Automatic and Strategic Measures as Predictors of Mirror Gazing Among Individuals with Body Dysmorphic Disorder Symptoms

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Abstract

The current study tests cognitive-behavioral models of body dysmorphic disorder (BDD) by examining the relationship between cognitive biases and correlates of mirror gazing. To provide a more comprehensive picture, we investigated both relatively strategic (i.e., available for conscious introspection) and automatic (i.e., outside conscious control) measures of cognitive biases in a sample with either high (n=32) or low (n=31) BDD symptoms. Specifically, we examined the extent that 1) explicit interpretations tied to appearance, as well as 2) automatic associations and 3) strategic evaluations of the importance of attractiveness predict anxiety and avoidance associated with mirror gazing. Results indicated that interpretations tied to appearance uniquely predicted self-reported desire to avoid, while strategic evaluations of appearance uniquely predicted peak anxiety associated with mirror gazing, and automatic appearance associations uniquely predicted behavioral avoidance. These results offer considerable support for cognitive models of BDD, and suggest a dissociation between automatic and strategic measures.

Keywords

Body dysmorphic disorder; cognitive bias; mirror gazing; automatic; implicit associations

Physical attractiveness is typically considered a virtue. Not only are attractive people commonly judged as more socially competent than less attractive people, they are often considered more intelligent and sometimes even more moral (Dion, 1986; Eagly et al., 1991). It is unsurprising, then, that many people have concerns regarding their physical appearance. However, in body dysmorphic disorder (BDD), appearance-relevant concerns become so pronounced that they are associated with intense distress and interference with the quality of everyday life (American Psychiatric Association, 1994).

In an effort to better understand the mechanisms underlying BDD, researchers have increasingly relied upon cognitive-behavioral models, which argue that individuals with BDD symptoms ‘overvalue’ the importance of physical appearance (e.g., Wilhelm & Neziroglu, 2002). Supporting these models, individuals with BDD endorse beliefs such as, “If my appearance is defective, I shall end up alone and isolated,” and “I have to have

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perfection in my appearance” (Veale et al., 1996). Research also indicates that when confronted with ambiguous everyday scenarios, individuals high (versus low) in BDD symptoms are more likely to make negative interpretations tied to their physical appearance (Buhlmann et al., 2002; Clerkin & Teachman, in press). In the present study, we were interested in examining whether these types of distorted beliefs about appearance actually predict symptoms of BDD.

In addition to maladaptive cognitive processing, cognitive-behavioral models emphasize the importance of behaviors for maintaining symptoms of BDD (Neziroglu et al., 2004). For example, mirror gazing is one of the hallmark features of BDD, with some individuals spending multiple hours checking their appearance in the mirror each day, and other persons avoiding mirrors because of the distress they feel and the time they waste while looking at their image (Phillips, 1986). Many individuals report becoming caught in a repetitive cycle as they alternate between mirror checking and avoidance (Veale & Riley, 2001). Indeed, on a self-report mirror gazing questionnaire, Veale and Riley (2001) found that individuals with BDD (versus healthy control participants) were reportedly more likely to check their image in a mirror, but they were also more likely to report avoiding certain types of mirrors. This behavior theoretically fuels symptoms of BDD as individuals are thought to engage in mirror checking and/or avoidance “in an attempt to reduce disgust, anxiety, or negative feelings in general” (Neziroglu et al., 2004, p. 919). However, these mirror gazing rituals are expected to paradoxically enhance anxiety as they reinforce distorted beliefs about one’s appearance (see Veale & Riley, 2001).

In the current study, we will test cognitive-behavioral models of BDD by examining whether evaluations and interpretations tied to physical appearance predict anxiety and two types of avoidance associated with mirror gazing. We will also examine both relatively strategic (i.e., explicit and/or readily available for conscious introspection), as well as automatic (i.e., indirect and outside conscious control) measures of cognitive biases. The inclusion of both automatic and strategic measures was deemed important for a variety of reasons. First, there is evidence to suggest that automatic and strategic evaluations may have differential predictive validity (see Devine; 1989; Wilson et al., 2000). For instance, in their “double dissociation” model, Asendorpf et al. (2002) demonstrated that relatively automatic forms of shyness (e.g., gaze aversion) were better predicted by automatic shyness associations, as measured by the Implicit Association Test (IAT; Greenwald et al., 1998. See Method for a description of the task). Meanwhile, relatively strategic forms of shyness (e.g., how long a person chooses to speak) were better predicted by strategic measures of shyness, as assessed by explicit questions. Similarly, Bessenoff and Sherman (2000) found that the proximity that participants positioned themselves from an overweight woman was significantly related to an automatic measure of anti-fat evaluations, but not to a strategic measure of anti-fat attitudes. Finally, within the clinical field, Teachman and Allen (2007) found that automatic fears of negative evaluation (a construct central to social phobia) were unrelated to a self-report measure of social anxiety, but they were related to a behavioral measure of social interactions.

It may be especially critical to tap into these types of automatic/strategic dissociations when studying BDD. First, given the extreme shame associated with BDD, it is likely that certain BDD-relevant beliefs are difficult for individuals to strategically report. For instance, individuals with BDD symptoms may avoid talking about their beliefs related to the importance of physical appearance out of fear that they will be perceived as vain. Research also indicates that it is not uncommon for individuals with BDD to have limited insight into the nature of their symptoms (Eisen et al., 2004). By including relatively automatic measures, we can minimize the impact of self-presentation concerns, and examine evaluations that lie outside conscious control or awareness. Finally, recent research has...
shown that automatic evaluations differentiate between individuals with and without symptoms of BDD. Specifically, Buhlmann and colleagues (2008) demonstrated that individuals diagnosed with BDD, relative to healthy control participants, were more likely to display lower levels of automatic self-esteem associations, as measured by an IAT. In the same study, Buhlmann et al. failed to find a group difference in automatic attractiveness evaluations. However, researchers indicated that this was likely due to methodological limitations, which we attempt to address in the current study (see Method for a description of the task).

