



Body image in and out of the lab: Correspondence between lab-based attentional bias data and body shape dissatisfaction experiences in daily life



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ABSTRACT

Accumulating lab-based studies have identified attentional biases in processing of negative appearance-related information among individuals with elevated trait body shape and weight dissatisfaction (BD). How these biases translate into experiences of BD in daily life remains unclear and, hence, was the focus of the present study. Thirty-eight women aged between 18–40 years completed a baseline survey and modified dot-probe task with both fat and thin appearance-related stimuli in a laboratory setting. Participants also downloaded a smartphone app that prompted them 10 times per day for 7 days to rate current body dissatisfaction. Results revealed that heightened BD in daily life tended to be transitory, and followed by a substantially lower rating of BD by the next survey (~1–2 h later). For individuals with elevated trait BD and facilitated attention towards thin body images, this reduction in state BD was more gradual. Surprisingly, delayed disengagement towards thin body images was associated with greater reduction in state BD. Consistent with the hypothesis, moderating effects were not observed when initial state BD level was low. Susceptibility for immediate, short-term attentional biases towards appearance-related information may be a vulnerability factor for the prolonged persistence of negative body image experiences in daily life.

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1. Introduction

Cognitive-behavioral accounts (e.g., Williamson, White, York-Crowe, & Stewart, 2004) emphasize the role of information processing in the onset and maintenance of eating disorders. Individuals with existing psychological risk (e.g., those who internalize unrealistic appearance standards and are concerned about their weight/shape) prioritise food- and appearance-related stimuli. This prioritisation ultimately elicits intense negative emotions for which corrective (e.g., body checking and concealment) or distracting (e.g., binge-eating) behaviors are used, in turn, to reduce these

negative emotions. Although lab-based studies provide support for preferential allocation of attention towards appearance-related content (i.e., attentional bias) among individuals who have elevated trait body dissatisfaction with their shape and/or size (BD) (Rodgers & DuBois, 2016), the extent to which short-lived attentional biases in lab conditions translate to sustained focus on body image in daily life remains untested. Thus, the present study provides a preliminary exploration of the correspondence between lab-based attentional biases towards appearance-related information and body shape dissatisfaction experiences in daily life.

A recent review by Rodgers and DuBois (2016) highlights several prominent features of appearance-related information processing. Based on cognitive tasks such as the dot probe paradigm and eye tracking tasks, individuals with elevated trait BD more quickly identify appearance-related stimuli, and are slower to disengage from this appearance-related information once identified (e.g., Gao et al., 2013; Rosser, Moss, & Rumsey, 2010). These attentional

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biases (both for thin and fat body images) may arise for individuals with trait BD (e.g., Gao et al., 2011; Rieger et al., 1998). Further, engagement with appearance-related information has been shown to elicit increased BD (e.g., Smith & Reiger, 2006, 2009). Thus, hypervigilance towards and subsequent difficulties disengaging from appearance-relevant information may exacerbate feelings of BD. Difficulty disengaging from appearance-relevant stimuli is also consistent with accumulated literature suggesting rumination about negative appearance-related content is common among individuals with an eating disorder or trait BD (Smith, Mason, & Lavender, 2018).

However, this delay in shifting attention away from appearance stimuli is potentially at odds with other findings showing a correlation between trait BD and tendency to endorse avoidance coping strategies in response to stressors and daily hassles (Cash, Santos, & Williams, 2005; Mohiyeddini, 2017; Wilson, Wilhelm, & Hartmann, 2014). These conflicting results underscore the difficulty in relying upon attentional bias data alone to understand persistence of BD experiences. Lab-based tasks demonstrate attentional processes with millisecond precision, but are not designed to address questions about duration of attentional capture of appearance threats (unless this attention resolves within seconds), nor the consequences for BD over longer time horizons (e.g., hours or days). Thus, it is assumed – though not directly tested – that individuals who exhibit biases towards quicker identification and delayed disengagement from appearance content have prolonged BD experiences that may explain their enduring, trait-level BD.

Independently, ecological momentary assessment (EMA) studies have been used to explore state BD, asking questions about frequency and duration of BD experiences in daily life. Importantly, findings from these EMA studies have revealed patterns of size- and shape-related body image experience in daily life that appear compatible with facilitated attention and delayed disengagement-related information processing biases found in these lab-based studies. At any moment, these individuals are also more likely to experience heightened state BD in their daily life (Fuller-Tyszkiewicz, Richardson, Lewis, Smyth, & Krug, 2018). Furthermore, state BD ratings at one time-point strongly predicted state BD at the next time-point, though this effect did not seem to be stronger for individuals with elevated trait BD (Fuller-Tyszkiewicz et al., 2018). Individuals with elevated trait BD more frequently report experiencing a range of contextual events demonstrated to promote state BD, such as upward appearance comparisons (against more attractive comparators), appearance-related teasing, and weight-related stigma (Fuller-Tyszkiewicz, 2019). Whereas experiences of stigma and teasing may be beyond their control, individuals with heightened trait BD seem to actively seek out upward comparisons (Leahey, Crowther, & Ciesla, 2011; Leahey, Crowther, & Mickelson, 2007; Rogers, Fuller-Tyszkiewicz, Lewis, Krug, & Richardson, 2017), despite the well documented negative impacts on state BD (Fuller-Tyszkiewicz, 2019). This is consistent with preferential processing of appearance-threatening content.

