <https://doi.org/10.1016/j.jpsychires.2005.03.006>
- Buhlmann, U., McNally, R. J., Etcoff, N. L., Tuschen-Caffier, B., & Wilhelm, S. (2004). Emotion recognition deficits in body dysmorphic disorder. *Journal of Psychiatric Research*, 38, 201-206. [https://doi.org/10.1016/S0022-3956\(03\)00107-9](https://doi.org/10.1016/S0022-3956(03)00107-9)
- Buhlmann, U., McNally, R. J., Wilhelm, S., & Florin, I. (2002). Selective processing of emotional information in body dysmorphic disorder. *Journal of Anxiety Disorders*, 16, 289-298. [http://dx.doi.org/10.1016/S0887-6185\(02\)00100-7](http://dx.doi.org/10.1016/S0887-6185(02)00100-7)
- Byrne, A., & Eysenck, M. W. (1995). Trait anxiety, anxious mood, and threat detection. *Cognition and Emotion*, 9, 549-562. <https://doi.org/10.1080/02699939508408982>
- Cash, T. F. (2000). *MBSRQ Users' Manual* (3rd rev, unpublished user's manual). Norfolk: Old Dominion University.
- Cardi, V., Corfield, F., Leppanen, J., Rhind, C., Deriziotis, S., Hadjimichalis, A., ... &

- Treasure, J. (2015). Emotional processing, recognition, empathy and evoked facial expression in eating disorders: An experimental study to map deficits in social cognition. *PLoS One*, 10, e0133827. <https://doi.org/10.1371/journal.pone.0133827>
- Chen, N., T., & Clarke, P. (2017). Gaze-based assessments of vigilance and avoidance in social anxiety: A review. *Current Psychiatry Reports*, 19, 59. <https://doi.org/10.1007/s11920-017-0808-4>
- Clark, D. M. (2001). A cognitive perspective on social phobia. In W. R. Crozier & L. E. Alden (Eds.), *International handbook of social anxiety: Concepts, research and interventions relating to the self and shyness* (pp. 405–430). Chichester: John Wiley & Sons.
- Clark, D. M., & Wells, A. (1995). A Cognitive Model of Social Phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, F. R. Schneier, R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69-93). New York: Guilford Press.
- Coles, M. E., Phillips, K. A., Menard, W., Pagano, M. E., Fay, C., Weisberg, R. B., & Stout, R. L. (2006). Body dysmorphic disorder and social phobia: Cross-sectional and prospective data. *Depression and Anxiety*, 23, 26-33. <https://doi.org/10.1002/da.20132>
- Connor, K. M., Davidson, J. R., Churchill, L. E., Sherwood, A., Weisler, R. H., & Foa, E.

- (2000). Psychometric properties of the Social Phobia Inventory (SPIN): New self-rating scale. *The British Journal of Psychiatry*, 176, 379-386. <https://doi.org/10.1192/bjp.176.4.379>
- Didie, E., R, Menard, W., Stern, A., P., & Phillips, K., A. (2008). Occupational functioning and impairment in adults with body dysmorphic disorder. *Comprehensive Psychiatry*, 49, 561-569. <https://doi.org/10.1016/j.comppsy.2008.04.003>
- Ekman, P. (1973). Cross-Cultural Studies of Facial Expression. In P. Ekman (Ed.), *Darwin and facial expression: A century of research in review* (pp. 169-222). New York: Academic Press.
- Fang, A., & Hofmann, S. G. (2010). Relationship between social anxiety disorder and body dysmorphic disorder. *Clinical Psychology Review*, 30, 1040-1048. <https://doi.org/10.1016/j.cpr.2010.08.001>
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behaviour Research Methods*, 39, 175-191. <https://doi.org/10.3758/BF03193146>
- Gilboa-Schechtman, E., Foa, E. B., & Amir, N. (1999). Attentional biases for facial expressions in social phobia: The face-in-the-crowd paradigm. *Cognition and Emotion*, 13, 305-318. <http://doi.org/10.1080/026999399379294>
- Goeleven, E., De Raedt, R., Leyman, L., & Verschuere, B. (2008). The Karolinska directed

emotional faces: A validation study. *Cognition and Emotion*, 22, 1094-1118.
<http://doi.org/10.1080/02699930701626582>

Greenberg, J. L., Reuman, L., Hartmann, A. S., Kasarskis, I., & Wilhelm, S. (2014). Visual hot spots: An eye tracking study of attention bias in body dysmorphic disorder. *Journal of Psychiatric Research*, 57, 125-132. <https://doi.org/10.1016/j.jpsychires.2014.06.015>