In sum, we have two primary goals with the present research. First, we are interested in evaluating whether measures of cognitive biases, and anxiety and avoidance associated with mirror gazing distinguish between individuals high versus low in symptoms of BDD. Although researchers have provided important information regarding strategic cognitions tied to BDD (see Veale, 2004; Wilhelm & Neziroglu, 2002), this is still a new area and relatively little is known about automatic cognitive processing in particular. Similarly, mirror gazing is considered critical for maintaining symptoms of BDD (Veale & Riley, 2001), but to the best of our knowledge, there have been no in vivo evaluations of this phenomenon. Thus, we will include a series of tasks to directly examine anxiety and avoidance associated with mirror gazing. Given the complicated relationship between avoidance and BDD symptoms (i.e., individuals with BDD are thought to check and avoid mirrors more often than individuals without BDD), we have also included two measures assessing different aspects of mirror avoidance. Specifically, we include a strategic, self-report measure, as well as a behavioral measure designed to capture some elements of relatively automatic processing.

Following cognitive behavioral models of BDD, our expectation is that individuals high (versus low) in BDD symptoms will display greater levels of cognitive biases. Specifically, we predict that they will place greater emphasis on the importance of physical appearance and make more negative appearance-relevant interpretations. Given the mixed findings for automatic biases in BDD (e.g., Buhlmann et al., 2008), these predictions are particularly strong for the strategic measures of cognition. However, we tentatively hypothesize that automatic evaluations will follow a similar pattern. Finally, individuals with greater BDD symptoms are expected to show more anxiety tied to mirror gazing, particularly during mirror tasks that most highlight one’s physical flaws (e.g., the magnifying mirror task). Evaluating mirror avoidance is a more exploratory aspect of the current study given the mixed findings that individuals with BDD check their image in the mirror more often than those without BDD, even though they are more likely to avoid certain types of mirrors (Veale & Riley, 2001).

Our second goal is to examine the extent that interpretations tied to appearance and evaluations of attractiveness (at an automatic and strategic level) predict anxiety and avoidance associated with mirror gazing. This will allow us to test some of the theoretical predictions in cognitive models of BDD: namely, that ‘overvaluing’ physical appearance contributes to BDD symptoms. Our expectation is that cognitive bias measures will predict anxiety and avoidance, and that these measures may show a relationship with one another partially based on their shared automatic versus strategic features (see Teachman et al., 2007). Furthermore, akin to Asendorpf et al. (2002) and Bessenoff and Sherman (2000), the strategic cognitive measures should be stronger predictors of those BDD symptoms that are more readily controlled (e.g., self-reported anxiety and desire to avoid each mirror), whereas the automatic cognitive measure should more strongly predict a relatively less strategic measure (e.g., behavioral avoidance when examined indirectly, without the participant’s awareness).
Method

Participants

Undergraduate students at the University of Virginia (N = 63; 42 women) participated in the study, either for course credit as part of the psychology participant pool or for payment. We recruited participants based on responses to items from a version of the Body Dysmorphic Disorder Questionnaire (BDDQ; Phillips, 1986), which was slightly modified to facilitate online administration to a college population. Specifically, the questionnaire was administered as part of a larger pre-screening battery for psychology students at the outset of each semester. Additionally, one participant contacted the first author after seeing an advertisement for a different study and was subsequently invited to participate based on responses to the BDDQ. Individuals were recruited for the high BDD group if they 1) indicated that they were very concerned and preoccupied with some part(s) of their body; 2) indicated that their main concern was not that they weren’t thin enough or that they might become too fat; and 3) reported extreme distress due to their preoccupation and/or some impairment in functioning (e.g., interference with social life; spending greater than 3 hours per day thinking about their appearance, etc.). Individuals were recruited for the low BDD group if they expressed that they were not very concerned with some part(s) of their body. While no formal diagnosis was made for individuals in the high BDD group, it is important to point out that because of the categorical nature of the questions on the BDDQ, selection criteria were actually quite stringent. For instance, in one semester, less than 4% of all individuals who completed the screening questionnaire qualified to participate as part of the high BDD symptom group.

The final sample for the high BDD group (n=32, 66% female) had a mean age of 18.56 (SD=1.08), and race or ethnicity was reported as 63% White, 19% Asian, 9% African American, 3% Hispanic, 3% Middle Eastern, and 3% biracial. Among participants high in BDD symptoms (who could endorse more than one area of concern), 63% indicated skin concerns, 44% indicate facial feature concerns, 41% indicated “other” body concerns, and 34% indicated hair concerns. The final sample for the low BDD group (n=31, 68% female) had a mean age of 18.74 (SD=1.08), and race or ethnicity was reported as 71% White, 10% Asian, 7% African American, 13% biracial.

Materials

Note. Only those materials relevant to the current hypotheses are listed here. Please contact the first author for a more complete listing.

BDD Symptoms—The Body Dysmorphic Disorder Questionnaire (BDDQ; Phillips, 1986) is a self-report screening measure with adequate sensitivity and specificity (Phillips, 1986) that assesses whether BDD may be present but does not give a definitive diagnosis.

The Body Dysmorphic Disorder Modification of the YBOCS (BDD-YBOCS; Phillips et al., 1997) is the most widely used measure for assessing the severity of BDD symptoms, and was included as a convergent measure of group assignment. In the current study, participants were provided with a definition of the word ‘defect’ as it applied to the measure, and were then asked to complete the BDD-YBOCS (modified) in a self-report format. Note, this self-report version has not been formally validated, but a similar version has been used successfully in a prior study examining cognitive biases in an analogue BDD population (e.g., Clerkin & Teachman, in press). Cronbach’s alpha in the current study was .86, suggesting good inter-item consistency.

