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Shorter communication

Facial asymmetry detection in patients with body dysmorphic disorder

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A B S T R A C T

Cognitive-behavioral models of body dysmorphic disorder (BDD) propose that individuals with BDD may possess a better or more developed sense of aestheticality than do individuals without BDD. Evidence for this proposition, however, is limited. One perceptual process that could contribute to heightened aestheticality is the ability to detect differences in symmetry. In this experiment we tested whether individuals with BDD ($n = 20$), relative to individuals with obsessive compulsive disorder (OCD; $n = 20$) and healthy controls ($n = 20$), show an enhanced ability to detect differences in the symmetry of others' faces, symmetry of dot arrays, and/or show a greater preference for symmetrical faces. Individuals with BDD were not significantly more accurate in detecting differences in facial symmetry or dot arrays relative to individuals with OCD and healthy controls. Individuals with OCD took longer to make facial symmetry judgments than did individuals in the other two groups. All participants, regardless of diagnostic group, preferred more symmetrical faces than nonsymmetrical ones. Taken together, our results do not support a heightened perceptual ability or evaluative preference for symmetry among individuals with BDD.

Individuals with body dysmorphic disorder (BDD) are preoccupied with imagined or very slight defects in their physical appearance (American Psychiatric Association, 2000). They often spend hours each day ruminating about their physical appearance and performing ritualistic behaviors to reduce their distress. For example, they may engage in excessive grooming, mirror checking, application of makeup, or camouflaging of their appearance with clothing or jewelry. The disorder commonly causes marked social, educational, and occupational impairment. They often have trouble holding steady employment, remaining in school, and developing relationships as a result of their appearance concerns. A study of 200 individuals with BDD recruited from the community indicated that 36% had missed a week or more of work in the prior month because of these concerns, and 11% had dropped out of school because of BDD (Phillips, Menard, Fay, & Weisberg, 2005). Alarmingly, more than 25% had attempted suicide because of unbearable distress about their appearance. Clearly, a significant need for better understanding of the factors that contribute to the development and maintenance of such a severe disorder exists.

Psychopathologists have formulated cognitive-behavioral theories to explain the development and maintenance of BDD (Neziroglu, Roberts, & Yaryura-Tobias, 2004; Veale, 2004; Veale et al., 1996; Wilhelm, Buhlmann, Cook, Greenberg, & Dimaite, in press). A number of cognitive, evaluative, and perceptual biases, as well as beliefs and attitudes, have been hypothesized to contribute to the development and maintenance of BDD. One hypothesis holds that people with BDD have an especially refined aesthetic sense (Veale, 2004; Veale et al., 1996). Harris (1982) coined the term "aestheticality" to denote "sensitivity of aesthetic perception," likening it to musicality. He proposed that heightened aestheticality would amplify a person's distress about his or her appearance. Thus, two individuals could be equivalent in physical attractiveness, but if one were to possess a higher level of aestheticality, that individual would be more self-conscious of any defect in appearance. In the words of Harris, any abnormality would be, "…a constant source of irritation, grating against his inborn sensitivity toward harmony of form and colour…" (p. 284).

Although heightened aesthetically may contribute to the development and maintenance of BDD, the empirical support for this proposition is limited. Both Veale, Ennis, and Lambrou (2002) and Phillips and Menard (2004) found that individuals with BDD are more likely to have an artistic background than are members of other psychiatric groups or the general population. The authors suggest that this could be due to an innate appreciation of art or beauty or innate perceptual sensitivity to beauty. Although this is

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a plausible explanation, the conclusions must be considered speculative without objective measurement of these processes. In a study comparing individuals with BDD to individuals seeking cosmetic surgery, and controls, Thomas and Goldberg (1995) presented participants with distorted images of their own face. Participants were then asked to change the width of the distorted image to represent what they see in the mirror. When the distorted image was initially thinner than reality, individuals with BDD significantly underestimated the width of their face relative to the other two groups. When the image was initially wider than reality, individuals with BDD again significantly underestimated the width of their face relative to healthy controls, but did not differ from individuals seeking plastic surgery. Although the authors interpreted these findings as evidence that individuals with BDD are more accurate in judging their own facial proportions, they did not directly compare the three participant groups in the degree of distortion from reality preventing a firm conclusion with regard to accuracy. Thus, the implications of this study are unclear. Stangier, Adam-Schwebe, Muller, and Wolter (2008) most recently examined the perceptual abilities of women with BDD relative to women with or without a disfiguring dermatological condition. Participants viewed a series of images of a neutral female face in which the aesthetic features of the face (nose, skin, hair, eyes) had been graphically manipulated to various degrees. For each face, participants rated the degree of distortion relative to the original, unchanged, neutral female face. Individuals with BDD, relative to the other two groups, were significantly more accurate at perceiving the degree of distortion in the aesthetic characteristics of the face. The authors conclude that the findings are suggestive of “an increased sensitivity in the perception of subtle deviations of the face from beauty standards” (p. 440). In contrast, however, Buhlmann, Etcoff, and Wilhelm (2008) found that individuals with BDD may magnify the beauty of other attractive individuals. Participants rated the attractiveness of a series of attractive, average, and unattractive faces. Individuals with BDD assigned significantly higher ratings to the attractive faces, when compared to the ratings provided by individuals with obsessive compulsive disorder (OCD) and healthy controls. The three groups did not differ in their ratings of average and unattractive faces.