Grochowski, A., Kliem, S., & Heinrichs, N. (2012). Selective attention to imagined facial ugliness is specific to body dysmorphic disorder. *Body Image*, 9, 261-269.
<https://doi.org/10.1016/j.bodyim.2012.01.002>

Hansen, C. H., & Hansen, R. D. (1988). Finding the face in the crowd: An anger superiority effect. *Journal of Personality and Social Psychology*, 54, 917.
<https://doi.org/10.1037/0022-3514.54.6.917>

Harrison, A., Sullivan, S., Tchanturia, K., & Treasure, J. (2010). Emotional functioning in eating disorders: Attentional bias, emotion recognition and emotion regulation. *Psychological Medicine*, 40, 1887-1897. <https://doi.org/10.1017/S0033291710000036>

Hart, T. A., Flora, D. B., Palyo, S. A., Fresco, D. M., Holle, C., & Heimberg, R. G. (2008). Development and examination of the social appearance anxiety scale. *Assessment*, 15, 48-59. <https://doi.org/10.1177/1073191107306673>

Holdnack, J. A., & Whipple Drozdick, L. (2009). *Advanced clinical solutions for WAIS-IV and WMS-IV: Clinical and interpretive manual*. San Antonio: Pearson.

- Kätsyri, J., Saalasti, S., Tiippana, K., von Wendt, L., & Sams, M. (2008). Impaired recognition of facial emotions from low-spatial frequencies in Asperger syndrome. *Neuropsychologia*, 46, 1888-1897. <https://doi.org/10.1016/j.neuropsychologia.2008.01.005>
- Kelly, M. M., Didie, E. R., & Phillips, K. A. (2014). Personal and appearance-based rejection sensitivity in body dysmorphic disorder. *Body Image*, 11, 260-5. <https://doi.org/10.1016/j.bodyim.2014.03.004>
- Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and Social Psychology Bulletin*, 9, 371-375. <http://dx.doi.org/10.1177/0146167283093007>
- Leary, M.R. & Kowalski, R.M. (1995) The Self-Presentation Model of Social Phobia. In: Heimberg, R.G., Liebowitz, M.R., Hope, D.A. & Schneier, F.R., (Eds.), *Social phobia: Diagnosis, assessment and treatment* (pp. 94-112). New York: Guilford Press.
- Lecrubier, Y., Sheehan, D., V., Weiller, E., Amorim, P., Bonora, I., Harnett, K...& Dunbar, G., C. (1997). The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: reliability and validity according to the CIDI. *European Psychiatry*, 12, 224-231. [https://doi.org/10.1016/S0924-9338\(97\)83296-8](https://doi.org/10.1016/S0924-9338(97)83296-8)
- Levinson, C. A., & Rodebaugh, T. L. (2011). Validation of the Social Appearance Anxiety Scale: Factor, convergent, and divergent validity. *Assessment*, 18, 350-356. <http://doi.org/10.1177/1073191111404808>

- Lundh, L. G., & Öst, L. G. (1996). Recognition bias for critical faces in social phobics. *Behaviour Research and Therapy*, 34, 787-794. <https://doi.org/10.1016/j.brat.2003.12.001>
- Lundqvist, D., Flykt, A., & Öhman, A. (1998). *The Karolinska directed emotional faces (KDEF)*. CD ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institutet.
- MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology*, 95, 15. <http://dx.doi.org/10.1037/0021-843X.95.1.15>
- Mansell, W., Clark, D., M., Ehlers, A., & Chen, Y., P. (1999). Social Anxiety and Attention away from Emotional Faces. *Cognition and Emotion*, 13, 673-690. <https://doi.org/10.1080/026999399379032>
- Menard, W., Fay, C., & Weisberg, R. (2005). Demographic characteristics, phenomenology, comorbidity, and family history in 200 individuals with body dysmorphic disorder. *Psychosomatics*, 46, 317-25. <https://doi.org/10.1176/appi.psy.46.4.317>
- Mogg K., & Bradley, B., P. (2018). Anxiety and threat-related attention: Cognitive-motivational framework and treatment. *Trends in Cognitive Science*, 22, 225-240. <http://dx.doi.org/10.1016/j.tics.2018.01.001>
- Nashiro, K., Sakaki, M., & Mather, M. (2012). Age differences in brain activity during emotion processing: Reflections of age-related decline or increased emotion regulation. *Gerontology*, 58, 156-163. <https://doi.org/10.1159/000328465>

Neziroglu, F., Khemlani-Patel, S., & Veale, D. (2008). Social learning theory and cognitive behavioural models of body dysmorphic disorder. *Body Image*, 5, 28-38. <https://doi.org/10.1016/j.bodyim.2008.01.002>