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Strategic Evaluations and Interpretations Tied to Appearance—The Interpretations Questionnaire—Appearance (Buhlmann et al., 2002) assesses interpretations across 22 ambiguous scenarios, half of which reflect BDD-relevant situations. For instance, in the BDD-relevant scenarios participants are provided with a short description of an ambiguous situation (e.g., “Two people are whispering and laughing behind you. You cannot hear them”), followed by the question: “What thoughts occur to you?” They are then asked to rate the likelihood of three thoughts coming to mind, including one related to body-image concerns (e.g., “They are making fun of how I look”). The two non-negative thought options reflect neutral or positive interpretations and are not necessarily related to appearance. Only the ratings for the threat interpretation option in the BDD-specific scenarios were evaluated in the current study (Cronbach’s alpha = .70).

The Beliefs About Appearance Scale (BAAS; Spangler & Stice, 2001) is a 20-item measure that assesses strategic beliefs about the perceived consequences of physical appearance for relationships, achievement, self-concept, and mood (e.g., “People will think less of me if I don’t look my best”; “My ability to feel happy depends upon how I look”). Extent of agreement was rated on a Likert-scale from 0 (not at all) to 4 (extremely). Cronbach’s alpha in the current sample was .90.

Automatic Evaluations of Appearance—The Implicit Associations Test (IAT; Greenwald et al., 1998) measures automatic associations in memory (automatic in the sense that evaluations occur outside conscious control, and at times, outside awareness). The IAT has adequate psychometric properties (Greenwald & Nosek, 2001), and like many tasks used by social cognition researchers it is a reaction time task that ostensibly reflects strength of association between concepts (Fazio, 2001). Specifically, the IAT compares the time taken to classify stimuli when paired categories match a person’s automatic associations versus when paired categories contradict automatic associations. When categories are paired to match a person’s automatic associations, participants are expected to classify the stimuli more quickly. Thus, it is a relative measure of associations, rather than a measure of absolute evaluations. In the present study, we modified the IAT category labels used by Buhlmann et al. (2008) to evaluate automatic evaluations of attractiveness as important (versus meaningless). Specifically, the categories ‘Attractive’ (versus ‘Plain’) were paired with the categories ‘Important’ versus ‘Meaningless’ (referred to as ‘IAT Attractive > Important’). We chose the category ‘Plain’ because this represented a natural contrast to the category ‘Attractive’ (our construct of interest), but it was not extremely negative in valence.

The task involves classifying stimuli during two opposing category pairing conditions: 1. a pairing hypothesized to be incompatible for persons with BDD symptoms (e.g., ‘attractive + meaningless’ and ‘plain + important’), and 2. a pairing hypothesized to be compatible for individuals with symptoms of BDD (e.g., ‘attractive + important’ and ‘plain + meaningless’). Participants were asked to correctly categorize as many stimuli as they could into the two opposing category pairings, which were located at the top left and right-hand sides of the computer screen (e.g., the word ‘pretty’ or the word ‘significant’ would fit into the pairing ‘Attractive + Important’). Both of the critical IAT blocks were composed of 60 trials, the first 20 of which were considered practice. These test trials were preceded by a series of single dimension categorization trials in which participants practiced categorizing stimuli into individual categories before they were paired together (e.g., just attractive/plain; just important/meaningless). Additionally, participants completed an unrelated practice IAT task prior to the test trials so they would become more familiar with the IAT procedure.

We expected that individuals in the high (relative to low) BDD group would have relatively more rapid associations between attractive + important (versus plain + meaningless). Thus, comparing response times on the compatible versus incompatible category pairing...
conditions derived our measure of automatic associations. The IAT data were scored according to the algorithm developed by Greenwald et al. (2003) to create a D score, which reflects the difference in mean reaction time across critical blocks divided by the standard deviations across blocks (it is conceptually similar to Cohen’s d). No participants’ IAT data were deleted because of high error rates or unusually fast or slow response times; overall IAT error rate was 5%. (Note, an IAT measuring evaluations of the self as good versus bad was also conducted to assess implicit self-esteem. This measure is not discussed in detail here given that it is not central to the hypotheses of the current study. See Buhlmann et al., 2008, for full description of the task.)

Anxiety and Avoidance Tied to Mirror Gazing

Self-reported Anxiety and Desire to Avoid: To assess BDD-relevant anxiety and avoidance, participants were asked to complete a series of mirror gazing tasks. Prior to completing the tasks, participants were reminded that they were allowed to stop the tasks whenever they wanted, and they did not have to engage in any task that they were uncomfortable with:

- **Full-Length Mirror BAT.** Two versions of this task were used. In both cases, participants were asked to stand approximately 18 inches from a full length mirror. During the first task, participants were asked not to make adjustments to their hair, face, or clothing while they looked into the mirror for up to 1 minute (referred to as Mirror-No Adjustments). During the second task, participants were allowed to make adjustments (e.g., fixing their hair; referred to as Mirror-Adjustments). Note that we limited the time during these tasks to 1 minute in order to minimize habituation effects.

- **Magnifying Mirror.** In this task, participants were asked to look into a magnifying mirror for up to 5 minutes (referred to as Mirror-Magnifying). Again, participants were asked not to make adjustments to their appearance during the task. At 30 second intervals throughout the task, participants were asked to indicate their subjective level of anxiety.

Following each mirror gazing task, participants were asked to complete two analogue scales that ranged from 0 to 100: 1. Peak Anxiety (maximum level of anxiety participants felt during any point of each mirror gazing task), and 2. Self-reported Desire to Avoid (the extent to which participants wanted to look away from each mirror). Both scales were administered in questionnaire format to maximize privacy.

Behavioral Mirror Avoidance: At the outset of the study, participants were told that they would be asked to look into a full-length mirror in subsequent study tasks. They were then asked to move a chair up to the mirror and take a seat. The proximity of the chair to the mirror was used to reflect behavioral avoidance (the further away, the greater avoidance). This measure was designed to capture elements of relatively automatic processing in the sense that participants were unaware that they were being measured (the distance was recorded when participants were no longer in the room and no mention of this measure was made).

