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ORIGINAL ARTICLE

The role of memory in the relationship between attention toward thin-ideal media and body dissatisfaction

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Abstract
Purpose This study examined the causal relationship between attention and memory bias toward thin-body images, and the indirect effect of attending to thin-body images on women's body dissatisfaction via memory.
Method In a 2 (restrained vs. unrestrained eaters) × 2 (long vs. short exposure) quasi-experimental design, female participants ($n = 90$) were shown images of thin models for either 7 s or 150 ms, and then completed a measure of body dissatisfaction and a recognition test to assess their memory for the images.
Results Both restrained and unrestrained eaters in the long exposure condition had better recognition memory for images of thin models than did those in the short exposure condition. Better recognition memory for images of thin models was associated with lower body dissatisfaction. Finally, exposure duration to images of thin models had an indirect effect on body dissatisfaction through recognition memory.
Conclusions These findings suggest that memory for body-related information may be more critical in influencing women's body image than merely the exposure itself, and that targeting memory bias might enhance the effectiveness of cognitive bias modification programs.

Keywords Attention · Memory · Exposure · Thin ideal · Body dissatisfaction

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Introduction

Body dissatisfaction has been identified as one of the key risk and maintenance factors for eating disorders [1], and also contributes to dysfunctional eating behaviors such as binge eating [2] and rigid dieting [3]. Research based on cognitive theories of eating disorders [4, 5] has emphasized the important roles that increased attention to and better memory for body-related information play in the development and maintenance of such body image issues [6], but the exact nature of the relationship between these biases and their impact on women's body image concerns is not well understood. There is evidence in the depression literature that biases in attention and memory are related [7, 8], but these associations have not been tested in the body image literature. Thus, the purpose of the present study was to test the relationships between attention and memory biases and women's body dissatisfaction that have been proposed by cognitive models but that remain untested.

Media images of thin, idealized female body shapes are one type of body-related information that women frequently encounter in their day-to-day lives (e.g., in magazines and on television). Although there are some inconsistent findings across studies, the majority of previous research on media exposure effects have found that exposure to thin-ideal images has a negative impact on women's body image [9, 10]. Research has also found that women report higher body dissatisfaction after they are trained to allocate more attention to body-related information, such as negative body-related words (e.g., "fat") [11]. Those studies provided evidence for a relationship between increased attention to body-related information and body dissatisfaction.

Other research has examined the effect of attention on body dissatisfaction by manipulating the exposure duration to experimental images [12, 13], on the assumption that there is relatively little opportunity for individuals to pay attention to the stimuli under brief exposure [12]. Studies using this method to control for attention have produced mixed results. Brown and Dittmar [12] found that prolonged exposure (10 s) to images of thin models resulted in more weight-related anxiety than did brief exposure (150 ms). In contrast, Joshi et al. [13] found no differences in the effects of prolonged (7 s) versus brief exposure (150 ms) on appearance self-esteem, and actually found that exposure to thin models, irrespective of duration, resulted in improved self-image among restrained eaters. Therefore, some aspects of the link between attention and body dissatisfaction remain unclear.

An unexplored component of cognitive theories that may help to further our understanding of the relationship between attending to thin-ideal media images and body dissatisfaction is the role of memory for those images. Biases in memory for body-related information are thought to maintain preoccupation with body size and shape [14]. Memory of body-related information should therefore have detrimental effects on women's body image, but no studies have directly examined this relationship. Another underexplored question has to do with the connection between attention and memory biases. One recent study found that the level of attention (as measured by gaze length) that participants allocated to images of female bodies was positively related to their subsequent recognition memory of those images [15]. This finding is consistent with similar research in the depression literature, which has found a relationship between attention and memory bias toward positive words in individuals with dysphoria [8]. Given this relationship between attention and memory bias, it is also possible that there is an indirect relationship between attention and body dissatisfaction via memory.

The present study builds on previous research by investigating the previously unexplored indirect effect of attending to thin-ideal images (manipulated through exposure duration) on body dissatisfaction (measured by participants' perceived discrepancy between their actual body size and ideal body size) via recognition memory. The present study also aimed to extend Jiang and Vartanian's correlational findings [15] by examining the effect of manipulating the duration of exposure to thin-body images on participants' subsequent recognition memory for those images, thereby allowing for a causal relationship to be established between attention and memory.