Together these studies suggest two potential aspects of aestheticality that could be aberrant in individuals with BDD (Veale, 2009). First, individuals with BDD may be more perceptually sensitive to aspects of physical appearance. In other words, they may notice things that other people do not notice. Second, individuals with BDD may demonstrate a stronger preference for beautiful people or objects.

One possible perceptual process that could contribute to heightened aestheticality is the ability to detect asymmetry. Because facial symmetry is one of the predictors of attractiveness (Rhodes, 2006), an enhanced ability to detect subtle deviations from symmetry could contribute to an enhanced ability to detect subtle differences in attractiveness.

In this experiment, we tested whether individuals with BDD can detect differences in the asymmetry of others' faces better than individuals with OCD and healthy controls can. We hypothesized that individuals with BDD would be significantly more accurate and faster than individuals with OCD and healthy controls at detecting subtle differences in facial asymmetry. Additionally, to determine whether this skill is specific to faces, we measured the ability to detect symmetry in dot arrays. We hypothesized that any observed advantage would be specific to faces and therefore no group differences would emerge in the dot array results. Finally, we also tested whether the three groups differed in the degree to which they prefer symmetry in the faces of others. We hypothesized that individuals with BDD relative to the other two groups would demonstrate a greater preference for symmetry.

Method

Participants

Twenty individuals with a primary DSM-IV diagnosis of BDD and 20 individuals with a primary DSM-IV diagnosis of OCD were recruited from the OCD and Related Disorders Clinic and Research Unit at the Massachusetts General Hospital. Twenty healthy controls were recruited from the community via online postings. All participants were 18 years of age or older and all provided informed consent. Individuals in the BDD group met DSM-IV criteria for a primary diagnosis of BDD, never met criteria for OCD, and scored 20 or higher on the 12-item BDD-Yale-Brown Obsessive Compulsive Scale (Phillips, Hollander, Rasmussen, & Aronowitz, 1997). Individuals in the OCD group, met DSM-IV criteria for a primary diagnosis of OCD, never met criteria for BDD, and scored 16 or higher on the 10-item Yale-Brown Obsessive Compulsive Scale (Goodman, Price, Rasmussen, & Mazure, 1989a, 1989b). Individuals in the healthy control group were free from any current or past Axis I disorder with the exception of specific phobia or past alcohol/substance abuse. In total, 67 individuals consented to participate in the study. Seven individuals were ineligible due to comorbid OCD and BDD ($n = 5$) or insufficient symptom severity ($n = 2$). Twelve of the individuals with BDD met diagnostic criteria for at least one current comorbid Axis I disorder. These included: Major Depressive Disorder ($n = 5$), Social Anxiety Disorder ($n = 3$), Specific Phobia ($n = 2$), Substance Abuse and Dependence ($n = 1$), Post Traumatic Stress Disorder ($n = 1$), Agoraphobia ($n = 1$), and Bulimia ($n = 1$). Ten of the individuals with OCD met diagnostic criteria for at least one current comorbid Axis I disorder. These included: Specific Phobia ($n = 6$), Social Anxiety Disorder ($n = 3$), Agoraphobia ($n = 2$), Panic Disorder ($n = 1$), Major Depressive Disorder ($n = 1$), Bipolar Disorder ($n = 1$), and Post Traumatic Stress Disorder ($n = 1$). Fourteen of the individuals with BDD were taking at least one psychotropic medication at the time of participation. These included: Antidepressants ($n = 14$), Antipsychotics ($n = 3$), Benzodiazepines ($n = 3$), Anticonvulsants ($n = 1$), stimulants ($n = 2$), and NMDA Antagonists ($n = 1$). Fifteen of the individuals with OCD were taking at least one psychotropic medication at the time of participation. These included: Antidepressants ($n = 14$), Antipsychotics ($n = 2$), Benzodiazepines ($n = 8$), Anticonvulsants ($n = 2$), Stimulants ($n = 1$), and NMDA Antagonists ($n = 4$). No healthy control was taking psychotropic medications. Subjects received $100 for participating. The groups did not significantly differ in age or education level. The BDD and OCD groups did not significantly differ in level of depression or BDD/OCD symptom severity (Table 1).

