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Attention Bias for Appearance Words Can be Reduced in Women: Results From a Single-Session Attention Bias Modification Task.

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Abstract

Background and Objectives: We tested whether a single-session of attention bias modification (ABM) could change bias towards appearance-related words and improve body satisfaction. **Methods:** Females (N = 102; M_{age} = 33 years) completed an ABM session where attention was trained towards positive appearance-related information (n = 31), away from negative appearance-related information (n = 37), or a non-training session (n = 34). Importance of appearance and shape concern were examined as moderators. **Results:** ABM was effective in women high on appearance importance, trained to direct attention away from negative appearance words. **Limitations:** Although the sample were non-clinical, their levels of shape concerns were higher than normative values. No long-term follow up of attention biases were conducted. **Conclusions:** These findings suggest that certain types of attention biases are amendable to change within a single session.

Keywords: Attention bias; attention bias modification; body image; women; appearance importance.

1.1 Attention Bias for Appearance Words Can be Reduced in Women: Results From a Single-Session Attention Bias Modification Task.

Body image problems are of growing concern and a significant risk factor for the development of eating disorders (Stice & Shaw, 2002). In western cultures, body dissatisfaction is found in up to 74% of women (Hay et al, 2008), resulting in a host of negative outcomes including poor self-esteem, dysfunctional eating behaviours, poorer wellness, functional impairment, and reduced quality of life (Becker et al., 2017; Kayano et al., 2008).

Recently, there has been an increase in research examining cognitive models of psychopathology. These models posit that biased processing of disorder-related material is important in the development and maintenance of various psychological conditions (e.g., Renwick, Campbell, & Schmidt, 2013). In particular, biased attention has been implicated in conditions such as depression, anxiety, substance use, and eating disorders (Aspen, Darcy, & Lock, 2013; Beard, Sawyer, & Hoffman, 2012). Attentional bias is the tendency for an individual to pay more attention to disorder-consistent or threat information (Bar-Haim et al., 2007). Applied to the body image domain, women with elevated body dissatisfaction may be hypervigilant for cues in the environment related to body shape, food, or appearance. Although these biases are stronger in individuals with disordered levels of body image disturbance, research has shown attentional biases in non-clinical females with high levels of weight and shape dissatisfaction (Gao et al., 2011; Gao et al, 2013; Perpiñá et al., 1993).

There has been a surge of interest in approaches to modifying attention biases, such as Attention Bias Modification (ABM), which implicitly re-direct participant's attention away from threat material. In an ABM task, participants are asked identify the location of a probe, as quickly but accurately as possible, which replaces two words on a computer screen. In training trials, the placement of the probe is manipulated so that it appears in the opposite location of the threat word or picture. Across many trials, participants learn to

direct their attention away from threat or negatively valanced material. ABM protocols have been applied to a number of psychological conditions, with small to medium effect sizes in depression and anxiety literature (Hallion & Ruscio, 2011).

To date, few studies have applied ABM to women with body image concerns. Smith and Rieger (2006) tested whether an attention bias could be induced towards negative appearance-related (e.g., fat), neutral (e.g., car), or negative emotional words (e.g., hate) in a group of non-clinical women with moderate levels of body satisfaction. Their findings demonstrated that a bias towards negative appearance words could be induced, which resulted in elevated shape and weight dissatisfaction after women completed a body image challenge involving exposure to thin-ideal media images. A later study (Smith & Rieger, 2009) also showed that attention bias could be induced towards a range of appearance and food words, compared to neutral words. Biasing attention towards negative shape and weight words again resulted in greater body dissatisfaction after completion of a body image challenge. Collectively, these studies support a causal link between attention bias for negative appearance stimuli and body dissatisfaction. Interestingly, the group of women who received training to direct their attention *towards* positive appearance material did not show any improvements in their level of body dissatisfaction, suggesting a specificity effect.