Following from previous studies that manipulated exposure duration to experimental images as a means of controlling for attention [12, 13], we created two attentional conditions in the present study by manipulating the duration of exposure to thin-body images (7 s vs. 150 ms). Participants also completed a recognition test to assess their recognition memory for the images following exposure. There were three main hypotheses: First, we hypothesized that participants who viewed the thin-body images for a longer duration (and paid more attention) in the present study would have better recognition memory of those images than would participants who viewed them for a shorter duration [7, 8, 15]. Second, based on cognitive theories [4, 5, 14], we expected that participants' recognition memory for the thin-body images would lead to increased body dissatisfaction (i.e., a larger actual–ideal discrepancy). Third, we tested the indirect effect of exposure duration to thin-body images on body dissatisfaction (actual–ideal discrepancy) via recognition memory.

We also examined whether the relationships between attention, memory, and body dissatisfaction differed between restrained and unrestrained eaters. Restrained eaters and individuals with eating disorders share similar concerns about body weight and cognitive processing of schema-relevant information [16, 17]. Therefore, investigating the aforementioned indirect effect among restrained eaters provides a useful starting point from which further predictions about the relationships between cognitive processes could be made for clinical populations. Based on Jiang and Vartanian's findings [15], we did not expect to see a difference between restrained and unrestrained eaters in the magnitude of the relationship between exposure duration and recognition memory. However, past research has shown that restrained eaters have heightened levels of body image concerns which differentiate them from unrestrained eaters [18, 19]. Therefore, it is possible that there may be restraint differences in the association between recognition memory for thin-body images and actual–ideal discrepancy, as well as in the indirect effect of exposure duration on actual–ideal discrepancy via recognition memory.

Methods

Participants

Ninety female undergraduate students from an Australian university participated in exchange for course credit or $10. Two participants were excluded from data analysis because their scores on the outcome measure of actual-ideal discrepancy were greater than 3 standard deviations from the mean. Thus, the final sample consisted of 42 restrained eaters and 46 unrestrained eaters. Their mean age was 19.44 years (SD $=$ 2.45; range 17–36), and there was no difference in age between restrained and unrestrained eaters ($F = 0.02$, $p = 0.89$). Height and weight were not recorded.

Materials and measures

Images

Images depicting a full view of a woman with a thin-body shape were used in this experiment. In order to mask the true purpose of the study, we also included a set of neutral images that did not feature a person or body part (e.g., stationery, household objects, and landscapes). The image set included 60 thin-body images and 60 neutral images. In both the long exposure and short exposure conditions, 30 thin-body images and 30 neutral images were presented in the image evaluation task, and a different set of 30 images of each type were used as novel images in the recognition test. For each participant, the images within each image type (thin-body and neutral) were randomly allocated to the image evaluation task or to the recognition test. This procedure ensured that not all participants received the same set of images in the image evaluation task and the recognition test. The images in both the image evaluation task and recognition task were presented in random order for each participant, with the following constraint: in order to further reduce participants' suspicion regarding the true purpose of the study, the first image presented to participants in the image evaluation task was always a neutral image. All images were professional photographs taken from modeling agency websites and fashion magazines that were determined by the authors to represent the thin ideal. The height of all body shape images was set at 900 pixels. The longest side of neutral images was constrained to 900 pixels, which could be either the height or the width depending on the orientation of the image.

Image evaluation task

Images were presented one at a time. Each image presentation was followed by a set of evaluation questions asking participants to rate the vividness of the colors used, the complexity of the image, the overall esthetic appeal, and how typical it was of a magazine image, which they rated using a scrollbar (0 = *Not at all*, 100 = *Extremely*). These questions were included to bolster the cover story and to ensure that participants actually looked at the images. Following Joshi et al. [13], images in the long exposure condition were presented for 7 s and images in the short exposure condition were presented for 150 ms. Each trial sequence was as follows: (1) a blank screen was shown for 500 ms; (2) a fixation cross was shown for 500 ms; (3) the image was shown for 150 ms or 7 s; and (4) a 150-ms blank screen was shown between image presentation and the evaluation questions. The image evaluation task was presented on a white background on a 24-inch LCD monitor, with the screen resolution set to 1920 × 1080 pixels. The task was programmed using Livecode software (Version 5.0.2).

