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BRIEF COMMUNICATION

No disadvantage for the processing of global visual features in obsessive-compulsive disorder

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Abstract

The present study examined whether patients with obsessive-compulsive disorder (OCD) focus on details at the expense of global aspects. A recent study of our group using Navon letters (e.g., the letter "S" composed out of "A" letters) did not yield differences between OCD patients and controls on local processing. However, the task used may have lacked sensitivity, because it did not involve a response conflict condition (i.e., global and local level associated with different responses). In the current study, we gradually varied between-level conflict. Twenty-eight OCD patients and 30 healthy controls had to attend to the global and the local level of each item. OCD patients displayed comparable performance: Patients neither displayed a preference to respond to the local level nor enhanced interference from the local level. In conclusion, the present study does not support the idea that a generalized bias to "miss the forest for the trees" forms part of the vulnerability to OCD.
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Keywords: OCD, Obsessions, Compulsions, Washer, Checker, Attention, Visual processing, Local-global processing

INTRODUCTION

For many years, a preference to process local stimuli at the expense of global features has been linked to symptoms of obsessive compulsive disorder (OCD). The assumption of a bias to "miss the forest for the trees" (Cabrera et al., 2001) seems plausible, clinically and empirically. Many OCD patients are guided by small details and random events and neglect the "full picture" (e.g., touching a stranger on the street may provoke concerns to have transmitted an incurable disease (washer) or that the person stumbles and eventually gets injured or even killed just seconds later (checker)). Although healthy individuals may also experience obsessive thoughts, a non-OCD person would not indulge in extended worry or rumination, because counter-cognitions and rational arguments would mitigate the threat of any worst-case scenario.

In addition, there is some albeit not fully conclusive evidence that patients with OCD adopt a piecemeal approach when organizing visual input which has been reconciled with a deficit to attend to global features (e.g., Penades et al., 2005). Thus, when asked to copy the Rey-Osterrieth Complex Figure Test (Savage et al., 1999; Savage et al., 2000) OCD spectrum disorder subjects (Mataix-Cols et al., 2003; Moritz et al., 2005; Penades et al., 2005; Savage et al., 2000; Shin et al., 2004) often add detail to detail, whereas healthy participants typically start with a central/global element, the latter resulting in superior recall (however see Bohne et al., 2005; Moritz et al., 2003).

A weakness of the local-global account of OCD is that such deficits have been also observed or inferred in other clinical samples (Porter & Coltheart, 2006) and that many psychopathological disturbances other than OCD could also be modeled as a disorder of holistic processing. For exam-

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ple, in panic disorder undue significance is given to certain body sensations (e.g., heart beat) leading to worries about heart attack or stroke; schizophrenia patients tend to jump to conclusions on the basis of minor events (Moritz & Woodward, 2005). Of further note, a recent study using the Rey-Osterrieth Complex Figure Test (Moritz et al., 2005), while being able to replicate the piecemeal processing style in OCD patients, did not detect differences between OCD patients and psychiatric controls on the Rey-task.

The authors (Moritz & Wendt, 2006) have recently investigated this hypothesis directly using hierarchical letters (i.e., a capital letter, for example "E", composed out of small capital letters such as "T"), a procedure first described by Navon (1977). Specifically, participants had to decide on the presence of target letters, independently of whether they occurred on the global or the local level (i.e., divided attention task). Failing to support the notion of an early perceptual bias towards local elements, OCD patients displayed overall response slowing but not more so when a target letter occurred at the global level as compared to when it occurred at the local level. It should be noted, however, that a possible shortcoming of the Moritz and Wendt (2006) study lies in the fact that no condition involving response conflict between the local and global stimulus level was included, which is assumed to be particularly sensitive for group differences in global-local processing. In fact Yovel et al. (2005) observed differences between a group of healthy controls and a group of participants scoring high on an obsessive-compulsive personality questionnaire only when comparing responses to the global level under conditions of presence *versus* absence of response conflict from the local level.

In the current study, we refined our divided attention task to meet this weakness. More precisely, we gradually varied response competition between the global and the local level by two manipulations. First, we presented non-target letters, which varied in similarity with two target letters assigned to different responses (Lamb & Robertson, 1989). Second, we presented trials in which global and local target letters were co-presented but associated with different responses, instructing participants to choose freely on these trials.

A bias towards local processing in OCD patients should thus manifest in two ways. First, compared with control participants, performance on global targets should be more strongly affected when a non-target letter on the local level resembles the current global target. Second, on free choice trials patients should display a relative advantage for responding to the local level.