As per Williamson et al.'s (2004) cognitive-behavioral model, it is plausible that the persistence of negative body image experiences in relation to size and shape depends on both level of dissatisfaction at the initial timepoint and predisposing risk in the form of trait BD and/or attentional biases. Individuals with healthier body image may occasionally experience state BD, but this may quickly dissipate, particularly if they are less predisposed to attentional bias patterns characterised by hypervigilance towards and difficulty disengaging from appearance-related information. In contrast, for individuals with elevated trait BD, instances of elevated state BD may take longer to subside as they begin to fixate on their feelings of BD once initiated. We are unaware of any studies that have tested this possibility with EMA data, nor attempts to correlate body image data from daily life (via EMA) with attentional bias information. As

these data span different timescales (milliseconds and seconds for attentional bias data, and one or more hours for EMA data), combining these data may further our understanding of the time course and consequences of momentary experiences of state BD. Specifically, the observed correlational pattern between attentional biases (hypervigilance and delayed disengagement) and state BD may strengthen arguments that attentional biases predispose individuals to elevated trait BD. Correlations with attentional bias data may also provide plausible cognitive mechanisms to explain why state BD experiences in daily life persist for some individuals. If delayed disengagement predisposes an individual to rumination about their appearance, cognitive strategies that reframe the importance of BD (e.g., Stice, Rohde, Gau, & Shaw, 2009; Summers & Cogle, 2018) may help to reduce duration and severity of BD in daily life. Insofar as hypervigilance is also or instead linked to state BD in daily life, treatment approaches that train individuals to be less sensitive to appearance-related content (e.g., Delinsky & Wilson, 2006) may be helpful.

Thus, the present study brings together two disparate yet potentially related bodies of research: lab-based attentional bias and EMA-based studies of body image. Under the assumption that elevated state BD is unpleasant and therefore something an individual would want to reduce (Heatheron & Baumeister, 1991), we predicted that – for the sample overall – elevated state BD (operationalised as at least one standard deviation above one's mean state BD level) at one timepoint would be followed by a decline in state BD at the next timepoint (measured on average ~1–2 hours later) (Hypothesis 1). However, based on Williamson et al.'s (2004) cognitive-behavioral model, we hypothesized that the magnitude of this reduction in state BD would depend on individual differences in trait BD and processing of appearance-related content. Specifically, it was predicted that the magnitude of reduction in elevated state BD would be smaller for individuals with greater trait BD (Hypothesis 2). We reason that this persistence of state BD experience may be the daily life equivalent or corollary of attentional biases (delayed disengagement or facilitated attention) observed in lab tasks. Thus, we predicted that individuals with greater levels of attentional bias will exhibit less change in state BD from one timepoint to the next when the initial state BD level is high (≥ 1 SD above the mean) (Hypothesis 3). Although Rodgers and DuBois (2016) showed that high trait BD individuals exhibit biased processing of both fat and thin images, in daily life studies comparisons to thinner/more attractive individuals more commonly leads to state BD (Fuller-Tyszkiewicz, 2019). As such, the moderating effects of these attentional biases were tested separately for processing of fat and thin images in the present study.

Finally, as a point of contrast to experiences when one's state BD is higher than usual, these proposed moderating effects were also tested when the same individual's initial state BD was low (operationalised as at least one SD below one's state mean BD level). Given the focus in the cognitive-behavioral model (Williamson et al., 2004) on appearance-related attentional biases as a mechanism for perpetuating *negative* body image, we expected that trait BD and attentional biases would be unrelated to level of change in state BD following experience of low state BD (Hypothesis 4).

2. Method

2.1. Participants

Participants were recruited from the general public as well as Deakin University. Due to gender and age differences in the expression of BD levels (Demarest & Allen, 1998) and in line with the bulk of past attentional bias studies of body image (Rodgers & DuBois, 2016), participation was limited to women. In total, 38 women,

aged between 18–40 years ($M = 24.11$, $SD = 4.94$) participated. The sample was predominantly comprised of individuals who identified as Caucasian (73.7 %; 21.1 % Asian and 5.3 % other), were currently working as well as studying (71.1 %), and had completed a tertiary course of study (68.4 %). Average BMI, calculated from self-report height and weight, was 22.50 ($SD = 2.88$).

