

Body dysmorphic disorder and face processing

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ABSTRACT Body dysmorphic disorder (BDD) is a mental disorder where an individual becomes so fixated on an exaggerated flaw in their image that it interferes with their daily lives. Current research shows that patients with BDD have deficits in visually processing faces and bodies, such that they rely on local (detail-oriented) processing. By contrast, the typical person processes faces as a whole using global (holistic) processing. This reliance on local processing may be a mechanism through which patients with BDD focus on minute flaws in their appearance, exacerbating their symptomatology. Furthermore, patients with BDD are more likely to incorrectly perceive others' facial expressions as being negative, further contributing to their emotional symptoms. Well-known treatments for BDD, such as cognitive behavioural therapy (CBT) and pharmacotherapy, are effective, but do not target the patient's visual processing deficits. Targeting the visual processing deficits could help alleviate the symptoms of BDD and decrease the chances of relapse. Future research should target BDD's distressing symptoms and visual processing deficits, creating a better treatment program.

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INTRODUCTION

Body dysmorphic disorder (BDD) is a psychiatric disorder that is defined by such features as an incessant fixation on perceived imperfections in physical appearance and is a relatively common and debilitating disorder (Fang & Wilhelm, 2015). BDD's symptoms in the DSM-5 are described as comprising a distress or impairment in social, occupational, or academic areas of functioning among others, due to intrusive thoughts regarding an imagined flaw in their appearance (American Psychiatric Association, 2013; Phillips et al., 2014). Furthermore, BDD is classified as an obsessive-compulsive and related disorder and diagnosis requires the presence of repetitive behaviours or mental acts (Schieber et al., 2015). A population-based survey performed in the USA found that the prevalence of BDD was 2.4% among adults aged 18 or older (Koran et al., 2008). In addition, BDD is associated with an increased risk of suicidal ideation and attempted suicide (Rief et al., 2006).

Patients diagnosed with BDD are described as having a fear of negative peer-evaluation, which may influence their body image concerns and how they view their social desirability (Buhlmann et al., 2006). Individuals with BDD have delusional or greatly exaggerated thoughts about their body image, which differentiates them from those with image concerns about actual deformities; in a person with BDD, there is no such flaw in their appearance, or the flaw is smaller in proportion to the person's perceptions of it (Phillips et al., 2010). These delusions could be a result of differences in their perceptual mechanisms (Fang & Wilhelm, 2015). For example, studies have hypothesized that participants with BDD, when compared with controls, will stare longer at their faces in a mirror due to a delusion that flaws in their physical appearance are greater than in reality (Veale & Riley, 2001; Möllmann et al., 2020). The consensus in current research is that BDD comprises deficits in visual processing mechanisms, which is observed in their misperceptions about flawed details in their appearances (Stangier et al., 2008; Feusner et al., 2010b; Jefferies et al., 2012; Toh et al., 2017a).

The findings discussed in this review highlight the importance of researching BDD patients' visual processing abnormalities as a target for treatment. The majority of BDD treatments do not attempt to ameliorate these deficits and tend to focus instead on the distressing symptoms (Phillips, 2014). Current treatments for BDD are founded in cognitive behavioural therapy (CBT) programs, such as psychoeducation, motivational and cognitive interventions, prevention of rituals, and perceptual retraining (Fang & Wilhelm, 2015). Although these forms of treatment can be effective, BDD has high rates of comorbidity with disorders such as, major depressive disorder and obsessive compulsive disorder that could affect the treatment response (Grant & Phillips, 2005). Further research is needed to improve treatments that could help prevent or ameliorate the chronicity, morbidity, and mortality associated with BDD (Phillips, 2014).

With future research on BDD, we can more effectively treat, diagnose, and understand the disorder. In this review, we focus on the face processing deficits in BDD revealed by face perception and emotion recognition studies. At the end of the review, we discuss the implications of the literature on face processing for developing innovative intervention programs to treat BDD.