General procedure

After signing informed consent, participants underwent the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, &

Table 1
Participant demographics and symptom severity.

	BDD ($n = 20$)	OCD ($n = 20$)	Healthy control ($n = 20$)
Number female	14	10	7
Age	30.05 (7.66)	34.80 (15.48)	37.95 (13.26)
Years of education	16.55 (3.35)	16.88 (4.33)	16.50 (1.96)
BDI score	19.10 (9.32)	15.10 (10.33)	2.65 (4.15)
BDD-YBOCS/YBOCS score	30.65 (4.42)	26.10 (4.66)	–

Note: data are presented as mean (SD) unless otherwise stated. BDI = Beck Depression Inventory; BDD-YBOCS = Yale-Brown Obsessive Compulsive Inventory modified for body dysmorphic disorder; YBOCS = Yale-Brown Obsessive Compulsive Inventory. Consistent with convention in the field, we computed a total BDD-YBOCS score for each participant by summing items 1–12 and a total YBOCS score for each participant by summing items 1–10.

Williams, 2002) to determine diagnostic eligibility. Participants in the BDD or OCD groups then completed the BDD-YBOCS or YBOCS, respectively. All participants then completed the symmetry detection task and self-report questionnaires. The study took approximately 2 h.

Clinician-rated measures

Yale-Brown Obsessive Compulsive Scale modified for body dysmorphic disorder (BDD-YBOCS; Phillips et al., 1997)

This 12-item measure provides an index of BDD symptom severity. Each item is scored on a 0–4 range. Total scores are obtained by summing items 1–12 and thus range from 0 to 48 with higher scores indicating greater symptom severity. The BDD-YBOCS has shown good interrater reliability and convergent validity.

Yale-Brown Obsessive Compulsive Scale (YBOCS; Goodman et al., 1989a, 1989b)

This 12-item measure provides an index of OCD symptom severity. Each item is scored on a 0–4 range. Total scores are obtained by summing items 1–10 and thus range from 0 to 40 with higher scores indicating greater symptom severity. The YBOCS has shown good interrater reliability and internal consistency as well as convergent and discriminant validity.

Self-report measures

Demographics

Participants reported their age, gender, race, ethnicity, marital status, level of education, and occupational status.

Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996)

This 21-item inventory measures depressive symptoms. It has high internal consistency and good construct validity.

Apparatus

Stimuli appeared on a T42 IBM laptop with a 28.5×21.5 cm screen. E-prime (Schneider, Eschman, & Zuccolotto, 2002) presented the computer tasks and recorded reaction times in milliseconds. Button-press responses were recorded on a serial-response box, Model 200a, manufactured by Psychology Software Tools, Inc.

Symmetry detection task

Facial symmetry detection

To assess for group differences in the ability to detect facial symmetry, we modified the procedures of experiments 1 and 2 of Rhodes, Proffitt, Grady, and Sumich (1998). Rhodes et al. created experimental stimuli that permit assessment of individual differences in the ability to detect facial symmetry. To create these stimuli, they digitally altered black-and-white photographs of male and female faces to create three alternate versions of each face that are either perfectly symmetrical (a blend of the normal face and a mirror image of the face), highly symmetrical (a 50% reduction in the difference between the perfectly symmetrical face and the normal face), or less symmetrical (a 50% increase in the difference between the normal face and the perfectly symmetrical face). Thus, there were four photographs of each face: the normal face, a low symmetry version, a high symmetry version, and a perfect symmetry version. There were 10 male and 10 female faces. Each face version appeared with each of its variants, producing a total of 6 pairs for each unique face (normal-low, normal-high, normal-perfect, low-high, low-perfect, high-perfect). Participants viewed every possible pairing of each face in each of two blocks of trials. Thus, each block contained 120 trials. The first block of trials assessed participants' preference for symmetry. Accordingly, participants reported which face was more attractive. The second block assessed participants' ability to detect differences in symmetry. Accordingly, participants reported which face was more symmetrical. Participants were unaware that they would make judgments about symmetry until Block 2. Every trial began with the presentation of a 500 ms fixation asterisk. Immediately thereafter, a pair of faces appeared side by side and the participant chose which face was more attractive (Block 1) or more symmetrical (Block 2) by pressing a key labeled “1” or “2” on the serial-response box which corresponded with labels beneath the photographs. The order of presentation of face pairs was random and placement of the more symmetrical face (left or right) was counterbalanced across faces and genders. Participants had an unlimited amount of time to respond and were not instructed to respond as quickly as possible. Reaction time was recorded in milliseconds. After a response was recorded by the computer, the next trial began.