While these studies validate the modification of attention biases, in an applied context it may not be useful to train women to direct their attention towards negative appearance stimuli. Recently, Loughnan, Mulgrew, and Lane (2015) tested the effectiveness of an ABM protocol wherein attention was directed away from negative appearance material. However, they found no significant changes in attention bias for positive or negative appearance words, nor changes to state or trait body satisfaction immediately or 2-weeks post-training. Thus, the effectiveness of ABM for women's body dissatisfaction remains unclear, despite evidence that suggests modification effects are possible (Smith & Reiger, 2006, 2009). More broadly, attention re-training has shown promise in other

approaches, notably in research by Smeets, Jansen, and Roefs (2011) who used eye tracking in combination with attention re-training. These researchers showed that women who were trained to direct their gaze towards previously defined unattractive areas of their bodies were more likely to report body dissatisfaction. Comparatively, women who were trained to direct attention towards previously rated attractive areas of their body reported increased body satisfaction. Collectively these findings suggest that attentional processes are important to target and may be a useful strategy to reduce women's body dissatisfaction.

The aim of the current study was to contribute to literature concerning the effectiveness of ABM for appearance-related stimuli in women. Most research to date has explored ABM in the context of body dissatisfaction as measured by the Body Shape Questionnaire (Cooper et al., 1987), either selecting participants based on their scores (Smeets et al., 2011; Smith & Rieger, 2006), dividing women into high and low body dissatisfaction groups based on their scores (Loughnan et al., 2015), or looking at scores post-training (Smith & Rieger, 2009). A related construct to satisfaction with appearance is the *importance* placed on appearance. The limited research suggests that greater investment or value placed on appearance is associated with various detrimental outcomes such as body dissatisfaction, dietary restraint, and exercise dependence in college women (Lamarche & Gammage, 2012), poorer outcomes after viewing thin-ideal media images (Ip & Jarry, 2008), and greater consumption of appearance-focused magazines (Slevec & Tiggemann, 2010). A person who places greater importance on their appearance may experience difficulty in shifting their attention away from appearance-related material. However, this idea has not yet been tested within the ABM literature. Therefore, we present the first comparison of the roles of appearance satisfaction and appearance investment in moderating responsiveness to ABM. Finally, research has reported similar levels of attention biases in studies using picture or word stimuli (e.g., Bar-Haim et al., 2007). Accordingly, we used word stimuli to reduce varied interpretations that can occur with pictures.

The aims of our study were two-fold. First, we sought to replicate Loughnan et al. (2015) by testing the efficacy of a single-session ABM protocol. Second, we sought to extend these findings by including an additional training condition (towards positive appearance words) and an additional moderating factor (importance of appearance) to further consider the conditions under which ABM may be most effective. We expected that training would be effective in that women in the Towards Positive condition would show a shift towards positive appearance words while women in the Away Negative condition would show a shift away from negative appearance words. In terms of moderating factors, we suggest that females with high levels of appearance importance or shape concerns will hold attention biases that are less likely to be manipulated in a single-session ABM because of an established pattern of attention to appearance-related information. Conversely, participants with low appearance importance or low shape concerns may not attend towards appearance-related information, as their body image is less salient in everyday life, and therefore there is little room to move for their attention biases. This study tested the role of these factors.

1.2 Method

1.2.1 Participants

Data were gathered from 102 female participants between the ages of 19 and 77 years (M = 33.39; SD = 13.78), with 95 participants providing data at follow up. Mean BMI was 24.61 (SD = 7.77), with 43.1% of the participants in a healthy weight range. The majority of participants were Caucasian (91.2%), with 53.9% currently studying. Participants were recruited through the university (32.4%) and the general community (67.6%).

1.2.2 Materials

1.2.2.1 Attention bias modification task. A modified version of the dot-probe task was used to measure and manipulate attention bias. The task began with a fixation cross in

the middle of the screen and participants pressed the spacebar to begin each trial. Two words were then presented simultaneously, in the upper and lower location of the screen. After 500ms the words disappeared and the dot-probe replaced one of the words. Participants indicated the location of the dot probe as quickly and accurately as possible using the Up / Down arrow keys on a keyboard.