Peirce, J. W. (2007). PsychoPy—psychophysics software in Python. *Journal of Neuroscience Methods*, 162, 8-13. <https://doi.org/10.1016/j.jneumeth.2006.11.017>

Phillips, K., A., Coles, M., E., Menard, W., Yen, S., Fay, C., & Weisberg, R., B. (2005). Suicidal ideation and suicide attempts in body dysmorphic disorder. *Journal of Clinical Psychiatry*, 66, 717-25. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/15960564>

Phillips, K. A., Hollander, E., Rasmussen, S. A., & Aronowitz, B. R. (1997). A severity rating scale for body dysmorphic disorder: development, reliability, and validity of a modified version of the Yale-Brown Obsessive Compulsive Scale. *Psychopharmacology Bulletin*, 33, 17. Retrieved from <https://psycnet.apa.org/record/1997-03978-003>

Phillips, K. A., Atala, K. D., Pope, H. G. (1995). *Diagnostic instruments for body dysmorphic disorder. New Research Program and Abstracts, American Psychiatric Association 148th annual meeting*. Miami: American Psychiatric Association.

Phillips, K. A., McElroy, S. L., Keck Jr, P. E., Pope Jr, H. G., & Hudson, J. I. (1993). Body dysmorphic disorder: 30 cases of imagined ugliness. *The American Journal of Psychiatry*, 150, 302. <http://dx.doi.org/10.1176/ajp.150.2.302>

Rapee, R. M., & Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social

phobia. *Behaviour Research and Therapy*, 35, 741-756. [https://doi.org/10.1016/S0005-7967\(97\)00022-3](https://doi.org/10.1016/S0005-7967(97)00022-3)

Sharpe, E., Wallis, D. J., & Ridout, N. (2016). The influence of variations in eating disorder-related symptoms on processing of emotional faces in a non-clinical female sample: An eye-tracking study. *Psychiatry Research*, 240, 321-327. <https://doi.org/10.1016/j.psychres.2016.04.065>

Sheehan, D. V., Lecrubier, Y., Harnett-Sheehan, K., Amorim, P., Janavs, J., Weiller, E., Hergueta, T., Baker, R., Dunbar, G. (1998). The Mini International Neuropsychiatric Interview (M.I.N.I.): The Development and Validation of a Structured Diagnostic Psychiatric Interview. *Journal of Clinical Psychiatry*, 59, 22-33. <https://doi.org/10.1186/s12875-017-0674-5>

Staugaard, S., R. (2010). Threatening faces and social anxiety: A literature review. *Clinical Psychology Review*, 30, 669-690. <https://doi.org/10.1016/j.cpr.2010.05.001>

Stroop, J., R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, 18, 643. <https://doi.org/10.1037/h0054651>

Trower, P., & Gilbert, P. (1989). New theoretical conceptions of social anxiety and social phobia. *Clinical Psychology Review*, 9, 19-35. [https://dx.doi.org/10.1016/0272-7358\(89\)90044-5](https://dx.doi.org/10.1016/0272-7358(89)90044-5)

Veale, D. (2004). Advances in a cognitive behavioural model of body dysmorphic disorder. *Body Image*, 1, 113-125. [https://doi.org/10.1016/S1740-1445\(03\)00009-3](https://doi.org/10.1016/S1740-1445(03)00009-3)

Veale, D. M., & Lambrou, C. (2002a) The importance of aesthetics in body dysmorphic disorder. *CNS Spectrums*, 7, 429–431. [https://doi.org/10.1016/S1740-1445\(03\)00009-3](https://doi.org/10.1016/S1740-1445(03)00009-3)

Veale, D., Ennis, M., & Lambrou, C. (2002b) Possible association of body dysmorphic disorder with an occupation or education in art and design. *American Journal of Psychiatry*, 159, 1788–1790. <https://doi.org/10.1176/appi.ajp.159.10.1788>

Veale, D., Gournay, K., Dryden, W., Boocock, A., Shah, F., Willson, R., & Walburn, J. (1996). Body dysmorphic disorder: a cognitive behavioural model and pilot randomised controlled trial. *Behaviour Research and Therapy*, 34, 717-729. [https://doi.org/10.1016/0005-7967\(96\)00025-3](https://doi.org/10.1016/0005-7967(96)00025-3)

Vink, M., Derks, J. M., Hoogendam, J. M., Hillegers, M., & Kahn, R. S. (2014). Functional differences in emotion processing during adolescence and early adulthood. *Neuroimage*, 91, 70-76. <https://doi.org/10.1016/j.neuroimage.2014.01.035>

Wechsler, D. (2011). *Test of premorbid functioning. UK version (TOPF UK)*. UK: Pearson Corporation.