Actual–ideal discrepancy

The Photographic Figure Rating Scale (PFRS) [20] was used to assess participants' perception of their current body size, their ideal body size, and the discrepancy between their actual and ideal body size as an indication of their state body dissatisfaction. The PFRS was used because it has greater ecological validity than traditional figural scales that use line-drawn silhouettes of body shapes [21]. The PFRS consists of 10 photographic figures ranging in BMI from 12.51 to 41.23. Participants are asked to choose the figure that best represents their current body size and then the figure that best represents their ideal body size. We derived four measures from the PFRS ratings. First, a directional actual–ideal discrepancy score was calculated by subtracting participants' ratings of their ideal body size from ratings of their current body size (directional discrepancy = current − ideal). A positive score indicates a current body size that is larger than the ideal body size, and reflects a greater degree of body dissatisfaction. Although most studies with figure rating scales have used directional discrepancies, averaging scores with opposite signs can obscure the true magnitude of the actual–ideal discrepancy [22]. Thus, an absolute actual–ideal discrepancy score (i.e., the absolute difference between the current body size rating and ideal body size rating; absolute discrepancy = |current − ideal|) was also calculated. Furthermore, other researchers have argued that the use of discrepancy scores leads to a loss of information because they collapse across two separate constructs [23]. Therefore, we also included separate analyses of current body size ratings and ideal body size ratings.

Distracter task

A 2-min distracter task was given to participants following the image evaluation task and the PFRS in order to eliminate any effects of rehearsal on the subsequent recognition test. Participants were asked to list as many countries as they could think of in six regions of the world: Oceania, Europe, Asia, Latin America, North America, and Africa.

Recognition memory

All of the thin-body and neutral images that were presented in the image evaluation task were shown in the recognition test (i.e., "old" images). Participants were also shown an equal number of thin-body and neutral images that they had not seen during the image evaluation task (i.e., "new" images). Specifically, participants in both conditions were presented with 30 "old" thin-body images and 30 "old" neutral images, along with 30 "new" images of each type in the recognition test. Thus, there were a total of 120 trials. For each image, participants were asked "Do you remember seeing this picture earlier?", and they indicated their response using an onscreen scrollbar ranging from 0 (Definitely NO. It is a NEW picture) to 100 (Definitely YES. It is an OLD picture). This recognition rating scale was adapted from Griffiths and Mitchell [24], and has been used in previous research on the relationship between attention and memory for body-related images [15]. Participants' ratings for the thin-body and neutral images were converted into a measure of sensitivity (d') using a signal detection model. The sensitivity d' score is a measure of participants' ability to discriminate between the "old" images that they had seen previously in the image evaluation task and the "new" images that they had not seen. A higher d' score indicates more accurate and selective recognition memory.

Dietary restraint

The Restraint Scale [25] was used to assess participants' restraint status. This 10-item scale measures the extent to which individuals engage in dietary restrictions, overeating, and experience weight fluctuations. The final score is a sum of the scores for all 10 items (range 0–35). Participants' scores were used as a dichotomous variable in the present data analyses so that our results could be compared with those of previous studies [13, 15, 26]. Participants who scored 15 or above were classified as restrained eaters ($n = 42$, $M = 19.45$, $SD = 3.69$), and those who scored below 15 were classified as unrestrained eaters ($n = 46$, $M = 9.80$, $SD = 3.93$). Cronbach's alpha in this study was 0.82.

