



# Impairment in local and global processing and set-shifting in body dysmorphic disorder



Lauren Kerwin <sup>a</sup>, Sarit Hovav <sup>b</sup>, Gerhard Hellemann <sup>c</sup>, Jamie D. Feusner <sup>a,\*</sup>

<sup>a</sup> UCLA Semel Institute for Neuroscience and Human Behavior, David Geffen School of Medicine at UCLA, USA

<sup>b</sup> Creighton University/University of Nebraska Medical Center, Department of Psychiatry, USA

<sup>c</sup> UCLA Semel Institute for Neuroscience and Human Behavior, Biostatistics Core, USA

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## ABSTRACT

Body dysmorphic disorder (BDD) is characterized by distressing and often debilitating preoccupations with misperceived defects in appearance. Research suggests that aberrant visual processing may contribute to these misperceptions. This study used two tasks to probe global and local visual processing as well as set-shifting in individuals with BDD. Eighteen unmedicated individuals with BDD and 17 non-clinical controls completed two global-local tasks. The embedded figures task requires participants to determine which of three complex figures contains a simpler figure embedded within it. The Navon task utilizes incongruent stimuli comprised of a large letter (global level) made up of smaller letters (local level). The outcome measures were response time and accuracy rate. On the embedded figures task, BDD individuals were slower and less accurate than controls. On the Navon task, BDD individuals processed both global and local stimuli slower and less accurately than controls, and there was a further decrement in performance when shifting attention between the different levels of stimuli. Worse insight correlated with poorer performance on both tasks. Taken together, these results suggest abnormal global and local processing for non-appearance related stimuli among BDD individuals, in addition to evidence of poor set-shifting abilities. Moreover, these abnormalities appear to relate to the important clinical variable of poor insight. Further research is needed to explore these abnormalities and elucidate their possible role in the development and/or persistence of BDD symptoms.

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## 1. Introduction

Body dysmorphic disorder (BDD) is characterized by preoccupations with perceived defects in physical appearance, which causes substantial distress or functional impairment (American Psychiatric Association, 2013). BDD is an often-severe disorder, in which 25% attempt suicide (Phillips and Menard, 2006) and nearly half are hospitalized during their lifetime (Phillips et al., 2005). Insight varies along a continuum, with 27–60% holding their belief with delusional intensity (Mancuso et al., 2010). The prevalence of BDD in community samples is estimated to be between 0.7% and 2.4% (Koran et al., 2008; Otto et al., 2001; Rief et al., 2006). Although highly debilitating and relatively common, BDD remains under-recognized and under-studied.

BDD is currently classified in the DSM-5 as an obsessive-compulsive related disorder (American Psychiatric Association, 2013). This is in part due to shared phenomenology of obsessive thoughts and compulsive behaviors; in BDD the repetitive and intrusive thoughts about perceived defects in appearance are often obsessional in nature, and individuals engage in repetitive behaviors such as checking or fixing their appearance, which are conceptualized as compulsive (American Psychiatric Association, 2013; Phillips et al., 2010a). There is growing evidence that abnormal visual processing may be an important phenotypic feature in BDD. For example, neuroimaging studies have shown abnormal brain activation patterns when individuals with BDD view faces. Feusner et al. (2007) found greater left hemisphere activation when individuals with BDD viewed others' faces; this hemispheric imbalance suggests that they rely more on extraction and processing of details. Feusner et al. (2010c) found that individuals with BDD, when viewing images of their face altered to present only low detail (therefore only representing overall stimulus organization) show hypoactivation relative to healthy controls

\* Corresponding author. UCLA Semel Institute for Neuroscience and Human Behavior, David Geffen School of Medicine at UCLA, 300 UCLA Medical Plaza, Suite 2200, Los Angeles, CA 90095-8346, USA.

E-mail address: [jfeusner@mednet.ucla.edu](mailto:jfeusner@mednet.ucla.edu) (J.D. Feusner).

in striate and extrastriate visual cortex. Individuals with BDD also show abnormalities in visual processing systems for low detail images of non-appearance related stimuli (houses) (Feusner et al., 2011).

Visuoperceptual difficulties may also be implicated in BDD individuals' difficulties with perception of facial emotional expressions (Buhlmann et al., 2006, 2004) and identity recognition of faces with emotional expressions (Feusner et al., 2010a). Additional evidence suggesting an imbalance in local (detail) versus global (holistic) processing in BDD comes from a study of inverted faces. When viewing inverted faces, relative to upright faces, BDD individuals show less slowing of response time relative to controls (Feusner et al., 2010b). This reduced inversion effect suggests a greater reliance on part decomposition and detail processing, for which inversion has less of an effect than for holistic processing (Farah et al., 1995). Another study using inverted faces demonstrated that individuals with BDD relative to healthy controls had enhanced ability to recognize inverted faces (Jefferies et al., 2012). Similar results were not found in a more recent study, although shorter presentation times and different stimuli were used (Monzani et al., 2013). Collectively, these studies largely support a local bias and global impairment for faces among BDD individuals and suggest similar deficits may exist for stimuli unrelated to BDD symptoms.