Participants progressed through four types of trials within the session: pre-assessment of attention bias, ABM training (or placebo), post-assessment of attention bias, and a set of booster (or placebo) trials. During the pre / post-assessment trials (120 trials each) and placebo version of the ABM (160 trials), the dot probe randomly replaced either the target or neutral word with equal frequency. During the ABM training trials (160 trials), the location of the dot probe was set by the researchers. In the Towards Positive ABM condition, the probe replaced the positive appearance-related words, thereby directing attention towards the positive appearance information. In the Away Negative condition, the probe always replaced the neutral word, directing attention away from the negative appearance-related word. In the ABM or placebo-ABM, each word pair was presented eight times. The ABM booster phase involved an extra 80 trials, including novel words of the same word-type, to ensure each participant ended on the ABM training phase. Participants also started with 20 practice trials containing novel words. There was a total of 500 trials.

1.2.2.2 Word stimuli. There were three word categories each containing 10 words: words considered to be generally associated with positive appearance (e.g., slim), words generally associated with a negative appearance (e.g., fat), and semantically-themed neutral words (e.g., asteroid; Loughnan et al., 2015). The words were matched on length, frequency, and syllables (Brysbaert & New, 2009; Cassin & von Ranson, 2005).

1.2.3 Measures

1.2.3.1 Demographics. Participant's self-reported gender, age, height, weight, relationship status, ethnicity, and education.

1.2.3.2 Body Shape Questionnaire. The 34-item Body Shape Questionnaire (BSQ; Cooper et al., 1987) assesses weight and shape concern in the previous four weeks. Response options ranged from 1 to 6 with high scores indicating greater body shape concerns (range = 34 - 204). The scale is internally consistent (Cronbach's alpha = .97), with good reliability and validity (Cooper et al., 1987). The Cronbach's in the current study was .95.

1.2.3.3 Body Image States Scale. The 6-item Body Image States Scale (BISS; Cash et al., 2002) assesses satisfaction with body and appearance "right now at this moment". Participants respond via a 9-point Likert scale where high scores indicating greater state body satisfaction. Three items are reverse scored. The scale has reasonable test-retest reliability of .69 over a one-to-two week period and sound internal consistency .77 (Cash et al., 2002). The Cronbach's alpha in the current study were .82 (baseline), .84 (laboratory), .83 (follow-up).

1.2.3.4 Appearance Orientation. The 12-item Appearance Orientation subscale of the Multidimensional Body-Self Relations Questionnaire measures the extent of investment in one's appearance (Cash, 2000). Participants respond via a 5-point Likert scale with total scores averaged and ranging between 1 (less investment in appearance) to 5 (higher investment in appearance). Four items were reverse scored. The scale has strong test-retest reliability after one month and strong internal consistency in previous research (α =.85; Cash, 2000), and in the current study (α = .85).

1.2.4 Procedure

Ethical approval was obtained from the ethics board of the home institution. Participants from the university and general community were recruited through university announcements and social-media. The study was described as examining attention to health information and body perception, however full details were not provided.

Participants first completed online measures of baseline trait and state body satisfaction, trait appearance orientation, and demographics before being invited to a laboratory session 1-2 weeks later. A random number generator was used to assign participants to conditions. The researcher who coordinated testing did not take part in the allocation of conditions and was unaware of the corresponding number for each condition. Participants were tested in small groups or individually depending on availability.

Each trial started with a fixation cross (+) in the center of the computer screen and a keyboard space-bar was used to initiate trials. In each trial, two words appeared simultaneously, one in the upper region of the screen and one in the lower for 500ms. A dot-probe (*) would then replace one of the words for 1500ms. Participants were instructed to identify the location of the probe as quickly and accurately as possible using the keypad. After the computer-task, participants then completed the BISS. One-to-two weeks later, participants received an email inviting them to complete the BISS again. A unique code was allocated to each participant that was used to match data across all three sessions.