Procedure

This study consisted of a 2 (restraint status) × 2 (exposure condition) quasi-experimental design. Participants were told that they were taking part in an image evaluation study investigating people's ability to make judgments about images under time pressure. Upon arrival at the laboratory, participants provided informed consent and were seated in front of computers. A maximum of three participants could be run in the same room at any one time, and participants were separated from each other by a divider between computer desks. Participants were randomly allocated to the short exposure or long exposure condition, and were asked to follow the instructions on the computer screen. The instructions provided a brief description of the image evaluation task. Participants were informed that they would be presented with images that they might see in magazines, which would be presented one at a time for a fixed amount of time, and they would then be asked to rate the images on their color, complexity, and overall esthetic appeal. They were not given any information regarding the nature of the images. After the image evaluation task, participants completed the PFRS followed by the distracter task, the recognition test, and the Restraint Scale. The experimenter stayed in the room throughout the experiment, but was out of participants' view. All participants were debriefed at the end of the experiment. This study was approved by the university's ethics committee.

Data analysis

To test the hypothesis that participants in the long exposure condition would have better recognition memory for the thin-body images than those in short exposure condition, a 2 (restrained vs. unrestrained) × 2 (long exposure vs. short exposure) ANOVA was conducted on d' scores. Indirect effect analyses [27] were used to test whether there were significant indirect effects of exposure duration to thin-body images on each of the PFRS measures through participants' recognition memory of those images.

Results

Recognition memory

Participants in the long exposure condition had better recognition memory for the thin-body images ($M = 3.28$, $SD = 0.84$) than did participants in the short exposure condition ($M = 1.22$, $SD = 0.54$), $F(1, 84) = 177.27$, $p < 0.001$, $\eta_p^2 = 0.68$. Restrained and unrestrained eaters did not differ in their recognition memory for thin-body images, $F(1, 84) = 0.79$, $p = 0.38$, $\eta_p^2 = 0.01$. There was also no significant restraint × exposure condition interaction, $F(1, 84) = 0.43$, $p = 0.51$, $\eta_p^2 = 0.01$. The same pattern of results was found for neutral images: Participants in the long exposure condition had better recognition memory for the neutral images ($M = 4.54$, $SD = 0.57$) than did participants in the short exposure condition ($M = 3.14$, $SD = 0.70$), $F(1, 84) = 108.66$, $p < 0.001$, $\eta_p^2 = 0.56$. There was no significant difference between restrained and unrestrained eaters' recognition memory for neutral images, $F(1, 84) = 1.00$, $p = 0.32$, $\eta_p^2 = 0.01$, and no restraint × exposure condition interaction, $F(1, 84) = 1.56$, $p = 0.22$, $\eta_p^2 = 0.02$.

Indirect effects of exposure duration on PFRS measures via recognition memory

Preliminary analyses

Moderated mediation analyses were conducted to determine whether the indirect effects of exposure duration on