2.2. Procedure

Following ethics approval at Deakin University, the study was advertised publicly via online forums and flyers, and to students via student mailing lists and on-campus posters. The study was described to prospective participants as comprising several key components: (1) a 20–30 minute lab session on-campus in which they would complete a brief survey about their body image and a computer task involving quick reactions to body images shown on a screen (Phase 1); and (2) a series of surveys signalled via a smartphone app to assess their body image in daily life (Phase 2). Interested participants emailed the research team to schedule a study meeting on campus to commence the study.

In Phase 1, participants individually attended a lab session on campus to complete an online survey with demographic information and a measure of trait BD. They also completed a computerised attentional bias task (dot probe; see below), and downloaded a smartphone app, Instant Survey (Richardson, 2015a, 2015b), for Phase 2. The app generated a random alphanumeric ID which the participant shared with the researcher to link their online survey, attentional bias task, and app-based data. The research team member explained that Phase 2 would start the day after the lab visit, and consist of the app signalling a brief survey 10 times per day for one week to measure state-based BD. Participants had 30 min to complete a survey once notified on their phone before the survey instance disappeared from the phone and was counted as missing data.

The surveys were programmed to signal at semi-random intervals in 1–2 hour blocks from 9am to 10 pm. This schedule was designed to sample across the whole day. The maximum number of surveys per day in the present study exceeds the number typically used per day in prior EMA studies (e.g., Fardouly, Pinkus, & Vartanian, 2017; Heron & Smyth, 2013a; Leahey & Crowther, 2008; Mason et al., 2018). This decision to increase the sampling within day is in line with several recent studies (Holland, Koval, Stratemeyer, Thomson, & Haslam, 2017; Tan et al., 2019), and is in recognition of recent work showing that lengthier intervals between assessments can lead to under-estimates of state-based associations (Fuller-Tyszkiewicz, Karvounis, Pemberton, Hartley-Clark, & Richardson, 2017; Kockler, Santangelo, & Ebner-Priemer, 2018).

At the completion of Phase 2, participants were remunerated with a \$20 gift voucher. Given the considerable time commitment of a lab session and app phase, the dollar amount of the gift voucher was not pro-rated for amount of app-based surveys completed. Impact of these design choices are covered further in the Discussion section.

2.3. Measures

2.3.1. Phase 1: baseline measurements in lab session (Day 1)

2.3.1.1. Trait body shape dissatisfaction. Dissatisfaction individuals feel in general about their appearance was measured using the 9-item version of the Body Satisfaction subscale of the Body Change Inventory (Mellor, Fuller-Tyszkiewicz, McCabe, & Ricciardelli, 2012; Ricciardelli & McCabe, 2002). These items are evaluated on a 5-point rating scale (*very unhappy, unhappy, neither unhappy nor happy, happy, and very happy*), and ask about satisfaction with specific body regions (e.g., chest, legs, thighs) and

global aspects of appearance (e.g., weight, shape, and muscles). Item scores were reverse-coded and added together, producing total scores ranging from 9 to 45 that indicate level of body shape dissatisfaction. Although the scale does not have established cut-offs for high shape body dissatisfaction, a score of 27 is consistent with someone indicating neutral responses across all items. Higher scores reflect greater dissatisfaction, and scores lower than 27 reflect greater satisfaction with appearance. Psychometric adequacy of this scale has been demonstrated in previous studies (e.g., Fuller-Tyszkiewicz et al., 2012). Internal consistency was acceptable in the present study ($\alpha = .79$).

2.3.1.2. Attentional biases. Attentional biases towards appearance-related information (both thin and fat body images) were derived from participant responses to a computer-based dot-probe task (Moussally, Brosch, & Van der Linden, 2016; MacLeod, Mathews, & Tata, 1986; Moussally, Rochat, Posada, & Van Der Linden, 2016). In this task, participants were instructed to fixate on a cross centrally located on the computer screen. After 500 ms, the fixation cross was replaced with two body images – one on the left side of the screen, and the other on the right. Each body image was either fat, thin, or neutral (medium weight range), and presented for 100 ms or 500 ms, after which time a dot appeared in the location of one of the two body images. Participants were instructed to use the keypad to identify the location of the dot (right or left) as quickly as possible. After responding, the screen was cleared of images before the process repeated – see Fig. 1 for a visual depiction of this sequence. This process was repeated 160 times, divided equally into four types of image pairings to produce balanced conditions: a thin condition (*thin* body paired with *neutral* body), fat condition (*fat* body paired with *neutral* body), neutral condition (*neutral* body paired with *neutral* body), and a control condition (*thin* body paired with *fat* body).

The present study used 40 images that were validated as being either fat or thin by Moussally et al. (Moussally, Brosch et al., 2016; Moussally, Rochat et al., 2016). In these studies, Moussally et al. demonstrated that these body images significantly differed in terms of participant ratings along dimensions of body shape (how big or small the body size was perceived to be) and valence (whether this body size was perceived as positive or negative). Participants were able to correctly differentiate thin, neutral, and fat body images, and ratings of body shape were unrelated to participant characteristics such as BMI, body dissatisfaction, or internalization of the thin ideal (Moussally, Brosch et al., 2016; Moussally, Rochat et al., 2016).