Dot symmetry detection

Following the procedures of Oinonen and Mazmanian (2007), we presented participants with 40 dot arrays developed by Evans, Wenderoth, and Cheng (2000). Half of the 40 dot arrays were perfectly symmetrical around the vertical axis. The remaining arrays were slightly asymmetrical. Participants viewed each array individually and were asked to determine whether the array was symmetrical or asymmetrical. They indicated their response by pushing a button. The order of presentation of the arrays was randomly determined. Participants were allowed an unlimited amount of time to respond and were not instructed to respond as quickly as possible. Reaction time was recorded in milliseconds.

Results

Data reduction

All trials were included in the computation of mean accuracy (Block 2) and mean preference for symmetry (Block 1). When computing mean reaction time, we excluded incorrect trials and trials with response latencies $\pm$ 3 SD from each participant's mean response latency: 17% of trials in Block 2 of the facial symmetry task and 23% of trials in the dot symmetry task were excluded. Reaction time was not computed for Block 1 of the facial symmetry task. There were no significant differences between the three groups in the mean number of trials included in Block 2 of facial symmetry task, $F(2, 57) = .29$, $p = .75$, or the dot symmetry task, $F(2, 57) = .82$, $p = .45$.

Analyses

To determine whether individuals with BDD were better able to detect facial symmetry relative to the OCD group and the healthy controls, we performed a one-way ANOVA with group as the between-subjects factor and percent accuracy in Block 2 of the facial symmetry task as the dependent variable. No group differences emerged, $F(2, 57) = .310$, $p = .74$. Contrary to our hypotheses, the individuals with BDD were not significantly better at detecting differences in facial symmetry relative to the other two groups.[1]

To determine whether individuals with BDD were able to detect differences in facial symmetry more quickly relative to the OCD group and the healthy controls, we performed a one-way ANOVA with group as the between-subjects factor and reaction time in

[1] To test whether symmetry detection ability was affected by type of face pair, we conducted a one-way between-groups ANOVA for each type of fair pair (low-normal; low-high; low-perfect; normal-high; normal-perfect; high-perfect) separately. No group differences emerged.

Block 2 of the facial symmetry task as the dependent variable. A marginally significant group difference emerged, $F(2, 57) = 2.85$, $p = .066$. Post-hoc pairwise comparisons revealed that the BDD group was significantly faster to respond than the OCD group was ($p = .035$) but not significantly different from the healthy controls. The healthy controls were marginally significantly faster to respond than the OCD group ($p = .054$). Examination of the mean reaction time scores suggests that the OCD group was characterized by response times greater than 5 seconds, whereas the BDD group and the healthy controls responded between 3 and 3.5 seconds after the images appeared on the screen.

To assess for group differences in the dot-array task, we conducted a one-way ANOVA with group as the between-subjects factor and percent accuracy in the dot symmetry task as the dependent variable. Again, no group differences emerged, $F(2, 57) = 1.05$, $p = .36$. To assess for group differences in response time in the dot-array task, we conducted a one-way ANOVA with group as the between-subjects factor and reaction time in the dot symmetry task as the dependent variable. No group differences emerged, $F(2, 57) = .67$, $p = .51$.

To determine whether the BDD group showed a greater preference for higher levels of symmetry, we first computed a symmetry preference score. The symmetry preference score was the proportion of trials in Block 1 of the facial symmetry task in which the participant chose the more symmetrical face as the more attractive face. We then performed a one-way ANOVA with group as the between-subjects factor and symmetry preference score as the dependent variable. No group differences emerged. We then performed a one-way ANOVA with group as the between-subjects factor and symmetry preference score as the dependent variable after selecting only those face pairs that an individual correctly answered in Block 2. In other words, we tested for group differences in preference for increased symmetry when we know that increased symmetry was detected. No group differences emerged. Contrary to our hypotheses, individuals with BDD did not show a stronger preference for symmetry relative to the other two groups (see Table 2).[2]

Table 2
Mean accuracy, reaction time, and symmetry preference score.