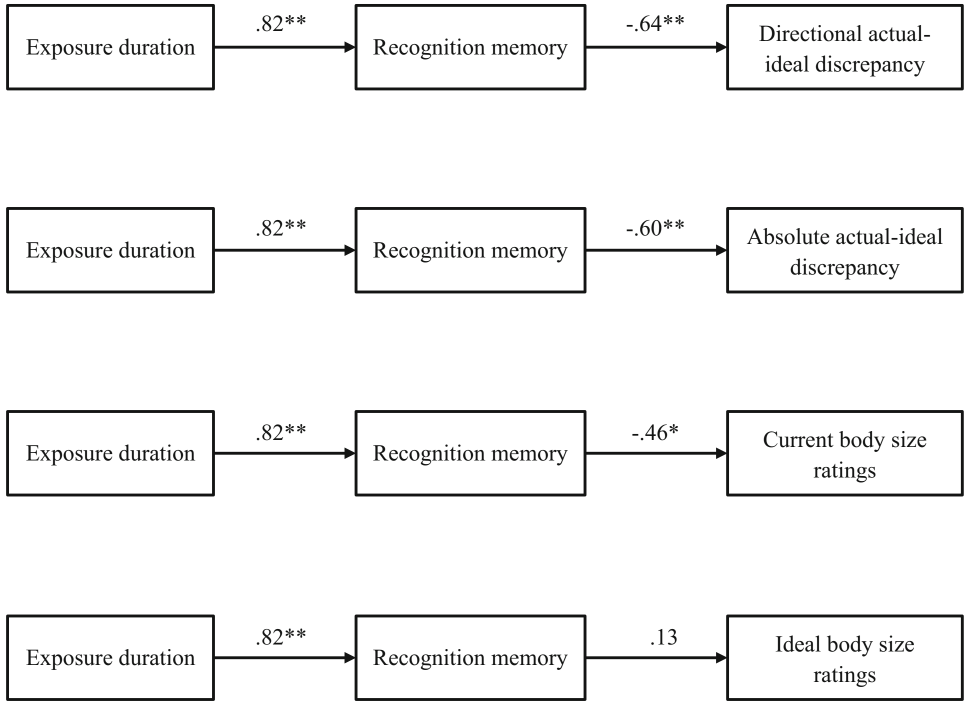

Fig. 1 Indirect effect analyses testing the indirect effects of exposure duration on each PFRS measure via recognition memory. All *numbers* represent standardized beta coefficients. $*p < 0.05$, $**p < 0.01$

the PFRS measures via recognition memory varied as a function of participants' restraint status. There were no significant interactions between restraint status and recognition memory for any PFRS measures ($ps > 0.14$). Given that there were no interactions between restraint status and exposure duration found in the above ANOVA analyses and no interactions between restraint status and recognition memory found in the current analyses, the indirect effects were tested collapsing across restraint groups.

Indirect effects

Indirect effects are displayed in Fig. 1. Consistent with the ANOVA results, exposure duration was a significant predictor of recognition memory for thin-body images, $t(86) = 13.38$, $p < 0.001$. Interestingly, better recognition memory for thin-body images predicted *lower* directional discrepancy scores, $t(85) = -3.60$, $p < 0.001$, *lower* absolute discrepancy scores, $t(85) = -3.43$, $p < 0.001$, and *lower* current body size ratings, $t(85) = -2.52$, $p = 0.01$. Recognition memory for thin-body images did not predict participants' ideal body size ratings, $p = 0.49$. The indirect effect of exposure duration on PFRS scores via recognition memory was significant for directional discrepancy (bias corrected 95 % CI −1.86, −0.51), absolute discrepancy (bias corrected 95 % CI −1.39, −0.39), and current body size ratings (bias corrected 95 % CI −1.83, −0.23). There was no significant indirect effect for ideal body size ratings (bias corrected 95 % CI −0.23, 0.59). Thus, the results indicated that recognition memory for thin-body images mediated the effect of exposure duration on participants' perceived actual–ideal discrepancy (both directional and absolute) and their perception of current body size.

Exposure duration was also a significant predictor of recognition memory for neutral images, $t(86) = 10.38$, $p < 0.001$, but recognition memory for neutral images was not a significant predictor of any PFRS measures ($ps > 0.25$), and there were also no significant indirect effects involving participants' recognition memory for neutral images.

Discussion

The present study extended existing literature on cognitive biases by examining the indirect relationship between attending to thin-ideal images and body dissatisfaction through participants' memory. There were three key findings. First, we found that there is a causal relationship between exposure duration and recognition memory of thin-body images for both restrained and unrestrained eaters. Consistent with our hypothesis, participants who viewed thin-body images for a longer duration had better recognition memory of those images than did participants who viewed the images for a shorter duration, which is also in line with previous research on depression [7, 8]. Furthermore, the causal link between exposure duration and recognition memory did not differ as a function of participants' restraint status, consistent with Jiang and Vartanian's findings [15]. Although we suggest that the enhanced memory performance found in the long exposure group was driven by a higher level of attention allocated to the images during extended exposure (see Ref. [12]), replication of this finding using a direct measure of attention (e.g., eyetracking) is needed to confirm this interpretation.