REVIEW

BDD and face perception

Clinical studies have shown that individuals with BDD explicitly attend to a specific feature of their appearance and disregard the rest (Fang & Wilhelm, 2015). This pre-occupation may relate to altered perceptual processing of faces: most individuals process a face by perceiving it as a whole image, a process called holistic processing (Richler et al., 2009). By contrast, individuals who use local processing perceive a face in terms of its individual features (e.g. nose, mouth, eyes) (Richler et al., 2009). One method of disrupting holistic processing is to turn the image of a face upside-down - although all objects are more difficult to recognize when they are turned upside-down, inversion disproportionately impairs the recognition of faces, a phenomenon known as the face inversion effect (Yin, 1969). Studies have shown that inverting a face forces

participants to process the face in terms of its individual parts than as a whole (Rossion, 2008).

Using inversion tasks to compare global and local processing mechanisms, researchers have found that individuals with BDD tend to process faces and objects at a detailed level rather than using holistic processing (Beilharz et al., 2016; Beilharz et al., 2017; Beilharz, 2019; Feusner et al., 2010b). Feusner et al. (2010b) applied the inversion manipulation to observe processing differences between participants with BDD and healthy controls. Their paradigm used a recognition task with upright and inverted faces that were presented for short (500ms) and long (5000ms) durations (Feusner et al., 2010b). The results showed that participants with BDD demonstrated less of an inversion effect compared to controls, which was consistent with their tendency to process faces locally (Feusner et al., 2010b). Although this difference between participants with BDD and controls was found for longer presentation times, none was observed for short durations, which suggests that BDD participants may be processing fast presentations globally/holistically (Feusner et al., 2010b). This could explain why individuals with BDD have distorted perceptions of their faces; specifically, abnormal visual processing contributes to thoughts of perceived flaws in their appearance (Feusner et al., 2010b). Furthermore, longer durations may allow enough time for participants with BDD to process the details of the face, whereas in shorter durations holistic processing capabilities seem to be intact (Monzani et al., 2013). It may therefore be useful to further study how different durations alter the processing of faces and other visual stimuli by individuals with BDD.

Rather than using holistic processing, individuals with BDD exhibit a heightened perception of minute changes in faces (Stangier et al., 2008). In Stangier et al.'s (2008) study, participants with BDD were presented with original faces, followed by an altered version. Alterations included pimples, scars, varying distances between features, different nose sizes, and hair loss. The controls and the BDD group were then asked to rate the degree of change from 0 to 5 (0 indicating no alteration and 5 extremely altered) (Stangier et al., 2008). Stangier et al. (2008) found that the BDD group was significantly more accurate than controls in identifying the alterations, which suggests that individuals with BDD are more sensitive to small changes in the face when compared to standard beauty expectations. This study highlights that over-reliance on local processing may affect the symptomatology of BDD such that normal features or small flaws may be misinterpreted as being large defects, resulting in delusions of facial unattractiveness (Stangier et al., 2008). Furthermore, engaging patients with BDD into relying on global processing mechanisms in novel treatment programs may lessen unrealistic perceptions of their appearances (Beilharz et al., 2016).

Monzani et al. (2013) observed global mechanisms in participants with BDD to determine if a failure of holistic processing contributes to the reliance on feature-based processing found in BDD. The researchers used the face inversion task with four conditions (upright faces, upright houses, inverted faces, and inverted houses), presenting each image for 250 ms (Monzani et al., 2013). The participants responded whether the two images were the same or different (Monzani et al., 2013). Accuracy rates and reaction times were recorded; no significant difference between the control and BDD groups were found (Monzani et al., 2013). They concluded

that their contrasting results may be due to the short duration of presentation, indicating that holistic processing mechanisms were still intact (Monzani et al., 2013). Monzani et al. (2013) suggest that studies that have found less of an inversion effect in participants with BDD under longer durations could attribute their results to the participants' having had enough time to involve more local processing. Another reason for the conflicting results could be the stimuli used in the experiments: patients with BDD have been reported to compare their facial features with those of famous individuals (Monzani et al., 2013). A study using the famous faces task found that participants with BDD recognized inverted famous faces more accurately than did controls, which was attributed to their reliance on local processing (Jefferies et al., 2012). Due to the variety of results from studies on BDD, observing the differences between processing of famous faces and of anonymous faces is necessary for future investigations, as individuals with BDD frequently compare themselves to famous individuals and may thus be extremely familiar with those used in studies (Monzani et al., 2013).