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67, 361-370.

Part C

APPENDICES OF SUPPORTING MATERIAL

Appendix A. Quality appraisal criteria (Kmet, Lee, Cook, 2004)

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Appendix B. Quality appraisal scores of reviewed papers

Study Criterion	Griffiths et al. (2014)	Sharpe et al. (2016)	Harrison et al. (2010a)	Harrison et al. (2010b)	Schneider et al. (2016)	Goddard et al. (2013)	Kanakam et al. (2013)	Cserjesi et al. (2011)	Cardi et al. (2015)	Goddard & Treasure (2013)	Cardi et al. (2012)	Cardi et al. (2014)
1. Aims	2	2	2	2	2	2	2	2	2	2	2	2
2. Design	2	2	2	2	2	2	2	2	2	2	2	2
3. Recruitment & selection	1	1	1	1	1	1	1	1	1	1	1	1
4. Sample description	2	2	2	2	2	2	1	1	2	2	2	2
5. Randomisation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6. Blinding of researchers	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7. Blinding of participants	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8. Measures	1	2	1	1	1	1	1	1	1	1	1	1
9. Number	2	1	2	2	1	1	2	1	2	2	2	2
10. Analysis	2	2	2	2	2	2	1	0	1	2	2	2
11. Variance?	2	2	2	2	2	2	2	2	2	2	2	2
12. Confounders	1	1	2	1	2	2	1	1	1	2	2	2
13. Results	2	2	2	2	2	2	2	1	2	2	2	2
14. Conclusions	2	2	2	2	2	2	2	1	2	2	2	2
Summary Score (%)	19/22 (86%)	19/22 (86%)	20/22 (91%)	19/22 (86%)	19/22 (86%)	19/22 (86%)	17/22 (77%)	13/22 (59%)	18/22 (82%)	20/22 (91%)	20/22 (91%)	20/22 (91%)

Appendix C. Outline of experimental design

Blocks (randomized for each participant)	Stimulus gender	Crowd	Target or No-Target	Number of trials
Block 1	Male	Neutral	All neutral (no target)	36
			1 angry face	12
			1 happy face	12
			1 disgust face	12
Block 2	Male	Angry	All angry (no target)	36
			1 neutral face	12
			1 happy face	12
			1 disgust face	12
Block 3	Male	Happy	All happy (no target)	36
			1 neutral face	12
			1 angry face	12
			1 disgust face	12
Block 4	Male	Disgust	All disgust (no target)	36
			1 neutral	12
			1 angry	12
			1 happy	12
Block 5	Female	Neutral	All neutral (no target)	36
			1 angry face	12
			1 happy face	12
			1 disgust face	12
Block 6	Female	Angry	All angry (no target)	36
			1 neutral face	12
			1 happy face	12
			1 disgust face	12
Block 7	Female	Happy	All happy (no target)	36
			1 neutral face	12
			1 angry face	12
			1 disgust face	12
Block 8	Female	Disgust	All disgust (no target)	36
			1 neutral	12
			1 angry	12
			1 happy face	12

Appendix D. Participant Information Sheet

Study title: Attention to faces in Body Dysmorphic Disorder (BDD)

Researcher: Angeliki Schiza, Trainee Clinical Psychologist
IRAS ID: 223927
Version: 2/ 08.07.2018

Hello. My name is Angeliki Schiza and I am a trainee clinical psychologist at Salomon's Centre for Applied Psychology, which is part of Canterbury Christ Church University. I would like to invite you to take part in a research study that is part of my doctorate degree in Clinical Psychology. Before you decide, it is important that you understand why the research is being done and what it would involve for you. Talk to others about the study if you wish.

Part 1: The purpose of this study and what will happen if you take part.

What is the purpose of the study?

We are interested in how people with a diagnosis of BDD process other people's faces. There is currently very little research on BDD and this project may help understand these difficulties better and develop more effective treatments.

Why have I been invited?

We are inviting two groups of people: Individuals with a diagnosis of BDD and individuals without mental health difficulties. We will compare the two groups. We would like to recruit 20 people in each group.

Do I have to take part?

It is your decision if you want to take part. If you agree to take part, you will be asked to sign a consent form. You are free to withdraw at any time, without giving a reason. This will not affect your care.

What will happen to me if I take part?

If you decide to take part, we will arrange to meet at a time that suits you at a suitable confidential location. This can be at the [REDACTED] at [REDACTED] Trust, another clinical location or a private room in a library. During this meeting, we will discuss the research again and you can ask any questions you have. I will ask you to sign a consent form which asks if you have understood the information about the study. We will then complete some initial questionnaires covering some quite personal areas, including your mood and your thoughts and feelings about your body. We will then carry out an experiment on a computer screen. This will involve looking at photographs of faces and pressing a computer key in response to the images. After completing the computer task, you will be asked to complete some further questionnaires. In total, our meeting will take up to 1 hour and 20 minutes.