Second, the present study provided the first empirical evidence to support a link between memory and body dissatisfaction. Contrary to our hypothesis, however, the findings did not indicate a detrimental effect of participants' memory for body-related information on their body image. Instead, we found an enhancement effect of memory on individuals' body satisfaction. Specifically, better recognition memory for thin-body images led to a smaller perceived discrepancy between current body size and ideal body size, as well as a smaller perceived current body size. Although the majority of past research has shown that exposure to thin-ideal images tend to have negative effects on women's body image [9, 10], several studies have actually found positive effects [26, 28, 29]. In fact, Myers and Biocca [29] argued that thin-ideal media images may inspire women to imagine themselves as having their ideal body shape (see also Ref. [26]). In the present study, participants' better recognition memory for thin-body images may have allowed them to imagine themselves as having their ideal body size, thereby shifting their perceived current body size closer to their ideal. Indeed, we found that participants' recognition memory for thin-body images predicted decreased current body size ratings but did not change their ideal body size ratings. Another possible explanation for this finding is that having better memory for body-related information may allow an individual to have a larger "database" of body shapes and sizes, which may facilitate more accurate judgments of their current body size. Given that past literature has suggested that individuals tend to overestimate their body size [30], more accurate judgments would involve a correction of this overestimation, thereby resulting in a smaller current body size rating. Further research is needed to test these possibilities and to clarify the precise mechanisms underlying this enhancement effect.

Finally, the most novel finding that emerged from the present study was that exposure to thin-body images had an indirect effect on participants' body size ratings through their recognition memory of those images. Extended exposure to thin-body images, which allows for more attention to be allocated, improved women's recognition memory for those images. This improved recognition memory for thin-body images, in turn, led to a smaller perceived discrepancy between their current body size and ideal body size, as well as a smaller perceived current body size. An implication of these findings is that the effect of exposure on body dissatisfaction demonstrated in previous studies may have been driven by participants' memory of the thin-ideal images rather than merely the exposure itself. Thus, future studies should include measures of memory to better understand how paying attention to thin-ideal media images affects women's body image. The fact that no restraint differences were found in this indirect relationship further reinforces the idea that the associations between attention, memory, and body dissatisfaction are similar for restrained and unrestrained eaters.

Note that in the present study, participants' memory (i.e., the intervening variable) was assessed after measuring their actual–ideal discrepancy (i.e., the dependent variable). Given that the recognition test also involved presentation of thin-body images to participants, it was necessary to administer the measure of actual–ideal discrepancy prior to the recognition test in order to control the amount of exposure to thin-body images. Furthermore, it is unlikely that completing the state measure of actual–ideal discrepancy would have an impact on participants' recognition performance. Indeed, studies on anxiety disorders and depression have indicated that biases in encoding, rather than in retrieval, play a role in the maintenance of such disorders [31, 32], which may also be the case for biased memory for body-related information. It is also important to note that the present study was conducted with a non-clinical analog sample of restrained eaters and unrestrained eaters, consistent with previous work in the area. Therefore, further research on individuals with eating disorders is needed to confirm these predictions and determine whether the present findings generalize to clinical populations. Furthermore, because this study only included young women, it would be important for future research to examine whether the findings also generalize to older women and to men.

A limitation of the present study is that we did not measure participants' height and weight. Therefore, we are unable to comment on whether participants' BMI plays a role in the relationships that were investigated in this study. Although BMI has previously been found to correlate with individuals' current body size ratings [20], there is no evidence in the extant literature to suggest that individuals' BMI interacts with exposure duration and attention [12, 15], with memory [15], or with social comparison processes [33], to influence body image. Based on this literature, we do not expect BMI to be a critical factor in investigations of the effect of cognitive biases on individuals' body dissatisfaction.

The present study investigated the previously unexplored relationships between attention, memory, and body dissatisfaction within the framework of cognitive theories of eating disorders [4, 5]. Our results suggest that women's memory of body-related information after exposure is perhaps more critical in influencing how they feel about their body than merely the exposure itself. Notably, restrained and unrestrained eaters showed the same memory effects on body dissatisfaction. An implication of these findings is that the effectiveness of existing cognitive bias modification interventions may be enhanced if the role of memory is also targeted. As suggested in depression research [34], multiple cognitive biases may need to be addressed simultaneously rather than in isolation of one another, if the biases were found to operate in a related manner.

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Conflict of interest Michelle Y. W. Jiang and Lenny R. Vartanian declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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