Chronic Mirror Avoidance and Distress: The Mirror Questionnaire (MQ; adapted from Veale & Riley, 2001) was administered to provide a more global measure of avoidance and distress associated with mirror gazing. The MQ contains two 3-item scales assessing avoidance (referred to as MQ-Avoidance) and distress (referred to as MQ-Distress). The avoidance scale assesses whether participants avoid certain types of mirrors, or mirrors in certain situations. The distress scale assesses the amount of distress participants report immediately before and after looking into a mirror, as well as after resisting the urge to look into a mirror. Cronbach’s alpha was .80 for MQ-Distress and .65 for MQ-Avoidance.
Procedure

Participants were informed that the purpose of the study was to gain a better understanding of the relationship between behavior, thoughts, and emotional responses; BDD was not mentioned. Following informed consent, baseline measures of anxiety (on a 0-100 verbal analogue scale) were obtained, and we measured behavioral avoidance by instructing participants to position a chair in front of a full-length mirror and take a seat. Next, participants completed the Interpretations Questionnaire and IAT, after which they completed the mirror tasks in a fixed order (Mirror-No Adjustments, Mirror-Adjustments, Mirror-Magnifying). Mirror-No Adjustments was administered before Mirror-Adjustments, because we wanted to first get an estimate of self-reported anxiety/avoidance when participants were not allowed to ‘fix’ their appearance. Mirror-Magnifying was placed at the end because this was the longest task, and we did not want habituation effects to influence the earlier two tasks. If participants’ distress levels after a mirror task had ended were elevated more than 20 points above their baseline level (indicating residual anxiety), relaxation exercises were conducted until distress levels were within 20 points of their baseline. This was done to reduce carryover effects across tasks. Finally, participants completed the Mirror Questionnaire and BAAS in random order, followed by the BDD-YBOCS (modified). We chose to place the MQ, BAAS, and BDD-YBOCS (modified) at the end of the study so participants would be less aware that the study was about BDD.

Results

Sample Characteristics

As expected, independent samples t-tests indicated that groups differed on BDD symptom measures in the expected direction. Specifically, individuals high in BDD symptoms (M=18.97; SD=5.33) scored higher on the BDD-YBOCS (modified) than individuals low in BDD symptoms (M=10.89; SD=5.24; t61=6.06, p<.001, d=1.53). Moreover, chi-square tests revealed that there were no significant gender (χ²=.03, p>.10) or ethnicity (χ²=.51, p>.10) differences between the high and low BDD symptom groups.

Evaluations and Interpretations Tied to Physical Appearance

We hypothesized that individuals in the high (versus low) BDD symptom group would place greater emphasis on the importance of physical appearance at both an automatic and strategic level. Additionally, we expected participants in the high BDD symptom group to make more negative appearance-related interpretations. To examine these hypotheses, we conducted a multivariate analysis of variance (MANOVA) with one between-subjects factor (BDD status) and three cognitive bias dependent variables: Strategic Appearance Evaluations, Automatic Appearance Evaluations, and Interpretations. As expected, there was a significant main effect for BDD status (F(3,58)=5.53, p=.002, η_p²=.22). Individuals high (versus low) in BDD symptoms explicitly evaluated the importance of being physically attractive as relatively greater (BAAS; t61=3.44, p=.001, d=.87), and were more likely to make negative interpretations tied to their appearance (IQ-S; t61=3.23, p=.002, d=.81). However, contrary to expectations, there were no BDD symptom group differences in automatic evaluations of attractiveness as important (versus meaningless) (IAT; t60=.44, p>.10, d=.11). The absolute value of the IAT result indicated relatively stronger associations with attractive as important (and plain as meaningless), compared to attractive as meaningless, but this did not differ by group. See Figure 1.

Contrary to findings from Buhlmann et al. (2008), there was also no difference between the high and low symptom groups on implicit self-esteem (t60=.45, p>.10). However, among individuals in the high BDD group, there was a non-significant trend for individuals who
Strategic Anxiety and Avoidance tied to Mirror Gazing

To evaluate self-reported peak anxiety during each mirror task, we computed a regress change score for each time point (i.e., we computed the unstandardized residual of baseline anxiety predicting peak anxiety during each of the three mirror tasks). Thus, we were able to capture peak anxiety that was independent from baseline anxiety (see Cohen et al., 2003, p. 570). We then conducted a repeated measures ANOVA with one between-subjects factor (BDD status) and one within-subjects factor (Peak Anxiety for: Mirror-Adjustments, Mirror-Adjustments, Mirror-Magnifying). There was not a significant main effect for Mirror Type (F(2,57) = .06, p > .10, η² = .002), nor was there a significant interaction between Mirror Type and BDD status (F(2,57) = .80, p > .10, η² = .03). However, in line with predictions, there was a non-significant trend for BDD status (F(1,58) = 3.45, p = .07, η² = .06). Across each of the mirror tasks individuals high in BDD symptoms experienced more anxiety than those low in BDD symptoms; however, this difference only reached significance in the Mirror-Magnifying task (t(60) = 2.16, p = .04, d = .55). There were no significant differences in peak anxiety for either of the other two tasks (Mirror-No Adjustments: t(59) = 1.35, p > .10, d = .34; Mirror Adjustments: t(61) = 1.44, p > .10, d = .36), though the presence of outliers may have obscured group differences on the Mirror Adjustments task. Specifically, within the low BDD symptom group, two individuals had extremely high scores on the Mirror Adjustments task (3 times the Interquartile Range of the rest of the scores within the low group). When these extreme outlier scores were removed, the difference between the high and low BDD symptom groups on the Mirror Adjustments task did reach significance (t(59) = 2.55, p = .01, d = .66).