1.3 Results

1.3.1 Scoring of Attention Bias

Attentional bias scores were calculated by subtracting the mean reaction time for congruent trials from the mean reaction time for incongruent trials ([upper location/non-congruent – lower location/congruent] + [upper location/non-congruent – upper location/congruent])/2. A score of zero indicates no attentional bias, positive scores indicate attention bias towards the appearance-related stimuli, whereas negative scores indicate attention away from the appearance stimuli. No major deviations from normality were noted across all data.

1.3.2 Preliminary Analyses

A series of one-way between-groups Analysis of Variance (ANOVA) demonstrated that the random allocation was successful as participants assigned to each condition did not

differ on BMI, age, pre-test shape concerns, pre-test appearance importance, or pre-test measures of attention bias (all *p*s > .05). However, there was a significant difference between the ABM conditions on baseline state body satisfaction, $F(2,99) = 3.27$, $p = .04$, which was entered as a covariate in all analyses. Table 1 presents the average questionnaire scores for each ABM condition. Age was weakly correlated with shape concerns ($r = -.26$, $p = .009$) but not appearance importance or state body satisfaction (*p*s > .05). There were no consistent correlations for attention bias and age or the body image measures, with the exceptions of age and post-test positive appearance attention bias ($r = -.21$, $p = .03$), and appearance orientation and post-test negative appearance attention bias ($r = -.25$, $p = .01$).

In the current study, participant's pre-test trait shape concerns were higher ($M = 93.60$, $SD = 33.70$) compared to other community samples ($M = 81.50$, $SD = 28.40$; Cooper et al., 1987). However, the participants had lower levels of state body satisfaction ($M = 4.82$, $SD = 1.47$) compared to previous research ($M = 5.39$, $SD = 1.38$; Cash et al., 2002), and lower importance of appearance ($M = 3.33$, $SD = 0.48$) compared to a community sample ($M = 3.91$, $SD = 0.60$; Cash, 2000).

	Towards Positive		Away Negative		No Training	
	n	*M* (*SD*)	*n*	*M* (*SD*)	*n*	*M* (*SD*)
BMI	31	25.58 (7.13)	37	24.42 (24.42)	34	23.92 (7.16)
Age	31	32.71 (13.02)	37	33.49 (15.64)	34	33.91 (12.63)
BISS						
Pre	31	4.38 (1.38)	37	4.80 (1.15)	34	5.24 (1.57)
Post	31	4.88 (1.24)	37	4.91 (1.28)	34	5.56 (1.75)
Follow-up	26	4.85 (1.32)	35	4.91 (1.28)	34	5.29 (1.50)
BSQ	31	93.78 (31.55)	37	100.61 (37.22)	34	85.78 (30.02)
App. Orient.	31	3.24 (.45)	37	3.39 (.47)	34	3.39 (.53)

Note. BISS = Body Image States Scale; BSQ = Body Shape Questionnaire; App. Orient. = Appearance Orientation subscale of the Multidimensional Body-Self Relations Questionnaire.

Table 1. *Mean Demographic and Body Image Scores Across Conditions.*

A median split was used to divide participants on pre-test scores of trait shape concerns and importance of appearance measures. For the Body Shape Questionnaire, a median split of 86.5 was used to create a high concern group (M = 121.21, SD = 23.42, n = 51) and a low concern group (M = 65.98, SD = 12.77, n = 51). The median split of 3.33 was used for participants scoring high levels of importance of appearance (M = 3.81, SD = 0.23, n = 44) and low levels (M = 2.99, SD = 0.27, n = 58). There was no significant correlation between shape concerns and importance of appearance, r = 0.15, *ns*. Inspection of participants within each grouping revealed overlap, however, it was only 24 participants (26% of the sample) who were in the high appearance evaluation group and the high shape concern group. Thus, it appears that dividing the group based on these variables largely resulted in unique sub-samples. Table 2 shows the attention bias scores for each condition for participants with high/low levels of shape concern from pre- to post-assessments while Table 3 shows these attention bias scores for participants with high/low levels of appearance importance.