	BDD	OCD	Healthy control
Facial symmetry accuracy	.84 (.10)	.85 (.09)	.83 (.09)
Facial symmetry RT (ms)	3217 (1176)	5127 (3475)	3390 (3165)
Dot symmetry accuracy	.80 (.13)	.78 (.14)	.75 (.12)
Dot symmetry RT (ms)	6953 (2595)	8454 (5021)	7152 (5219)
Symmetry preference score	.71 (.10)	.71 (.11)	.69 (.09)

Note: all data are presented as means (SD).

Discussion

Contrary to our hypotheses, individuals with BDD did not demonstrate any greater ability to detect subtle differences in facial asymmetry relative to individuals with OCD and healthy controls. The accuracy of all three groups was comparable to that of university students (Rhodes et al., 1998). The group differences in reaction time are more suggestive of slowness to make a decision by individuals with OCD rather than speed of individuals with BDD. We also did not observe any advantage for the BDD group in the dot symmetry detection task. Again, the performance of all three groups was comparable to that of university students (Evans et al., 2000). Together these findings fail to provide evidence for a symmetry detection advantage among individuals with BDD.

Individuals with BDD also failed to demonstrate a greater preference for symmetry relative to the other two groups. All three groups preferred the more symmetrical face approximately 70% of the time. This is consistent with theory and research in evolutionary psychology demonstrating a universal preference for symmetry and again similar to the findings of Rhodes et al. (1998).

Although somewhat surprising, there may be several reasons why we did not observe a significant advantage in symmetry detection among the individuals with BDD relative to the other two groups. If aestheticality is considered to be a general dimension of perception, then any differences in ability should be apparent when processing other faces as well as one's own face. However, it is possible that an advantage could emerge in the processing of one's own face only. This would be especially true if any perceptual advantage among individuals with BDD was the result of extensive mirror gazing. The findings of Buhlmann et al. (2008) also suggest that individuals with BDD may apply different standards to their own face than they do to other's faces. Although the participants in that study significantly overestimated the attractiveness of other attractive faces, they also significantly underestimated their own attractiveness relative to ratings provided by independent evaluators. Future work assessing symmetry detection in individuals with BDD should assess the ability to detect differences in symmetry in photographs of one's own face.

It is also possible that the individuals with BDD may be using a different strategy to attain the same outcome. Neuropsychiatric and neuroimaging findings suggest that individuals with BDD employ a more detail-oriented visual processing style when compared with healthy controls (Deckersbach et al., 2000; Feusner, Townsend, Bystritsky, & Bookheimer, 2007). In a face-matching task, Feusner et al. (2007) found a difference in brain activation patterns between individuals with BDD and healthy controls in the absence of any differences in performance. Although it is impossible to make any conclusions regarding strategy from this experiment, future work employing eye tracking or neuroimaging could shed light on this question.

Future studies could also be improved by asking participants to rate their confidence in their choices. Although participant feedback was not systematically recorded in this study, many individuals within the BDD group reported that they believed themselves to be very good at detecting facial symmetry. It is possible that individuals with BDD are not characterized by a perceptual advantage, but rather a greater confidence in their abilities.

It would also be interesting to examine what effect a time-limit and/or an instruction to respond as quickly as possible would have on performance. We chose to allow participants an unlimited amount of time to view the images and did not instruct them to respond as quickly as possible. We did this for two reasons: 1) to closely replicate the procedures of Rhodes et al. (1998) and 2) to ensure that participants' judgments were based on what they were viewing in front of them as opposed to reconstructions in memory. It is possible, however, that individuals with BDD are better able to make quick assessments of facial symmetry relative to the other two groups. Indeed, Stangier et al. (2008) found significant group differences in the ability to detect changes in aesthetic features of a face when they limited viewing time to 200 ms. It could be that the perceptual processes that set individuals with BDD apart from other individuals occur very rapidly. That we did not observe a difference between the BDD group and the healthy controls in reaction time suggests that this would not be the case in this study, but it would be worthy of further investigation. It could be that the individuals with BDD delayed their response for other reasons (e.g., distraction due to self-comparison) and could have completed the judgment in less time.

[2] To test whether symmetry preference was affected by type of face pair, we conducted a one-way between-groups ANOVA for each type of fair pair (low-normal; low-high; low-perfect; normal-high; normal-perfect; high-perfect) separately. No group differences emerged.

Finally, it should be emphasized that symmetry detection is just one potential perceptual process that could contribute to heightened aestheticality. Future work examining other potential processes could shed additional light on the validity of aestheticality as a feature within cognitive-behavioral models of BDD.

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