BDD patients' attention to local rather than global features in viewing faces and other objects is hypothesized to correspond with abnormalities found in neurological studies (Fang & Wilhelm, 2015; Feusner et al., 2007; Feusner et al., 2011). Brain imaging studies indicate a left-hemispheric local bias in individuals with BDD, which is consistent with the behavioural results, demonstrating that BDD's processing abnormalities are not only attributable to the behavioural symptoms associated with BDD – the left hemisphere has been characterized as being more analytical, and the right hemisphere more global (Buchanan et al., 2014; Grace et al., 2017a; Grace et al., 2017b; Fang & Wilhelm, 2015; Feusner et al., 2007; Moody et al., 2015; Bradshaw et al., 1976).

Collectively, these behavioural and neuroimaging findings suggest that the clinical characteristics associated with BDD might be related to a local processing strategy (Buchanan et al., 2014; Grace et al., 2017a; Grace et al., 2017b; Fang & Wilhelm, 2015; Feusner et al., 2007; Moody et al., 2015). If individuals with BDD attend to the details of a face, they might be more prone to fixate on its small imperfections than individuals without BDD who look at a face more holistically (Stangier et al., 2008). Overall, BDD's processing deficits may contribute to their negative symptoms (Feusner et al., 2007; Feusner et al., 2011). Future treatments should target this global perceptual difference to successfully treat BDD (Beilharz, 2019).

BDD and emotion recognition

Current research suggests that people with BDD also have an abnormal mechanism for processing emotional expressions (Grace et al., 2019). Processing emotional expressions is critical for everyday social interactions, and deficits in this area are associated with significant social impairment (Behere et al., 2008). A study using identity-matching tasks with emotional expressions found that participants with BDD returned slower mean reaction times than controls and that they made more errors matching faces with emotional expressions but not for matching neutral faces (Feusner et al., 2010a). Feusner et al. (2010a) concluded that deficits in emotion recognition are rooted in BDD patients' abnormal visual processing mechanisms.

BDD patients seem to be biased towards interpreting expressions

as being negative compared to controls (Buhlmann et al., 2004; Buhlmann et al., 2006; Grace et al., 2019; Johnson et al., 2018). A study on emotion recognition in BDD by Buhlmann et al. (2006) gave participants a photograph and described for them a situation about themselves (“self-referent”) or another person (“other-referent”); for example, a self-referent scenario was presented as: “Imagine that the bank teller is looking at you. What is his facial expression?”; an example of other-referent scenario provided was: “Imagine that the bank teller is looking at a friend of yours. What is their facial expression?”. Buhlmann et al. (2006) found that participants with BDD identified contemptuous and angry expressions in the self-referent scenarios more often than controls, but not for other-referent scenarios. Buhlmann et al. (2006) concluded that BDD patients generally have poor insight on their own facial features, which also leads to a bias towards interpreting other people’s emotional expressions as being negative towards themselves even when this is not the case. Further, their impression of negativity reinforces their own concerns about their appearances, as well as disrupting their view of their personal social desirability, perhaps interpreting negative facial expressions as social rejection (Buhlmann et al., 2006).

Another study researched how participants with BDD processed their own faces using eye-tracking technology (Toh et al., 2017b). Toh et al. (2017b) used black-and-white photographs of six models who displayed six universal facial expressions (anger, disgust, fear, happiness, sadness, and surprise), one neutral facial expression as a control condition, and a photograph of the participant’s own face displaying a neutral expression. Each photograph was shown for 8 seconds and was then followed by a 2-second interval for the participant to respond (Toh et al., 2017b). Toh et al. (2017b) found that participants with BDD had fewer fixations and a diminished visual attention to the noticeable features of their face compared to controls. Interestingly, the attention of participants with BDD lingered on other people’s faces for longer durations than they did on their own faces (Toh et al., 2017b). Toh et al. (2017b) also found that participants with BDD showed a recognition bias towards angry faces, indicating a susceptibility to misidentifying facial expressions. The results of this study show that BDD patients have limited abilities in scanning their own faces and suffer facial expression recognition deficits (Toh et al., 2017b). Toh et al. (2017b) interpreted their findings as an indication that patients with BDD may be reluctant to analyse their own facial features and suggested that treatment strategies can aid emotion recognition by altering the eye-tracking mechanisms of patients with BDD. Deficits in emotion recognition may be due to negative self-evaluation of their appearances, leading to delusional thoughts of rejection or negative judgement from others (Bjornsson et al., 2010; Buhlmann et al., 2004; Buhlmann et al., 2006; Fang & Wilhelm, 2015; Feusner et al., 2010a; Grace et al., 2019; Stangier et al., 2008). Future interventions for BDD should target negative self-evaluations by focusing on deficits in processing and interpreting emotions (Grace et al., 2019).