	Towards Positive		Away Negative		Neutral	
	High SC	Low SC	High SC	Low SC	High SC	Low SC
	M (*SD*)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SE)*	*M (SD)*
Pre-assessment						
Positive appearance	2.69 (12.19)	7.49 (10.79)	11.93 (7.75)	-1.87 (10.96)	25.23 (12.90)	10.38 (9.88)
Negative appearance	14.44 (12.08)	-1.39 (10.69)	13.06 (8.42)	20.69 (11.90)	6.25 (8.76)	4.42 (6.70)
Neutral	24.16 (12.38)	-8.88 (10.96)	-12.67 (7.34)	5.47 (10.39)	1.00 (12.66)	-13.39 (9.69)
Post-assessment						
Positive appearance	-4.33 (10.61)	8.18 (9.39)	13.24 (9.05)	-15.29 (12.80)	7.77 (10.48)	11.88 (8.02)
Negative appearance	14.12 (10.54)	17.42 (9.34)	-3.35 (8.64)	-0.57 (12.22)	59.17 (10.48)	-9.42 (8.03)
Neutral	-24.71 (16.17)	3.10 (14.32)	5.88 (10.19)	-7.00 (14.41)	-12.91 (14.95)	-5.33 (11.44)

Table 2. *Attention Bias Scores for each ABM Condition at Pre- and Post-Assessment, across Participants with High/Low levels of Body-dissatisfaction.*

	Towards Positive		Away Negative		Neutral	
	High Importance	Low Importance	High Importance	Low Importance	High Importance	Low Importance
	M (SE)	*M (SE)*	*M (SE)*	*M (SE)*	*M (SE)*	*M (SE)*
Pre-assessment						
Positive appearance	5.50 (12.30)	5.12 (8.77)	19.21 (9.81)	-2.17 (8.60)	10.37 (9.74)	21.88 (9.52)
Negative appearance	1.40 (11.21)	8.24 (8.00)	18.06 (9.95)	13.98 (7.81)	4.91 (8.88)	5.22 (8.68)
Neutral	9.44 (12.20)	2.84 (8.69)	-15.52 (9.74)	.67 (8.49)	-.75 (9.65)	-13.38 (9.44)
Post-assessment						
Positive appearance	-.74 (12.01)	-.63 (8.57)	0.52 (9.58)	5.03 (8.36)	19.38 (9.51)	7.37 (9.23)
Negative appearance	26.75 (12.45)	11.00 (8.88)	-18.38 (9.93)	9.86 (8.66)	6.44 (9.85)	25.92 (9.64)
Neutral	-17.66 (15.83)	-2.56 (11.29)	5.73 (12.64)	-1.85 (11.02)	-6.28 (12.53)	-13.13 (12.26)

Note. High/Low Importance = the participants score on level of importance of appearance before the implementation of the ABM. Scores are covariate-adjusted by baseline BISS

Table 3. *Attention Bias Scores for each ABM Condition at Pre- and Post-Assessment, across Participants with High/Low levels of Appearance Importance*

1.3.3 Immediate Effects

1.3.3.1 Changes to attention bias scores as a function of trait shape concerns. To address the first aim regarding changes to attention bias scores, we conducted a 2 (Time: pre and post measures of attention bias) x 3 (Word-type: positive, negative, neutral) x 3 (Condition: Towards positive ABM vs. Away negative ABM vs. No Training) x 2 (Trait shape concerns: High vs. low) mixed factorial ANCOVA, with baseline BISS as a covariate. A significant 4-way interaction was found, $F(2, 95) = 5.53$, $p = .005$, partial $\eta^2 = .104$. This 4-way interaction was followed up by examining the 3-way interactions within each ABM condition. All main effects and interactions were non-significant ($p > .05$) in the Towards Positive and Away Negative ABM conditions.