For the purposes of derivation of attentional bias scores for each participant, reaction times for each of the 160 trials are separated into congruent trials, incongruent trials, and neutral trial times. Congruent trials included dots that replaced the fat/thin stimuli in the conditions where a fat or thin image was paired with a neutral body image, whereas incongruent trials included dots that replaced the neutral stimuli when paired with a fat or thin body image. Neutral trial times were derived from pairings of two neutral body images. Attentional biases are then derived from comparison of several of these types of trials (congruent, incongruent, neutral), and are premised on the notion that biases towards appearance-related information should produce different reaction times relative to the neutral, control condition. In this study, we focused on two commonly tested forms of attentional bias: facilitated attention and delayed disengagement.

2.3.1.2.1. Facilitated attention. Facilitated attention is characterised as quicker initial detection of the dot probe when presented in the location of an individual's focus. As such, it is tested with very brief displays of stimuli (100 ms) prior to presentation of the dot probe. Facilitated attention towards fat or thin body images is evident when an individual is quicker to identify the dot probe

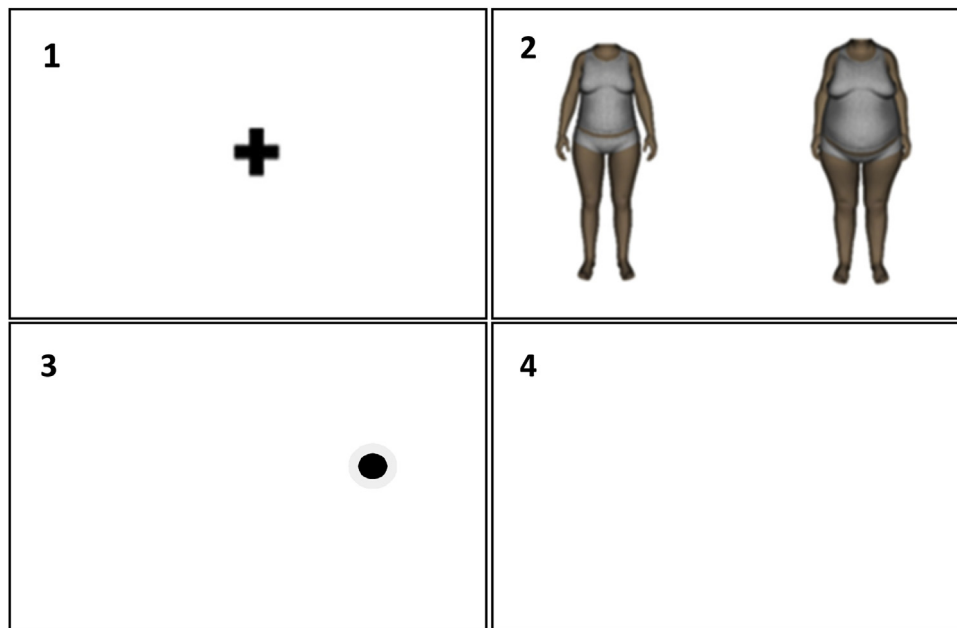


Fig. 1. Example illustration of a congruent, fat condition trial. Slide numbers 1–4 represent the order of slide presentation. The first slide contains the fixation cross. The second slide illustrates the fat body (right) and the neutral (medium weight) body (left). Slide number 3 slide displays the probe that replaces either the right or left body. The fourth slide represents the inter-trial screen.

when it replaces a thin or fat body image (congruent trial) relative to reaction times when the probe replaces an image in the neutral condition. Thus, facilitated attention indices for each participant were computed by subtracting the average reaction times of the congruent fat or thin condition from the average reaction time of the neutral condition. Positive values for this index indicate that an individual is quicker to identify the probe when it replaces a thin (or fat) body image. Separate values were obtained for facilitated attention towards thin images and fat images.

2.3.1.2.2. Delayed disengagement. Delayed disengagement reflects an individual's difficulty shifting attention away from a stimulus once engaged. Thus, if the dot probe is presented in the location of the stimuli that is not being attended to by the participant (incongruent condition), reaction times for identifying the probe would be expected to be slower. For this type of bias, a longer presentation time (500 ms) is given for the display of stimuli. Delayed disengagement indices for each participant were computed by subtracting the average of the neutral condition reaction times from the reaction time averages of either the *incongruent* fat condition or thin condition. Positive values for this index indicate that an individual took longer to react when the dot probe was placed away from a thin/fat body image and are thus taken to indicate delayed disengagement. Separate values were obtained for delayed disengagement from thin and fat images.