Developing perceptual treatments for BDD

The most frequently applied and effective treatment for BDD includes a combination of CBT and pharmacotherapy, like selective serotonin reuptake inhibitors (SSRIs) (Dong et al., 2019). CBT reinforces positive behaviours and emotional patterns of thinking that help the individual cope with personal challenges (Dong et al., 2019; Fang & Wilhelm, 2015). SSRIs are used to improve symptoms of obsessive thinking and compulsive behaviours in

BDD (Phillips & Hollander, 2008). In addition, there are non-psychiatric treatments such as cosmetic surgery (Veale, 2000). However, these have not shown significant improvement on BDD symptoms, and have worsened personal concerns and symptomatology in individuals with BDD (Beilharz, 2019; Veale, 2000; Bowyer et al., 2016). Overall, numerous meta-analyses have suggested further research into the long-term efficacy of treating BDD with CBT, pharmacotherapy, and non-psychiatric treatments to target the high rates of relapse associated with BDD (Harrison et al., 2016; Prazeres et al., 2013; Phillipou et al., 2016; Beilharz, 2019). Although current treatments have beneficial aspects for BDD patients, they do not target the visual processing deficits that could be causing the symptoms (Beilharz et al., 2017). Targeting the visual processing deficits of BDD could help prevent relapse while also remediating the distressing symptoms in the long-term (Beilharz et al., 2017).

Treatments concerning eye movements combined with cognitive behavioural programs show promise as an effective treatment for BDD (Toh et al., 2017b). Understanding an individual’s eye movements could identify differences in visual processing from controls, which could help create a new treatment program targeting inaccuracies in facial processing and emotion recognition (Toh et al., 2017b). More specifically, introducing new eye movement mechanisms to target overreliance on local processing and train individuals with BDD to rely on holistic processing could be an effective treatment (Toh et al., 2017b). An eye tracking training program could incorporate a top-down strategy emphasizing the global qualities of a face, as well as a bottom-up approach that focuses on the processing of finer details (Beilharz et al., 2017).

Alternative treatment strategies could also involve aspects of mirror-checking behaviour in people with BDD, such as mirror exposure therapy (MET) (Griffen et al., 2018; Möllmann et al., 2020). MET is a methodical and repetitive treatment strategy that helps individuals view themselves in a mirror (Griffen et al., 2018). Therapists direct the patient’s gaze and modify the amount of time they spend looking into a mirror to create a healthier self-image (Griffen et al., 2018). Some individuals with BDD tend to concentrate on precise areas of their face and body when viewing themselves in the mirror, magnifying the concerns about their appearance (Beilharz, 2019; Silver & Farrants, 2016; Veale & Riley, 2001). By contrast, some individuals with BDD avoid the features that preoccupy them when viewing themselves in a mirror but continue to obsessively look at themselves (Griffen et al., 2018). Other individuals may find their reflections aversive and avoid mirrors in general (Beilharz, 2019). MET has been used as an effective treatment strategy for individuals with eating disorders or immense disapproval of their own body or face (Griffen et al., 2018). MET can be combined with CBT to alter the perceptual abilities of individuals with BDD, retraining them using photographs of themselves or extending mirror exposure times (Möllmann et al., 2020). The potential benefits of MET are evident, however, further research on how it can be applied in combination with CBT and pharmacotherapy needs to be explored (Griffen et al., 2018; Möllmann et al., 2020).

CONCLUSIONS

The research discussed in this paper demonstrate the differences in visual processing strategies between participants with BDD and controls. Patients with BDD have deficits in processing faces holistically and focus on the details of their faces (Stangier et al.,

2008; Toh et al., 2017a). Emotion recognition studies have shown that patients with BDD have deficits in recognizing emotions that may be a result of negative self-evaluations of their appearances, leading to manifestations of the disorder (Buhlmann et al., 2006; Fang & Wilhelm, 2015). Additionally, neurological studies have shown differences in the processing and structure of the left cerebral hemisphere of participants with BDD compared to controls (Grace et al., 2017a; Buchanan et al., 2014). Understanding the perceptual aspects of BDD and its symptoms can help ameliorate an individual's symptomatology and body image concerns. In turn, this could help decrease suicidal ideation and the prevalence of BDD in general (Rief et al., 2006). The studies involving face perception and emotion recognition deficits provide evidence for the delusional perceptions found in patients with BDD. Future research should consider each one of these differences to find a more effective perceptual treatment strategy, such as targeting BDD's bias towards local processing (Beilharz et al., 2016) and treating BDD's irregular processing of negative emotions (Grace et al., 2019).