METHODS

Participants

Twenty-eight patients fulfilling DSM-IV criteria for OCD, as determined *via* a clinician-rated semi-structured interview (MINI, Sheehan et al., 1998), participated in the study (19 women, 9 men; age: 34.29 years, *SD*: 10.87; previous hospitalizations: 1.88, *SD*: 1.36; verbal intelligence quotient (IQ): 107.14, *SD*: 12.32). None of the patients had a history of comorbid drug dependence, substantial neurological disorder (e.g., stroke, multiple sclerosis, head trauma) including OCD spectrum disorders (e.g., Tourette's syndrome), and current or previous psychotic symptoms (delusions, hallucinations, manic-depressive symptoms). However, comorbid depression as well as other anxiety disorders were tolerated. The Yale-Brown Obsessive-Compulsive Scale (Y-BOCS, Goodman et al., 1989) was administered to assess OCD symptom severity (*M*: 25.11, *SD*: 7.15). The Hamilton Depression Rating Scale (HDRS) (17 items) served to assess depression (*M*: 11.00, *SD*: 6.88). Scores for obsessions and compulsions were computed using a new algorithm (obsessions: items 1–3, compulsions: 6–8, resistance against symptoms: 4 and 9, Moritz et al., 2002).

Twenty-seven patients were medicated with antidepressant agents, one took an additional neuroleptic agent and one did not take any medication at all.

Thirty participants served as healthy controls (19 females, 11 males; age: 32.07 years, *SD*: 12.01; verbal IQ: 113.28, *SD*: 13.91). Healthy controls were drawn from hospital staff, an established subject pool, and by word-of-mouth. Healthy participants displayed neither psychopathological disturbances as determined with the MINI structured interview (Sheehan et al., 1998) nor any neurological disorder. All participants gave written informed consent to participate after they had been fully informed about the study. The present study fully complied with the ethical guidelines according to the Helsinki declaration. None of the participants took part in the previous study (Moritz & Wendt, 2006).

All human data included in this manuscript was obtained in compliance with the regulations of our institution.

Experiment

Experiments were individually presented on an Apple-Macintosh computer monitor equipped with Superlab. Participants were instructed that large letters (e.g., "S") would be presented to them consisting out of small identical letters (e.g., "E"). Their task was to press the "b" on a computer key whenever the letter "S" was displayed (either as local or global features) and "n" whenever "H" (local or global features) was shown. "A" "E" and "O" (local or global features) served as distractor letters (i.e., no response). Whereas "O" was a neutral distractor that shared little resemblance to target features, "A" and "E" served as related distractors (see Fig. 1) that either differed in one or two features from the current target and the target associated with the other response. As noted earlier, we also introduced an ambiguous condition (Hs, Sh), where the subject was free to respond to either the global or local level.

The letters were centrally presented on the monitor in black against a while background. Each stimulus was 0.40 ×

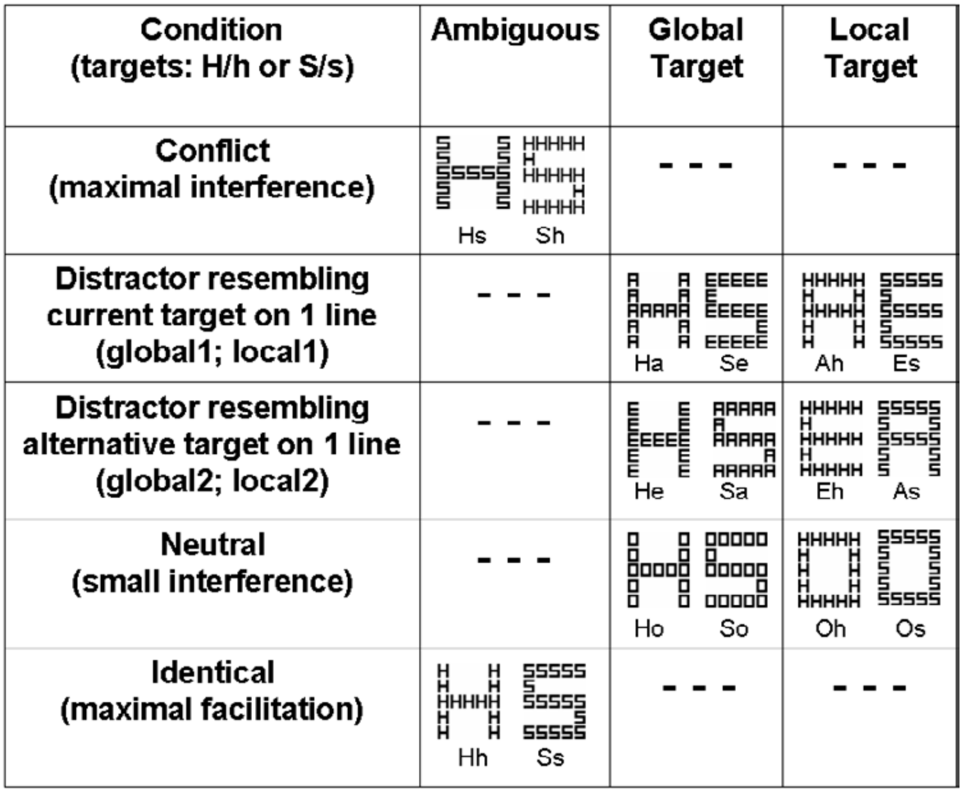

Fig. 1. Eight different conditions with each two subconditions were set up that differed regarding Target and Conflict.