Reaction times shorter than 200 ms were excluded from mean computation as these were considered unreliable (Moussally, Brosch et al., 2016; Moussally, Rochat et al., 2016). No reaction times exceeded 2000 ms, Moussally et al.'s cut-off for reaction times deemed too long to be reliable.

2.3.2. Phase 2: state-based measurements from smartphone app (Days 2–8)

2.3.2.1. State-based body satisfaction. Participants indicated their current level of body satisfaction using an 11-point end-defined scale (0 = *completely dissatisfied* to 10 = *completely satisfied*), which was then reversed so that high scores indicate greater state BD. This single-item method in measurement is consistent with prior body image studies (Rogers et al., 2017; Sonnevile et al., 2012; Tan

et al., 2019). Prior studies have demonstrated sensitivity to change from moment-to-moment of this single item state-based measure, as well as correlations with constructs theoretically relevant to state body dissatisfaction, including appearance comparisons, exercise for appearance-related reasons, and appearance focus (Fuller-Tyszkiewicz, Dias, Krug, Richardson, & Fassnacht, 2018; Rogers et al., 2017; Tan et al., 2019).

2.4. Data analytical plan

2.4.1. EMA data screening

The large number of surveys in the EMA design presents several threats to validity of results, in terms of systematic bias due to differences in compliance rates and state BD ratings within and across days. Several preliminary analyses were conducted to evaluate level of threat present in the current sample. First, differences in compliance (i.e., number of EMA surveys completed per individual) were inspected by correlating compliance with body image-related baseline variables - trait BD and self-reported BMI. Second, systematic differences in state body dissatisfaction ratings over the course of the study were explored by regressing via multilevel modelling state body dissatisfaction ratings onto time of day (coded in 24-h time) and day of week (coded as weekend = 1, weekday = 0). Third, reactivity effects due to repeated questioning about state BD were evaluated with a multilevel model regressing state BD onto assessment order for participant, from their first to last assessment across the 7-day testing period.

2.4.1.1. Hypothesis testing. Change in state BD ratings across consecutive EMA surveys were calculated by subtracting prior ($t - 1$ rating) from current BD rating (rating at time t), such that positive scores indicate worsening BD over time. These difference scores were only calculated from consecutive timepoints within the same day, as per prior studies which limit state-based exploration to within-day effects (e.g., Fitzsimmons-Craft et al., 2015; Rogers et al., 2017).

Separate multilevel models were then used to estimate average level of change in state BD from timepoint to timepoint (for testing

Table 1
Descriptive statistics for key study variables.

| Variable | Mean | SD |
|---|---------|--------|
| State BD | 4.206 | 2.414 |
| State BD change (when initial BD value is low) | -1.925 | 2.210 |
| State BD change (when initial BD value is high) | 1.431 | 1.752 |
| Trait BD | 25.753 | 6.432 |
| Delayed disengagement from thin images | 6.284 | 8.929 |
| Delayed disengagement from fat images | 17.410 | 8.381 |
| Facilitated attention towards thin images | -3.697 | 9.968 |
| Facilitated attention towards fat images | -28.114 | 13.966 |

Note. BD = body dissatisfaction. Disengagement and facilitated attention statistics are reported in milliseconds. State BD change = present state BD - state BD at previous timepoint. Positive scores for the delayed disengagement and facilitated attention variables reflect stronger attentional biases towards these body images.

Hypothesis 1), and to predict magnitude of these changes based on trait BD (Hypothesis 2) and each of the attentional bias variables (delayed disengagement and facilitated attention; Hypothesis 3). For these analyses, bias variables and trait BD were grand-mean centred. For each predictor variable, the multilevel model was run twice; once for situations where participants reported high state BD (operationalised as at least 1 SD above the mean state level) at time $t - 1$, and once for situations where the same individuals provided lower state BD (at least 1 SD below the mean state level) ratings at $t - 1$. The latter analyses - with low initial state BD - allowed for testing of Hypothesis 4.

Given that what is experienced as a high level of state BD is likely to differ across individuals, the present study followed Smyth and Heron's (2016) method of operationalising high state BD as 1 SD above the individual's mean across all completed EMA assessments. We applied a similar definition for low state BD as 1 SD below an individual's mean. This operationalisation resulted in 400 state BD estimates for the high state BD analyses, and 390 state BD estimates for the low state BD analyses (out of a total of 1803 state BD reports across all participants). Considering the semi-random schedule of EMA surveys employed in the current study, time lag between consecutive surveys was included as a covariate. Pseudo- R^2 values were calculated as per Snijders and Bosker (2012).

3. Results

3.1. Data screening and descriptive analyses

On average, participants completed 47.45 EMA assessments out of 70 ($SD = 9.80$, range = 30–65), which is consistent with prior studies (Jones et al., 2019). The average time lag between surveys within day was 1.66 h ($SD = 1.27$ h), with 85% of surveys spread a maximum of 2 h apart. Average number of EMA surveys completed per person was unrelated to trait BD ($r = .083$, $p = .619$) and BMI ($r = .200$, $p = .905$). Thus, all participants were retained in subsequent analyses despite differences in number of EMA surveys completed.