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REFERENCES

- [1] American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.
- [2] Behere, R, Raghunandan, V., Venkatasubramanian, G., Subbakrishna, D., Jayakumar, P., Gangadhar, B. (2008). Trends-a tool for recognition of emotions in neuropsychiatric disorders. *Indian Journal of Psychological Medicine* 30(1), 32-38.
- [3] Beilharz, F. (2019). *Visual Processing in Body Dysmorphic Disorder: Investigating Eye Movements and Piloting a Novel Training Program* [Doctoral dissertation submitted for publication]. Department of Psychology, Swinburne University of Technology.
- [4] Beilharz, F., Atkins, K., Duncum, A., & Mundy, M. E. (2016). Altering visual perception abnormalities: A marker for body image concern. *PLoS One* 11(3) doi: 10.1371/journal.pone.0151933
- [5] Beilharz, F., Castle, D.J., Grace, S., & Rossell, S.L. (2017). A systematic review of visual processing and associated treatments in body dysmorphic disorder. *Acta Psychiatrica Scandinavica* 136(1), 16-36. doi: 10.1111/acps.12705
- [6] Bjornsson, A. S., Didie, E. R., & Phillips, K. A. (2010). Body dysmorphic disorder. *Dialogues in Clinical Neuroscience* 12(2), 221.
- [7] Bowyer, L., Krebs, G., Mataix-Cols, D., Veale, D., & Monzani, B. (2016). A critical review of cosmetic treatment outcomes in body dysmorphic disorder. *Body Image* 19, 1-8.
- [8] Bradshaw, J. L., Gates, A., & Patterson, K. (1976). Hemispheric differences in processing visual patterns. *The Quarterly Journal of Experimental Psychology* 28(4), 667-681. doi: 10.1080/14640747608400593
- [9] Buchanan, B., Rossell, S., Maller, J. J., Toh, W. L., Brennan, S., & Castle, D. (2014). Regional brain volumes in body dysmorphic disorder compared to controls. *Australian & New Zealand Journal of Psychiatry* 48(7), 654-662. doi: 10.1177/0004867413520253
- [10] Buhlmann, U., Etcoff, N. L., & Wilhelm, S. (2006). Emotion recognition bias for contempt and anger in body dysmorphic disorder. *Journal of Psychiatric Research* 40(2), 105-111. doi: 10.1016/j.jpsychires.2005.03.006
- [11] Buhlmann, U., McNally, R. J., Etcoff, N. L., Tuschen-Caffier, B., & Wilhelm, S. (2004). Emotion recognition deficits in body dysmorphic disorder. *Journal of Psychiatric Research* 38(2), 201-206. doi: 10.1016/S0022-3956(03)00107-9
- [12] Dong, N., Nezhgorova, V., Hong, K., & Hollander, E. (2019). Pharmacotherapy in body dysmorphic disorder: Relapse prevention and novel treatments. *Expert Opinion on Pharmacotherapy* 20(10), 1211-1219.
- [13] Fang, A., & Wilhelm, S. (2015). Clinical features, cognitive biases, and treatment of body dysmorphic disorder. *Annual Review of Clinical Psychology* 11(1), 187-212. doi: 10.1146/annurev-clinpsy-032814-112849
- [14] Feusner, J. D., Bystritsky, A., Hellemann, G., & Bookheimer, S. (2010a). Impaired identity recognition of faces with emotional expressions in body dysmorphic disorder. *Psychiatry Research* 179(3), 318-323. doi: 10.1016/j.psychres.2009.01.016
- [15] Feusner, J. D., Hembacher, E., Moller, H., & Moody, T. D. (2011). Abnormalities of object visual processing in body dysmorphic disorder. *Psychological Medicine* 41(11), 2385-2397. doi: 10.1017/S0033291711000572
- [16] Feusner, J. D., Moller, H., Altstein, L., Sugar, C., Bookheimer, S., Yoon, J., & Hembacher, E. (2010b). Inverted face processing in body dysmorphic disorder. *Journal of Psychiatric Research* 44(15), 1088-1094. doi: 10.1016/j.jpsychires.2010.03.015
- [17] Feusner, J. D., Townsend, J., Bystritsky, A., & Bookheimer, S. (2007). Visual information processing of faces in body dysmorphic disorder. *Archives of General Psychiatry* 64(12), 1417-1425. doi: 10.1001/archpsyc.64.12.1417
- [18] Frey, R. J., & Harmon, A. (2016). Body Dysmorphic Disorder. In D. S. Blanchfield (Ed.), *The Gale Encyclopedia of Children's Health: Infancy through Adolescence* (3rd ed., Vol. 1, pp. 385-389). Farmington Hills, MI: Gale. Retrieved from <http://link.galegroup.com.ezproxy.library.uvic.ca/apps/doc/CX3630900119/GVRL?u=uvictoria&sid=GVRL&xid=0160d74a>
- [19] Grace, S. A., Buchanan, B., Maller, J. J., Toh, W. L., Castle, D. J., & Rossell, S. L. (2017a). Reduced cortical thickness in body dysmorphic disorder. *Psychiatry Research: Neuroimaging* 259, 25-28. doi: 10.1016/j.psychres.2016.11.004