Findings from neuropsychological studies complement the results of face processing studies, showing that BDD individuals have difficulty in integrating perceptual information, with the resultant reliance on piecemeal, local information rather than on the larger, organizing features. Thus, when asked to copy the Rey–Osterrieth Complex Figure, individuals with BDD add detail to detail; non-clinical controls start with the global elements, which results in superior recall (Deckersbach et al., 2000). A previous study in individuals with OCD showed a similar pattern to the BDD group in this study (Savage et al., 1999). Individuals with BDD also show impairments in executive function tasks of cognitive flexibility, on-line manipulation, as well as planning and organizing information (Dunai et al., 2010; Hanes, 1998). Spatial memory capacity and visual memory remain intact (Dunai et al., 2010). A study directly comparing individuals with BDD to those with OCD suggests similar abnormalities on performance of most executive planning tasks, with worse performance in the BDD group on accuracy of spatial planning (Labuschagne et al., 2013). These studies and clinical phenomenology suggest that BDD patients have abnormalities in analyzing visual information and abnormalities in executive functioning. It is possible that these abnormalities in information processing may significantly contribute to the symptomatology.

This study investigated whether aberrant visual information processing arises in BDD as the result of a propensity to focus attention at the local level (i.e., local bias), coupled with a deficit in set-shifting – the process of updating and shifting cognitive strategies in response to environmental changes. Previous studies have found evidence for general abnormalities in executive functioning in BDD (Deckersbach et al., 2000; Dunai et al., 2010; Hanes, 1998), although none have specifically examined set-shifting. In addition, no study in BDD has examined set-shifting with respect to global and local visual stimuli, which may be relevant to the phenomenology of perceptual distortions. In the related disorder OCD, most studies show evidence of deficits in set-shifting ((Kuelz et al., 2004; Penades et al., 2005; Rampacher et al., 2010) and see review (Kuelz et al., 2004)). Multiple studies in anorexia nervosa, a related disorder involving body image disturbance, also have found impairments in set-shifting (for review see (Roberts et al., 2007)).

To this end we used two tasks, the embedded figures task (EFT) (Witkin, 1971) and a modified version of the Navon task (Navon,

1977). The EFT consists of a complex figure comprised of smaller “embedded” figures; participants were required to select the complex figure that contained an embedded target shape. The Navon task consists of global letters made out of local letters; participants were required to detect a target letter, either at the global or local level, while ignoring information at the other level. The EFT has not been performed previously in BDD, to our knowledge. The Navon task has been performed (Monzani et al., 2013) although using different stimuli and methodology (see Discussion).

We hypothesized that individuals with BDD would, a) show a local bias by performing faster than control participants on the EFT and on local trials of a Navon task; and b) demonstrate set-shifting abnormalities consisting of shifting attention more slowly relative to controls on the Navon task between target levels and redirecting their attention the slowest when shifting from local to global. A secondary objective was to investigate the relationship between global-local processing and relevant clinical variables. Specifically, we hypothesized that response times on the local and global Navon trials and on the EFT would correlate negatively with BDD symptom severity and degree of insight. Although this has not been researched before, we hypothesized this relationship based on a proposed model that impairments in local and global processing and set-shifting may contribute to visual perceptual distortions, which subsequently lead to more severe symptoms and poorer insight (Li et al., 2013).

## 2. Method

### 2.1. Participants

Participants were recruited from the University of California Los Angeles and surrounding communities in three ways: (a) through referrals from mental health providers, dermatologists and cosmetic surgeons, (b) via posted advertisements, and (c) from a website introducing the research.

Eighteen BDD and seventeen control participants of equivalent sex, age, and educational level, all right-handed with visual acuities of at 20/40 or better (corrected or uncorrected), were recruited from the community. Visual acuity was assessed using the Snellen eye chart. Individuals were excluded from the control group if they met DSM-IV criteria for any current or past Axis I psychiatric disorders, as assessed with the Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998). We excluded control and BDD individuals if they were actively suicidal, had any current neurological disorder, were pregnant, or had any current medical disorder that may have affected cerebral metabolism.

None were taking psychotropic medications or enrolled in psychotherapy, including cognitive-behavioral therapy. The University's Institutional Review Board approved this study. Written informed consent was obtained from all participants. All participants received \$50 for their participation in the research.

### 2.2. Procedures

Screening assessments to determine eligibility of the participants with BDD included the BDD Diagnostic Module (Phillips et al., 1995), a reliable diagnostic module modeled after the DSM-IV. Diagnoses were made by J.D.F., a board-certified psychiatrist with clinical expertise in this population. All BDD participants had pre-occupations with perceived facial defects. Comorbid diagnoses were confirmed by structural clinical interviews using the MINI. Although BDD was the primary diagnosis in all cases, some BDD participants also had major depressive disorder ( $n = 1$ ), generalized

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