To assess participants’ self-reported desire to avoid each mirror, we conducted a second repeated measures ANOVA with one between-subjects factor (BDD status) and one within-subjects factor (Self-reported Desire to Avoid during each of the three mirror tasks). This was an exploratory analysis given the mixed findings that individuals with BDD symptoms reportedly experience more avoidance and checking behaviors (relative to individuals without BDD; Veale & Riley, 2001). Interestingly, there was a significant main effect for BDD status (F(1,59) = 8.15, p = .006, η² = .12), such that individuals high (versus low) in BDD symptoms experienced a greater desire to avoid looking into the mirror during each of the 3 mirror tasks (Mirror-No Adjustments: t(61) = 2.42, p = .02, d = .61; Mirror-Adjustments: t(61) = 2.86, p = .006, d = .73; Mirror-Magnifying: t(61) = 2.53, p = .01, d = .64). There was also a significant main effect for Mirror Type (F(2,58) = 13.79, p < .001, η² = .32). Participants experienced a greater desire to avoid looking into the mirror during Mirror-No Adjustments (relative to Mirror-Adjustments: t(61) = 5.10, p < .001, d = .35) and during Mirror-Magnifying (relative to Mirror-Adjustments: t(61) = 3.08, p = .003, d = .35). There was no significant difference between Mirror-No Adjustments and Mirror-Magnifying (t(61) = .01, p > .10, d = .001). Furthermore, there was no significant BDD status by Mirror Type interaction (F(2,58) = .05, p > .10, η² = .002).

Finally, to examine group differences in chronic distress and avoidance associated with mirror gazing, we evaluated scores on the Mirror Questionnaire (MQ-Distress and MQ-Avoidance). Using these variables, we conducted a MANOVA with one between-subjects factor (BDD status) and two dependent variables: MQ-Distress and MQ-Avoidance. Consistent with Veale and Riley (2001), there was a significant main effect for status (F(2,60) = 6.51, p = .003, η² = .18) with individuals high (versus low) in BDD symptoms reporting greater avoidance (MQ-Avoidance; t(60) = 2.14, p = .04, d = .54) and distress (MQ-Distress; t(60) = 3.49, p = .001, d = .88).
Behavioral Avoidance tied to Mirror Gazing

In the current study, behavioral avoidance was measured by recording the distance participants spontaneously positioned a chair in front of the mirror (the further away, the greater the avoidance). Given the complicated relationship between BDD symptoms and mirror avoidance (Veale & Riley, 2001), this test was a more exploratory analysis. Results indicated that there was no BDD symptom group difference in Behavioral Avoidance ($t_{60}=1.20$, $p>.10$, $d=.31$). Although individuals high in BDD symptoms ($M=112.49$ cm; $SD=37.01$) positioned the chair further from the mirror than individuals low in BDD symptoms ($M=100.26$ cm; $SD=42.96$), this difference was not statistically significant. (Note, one participant moved the chair (without moving it back to the original spot) before the experimenter had a chance to measure the distance; thus, this data point was cut from analyses. If other participants moved their chairs prior to measurement, they were asked to move the chairs back close to their original spot.)

Relationships between Cognitive Biases and BDD Symptom Measures

A second objective of the current study was to examine the relationship between interpretations and automatic and strategic evaluations of physical appearance, and, more importantly, the extent to which these measures predicted anxiety and avoidance tied to mirror gazing. In order to simultaneously evaluate the relationship between these multiple predictors and dependent variables, we used structural equation modeling (SEM). SEM also made it possible to create a ‘latent’ factor of anxiety and self-reported desire to avoid across the mirror tasks, which helped account for measurement error on a given indicator (because the factor reflects the common variance across the indicators). All models were fit to the data using AMOS, and full information maximum likelihood methods were used so that incomplete data were treated as missing at random (Little & Rubin, 1987).

We first created two baseline models to evaluate strategic responses across the mirror tasks — Mirror Anxiety (see Figure 2) and Mirror Self-reported Desire to Avoid (see Figure 3). For each model, we used three indicators to represent each latent construct. The latent anxiety factor was composed of peak anxiety (i.e., the regressed change score) across each of the three mirror tasks; the latent avoidance factor was composed of self-reported desire to look away from the mirror across each of the mirror tasks. For each model, the predictor variables were interpretations tied to appearance (IQ-S), strategic evaluations of appearance (BAAS), and automatic evaluations of appearance (IAT Attractive > Important). To simultaneously test whether there were significant relationships among the measures of cognitive biases, these three measures were allowed to inter-correlate.

As evident in Figure 2, in the Mirror Anxiety model, each of the peak anxiety indicators loaded significantly onto the latent construct. Of primary interest, the measure of strategic evaluations of physical appearance was the only significant, unique predictor of the latent construct of peak anxiety. With respect to relationships among cognitive biases, interpretations and strategic evaluations of appearance were significantly related to one another. However, the measure of automatic evaluations of physical appearance was not significantly related to either of the predictor variables, nor was it related to the latent construct of anxiety. In the Mirror Self-reported Desire to Avoid model, each of the avoidance indicators also loaded significantly onto the latent construct (see Figure 3). Here, the only significant predictor of the latent construct of self-reported desire to avoid was interpretations tied to appearance. Interpretations and strategic evaluations of appearance were again significantly related to one another, and, once again, automatic appearance evaluations were not related to any of the other variables. Thus, the latent factor of peak anxiety was best predicted by strategic evaluations of appearance, while the latent factor of self-reported desire to avoid was best predicted by interpretations tied to appearance.
Moreover, in line with expectations, strategic measures of cognition were related to one another, but were unrelated to automatic appearance evaluations.

Tables 1 and 2 outline the goodness of fit indices for the Mirror Anxiety and Avoidance models, including the root-mean-square error of approximation index (RMSEA; less than .08 is considered an acceptable fit as defined by Browne & Cudeck, 1993, with lower numbers indicating a better fit), the comparative fit index (CFI), and the normed fit index (NFI). Both the CFI and NFI vary from 0-1, with values above .90 indicating an acceptable fit (Hu & Bentler, 1999; higher numbers indicate a better fit). The fit indices for both models were adequate according to the NFI and CFI, although the RMSEA was somewhat high.