- [20] Grace, S. A., Labuschagne, I., Kaplan, R. A., & Rossell, S. L. (2017b). The neurobiology of body dysmorphic disorder: A systematic review and theoretical model. *Neuroscience and Biobehavioral Reviews* 83, 83-96. doi: 10.1016/j.neubiorev.2017.10.003
- [21] Grace, S. A., Toh, W. L., Buchanan, B., Castle, D. J., & Rossell, S. L. (2019). Impaired Recognition of Negative Facial Emotions in Body Dysmorphic Disorder. *Journal of the International Neuropsychological Society* 25(8), 884-889.
- [22] Grant, J., & Phillips, K. (2005) Recognizing and treating body dysmorphic disorder. *Annals of Clinical Psychiatry* 17(4), 205-210. doi: 10.3109/10401230500295313
- [23] Griffen, T., Naumann, E., & Hildebrandt, T. (2018). Mirror exposure therapy for body image disturbances and eating disorders: a review. *Clinical Psychology Review* 65, 163-174. <https://doi.org/10.1016/j.cpr.2018.08.006>
- [24] Harrison, A., de la Cruz, L. F., Enander, J., Radua, J., & Mataix-Cols, D. (2016). Cognitive-behavioral therapy for body dysmorphic disorder: A systematic review and meta-analysis of randomized controlled trials. *Clinical Psychology Review* 48, 43-51.
- [25] Jefferies, K., Laws, K. R., & Fineberg, N. A. (2012). Superior face recognition in body dysmorphic disorder. *Journal of Obsessive-Compulsive and Related Disorders* 1(3), 175-179. doi: 10.1016/j.jocrd.2012.03.002
- [26] Johnson, S., Williamson, P., & Wade, T. D. (2018). A systematic review and meta-analysis of cognitive processing deficits associated with body dysmorphic disorder. *Behaviour research and therapy* 107, 83-94.
- [27] Koran, L., Abujaoude, E., Large, M., & Serpe, R. (2008). The Prevalence of Body Dysmorphic Disorder in the United States Adult Population. *CNS Spectrums* 13(4), 316-322. doi: 10.1017/S1092852900016436
- [28] Möllmann, A., Hunger, A., Schulz, C., Wilhelm, S., & Buhlmann, U. (2020). Gazing rituals in body dysmorphic disorder. *Journal of Behavior Therapy and Experimental Psychiatry* 68, 101522.
- [29] Monzani, B., Krebs, G., Anson, M., Veale, D., & Mataix-Cols, D. (2013). Holistic versus detailed visual processing in body dysmorphic disorder: Testing the inversion, composite and global precedence effects. *Psychiatry Research* 210(3), 994-999. doi: 10.1016/j.psychres.2013.08.009
- [30] Moody, T. D., Sasaki, M. A., Bohon, C., Strober, M. A., Bookheimer, S. Y., Sheen, C. L., & Feusner, J. D. (2015). Functional connectivity for face processing in individuals with body dysmorphic disorder and anorexia nervosa. *Psychological Medicine* 45(16), 3491-3503. doi: 10.1017/S0033291715001397
- [31] Phillips, K. A. (2014). Body dysmorphic disorder: common, severe, and in need of treatment research. *Psychotherapy and Psychosomatics* 83, 325-329. <https://doi.org/10.1159/000366035>
- [32] Phillips, K. A., & Hollander, E. (2008). Treating body dysmorphic disorder with medication: evidence, misconceptions, and a suggested approach. *Body image* 5(1), 13-27.
- [33] Phillips, K.A., Hart, A., Simpson, H., & Stein, D. (2014). Delusional versus nondelusional body dysmorphic disorder: Recommendations for DSM-5. *CNS Spectrums* 19(1), 10-20. doi: 10.1017/S1092852913000266
- [34] Phillips, K. A., Wilhelm, S., Koran, L. M., Didie, E. R., Fallon, B. A., Feusner, J., & Stein, D. J. (2010). Body dysmorphic disorder: Some key issues for DSM-V. *Depression and anxiety* 27(6), 573-591.
- [35] Phillpou, A., Rossell, S. L., Wilding, H. E., & Castle, D. J. (2016). Randomised controlled trials of psychological and pharmacological treatments for body dysmorphic disorder: A systematic review. *Psychiatry research* 245, 179-185.
- [36] Prazeres, A. M., Nascimento, A. L., & Fontenelle, L. F. (2013). Cognitive-behavioral therapy for body dysmorphic disorder: a review of its efficacy. *Neuropsychiatric disease and treatment* 9, 307.
- [37] Rief, W., Buhlmann, U., Wilhelm, S., Borkenhagen, A., & Brähler, E. (2006). The prevalence of body dysmorphic disorder: A population-based survey. *Psychological Medicine* 36(6), 877-885. doi: 10.1017/S0033291706007264
- [38] Richler, J., Mack, M., Gauthier, I., & Palmeri, T. (2009). Holistic processing of faces happens at a glance. *Vision Research* 49, 2856-2861. <https://doi.org/10.1016/j.visres.2009.08.025>
- [39] Rossion, B. (2008). Picture-plane inversion leads to qualitative changes of face perception. *Acta Psychol (Amst)* 128(2), 274-289.
- [40] Silver, J., & Farrants, J. (2016). 'I Once Stared at Myself in the Mirror for