A 3-way interaction was found between Time, Word-type, and Shape Concern in the No Training condition, $F(2, 30) = 4.43$, $p = .02$, $f = .54$. However, this interaction is not relevant to the hypotheses and did not hold when follow-up analyses were conducted. Therefore, there was no evidence of changes to attention bias scores after the ABM protocol.

1.3.3.2 Changes to attention bias scores as a function of trait appearance orientation. To examine the role of importance of appearance (as per the second aim of the study), the previous analysis was repeated but replaced the shape concern independent variable with importance of appearance. A significant 4-way interaction was found, $F(2, 95) = 3.91$, $p = .023$, partial $\eta^2 = .08$. Only theoretically meaningful results and findings of the highest significance level are reported for brevity.

This 4-way interaction was followed up by exploring the 3-way interactions within each ABM condition. There were no significant main effects or interaction effects within the No Training and Towards Positive conditions (all ps $> .05$). In the Away Negative condition, a significant 3-way word by time by appearance importance interaction was present, $F(2, 33) = 3.45$, $p = .04$, $f = .45$. This 3-way interaction was then followed up by investigating changes to attention bias scores over time within each group of women. For women who

were low on appearance importance, there were no changes in attention bias from pre- to post-training for positive appearance words ($t(20) = -0.51$, $p > .05$), negative appearance words ($t(20) = -0.34$, $p > .05$), or neutral words ($t(20) = 0.16$, $p > .05$). For women who were high on appearance importance, there was a significant change in attention bias scores for negative appearance words from pre-training ($M = 18.04$, $SD = 42.71$) to post-training ($M = -18.58$, $SD = 26.31$; $t(15) = -2.70$, $p = .01$). There were no changes to attention bias across for positive appearance words ($t(15) = 1.06$, $p > .05$) or neutral words ($t(15) = -1.44$, $p > .05$). Thus, results indicate that the Away from Negative training was successful in redirecting attention away from negative appearance information in women with high levels of appearance importance.

1.3.4 Effects of ABM on State Body Satisfaction

1.3.4.1 Immediate effects. A series of ABM condition by vulnerability factor (trait shape concern or appearance importance) analyses were conducted on the dependent variable of state body satisfaction to test for differences between groups post-training. Baseline BISS was used as a covariate. There were no effects on state body satisfaction across the trait shape concern analysis (2-way interaction $F(2, 95) = .19$, $p > .05$, $f = .06$) or appearance importance analysis (2-way interaction $F(2, 95) = .63$, $p > .05$, $f = .11$). Therefore, state body satisfaction did not differ between conditions immediately after training.

1.3.4. Follow-up effects. The above analyses were repeated with the 1-2 week follow-up state body satisfaction scores. There were no significant effects across the trait shape concern by ABM condition analysis (2-way interaction $F(2, 88) = 0.28$, $p > .05$, $f = .07$). Similarly, there were no effects found in the appearance importance analysis (2-way interaction $F(2, 88) = 2.82$, $p > .05$, $f = .07$).

1.4 Discussion

This study tested the malleability of attention for appearance-related words via two versions of an attention bias modification task in a sample of non-clinical women. Effects were tested across the traditionally studied measure of trait body satisfaction, operationalized here as shape concern, but extended the literature by also considering importance of appearance. Results suggest that attention bias may be modified in a single session, but only for women with high levels of importance placed on appearance whose attention was trained away from negative appearance words.

Results of the current study are consistent with Loughnan et al. (2015) who found no evidence of improvement in attention bias scores for women with high or low levels of shape concern after completing a single-session of Away from Negative training. The significant changes in attention bias scores for women high on appearance importance (in the Away Negative condition) suggest that this characteristic may be more responsive to ABM compared to satisfaction with appearance. This outcome diverged from our initial expectation that women with high levels of importance of appearance would require more training to overcome a history of placing value on appearance. Conversely, it may be that women who value their appearance were more responsive to the training as the appearance words readily captured their attention. If confirmed by further research, this finding may have important implications for intervention approaches. Cognitions surrounding appearance importance may be crucial to negative body image schemas which then trigger body dissatisfaction and reinforce attention bias to negative appearance-related stimuli.