Will I be paid?

You will be given a Love to Shop voucher of £10 for your contribution.

What are the possible disadvantages and risks of taking part?

Although the likelihood is low, some people might find answering questionnaires about their personal feelings and thoughts distressing. You do not have to answer any questions you do not want to, and you can pause or stop entirely at any time. There will be time at the end to discuss any issues that may arise.

What are the possible benefits of taking part?

Some people find taking part in research interesting and enjoyable. We cannot promise the study will help you personally but the information we get may help improve the treatment for people with difficulties related to BDD.

Will my taking part in the study be kept confidential?

Yes. We will follow ethical and legal practice and all information about you will be handled in confidence. Details are included in Part 2.

.....

Part 2: More detailed information**Confidentiality**

We will ask your permission at the start of the study to let your GP and care team know that you are taking part in this study. We will not share your information and results with them.

Your information will remain anonymous and confidential unless you disclose something to suggest that you or someone else is currently at risk. I would need to discuss this with you and may need to pass this on to my supervisor and your care team.

Each participant is given a code. This code will be used instead of your name and it will not be possible to link your data with you. Your anonymous data will be stored securely within Canterbury Christ Church University premises in accordance with the Data Protection Act 1998 and the University's own data protection requirements. Data can only be accessed by me, Angeliki Schiza, and my supervisors, Dr. Martin Anson and Dr. Blake Stobie.

What will happen if I don't want to carry on with the study?

If you decide to withdraw from the study, we will ask you if we can still use the data you provided. If you say no, we will delete all the data you provided.

What if there is a problem?

If you have a concern about the study, you should speak to me, Angeliki Schiza, in the first instance, and I will do my best to address the problem. If you remain unhappy and wish to complain formally, you can do this by contacting Professor Paul Camic, Research Director, Canterbury Christ Church University, 1 Meadow Road, Tunbridge Wells, TN1 2YG or by email at paul.camic@canterbury.ac.uk.

Additionally, although we do not expect anything to go wrong, in the event that something does go wrong and you are harmed during the research due to someone's negligence, you may have grounds for a legal action against Canterbury Christ Church University but you may have to pay your legal costs. The normal NHS complaints mechanisms will be open to you. Both the university and the researchers have indemnity insurance.

What will happen to the results of the study?

A report from the study may be submitted to a journal that publishes mental health research. If you wish, we can send you the main findings upon completion.

Who is sponsoring the research?

The study is being organised and funded as part of a doctorate degree at Canterbury Christ Church University.

Who has reviewed the study?

This study has been approved by the NHS Research Ethics Committee, the [REDACTED] Trust Research and Development board, and the Canterbury Christ Church University ethics panel.

For further information and to take part:

1. You can let your clinician or group facilitator know that you are interested in the project and I will then contact you via your preferred means of contact.

or

2. You can leave a message for me on a 24-hour voicemail phone line at 03330 117070. Please state that your message is for me, Angeliki Schiza, and your contact details and I will get back to you.

or

3. You can return the opt-in form, if you have been given one.

Thank you for your time.

Appendix E. Opt in form

Attention to faces in Body Dysmorphic Disorder

This research investigates how people with BDD process other people's faces. Please read the participant information sheet for further details. If you are interested to find out more about the study, you are aged between 18-60 years old and are currently experiencing BDD-related difficulties, please return this slip in the envelope provided. The Principal Investigator, Angeliki Schiza will contact you to provide more information.

I am interested to hear more about the research project.

My contact details are

We will be in touch shortly. Thank you for expressing your interest.

Appendix F. Demographic Information

Participant number					
Date/time of testing					
Age					
Gender					
Where recruited from					
Where tested					
I would like to be sent an overview of the results of the study	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; width: 50%;">Yes</td> <td style="text-align: center; width: 50%;">No</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>	Yes	No	<input type="checkbox"/>	<input type="checkbox"/>
Yes	No				
<input type="checkbox"/>	<input type="checkbox"/>				

Features of concern:	<ol style="list-style-type: none"> 1. 2. 3. 4. 5. 6. 7.
Age of onset	
Date of onset of current episode	
Stage on current pathway (if in therapy number of sessions completed)	
Previous therapy (number of courses and sessions)	
Triggers at onset	
Medication	
Other diagnoses	