- Eleven Hours.' Exploring mirror gazing in participants with body dysmorphic disorder. *Journal of Health Psychology* 21(11), 2647-2657.
- [41] Schieber, K., Kollai, I., de Zwaan M., & Martin, A. (2015). Classification of body dysmorphic disorder-what is the advantage of the new DSM-5 criteria? *Journal of Psychosomatic Research* 78(3), 223-227. <https://doi.org/10.1016/j.jpsychores.2015.01.002>
- [42] Stangier, U., Adam-Schwebe, S., Müller, T., & Wolter, M. (2008). Discrimination of facial appearance stimuli in body dysmorphic disorder. *Journal of Abnormal Psychology* 117(2), 435-443. doi: 10.1037/0021-843X.117.2.435
- [43] Toh, W.L., Castle, D.J., & Rossell, S.L. (2017a). Face and object perception in body dysmorphic disorder versus obsessive-compulsive disorder: the mooney faces task. *Journal of the International Neuropsychological Society* 23(6), 471-480. doi: 10.1017/S1355617717000327
- [44] Toh, W. L., Castle, D. J., & Rossell, S. L. (2017b). How individuals with body dysmorphic disorder (BDD) process their own face: A quantitative and qualitative investigation based on an eye-tracking paradigm. *Cognitive Neuropsychiatry* 22(3), 213-232. doi: 10.1080/13546805.2017.1300090
- [45] Veale, D. (2000). Outcome of cosmetic surgery and 'DIY' surgery in patients with body dysmorphic disorder. *Psychiatric Bulletin* 24(6), 218-221.
- [46] Veale, D., & Riley, S. (2001). Mirror, mirror on the wall, who is the ugliest of them all? The psychopathology of mirror gazing in body dysmorphic disorder. *Behaviour research and therapy* 39(12), 1381-1393.
- [47] Yin, R. K. (1969). Looking at upside-down faces. *Journal of Experimental Psychology* 81(1), 141-145.