The absence of group differences in state body satisfaction either immediately after the training or 1-2 weeks later is congruent with Loughnan et al. (2015) who also found no short-term changes. However, Loughnan et al. (2015) were unable to modify attention biases in their training. It is possible that any training effects may be gradually integrated into a person's daily information processing and environmental interaction may be required to solidify the learning. Previous research has found residual effects of ABM rather than

immediate effects (Bar-Haim et al., 2007; Bar-Haim, Morag, & Glickman, 2011). The broader literature emphasises the importance of multiple ABM sessions for improved outcomes (Kemps, Tiggemann, & Elford, 2015). Although, like the current study, immediate changes to attention bias scores can be found after just one session (Kakoschke, Kemps, & Tiggemann, 2014; Kemps, Tiggemann and Hollit, 2014; Kemps et al., 2014). The effectiveness of ABM may also be seen in other forms, such as a body image challenge as used by Smith and Rieger (2006, 2009). Given the significant immediate changes to attention bias scores in the Away from Negative training, future research may benefit from testing the effectiveness of multiple sessions across a range of attention and body image measures. This would be necessary to support the practical use of ABM for the prevention of chronic body image problems in females.

The findings should be interpreted within the context of the following limitations. First, baseline levels of shape concern were higher than other non-clinical, community samples (Cash et al., 2002; Cooper et al., 1987). High levels of shape concern may result in attention patterns that are less flexible to change. Second, it is possible that demand effects occurred as participants became more familiar with the study from the three testing points. Future research could implement a distraction task in between phases of ABM and questionnaires. Third, while comparable to other research exploring ABM for body image problems (e.g. Smith & Rieger, 2009; Loughnan et al., 2015), the current study had small subgroups. Fourth, the generalisability of the results is limited to females. Yet, body disturbance and eating disorders are also increasing in males, who may also benefit from ABM. Fifth, a median split was used for trait shape concern, which does have limitations (Irwin & McClelland, 2003). Finally, longer-term follow-up of attention biases are needed to establish longevity of changes.

We used a general measure of appearance investment, but other scales include components such as self-evaluative salience and motivational salience (e.g., the Appearance

Schemas Inventory Revised; Cash, Melnyk, & Hrabosky, 2004), which have varying associations with numerous outcomes, including responses to the media (Ip & Jarry, 2008). Future research should explore appearance investment in more detail. Finally, the study was limited by the implementation of a single-session ABM task. While single-session ABM can be effective (Smith & Rieger, 2006, 2009), multiple training sessions may have more enduring effects (Beard et al., 2012; Kemps et al., 2014). Repeated ABM would likely reinforce the learning and redirection of biases, giving the individual practice in filtering out other competing appearance-related information.

Our findings suggest that even a single session of ABM can be useful in modifying specific types of attention biases. Since ABM procedures require little time investment and minimal cost, it has the potential to become an important clinical intervention for treatment and prevention of various types of psychopathology (Bar-Haim, 2010). Further, ABM procedures are suited to mobile devices, thus providing individuals with an inexpensive training program they can undertake in privacy and at their own leisure (e.g., Cox et al., 2014). Delivering ABM via mobile devices would also allow users to engage with the task in times of stress. Research has shown that attention biases can be triggered by priming events, such as recent illness (Karademas, Sideridis, & Kafetsios, 2008), food exposure (Geyskens, Soetens, & Roets, 2010), and idealized media imagery (Lane et al., 2017). Thus, engaging in attentional retraining in response to real-life stressors may be beneficial.

In conclusion, this study adds to the growing body of research on the use of ABM as an intervention for non-clinical females with body image problems. The results support the potential importance of appearance investment, as women high on this construct were responsive to training in the Away Negative condition. Increased research into the underlying mechanisms of change may help to improve treatment outcomes.

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