Next, a series of nested structural regression models were compared (see McArdle & Hamagami, 1996) to directly test the observed relationships between the cognitive bias measures and the latent factors of strategic anxiety and self-reported desire to avoid. Specifically, for each baseline model (Mirror Anxiety and Mirror Self-reported Desire to Avoid), we evaluated a set of competing models where we sequentially constrained each of the paths connecting the cognitive bias measures with the latent variables to zero. If the change in fit (based on the change in chi square for the relevant \( \Delta \text{df} \)) between the baseline and competing models indicates a significantly higher chi square value, this points to a significant loss of model fit, suggesting that there was a meaningful relationship between the cognitive bias measure and latent factor of strategic anxiety or self-reported desire to avoid. Confirming the above results, setting the path from strategic evaluations of appearance to the latent anxiety factor to zero resulted in a significant loss of model fit. Analogously, setting the path from interpretations to the latent self-reported desire to avoid factor resulted in a significant loss of model fit. Meanwhile, setting the other paths from the cognitive bias measures to the latent factors to zero resulted in no significant loss of fit for either the Mirror Anxiety or Self-reported Desire to Avoid models (see Tables 1 and 2). These analyses increase confidence that interpretations tied to appearance uniquely predict self-reported desire to avoid, while strategic evaluations of appearance uniquely predict peak anxiety associated with mirror gazing.

Next, we re-ran the baseline Mirror Anxiety and Self-reported Desire to Avoid models with the high BDD symptom group alone, given the limitations of examining relationships when using an extreme groups design. The pattern of relationships between each of the cognitive bias measures and the latent anxiety and self-reported desire to avoid factors were largely consistent (see Figures 2 and 3). However, in both models the relationship between interpretations and strategic evaluations tied to physical appearance was no longer significant, presumably due to low power with the reduced sample size.

Finally, we created a third model using AMOS that evaluated behavioral avoidance (see Figure 4). This allowed us to compare the pattern of relationships in a similar format to the previous two models. Again, the predictor variables were strategic evaluations of appearance (BAAS), interpretations tied to appearance (IQ-S), and automatic evaluations of appearance (IAT Attractive > Important). The dependent variable was the distance participants’ spontaneously positioned the chair from the mirror (the further away, the greater the avoidance). Interpretations and strategic evaluations of physical appearance were unrelated to either automatic evaluations or behavioral avoidance. However, as predicted, automatic evaluations did predict behavioral avoidance. Specifically, greater ratings of attractiveness as important (versus meaningless) were associated with participants spontaneously positioning themselves further away from the mirror. Note, given that it is unusual to examine prediction of a single manifest indicator using SEM when no latent factors are included in the model (and the fit indices are not interpretable in this context), we also checked that a standard simultaneous regression (with the three cognitive biases predicting the distance positioned) was also significant.
behavioral avoidance) produced the same results. Again, only the IAT Attractive > Important was a significant predictor of behavioral avoidance \( (B=.31, p=.02) \). Thus, in line with predictions, behavioral avoidance was best predicted by automatic appearance evaluations.

**Discussion**

We had two primary objectives with the current study: 1) to determine whether measures of cognitive bias and correlates of mirror gazing distinguish between individuals high versus low in symptoms of BDD, and 2) to determine whether interpretations and evaluations tied to appearance predict anxiety and avoidance associated with mirror gazing. In both cases, we were also interested in examining the role that measures reflecting relatively automatic versus strategic processing requirements play in the expression and prediction of BDD symptoms.

**Group Differences in Cognitive Biases and Mirror Gazing**

Across a range of tasks reflecting strategic processes, individuals high in BDD symptoms demonstrated greater appearance-relevant biases than those low in BDD symptoms. In line with predictions, individuals high (versus low) in BDD symptoms were more likely to make negative interpretations tied to their appearance (Interpretations Questionnaire), overemphasize the importance of being attractive (Beliefs About Appearance Scale), and report a chronic tendency toward distress and avoidance associated with mirror gazing (Mirror Questionnaire). These findings are consistent with past research (e.g., Veale et al., 1996; Buhlmann et al., 2002), and indicate that individuals with symptoms of BDD believe physical appearance is related to many aspects of their lives. It makes sense that persons who place such a high premium on the way that they look would also have a conflictual relationship with mirrors, given that mirrors are by definition designed to highlight one’s physical features.

In fact, during the *in vivo* mirror tasks, individuals high in BDD symptoms exhibited a greater desire to look away from each mirror (Mirror Self-reported Desire to Avoid). Notably, our measure of self-reported desire to avoid constituted just one type of potential avoidance behavior. It is possible that participants were avoiding in more subtle ways as well (e.g., averting their gaze). This more subtle avoidance behavior may help explain the mixed results for the self-reported anxiety ratings; for instance, averting one’s gaze (and thus reducing the emotional impact of the exposure) is likely easier for a large mirror than for a magnifying mirror placed close to one’s face. Indeed, although individuals high (versus low) in BDD symptoms experienced more anxiety across the mirror tasks, this group difference only reached significance for the Mirror-Magnifying task. We are hesitant to over-interpret the null findings for anxiety in response to Mirror-Adjustments and Mirror-No Adjustments, particularly because there was a BDD group difference on the Mirror-Adjustments task once extreme outliers within the low BDD group were removed. Additionally, given that the group means were in the expected direction, it seems likely the relatively lower levels of symptom severity within our analogue sample (compared to a diagnosed sample) contributed to the lack of statistically significant group differences. At the same time, these findings do support the idea that not all mirrors or exposures are equally upsetting for individuals with symptoms of BDD (Veale & Riley, 2001). For instance, participants were asked to look into the magnifying mirror for up to 5 minutes (versus 1 minute for the other two tasks), suggesting that anxiety may be exacerbated for longer mirror gazing sessions. Additionally, given that approximately 90% of perceived defects in BDD involve facial or head features (Phillips et al., 1993), it is unsurprising that the group difference in anxiety would have been most pronounced for the hand-held magnifying mirror. Similarly, participants reported less desire to look away from the mirror.
during the task where they could make adjustments to their hair, face, or clothing (Mirror-Adjustments) than during either of the other two tasks (Mirror-No Adjustments and Mirror-Magnifying). This finding is consistent with the idea that individuals feel compelled to ‘fix’ their appearance, and will feel motivated to avoid mirrors when prevented from conducting their grooming rituals.