Separate multilevel models revealed that state BD ratings at a given timepoint were unrelated to time of day ($B = 0.018$, 95% CIs: -0.01, 0.05, $p = .241$), whether it was a weekend day ($B = -0.06$, 95% CIs: -0.27, 0.15, $p = .598$), or order of assessment within-person ($B = 0.00$, 95% CIs: -0.01, 0.01, $p = .944$). Thus, systematic biases in state BD ratings due to timing or reactivity are not evident in the present sample.

Table 1 provides descriptive statistics for state and trait BD and attentional bias scores from the dot probe task. The averages for state and trait BD were both slightly below the neutral scale midpoints, though there was considerable variability in scores around these means. For the sample as a whole, state BD tended to increase by almost 2 units following an initially low level of state BD, and tended to decrease by almost 1.5 units following an

Table 2
Multilevel models predicting change in state body dissatisfaction over consecutive timepoints.

| Predictors | Low | | High | |
|------------------|----------------------|----------|-----------------------|----------|
| | <i>B</i> [95% CIs] | <i>p</i> | <i>B</i> [95% CIs] | <i>p</i> |
| Intercept | 1.037 [0.70, 1.37] | < .001 | -1.839 [-2.24, -1.44] | < .001 |
| Trait BD | -0.020 [-0.06, 0.02] | .392 | 0.056 [0.01, 0.10] | .022 |
| <i>R-squared</i> | < .01 | | .10 | |
| Intercept | 1.118 [0.80, 1.43] | < .001 | -1.811 [-2.21, -1.41] | < .001 |
| DD thin | 0.020 [-0.01, 0.05] | .252 | -0.047 [-0.08, -0.01] | .010 |
| <i>R-squared</i> | < .01 | | .17 | |
| Intercept | 1.011 [0.69, 1.33] | < .001 | -1.676 [-2.08, -1.27] | < .001 |
| DD fat | -0.008 [-0.03, 0.02] | .606 | 0.024 [-0.01, 0.06] | .109 |
| <i>R-squared</i> | < .01 | | < .01 | |
| Intercept | 0.998 [0.68, 1.32] | < .001 | -1.738 [-2.13, -1.34] | < .001 |
| FA thin | 0.000 [-0.02, 0.03] | .991 | 0.034 [0.01, 0.06] | .023 |
| <i>R-squared</i> | < .01 | | .11 | |
| Intercept | 1.009 [0.69, 1.32] | < .001 | -1.735 [-2.13, -1.34] | < .001 |
| FA fat | 0.010 [-0.01, 0.03] | .322 | 0.001 [-0.02, 0.02] | .454 |
| <i>R-squared</i> | < .01 | | < .01 | |

High = state body dissatisfaction ratings at least 1 SD above the participant's mean state BD ratings across the EMA phase. Low = state BD ratings at least 1 SD below the participant's mean state BD ratings across the EMA phase. Given the variable time interval scheduling for the study's EMA data, all models in this table control for time interval between initial state BD rating and subsequent state BD rating. *R-squared* estimate for the trait-level moderator in each model is provided in italics. FA = facilitated attention, DD = delayed disengagement, BD = body dissatisfaction.

initially high level of state BD. The magnitude of delayed disengagement and facilitated attention biases are broadly consistent with effects found previously for a non-clinical population (Moussally, Brosch et al., 2016; Moussally, Rochat et al., 2016). The negative mean scores for facilitated attention suggest that the average participant was not hypervigilant towards fat or thin body images, though positive mean scores for delayed disengagement suggests that the majority of participants were potentially distracted by thin and fat images once identified.

3.2. Multilevel models

Table 2 provides the results of several multilevel models run to evaluate the moderating effect of trait variables (trait BD and both delayed disengagement and facilitated attention for fat and thin stimuli) on change in state BD ratings from one timepoint to the next. Across each model, the intercept value reflects the average level of change in state BD (controlling for time interval between assessments and these trait level predictors). For instances where the initial state BD rating was low (at least 1 SD below an individual's average state level), the subsequent change was an increase in state BD of approximately 1 unit on the 0–10 state BD scale (all $ps < .001$ for these intercepts). In contrast, for the sample overall, initial high state BD ratings (at least 1 SD above one's mean state level) tended to be followed by significant reduction in state BD levels by the subsequent time point of over 1.5 units ($p < .001$), consistent with Hypothesis 1.