Highest educational attainment and years of education	Tick one box
University Higher Degree (e.g. MSc, PhD)	
First degree level qualification including foundation degrees, graduate membership of a professional Institute, PGCE	
Diploma in higher education	
Teaching qualification (excluding PGCE)	
Nursing or other medical qualification not yet mentioned	
A Level	
Welsh Baccalaureate	
International Baccalaureate	
AS Level	
Higher Grade/Advanced Higher (Scotland)	
Certificate of sixth year studies	
GCSE/O Level	
CSE	
Standard/Ordinary (O) Grade / Lower (Scotland)	
Other school (inc. school leaving exam certificate or matriculation)	
None of the above (please specify)	

Ethnic Origin (tick one box)			
White	Mixed	Asian or Asian British	Black or Black British
<input type="checkbox"/> British	<input type="checkbox"/> Asian and Black Caribbean	<input type="checkbox"/> Indian	<input type="checkbox"/> Caribbean
<input type="checkbox"/> Irish	<input type="checkbox"/> Asia and African	<input type="checkbox"/> Pakistani	<input type="checkbox"/> African
<input type="checkbox"/> Gypsy	<input type="checkbox"/> Asian and White	<input type="checkbox"/> Bangladeshi	<input type="checkbox"/> Any Other Black background (please specify)
<input type="checkbox"/> Irish Traveller	<input type="checkbox"/> White and Black Caribbean	<input type="checkbox"/> Chinese
<input type="checkbox"/> Other European (please specify)	<input type="checkbox"/> White and Black African	<input type="checkbox"/> Japanese	Other ethnic group
<input type="checkbox"/> Any other White background (Please specify)	<input type="checkbox"/> Other mixed background (please specify)	<input type="checkbox"/> Thai	<input type="checkbox"/> Arab
.....	<input type="checkbox"/> Other Asian Background (please specify)	<input type="checkbox"/> Turkish
	<input type="checkbox"/> Any other ethnic group (please specify)	<input type="checkbox"/> Prefer not to say

Appendix G. Test of Premorbid Functioning (TOPF)

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Appendix H. Mini International Neuropsychiatric Interview (MINI)

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Appendix I. Brief Fear of Negative Evaluation Scale (BFNE)

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Appendix J. Social Phobia Inventory (SPIN)

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Appendix K. Social Appearance Anxiety Scale (SAAS)

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Appendix L. Hospital Depression and Anxiety Scale (HADS)

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**Appendix M. Multidimensional Body-Self Relations Questionnaire-Appearance Scales
(MBSRQ-AS)**

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Appendix N. Body Dysmorphic Disorder Questionnaire (BDD-Q)

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Appendix O. Body Dysmorphic Disorder Yale-Brown Obsessive-Compulsive Scale (BDD-YBOCS)

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Appendix P. Examples of experimental stimuli

Figure 1. Example of a target trial with an angry target in a neutral crowd.

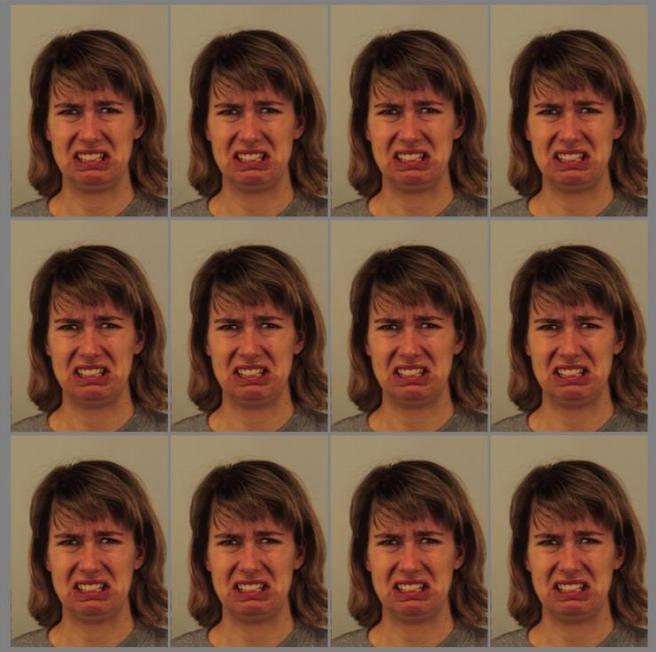
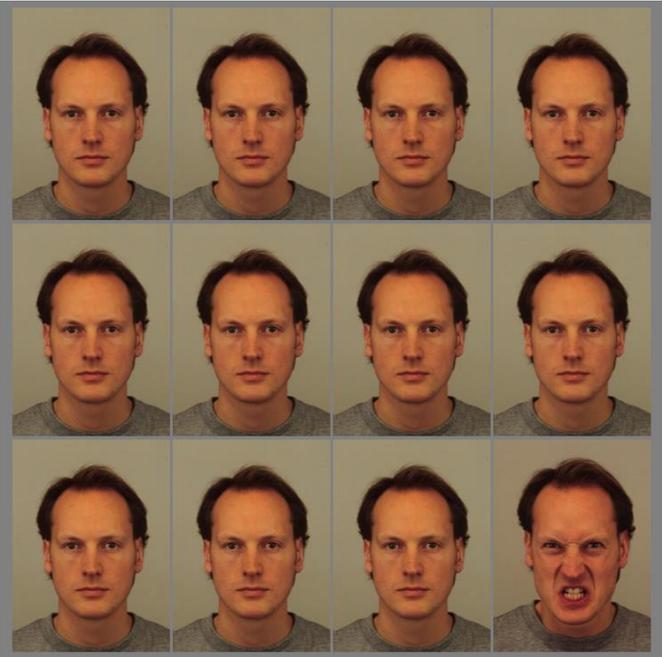