Finally, there were no group differences on either of the measures reflecting aspects of relatively automatic processing requirements: automatic evaluations of appearance (on the IAT) or behavioral avoidance (placement of chair relative to the mirror). With respect to automatic appearance evaluations, it is possible that there were no group differences in part because of the egodystonic nature associated with overvaluing physical appearance (see Buhlmann et al., 2008). Anecdotally, many individuals with BDD symptoms report feeling ashamed that they place such emphasis on their appearance. However, this explanation is not wholly satisfactory because individuals high (versus low) in BDD symptoms did endorse greater strategic appearance biases. Thus, we believe that the null findings are probably due to design constraints of the IAT. Specifically, the IAT requires a relative comparison category to ‘attractive,’ which may have reduced our ability to see group differences. When evaluating attractive as important, for instance, participants were simultaneously evaluating being plain as meaningless. These category pairings are not orthogonal, and being ‘plain’ may be considered just as important for someone with BDD symptoms, even if this meaning connotes a negative value. This seems particularly likely given evidence that individuals with BDD symptoms are characterized by high levels of perfectionism (see Buhlmann, Etcoff, & Wilhelm, 2008). Following Buhlmann et al. (2008), it seems plausible that people high in BDD symptoms will think the category label “Plain” is more negative than individuals low in BDD symptoms, and in a sense, more “meaningful” as well. Similarly, Buhlmann et al. (2008) pointed to problems with the relative nature of the IAT when they failed to find BDD group differences in automatic attractiveness evaluations (they used ‘kind’ as the relative comparison category to ‘attractive’). Given these methodological challenges, we believe that future research investigating automatic appearance evaluations in BDD should consider tasks that do not require a relative comparison category (e.g., the Single Category IAT; Karpinski & Steinman, 2006).

Meanwhile, our measure of behavioral avoidance may not have been sensitive enough to tap into group differences in BDD symptoms. In particular, within the high BDD group it is possible that mirror checkers (i.e., individuals who tend to check their appearance in the mirror) cancelled out the effects of individuals who tend to avoid mirrors. If this were the case, the high and low symptom groups would have appeared to perform similarly on this task. Nevertheless, it is important to mention that individuals high in BDD symptoms did place their chair more than 10 centimeters further from the mirror than individuals low in BDD symptoms. Thus, future research is necessary to clarify the extent to which this type of behavioral avoidance is relevant for the expression of BDD symptoms. Furthermore, while this task was designed to capture relatively automatic responding in the sense that participants were unaware they were being measured, there is no assurance that participants did not strategically place their chair closer to or further from the mirror. Therefore, evaluating behavioral measures that more clearly tap into the various features of automaticity will be an important avenue for future research.

**Predictive Validity of Interpretations and Evaluations Tied to Appearance**

The prediction of anxiety and avoidance by the various cognitive biases offers support for cognitive-behavioral models of BDD symptoms, and suggests a dissociation between automatic and strategic measures. In fact, each cognitive bias measure predicted a different form of anxiety or avoidance. Interpretations tied to appearance uniquely predicted self-reported desire to avoid, while strategic evaluations of appearance uniquely predicted peak

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anxiety, and automatic evaluations of appearance uniquely predicted behavioral avoidance. Again, the differential prediction between automatic and strategic measures of cognition supports Asendorpf et al.’s (2002) double dissociation model, indicating that avoidance behavior may be determined by multiple pathways.

An unexpected finding from the current study was that interpretations and strategic appearance evaluations differentially predicted anxiety and avoidance. While strategic appearance evaluations were associated with anxiety tied to mirror gazing, they were not associated with the desire to look away from each mirror. We did not predict this finding, but it fits with one of the well-known paradoxes associated with BDD: individuals often feel intense distress while looking into a mirror, even though they feel unable to turn away. If individuals believe that being physically attractive is paramount, they are likely to experience greater anxiety when confronted with even minor physical flaws. At the same time, individuals who overvalue attractiveness may not want to turn away from a mirror given that they may feel compelled to ‘fix’ what they see. Meanwhile, many of the BDD-relevant interpretations on the Interpretations Questionnaire were associated with appearance-based rejection (e.g., “They are making fun of how I look”). Thus, it is understandable that someone who interprets ambiguous information in a threatening way would feel a greater desire to avoid situations where ambiguity is heightened (e.g., looking into a mirror). Along these lines, Veale and Riley (2001) note: “The act of mirror gazing also creates further confusion for many patients as they report seeing one or more faces at different times or in different mirrors or lights” (pp. 1389-1390). In any case, it is important for clinicians to be aware of the differential predictive validity of cognitive biases, given that changing one form of bias will not necessarily affect a broad array of BDD symptoms.

This is particularly important when one considers the pattern of relationships among the cognitive bias measures. As expected, strategic measures (i.e., interpretations and strategic appearance evaluations) were significantly related to one another. This finding is not surprising—it makes sense that someone who believes appearance has important consequences is likely to interpret ambiguous situations as being appearance-relevant. In other words, both strategic measures reflect the belief that appearance is an integral part of one’s everyday life. Interestingly, these strategic measures were not significantly related to automatic appearance evaluations. This is consistent with the idea that the degree cognitive bias indicators relate to one another may be partially due to their shared automatic versus strategic features (Teachman et al., 2007). It is, however, equally plausible that the relative comparison category in the IAT (plain vs. attractive) diminished our ability to see meaningful relationships among predictor variables.