In support of Hypothesis 2, the magnitude of reduction in initial high state BD by the subsequent timepoint was lower for individuals with higher trait BD ($B = 0.056$, 95% CIs: 0.01, 0.10, $p = .022$, $R^2 = .10$). Evidence was mixed for Hypothesis 3. While individuals who scored higher on facilitated attention towards thin body image stimuli had a smaller magnitude reduction in state BD following initially high levels of state BD ($B = 0.034$, 95% CIs: 0.01, 0.06, $p = .023$, $R^2 = .11$) as anticipated, moderating effects of facilitated attention towards fat body images ($B = 0.001$, 95% CIs: -0.02, 0.02, $p = .454$, $R^2 < .01$) and delayed disengagement from fat body images ($B = 0.024$, 95% CIs: -0.01, 0.06, $p = .109$, $R^2 < .01$) were nonsignifi-

cant. Furthermore, and unexpectedly, the magnitude of reduction in high state BD by the subsequent timepoint was greater for individuals who exhibited greater delayed disengagement from thin body image stimuli during the lab task ($B = -0.047$, 95 % CIs: -0.08 , -0.01 , $p = .010$, $R^2 = .17$). Hypothesis 4 was supported, as trait BD and the attentional bias variables failed to moderate magnitude of change in state BD following initially low levels of state BD ($ps \geq .252$, R^2 estimates $\leq .01$).

4. Discussion

Separate lines of evidence from lab-based and daily life (EMA) studies suggest that individuals with elevated trait body shape and size dissatisfaction may process appearance-related information differently to individuals who are satisfied with their appearance (Fuller-Tyszkiewicz, 2019; Rodgers & DuBois, 2016). However, the empirical relationship between these two strands of evidence has not been previously tested. The present study constitutes the first attempt to address this gap, and revealed a complex pattern of associations between attentional biases, trait BD, and experiences of body shape dissatisfaction in daily life.

As hypothesized, experiences of elevated state BD at one timepoint were followed by reductions in state BD at a subsequent timepoint (approximately 1–2 hours later). Furthermore, this magnitude of state BD reduction was smaller for individuals with elevated trait BD, consistent with the notion that BD experiences persist for some individuals because they are less equipped to regulate these negative feelings and engage flexibly with negative appearance thoughts (Smith et al., 2018). Attentional bias data from the present study suggest that this persistence of state BD (as observed by smaller reductions in state BD once initially encountered) may be related to biased information processing of body image stimuli. For individuals who were quicker to identify the dot probe when located in place of *thin* body image stimuli, heightened state BD reduced to a lesser degree. This facilitated attention has been found previously for individuals with heightened trait BD (e.g., Gao et al., 2011, 2013, 2014), and may signal a vulnerability towards negative, body image threatening information in one's environment: whereas other individuals may be better equipped to dismiss (or may simply ignore) negative appearance-related stimuli, individuals with this facilitated attention bias may actively seek out this negative information in their environment, thus contributing to the likelihood of episodes of elevated state BD (Roefs et al., 2008).

However, the anticipated effect of delayed disengagement from appearance-related stimuli was not supported by present findings. Instead, it was found that individuals with greater delayed disengagement from thin body image stimuli actually experienced greater subsequent reduction in state BD following an initially high state BD level. Such a finding is inconsistent with prior findings that stronger ruminative tendencies are associated with higher trait BD (Smith et al., 2018), and also with attentional bias studies in which individuals with higher trait BD have been shown to exhibit greater delayed disengagement from appearance content (Moussally, Brosch et al., 2016; Glauert, Rhodes, Fink, & Grammer, 2010; Moussally, Rochat et al., 2016; Shafran, Lee, Cooper, Palmer, & Fairburn, 2007; although see Gao et al., 2011 who instead found a speeded detection-subsequent avoidance pattern for thin body image stimuli).

We speculate that the unexpected effect for delayed disengagement may be due to confounding. Whereas the longer reaction time when an individual is encouraged to look away from the body image stimuli is interpreted as difficulty shifting attention, delayed reaction times may also result if an individual were attempting to avoid the appearance-related stimuli. The assumption for delayed

disengagement is that one's focus remains in the location of the appearance content. If instead an individual has chosen to look away entirely from the images presented, then this too may lead to delayed reaction time for identifying the dot probe. Such an explanation is admittedly at variance with the typical interpretation of delayed reaction times in this attentional bias task, though others have raised similar concerns about where an individual is actually devoting their attentional resources during the period of testing (e.g., Jiang & Vartanian, 2018). An avoidance-based interpretation of present findings is consistent with the pattern of findings as we would expect avoidance to be associated with slower reaction times and, if tending towards avoidance of negative body image thoughts, greater reduction in state BD once identified. This avoidance-based interpretation is also consistent with prior research showing tendencies towards avoidance coping strategies when dealing with appearance threats both in cross-sectional surveys (Cash et al., 2005; Mohiyeddini, 2017; Wilson, Wilhelm, & Hartmann, 2014) and attentional bias tasks (Gao et al., 2011) for individuals with negative body image. Some researchers advocate for use of eye-tracking software to augment understanding of reaction times obtained via dot probe tasks (e.g., Jiang & Vartanian, 2018). We suggest further research explore this possibility to provide greater insights into the nature of delayed reaction times in response to appearance-related content, and consequences for BD in daily life.

It is noteworthy that attentional biases towards thin images – though not fat images – moderated change in state BD. While it may seem that biases towards fat images would be important for sustaining one's state BD, it is important to emphasize that the bulk of EMA studies to date show that focus on thin physiques more consistently and strongly predicts increased state BD (Fuller-Tyszkiewicz, 2019). While there is evidence of attentional biases towards both fat and thin body images among individuals with elevated trait BD, the evidence base for biases towards thin images appears larger and more consistent (Rodgers & DuBois, 2016). Furthermore, Jansen, Nederkoorn, and Mulken (2005) showed that the pattern of attention may depend on whether an individual is observing their own body or that of others. They found that individuals with elevated disordered eating symptoms (including shape and weight concerns) were more likely to focus on the less attractive aspects of their own appearance but the more attractive aspects of bodies of others.

Finally, the current design allowed for examination of effects when the initial BD state was high vs low. Although initially high and low state BD experiences tended to be followed by state BD levels shifting towards the mean, it was only in the context of initially high state BD that trait BD and the attentional bias constructs moderated magnitude of change in state BD. Thus, while the shifts in state BD may in part be attributable to statistical regression to each individual's mean state BD level, observed moderation effects suggest that this is not the only reason for these shifts in state BD.

The cognitive-behavioral model (Williamson et al., 2004) identifies abnormal information processing of appearance content as a risk factor for body image disturbances. As a small, first study to explore the association between EMA and lab-based attentional bias data, our findings offer preliminary support for this notion. Facilitated attention towards appearance-related stimuli may signal potential hypervigilance towards appearance threats within one's environment. A recent systematic review showed that cognitive bias modification training for biases in attention and in interpretation may be beneficial for reducing disordered eating symptomatology, including body image disturbances (Matheson, Wade, & Yiend, 2019). Efforts to challenge values regarding the thin ideal (Stice et al., 2009) or to supplant one's negative body image with more positive, accepting views (Rodgers et al., 2018) may also help individuals who are susceptible to hypervigilance to deal with appearance threats once identified in their environment.

Despite potential relevance for theory and practice, these findings require replication, and gaps in understanding remain. A key challenge in exploring dynamic processes such as fluctuations in state BD is accurately capturing the change process. Whereas our lab-based cognitive task provides insights into immediate attentional allocation and our EMA design explores potential change in state BD over a span of hours, it is unclear what happens in the intervening period between EMA assessments. One possible explanation for the reduction in state BD for the overall sample is use of avoidance coping (Cash et al., 2005). However, in such a case, the change process is unlikely to be a smooth decline in BD: At one point in time, the individual is thinking about their appearance, and at the next they are not. For individuals who show less steep decline in state BD once initially elevated, it may be that – due to individual difference factors such as trait BD or facilitated attention – they are primed to engage in a range of appearance-related behaviors (e.g., appearance comparisons, trying on clothes, weight-based conversations, etc.) that extend their period of dissatisfaction. Indeed, recent findings by Rogers et al. (2017) show that individuals are likely to engage in upward appearance comparisons when they are already dissatisfied with their appearance. Future research might investigate this timecourse for state BD decline further by supplementing state BD measurement with questions that contextualise the reported BD experiences in EMA timepoints. For instance, participants may be asked how much time they spent thinking about their appearance, whether they engaged in other appearance-related behaviours (e.g., appearance comparisons), and what strategies they employed to deal with state BD once identified. Though this added questioning about time spent thinking about one's appearance may raise concerns about reactivity effects, existing studies suggest that focus on body image in EMA contexts may not undermine data quality (Fuller-Tyszkiewicz et al., 2013; Heron & Smyth, 2013b). Further, studies have recently shown how appearance rumination may be measured in this context (e.g., Seidel et al., 2016).

We note too that the present study limited its focus to dissatisfaction with body size and shape. This is not to imply that body image concerns are limited to shape and size. We are unaware of any studies that have explored daily life experiences or attentional biases for other forms of body image focus, such as focus on aesthetic or functional concerns (such as scarring, dermatological conditions, or amputations). Thus, the generalizability of current findings to these contexts remain unclear. We encourage further research with more diverse body image foci to rectify this gap.

In conclusion, present preliminary findings are consistent with key notions of cognitive-behavioral accounts of body image experiences: (a) trait BD acts as a predisposing psychological risk factor for information processing of appearance-related content; (b) continuation of persistent, high state BD may also depend on the initial level of state BD; and (c) attentional biases (facilitated attention and, possibly, delayed disengagement) may contribute to duration of negative body image (Williamson et al., 2004). Replication and extension are encouraged, particularly with attention drawn to what is captured by delayed disengagement, and what happens subsequent to initially high state BD experiences in daily life.

Declaration of Competing Interest

None of the authors have a conflict of interest to declare.

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