Figure 2. Example of a no-target trial with a disgusted crowd.



Appendix Q: Participant Consent Form

PARTICIPANT CONSENT FORM

Title of Project: Attention to faces in Body Dysmorphic Disorder

Name of Researcher: Angeliki Schiza

Please initial box

1. I confirm that I have read and understand the information sheet dated 24.05.2017 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

3. I understand that relevant sections of any of my medical notes and data collected during the study may be looked at by responsible individuals from regulatory authorities and/or the NHS Trust, where it is relevant to my taking part in this research. I give permission to these individuals to have access to my records.

4. I understand that anonymised data collected during the study may be looked at by the lead supervisor, Dr Martin Anson. I give permission for this individual to have access to my anonymised data.

5. I agree to my GP being informed of my participation in the study.

6. I agree to take part in the above study.

You will be given a copy of the signed consent form.

Name of Participant _____ Date _____

Signature _____

Name of Person taking consent _____ Date _____

Signature _____

Appendix R. Confirmation of ethical approval from REC

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Appendix S. Confirmation of ethical approval from HRA

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Appendix T. REC confirmation of approval of substantial amendment

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Appendix U. HRA confirmation of approval of substantial amendment

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Appendix V. R&D approval

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Appendix W: Assumptions of normality for each variable

Variable	BDD group	Control group
NA MRT	Meets assumptions of normality (Shapiro-Wilk p=.65)	Meets assumptions of normality (Shapiro-Wilk p=.19)
NH MRT	Meets assumptions of normality (Shapiro-Wilk p=.41)	<i>Does not meet assumptions of normality (Shapiro-Wilk p=.01)</i>
HA MRT	Meets assumptions of normality (Shapiro-Wilk p=.13)	Meets assumptions of normality (Shapiro-Wilk p=.68)
HN MRT	Meets assumptions of normality (Shapiro-Wilk p=.36)	Meets assumptions of normality (Shapiro-Wilk p=.99)
AA MRT	Meets assumptions of normality (Shapiro-Wilk p=.73)	Meets assumptions of normality (Shapiro-Wilk p=.99)
NN MRT	Meets assumptions of normality (Shapiro-Wilk p=.12)	Meets assumptions of normality (Shapiro-Wilk p=.8)
AN MRT	<i>Does not meet assumptions of normality (Shapiro-Wilk p=.05)</i>	Meets assumptions of normality (Shapiro-Wilk p=.57)
AH MRT	Meets assumptions of normality (Shapiro-Wilk p=.73)	Meets assumptions of normality (Shapiro-Wilk p=.98)
HH MRT	Meets assumptions of normality (Shapiro-Wilk p=.65)	<i>Does not meet assumptions of normality (Shapiro-Wilk p=.01)</i>
ND MRT	<i>Does not meet assumptions of normality (Shapiro-Wilk p=.003)</i>	Meets assumptions of normality (Shapiro-Wilk p=.11)
HD MRT	Meets assumptions of normality (Shapiro-Wilk p=.67)	Meets assumptions of normality (Shapiro-Wilk p=.81)
DD MRT	Meets assumptions of normality (Shapiro-Wilk p=.79)	Meets assumptions of normality (Shapiro-Wilk p=.81)

Note: Variable presents ‘crowd’ first followed by ‘target’ (e.g. ‘NA MRT’ signifies the Mean Reaction Time for identifying an angry target in a neutral crowd)

Appendix X. Summary letter of results to participants

The below letter is a draft that will be sent out to participants following review by the exam board.

Dear Participant,

Thank you very much for taking part in the study ‘Selective attention to social threat in Body Dysmorphic Disorder’. Your help was much appreciated. I am writing to you because the study is now complete and I thought you might like to hear about the findings.