Limitations and Conclusions

The findings from the present study must be interpreted in light of several limitations. First, although the current analogue sample was carefully screened, they were not diagnosed with BDD. Thus, it is not clear whether these results will generalize to a clinical sample, or to individuals with more comorbid emotional difficulties. Second, this study makes important strides in understanding the relationship between BDD symptoms and mirror gazing, but future research is necessary to investigate additional measures of avoidance (e.g., evaluations of the time participants spontaneously spend in front of various mirrors). Tied to this, evaluating bias in the context of mirror gazing is challenging because while completely avoiding mirrors is “biased,” so too is spending an inordinate amount of time looking into them. Thus, it will be critical for future research to examine this potentially non-linear relationship between BDD symptoms and mirror avoidance. Finally, as mentioned, the relative nature of the IAT makes it difficult to draw firm conclusions about the role of automatic appearance evaluations in BDD.
Nevertheless, this study offers considerable support for cognitive behavioral models of BDD symptoms, and suggests a dissociation between automatic and strategic measures. In particular, interpretations tied to appearance uniquely predicted self-reported desire to avoid, strategic evaluations of appearance uniquely predicted anxiety, and automatic evaluations of appearance uniquely predicted behavioral avoidance. Thus, although there were consistent group differences only for strategic (but not automatic) measures of cognitive processing, both automatic and strategic appearance evaluations and interpretations predicted aspects of mirror gazing, one of the most troubling features of BDD.

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References


Veale D, Riley S. Mirror, mirror on the wall, who is the ugliest of them all? The psychopathology of mirror gazing in body dysmorphic disorder. Behavior Research and Therapy. 2001; 39:1381–1393.


Figure 1.
Group differences in evaluations and interpretations tied to physical appearance.

*Note.* Group means (and SE bars) for item-level negative appearance interpretations on the Interpretations Questionnaire-Self and Beliefs About Appearance Scales, and D-scores for IAT Attractive is Important > Meaningless. All scales were converted to z-scores for ease of presentation; however, it is important to note that the scales use very different metrics so are not directly comparable. Higher scores indicate a greater emphasis on the importance of physical appearance (* = p<.05).
Figure 2.
Automatic and strategic cognition predicting peak anxiety: Structural equation model with standardized coefficients noted (for both the full sample and high BDD group alone).

Note. * indicate error terms. * = p < .05; + = p < .10
The numbers in brackets reflect the standardized coefficients for the model run with only the High BDD symptom group, and the numbers not in brackets reflect the coefficients for the full sample.
Figure 3.
Automatic and strategic cognition predicting self-reported desire to avoid: Structural equation model with standardized coefficients noted (for both the full sample and high BDD group alone).

Note. $\Rightarrow$ indicate error terms. * = $p<.05$; + = $p<.10$

The numbers in brackets reflect the standardized coefficients for the model run with only the High BDD symptom group, and the numbers not in brackets reflect the coefficients for the full sample.
**Figure 4.**
Automatic and strategic cognition predicting behavioral avoidance: Structural equation model with standardized coefficients noted (for both the full sample and high BDD group alone).

*Note.* $\cdot\cdot$ indicate error terms. $^* = p<.05; {+} = p<.10$

The numbers in brackets reflect the standardized coefficients for the model run with only the High BDD symptom group, and the numbers not in brackets reflect the coefficients for the full sample.
Table 1

Fit statistics for peak anxiety models

<table>
<thead>
<tr>
<th>Goodness-of-fit indices</th>
<th>X^2</th>
<th>df</th>
<th>ΔX^2/Δdf</th>
<th>p &lt; .05</th>
<th>ΔNFI</th>
<th>CFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1a: Mirror Anxiety (Figure 2)</td>
<td>8.48</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>.94</td>
<td>.98</td>
<td>.08</td>
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<tr>
<td>Competing models evaluating paths from cognitive bias predictors to Mirror Anxiety factor:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1b: Path from IQ-S set to zero</td>
<td>8.60</td>
<td>7</td>
<td>−1.2/1</td>
<td>No</td>
<td>.94</td>
<td>.99</td>
<td>.06</td>
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<tr>
<td>Model 1c: Path from BAAS set to zero</td>
<td>16.18</td>
<td>7</td>
<td>−7.70</td>
<td>Yes</td>
<td>.89</td>
<td>.93</td>
<td>.15</td>
</tr>
<tr>
<td>Model 1d: Path from IAT set to zero</td>
<td>8.55</td>
<td>7</td>
<td>−.07</td>
<td>No</td>
<td>.94</td>
<td>.99</td>
<td>.06</td>
</tr>
<tr>
<td>Check that a similar pattern of relationships is evident when the Baseline Model is run within the High BDD group alone:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1e: Baseline Model in High BDD group alone</td>
<td>7.43</td>
<td>6</td>
<td>—</td>
<td>—</td>
<td>.86</td>
<td>.95</td>
<td>.09</td>
</tr>
</tbody>
</table>

Note: ΔX^2/Δdf = change in chi-square and degrees of freedom relative to the baseline model; p < .05 indicates whether the alternate model is significantly different from the baseline model based on ΔX^2 tested on a χ^2 distribution with df equal to the Δdf between the models; NFI = Normed Fit Index; CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation.
### Table 2

**Fit statistics for self-reported desire to avoid models**

<table>
<thead>
<tr>
<th>Goodness-of-fit indices</th>
<th>Model 2a: Mirror Self-reported Desire to Avoid (Figure 3)</th>
<th>Model 2b: Path from IQ-S set to zero</th>
<th>Model 2c: Path from BAAS set to zero</th>
<th>Model 2d: Path from IAT set to zero</th>
<th>Model 2e: Baseline Model in High BDD group alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>X²</td>
<td>df</td>
<td>ΔX²</td>
<td>Δdf</td>
<td>p &lt; .05</td>
<td>Δ NFI</td>
</tr>
<tr>
<td>12.36</td>
<td>6</td>
<td>---</td>
<td>---</td>
<td>.93</td>
<td>.96</td>
</tr>
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</table>

**Note:** ΔX²/Δdf = change in chi-square and degrees of freedom relative to the baseline model; p < .05 indicates whether the alternate model is significantly different from the baseline model based on ΔX² tested on a χ² distribution with df equal to the Δdf between the models; NFI = Normed Fit Index; CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation.