



Review

Visual processing in anorexia nervosa and body dysmorphic disorder: Similarities, differences, and future research directions



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ABSTRACT

Anorexia nervosa (AN) and body dysmorphic disorder (BDD) are psychiatric disorders that involve distortion of the experience of one's physical appearance. In AN, individuals believe that they are overweight, perceive their body as "fat," and are preoccupied with maintaining a low body weight. In BDD, individuals are preoccupied with misperceived defects in physical appearance, most often of the face. Distorted visual perception may contribute to these cardinal symptoms, and may be a common underlying phenotype. This review surveys the current literature on visual processing in AN and BDD, addressing lower- to higher-order stages of visual information processing and perception. We focus on peer-reviewed studies of AN and BDD that address ophthalmologic abnormalities, basic neural processing of visual input, integration of visual input with other systems, neuropsychological tests of visual processing, and representations of whole percepts (such as images of faces, bodies, and other objects). The literature suggests a pattern in both groups of over-attention to detail, reduced processing of global features, and a tendency to focus on symptom-specific details in their own images (body parts in AN, facial features in BDD), with cognitive strategy at least partially mediating the abnormalities. Visuospatial abnormalities were also evident when viewing images of others and for non-appearance related stimuli. Unfortunately no study has directly compared AN and BDD, and most studies were not designed to disentangle disease-related emotional responses from lower-order visual processing. We make recommendations for future studies to improve the understanding of visual processing abnormalities in AN and BDD.

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1. Introduction

Anorexia nervosa (AN) and body dysmorphic disorder (BDD) are psychiatric disorders characterized by disturbances in the experience of one's physical appearance. In AN, individuals are preoccupied with body weight and size, often resorting to caloric restriction to maintain a low body weight. They hold often-delusional convictions of being overweight, despite substantial evidence to the contrary. Additionally, they focus on specific body areas that they believe appear "fat," such as the abdominal region, hips, and face. In BDD, individuals are preoccupied with misperceived defects in

appearance (Phillips et al., 2010). As a result, they believe that they look deformed or ugly, even though the perceived abnormalities are not noticeable to others or appear minor. They are often concerned with specific details, typically of the face or head (e.g. skin blemishes, hair texture, shape of nose), although any body part may be of concern. As in AN, they also are highly convinced of their perceptions, and 27–60% are classified as currently delusional (Mancuso et al., 2010; Phillips et al., 2006). Both disorders may manifest similar phenomenologic patterns involving hypervigilant attention to details of appearance, which are perceived as flawed, likely contributing to often-delusional distortions in perception.

AN and BDD are associated with substantial psychological distress and functional impairment. Underscoring the broad public health significance of these conditions, the lifetime risk of attempted suicide in BDD is 22–27.5% (Phillips et al., 2005a; Phillips and Diaz, 1997; Veale et al., 1996), and the risk of completed suicide is 30 times that of the general population (Phillips and Menard, 2006). AN is associated with a mortality rate of 5–7% per decade,

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and an overall standardized mortality higher than any other psychiatric illness (Sullivan, 1995).

In addition to similarities in phenomenology, AN and BDD share a peak onset during adolescence, high risk for chronicity, and have similar comorbidity patterns (although there are higher rates of generalized anxiety disorder in AN and higher rates of panic disorder in BDD) (American Psychiatric Association, 2000; Phillips and Kaye, 2007; Phillips et al., 2005b; Swinbourne and Touyz, 2007). AN and BDD co-occur frequently; up to 32% of BDD patients also have a lifetime comorbid eating disorder (Ruffolo et al., 2006) and 25–39% of those with AN are diagnosed with comorbid BDD (Grant et al., 2002; Rabe-Jablonska Jolanta and Sobow Tomasz, 2000). There is also overlap in specific areas of appearance concerns, e.g. size of abdomen, hips, and thighs (Grant and Phillips, 2004). Approximately 30% of individuals with BDD report significant weight concerns, a characteristic linked to greater symptom severity and morbidity (Kittler et al., 2007). The few studies that have directly compared AN and BDD found similarities on clinical and psychological measures, with both groups exhibiting severe body image symptoms and low self-esteem compared to healthy controls (Hrabosky et al., 2009; Kollei, Brunhoeber, Rauh, de Zwaan, & Martin, 2012; Rosen and Ramirez, 1998). There are also important differences, most notably that the gender distribution is less skewed toward females in BDD (Buhlmann et al., 2010; Koran et al., 2008; Rief et al., 2006).

The similarities in clinical features suggest that AN and BDD may represent overlapping body image disorders (Cororve and Gleaves, 2001). However, BDD is currently categorized as a somatoform disorder in DSM-IV-TR and as a form of hypochondriasis in ICD-10, while AN is categorized as an eating disorder in both systems (American Psychiatric Association, 2000; World Health Organization, 1992). Moreover, BDD is often considered to be on the obsessive-compulsive disorder (OCD) spectrum, due to similar phenomenology, demographics, heredity, course of illness, and response to treatment (Hollander and Wong, 1995; Phillips et al., 2007). (Of note, AN also has some features suggestive of overlap with OCD, including obsessive thoughts and ritualized eating behaviors, high comorbidity of OCD, and a high proportion of first degree relatives with OCD (Phillips et al., 2007).)

Since distorted perception of appearance is a key feature of both AN and BDD, examining visual processing as a phenotype may provide a level of understanding about the relationship between these two disorders, and about the neurobiology behind this phenomenon, which is less likely to be captured by examining individual categorical diagnoses (Insel and Cuthbert, 2009). This has important clinical relevance, as persistent perceptual disturbance is a strong predictor of relapse in AN (Keel et al., 2005). There is a considerable need for understanding the neurobiology of perception in AN and BDD, including any similarities and differences, to help guide the development of rational treatments. To maintain focus on the phenotype of abnormal visual perception of appearance, we did not include other disorders in this review such as OCD or social anxiety disorder; these disorders may also be related to AN and BDD, although perhaps via different overlapping phenotypes (heightened self-consciousness, tendencies for obsessive thoughts and compulsive behaviors, etc.). We have not included other eating disorders, such as bulimia nervosa (BN), for several reasons. Among BN, AN, and BDD there is overlap of certain common clinical features (perceptual distortions, high trait perfectionism, and high comorbid anxiety) (American Psychiatric Association, 2000; Phillips et al., 2005b, 2010; Sutandar-Pinnock et al., 2003; Swinbourne et al., 2007). However, BN has additional characteristics that set it apart from AN and BDD with respect to perception and visual processing. For one, distorted body image perception is required for a diagnosis of AN or BDD, but not for BN (American Psychiatric

Association, 2000). While many individuals with BN do have body image disturbances (Jansen et al., 2005; Schneider et al., 2009), this disorder is characterized by a preoccupation with shape and weight, along with body dissatisfaction (even if shape and weight are accurately perceived) (Stice and Agras, 1998). Thus, BN is more heterogeneous when it comes to perceptual distortions, with less consistency than in AN and BDD. Another characteristic that sets BN apart from AN and BDD, in general, is that individuals with BN have higher rates of impulsivity (Claes et al., 2012a; Claes et al., 2012b) and comorbidity with impulse control-related disorders (Fernandez-Aranda et al., 2008). Finally, there is support for the conceptualization of AN and BDD, unlike BN, as including individuals with low insight or delusional beliefs (Hartmann et al., 2013; Konstantakopoulos et al., 2012; Mancuso et al., 2010).

Conscious perception is a complex phenomenon that relies on multiple visual processing systems in the brain, along with tightly linked cognitive and emotional processes that contribute to the subjective perceptual experience (Moutoussis, 2009; Zeki and Bartels, 1999). Visual information is exchanged through functional connections between lower- and higher-order visual areas (occipital, temporal, and parietal), and centers for emotion, cognition, and memory (Lamme and Roelfsema, 2000). This facilitates both bottom-up, perceptually driven visual inputs to emotion and cognitive systems, and top-down modulation of visual input based on conscious interpretation (Hanson et al., 2007; Iaria et al., 2008). An individual's current psychological state and past experiences with emotionally charged visual stimuli (e.g. images of bodies and faces for AN and BDD) are ever-present confounds in studies assessing visual processing (Rossignol et al., 2012; Schettino et al., 2012). Pre-existing or symptom-dependent abnormalities in the function of lower-order visual systems, higher-order cognitive and emotional systems, or both, could be involved in abnormal perception. The majority of studies performed in AN and BDD thus far, unfortunately, have not been designed to discern top-down from bottom-up phenomena. This review focuses on studies that have addressed visual processing in individuals with AN or BDD. We define visual processing as phenomena involved in any of the following steps: acquisition of visual input in the peripheral sensory system (ophthalmologic), relay of this information to the central nervous system, neural processing of visual information in occipital and occipito-parietal regions (from basic feature characteristics to more complex aspects), and further elaboration and integration into representations of whole percepts (e.g. face or body images) in (primarily) temporal brain areas.

Our goal was to examine evidence for abnormalities of different aspects of visual processing in AN and BDD, from the function and structure of the eye to higher order processing of human face and body images. To focus the review, we excluded studies that lacked information on visual processing itself but may have otherwise investigated consciously or unconsciously held beliefs about appearance, emotional reactions to visual stimuli (including food stimuli), facial emotional recognition, and visual memory or attention. Another goal was to compare visual processing abnormalities between these related disorders; definitive conclusions, however, were limited because no study directly compared these two groups.

We organized these studies into: a) ophthalmologic findings; b) perceptual organization as assessed through neuropsychological tests of visuospatial, global/local processing, or multi-sensory integration that included visual stimuli; c) visual processing of naturalistic images (face or body images); and d) functional and structural brain imaging studies of visual processing. The latter category could provide information about visual processing at any of the aforementioned steps. In addition, we included studies that examined evidence for any abnormalities as either state (secondary to symptoms of the illness) or trait (pre-existing) characteristics in AN or BDD.

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