

Local–global processing in obsessive–compulsive disorder and comorbid Tourette’s syndrome

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Abstract

Neuropsychological and neuroimaging studies implicate attentional difficulties in obsessive–compulsive disorder (OCD), but results are inconsistent due possibly to sample heterogeneity and lack of control of comorbid disorders, such as Tourette’s syndrome (TS). Nevertheless, it has been suggested that OCD symptomatology may be a result of overfocused attention at a local level. Therefore, this study aimed to examine the ability of OCD patients (pure and comorbid OCD + TS) to process local and global stimuli. Using a local–global paradigm, participants were required to respond to the directed level (local or global) of various stimuli. Results indicate that pure OCD participants were impaired on the global task, whereas comorbid OCD + TS participants had difficulty processing local information. Results are consistent with previously reported lateralisation anomalies and suggest that OCD negatively affects the ability to process hierarchically presented stimuli.

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1. Introduction

Obsessive–compulsive disorder (OCD) is characterised by recurrent, intrusive thoughts (obsessions), and/or behaviours (compulsions) that interfere with daily functioning. In addition, patients also commonly present with other behavioural and emotional problems, including Tourette’s syndrome (TS), which may even be an alternative manifestation of a common gene deficit. Neuroimaging studies in OCD patients have yielded inconsistent results, although they typically implicate anterior cingulate and orbitofrontal cortices

(Perani et al., 1995; Robinson et al., 1995; Scarone et al., 1992). With regards to subcortical pathology, there is evidence of both increased (Scarone et al., 1992) and decreased (Luxenberg et al., 1988; Robinson et al., 1995) volumes of the caudate, as well as increased metabolic activities in the caudate, globus pallidus, putamen, and thalamus (Baxter et al., 1987; Perani et al., 1995).

The involvement of fronto-striatal pathways in OCD patients predicts cognitive impairments, including problems with attention. For example, the dorsolateral prefrontal circuit subcortically innervates the caudate, globus pallidus, and substantia nigra, areas which are implicated in the pathophysiology of OCD. Functionally, this circuit is thought to subserve various aspects of executive functioning, including the ability to plan, maintain, and shift set, verbal fluency, and is

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also thought to be involved in various aspects of motor programming (Cummings, 1993). Furthermore, the dorsolateral prefrontal circuit is also particularly important in maintaining and shifting attention (Bradshaw and Mattingley, 1995; Stelmach and Phillips, 1996). Results of neuropsychological studies in OCD have been inconsistent, with evidence both for and against such attentional impairments. For example, Veale, Sahakian, Owen, and Marks (1996) employed The Cambridge Automated Neuropsychological Test Battery (CANTAB), a computerised attentional set-shifting task, with OCD patients. The authors reported that patients were more impaired than controls, indicating deficits in both acquiring and maintaining cognitive set (Veale et al., 1996). In contrast however, Purcell, Maruff, Kyrios, and Pantelis (1998), who also administered the computerised CANTAB attentional set-shifting task to OCD patients and controls, reported that patients were unimpaired, suggesting normal attentional set-shifting abilities. Purcell et al. (1998) argued that differences on set-shifting tasks with OCD patients may be attributed to sample heterogeneity and a lack of control of comorbid disorders. Furthermore, there is also evidence indicating that clinical symptomatology may differ between patients with pure and comorbid OCD (George, Trimble, & Robertson, 1993; Miguel et al., 1997; Zohar et al., 1997). For example, OCD + TS patients have more violent, sexual, and symmetrical obsessions and more touching, blinking, counting, and self-damaging compulsions, whereas pure OCD patients tend to have obsessions relating to dirt and germs, and more cleaning compulsions (George et al., 1993; Zohar et al., 1997). Furthermore, compulsions are more likely to arise spontaneously for OCD + TS patients, whereas cognitions typically precede compulsions for pure OCD patients (George et al., 1993; Miguel et al., 1997).

In an attempt to further examine attentional impairments in OCD patients, Savage et al. (1999) used the Rey–Osterrieth Complex Figure Test (RCFT) and found that patients fixated on small, local details, while control subjects focused on the overall global form. Therefore, OCD patients appeared to have problems in overfocusing attention at the local level. Moreover, Savage et al. (1999) explains that OCD symptomatology may be related to a 'local-bias' in the allocation of attention. For example, fear of forgetting to turn off the stove may be linked to a failure to appreciate the larger environment, such that attentional resources are over focused on the stove, thereby giving it greater importance than is warranted (Savage et al., 1999).

Navon (1977) proposed the *global precedence hypothesis*, which states that the overall global form is perceived prior to the more local details. Moreover, global features can be attended to without being affected by the local details, but it is not normally possible to process the

local features without interference from the global form (Navon, 1977; Paquet & Wu, 1994). This provides support for the notion that global processing is a necessary part of perception prior to the more fine-grade analysis of a visual scene (Navon, 1977).

Several studies have suggested a hemispheric asymmetry in cerebral activation during local–global processing, such that the left hemisphere is involved in processing local information and the right is involved in processing global information (Delis, Kiefner, & Fridlund, 1998; Fink, Marshall, Halligan, & Dolan, 1999; Proverbio, Minniti, & Zani, 1998). However, these studies have employed various techniques, such as behavioural observation, PET and ERP, and do not provide any precise information about the anatomical regions involved in hierarchical processing. In attempt to investigate the brain regions associated with processing local and global information, Martinez et al. (1997) used fMRI in a group of healthy controls. Similar to previous studies, it was reported that the right hemisphere is more efficient in processing global information, whereas the left hemisphere shows a bias toward local processing. This suggests that within the overall structure of the attention system, each hemisphere has a specialised function in the level of detail to which attention is allocated (Posner & Peterson, 1990).

In an attempt to elucidate the nature of attentional impairments, as well as to examine the influence of comorbid TS, this study employed a computerised local–global paradigm with pure OCD and comorbid OCD + TS groups. There were three stimulus Configuration types (congruent, neutral, and incongruent), all of which were large global numbers made up of small, local numbers. Congruent configurations consisted of the same stimuli at both levels (i.e., a large 1 composed from small 1's), whereas incongruent configurations involved the stimuli at the local level being opposite to the response at the global level (i.e., a large 1 composed of small 2's). Neutral configurations consisted of an unavailable response at the level opposite to that which attention was allocated (e.g., in the local task a large 3 or 4 composed of small 1's).

As OCD patients may have problems in overfocusing attention, it was hypothesised that pure OCD patients would show superior performance on local configurations, and impairments on global configurations, compared to controls. Due to the lack of research on adults with OCD + TS, it was difficult to predict possible outcomes for the comorbid group. However, as TS may involve left hemisphere disruption (Peterson et al., 1993; Singer et al., 1993), comorbid OCD + TS patients may have problems processing stimuli at the local level, as well as at the global level, compared to controls. Furthermore, as OCD patients may have problems in inhibiting irrelevant information all patients (pure and comorbid) may be considerably more affected by

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