Aim of the study We wanted to find out whether people who have concerns related to BDD have a biased way of perceiving others, particularly whether they pay more attention to threatening and rejecting others, than people who do not have any appearance concerns.

What we did In order to find out whether people with BDD have a bias towards rejecting others, we compared 20 people who have this diagnosis, to 20 people who did not have mental health diagnoses. All participants did a computer task where they saw faces on the screen with different emotional expressions: happy, angry, disgusted, neutral. Sometimes, all faces were the same and at other times, one was different. Participants had to press a key to state if the photographs were the same or different. If they were able to spot the different face quicker, that indicated that they had a biased attention towards that emotion. Equally, if they reacted slower towards a crowd of faces showing the same emotion, they had a bias towards that emotion, as they were distracted by it. Anger and disgust were considered to be socially rejecting emotions. Participants also completed questionnaires about how anxious they are in social situations and about their mood.

What we found We found that participants with BDD-related concerns had high levels of anxiety about being negatively evaluated by others about their appearance and being negatively evaluated as a person, independent of their appearance. We found that both the BDD and the Control groups tended to spot rejecting faces faster than happy and neutral faces and were more distracted by anger. However, both groups had this pattern to the same amount, so our hypothesis that the BDD group would be more prone to zoom into rejection was not supported. This may show that people with anxiety about their appearance pay attention to other factors when they look at someone rather than whether they are being accepted. However, as we had a small number of participants and there were some limitations in the experimental method we used, we cannot draw firm conclusions based on these findings.

What next? This was a small study, so we have recommended that more studies like it are done to understand what maintains social anxiety about appearance. This study has shown that individuals with BDD have high levels of general social anxiety and social anxiety about their appearance. These may be important elements that need to be addressed in therapy.

Many thanks again for taking part in this research. Please do not hesitate to contact me should you have any further questions (a.schiza969@canterbury.ac.uk).

Yours sincerely,
Angeliki Schiza

Appendix Y. Letter to ethics committee of provisional results

Date:

REC reference number:

IRAS number:

Study Title:

Dear [chair of REC/R&D manager],

I am writing to inform you of the provisional initial results from the above research project as it is now complete. The research has been conducted as specified in the approved ethics applications.

Summary of research

Background and Objectives: Body Dysmorphic Disorder (BDD) involves a severe preoccupation with a perceived or minor flaw in appearance and is associated with high levels of social and psychological distress. To date, little research has been devoted to understanding what triggers and maintain these difficulties. This study aimed to find out whether individuals with BDD selectively attend towards socially rejecting others in their environment. It was hypothesized that if people with BDD overly focus on signs of social rejection, they would overestimate how many people are reacting negatively towards them, and might personalise this by attributing it to their perceived appearance flaws. Thus an attentional bias towards social rejection was considered to maintain BDD preoccupations.

Materials and methods: 20 individuals with a diagnosis of BDD and 20 individuals without mental health diagnoses took a computer task that measured attentional bias to social threat. This task is called ‘face in the crowd’ and involves detecting an emotionally incongruent face in a group (crowd) of faces. Faster detection of a threatening face (angry or disgusted) in a crowd of neutral or happy faces implies an attentional bias to threat. Slower reactions when presented with a full crowd of angry faces implies that participants are devoting more attentional resources to processing threat. Participants completed the computer task and additional questionnaires in a face to face meeting with the main researcher.

Results: The study found that the BDD group had high levels of social anxiety related to appearance and independent of appearance concerns. It also found that both the BDD and Control groups had an attentional bias towards threat, with faster detection of angry faces amongst crowds of neutral or happy faces and slower reaction times when presented with crowds of angry faces. However, there were no significant differences between groups, indicating that the BDD group was no more prone than healthy controls to selectively attend towards rejecting stimuli. Therefore, the attentional bias hypothesis was not supported.

Discussion: These findings may indicate that social anxiety about appearance is not related to selectively processing social rejection in one’s environment. However, due to the small sample size, conclusions are drawn with caution and further research with larger samples and different methodologies is needed. As the study has replicated previous research that found high levels of general social anxiety and social anxiety about appearance in participants with BDD, these may be important factors that need to be addressed in therapeutic interventions.

Arrangements for publication and dissemination

The findings are being submitted as part of my thesis for the partial fulfilment of the doctorate in Clinical Psychology at Canterbury Christ Church University. Following feedback from the examiners, a paper will be prepared for submission to a peer reviewed journal. A summary of findings will be sent to participants, following review by the examiners.

Yours sincerely,

Angeliki Schiza
Trainee Clinical Psychologist

Appendix Z. Author guidance

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