0.40 inches tall. The stimuli remained visible until the participant pressed a key. The interval between a response to a target and the onset of the next stimulus was 2000 ms. Responses had to be made as fast and as accurately as possible. A written computerized feedback was provided in case errors were made.

To familiarize participants with the task, 16 items (two for each condition) were run for practice. Afterwards, 10 items were displayed per condition. The specific items and conditions are displayed in Figure 1 (capital letters designate the global feature—small letters designate local features; the actual items involved uppercase letters only).

RESULTS

Participants did not significantly differ on any sociodemographic background variable (all comparisons at least $p > .1$). Errors were below 1% in both groups.

A 2-way mixed ANOVA with Condition (8 different conditions, see Fig. 1) as within-subjects factor, Group (OCD, healthy sample) as between-subject factor and mean reaction times (correct responses only) as dependent variable yielded a significant effect of Condition, $F(7,392) = 44.03$, $p < .001$, $\eta^2_{\text{partial}} = .44$. Subsequent pairwise *t*-tests revealed that participants responded fastest in the identity condition, followed by the neutral condition, whereas reaction times were slowest for the related distractor and the conflict condition (see Fig. 2). The group effect was significant indicating greater overall slowing in patients, $F(1,56) = 4.95$, $p = .03$, $\eta^2_{\text{partial}} = .08$. Neither interaction nor any of the contrasts turned significant, $F(7,392) = 0.57$, $p > .7$, $\eta^2_{\text{partial}} = .01$. When the sample was split for OCD subtypes, again no group differences were noted (contamination/washer ($n = 19$): $p > .6$; $\eta^2_{\text{partial}} = .01$; aggression/checker ($n = 16$): $p > .3$; $\eta^2_{\text{partial}} = .02$; symmetry/order ($n = 9$): $p > .3$, $\eta^2_{\text{partial}} = .03$; hoarding ($n = 6$): $p > .1$, $\eta^2_{\text{partial}} = .05$). Patients with late *versus* early onset (onset before adoles-

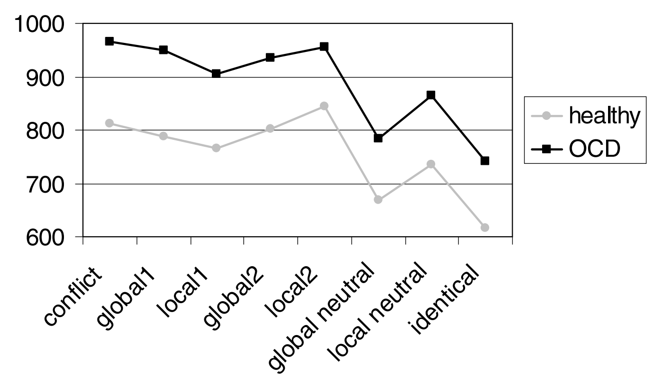

Fig. 2. Except for greater slowing in patients, which was correlated with depression but not OCD symptoms, both groups displayed comparable performance. Notably, OCD patients did not display greater slowing for the conditions most sensitive to local interference (global1 and conflict).

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cence) also did not differ on any of the conditions ($p > .9$, $\eta^2_{\text{partial}} = .01$).

For the conflict condition (targets were presented simultaneously at the local or global level), healthy participants were no more prone to prefer the local over the global target (healthy, percentage global responses: 25%: OCD: 25%; $p > .8$). This was again not moderated by subtype (at least $p > .2$).

Correlational analyses between the different parameters ($\text{global}_{\text{one feature different}}$ minus $\text{local}_{\text{one feature different}}$; $\text{global}_{\text{two features different}}$ − minus $\text{local}_{\text{two features different}}$; $\text{global}_{\text{neutral distractor}} - \text{local}_{\text{neutral distractor}}$; conflict − identical) did not yield any significant correlations with Y-BOCS and HDRS subscores even before Bonferroni correction ($p > .1$). Mean reaction time was significantly correlated with the HDRS ($r = .58$, $p < .001$) but not Y-BOCS obsessions, compulsions or resistance ($r < .16$, $p > .3$). Highest correlations emerged for the core depression ($r = .48$, $p < .01$) and the anxiety subscore of the HDRS ($r = .49$, $p < .01$), whereas sleep ($r = .24$, $p > .1$) and anorexia ($r = .18$, $p > .3$) did not impact on psychomotor speed.

DISCUSSION

The present study confirms results obtained from our pilot study (Moritz & Wendt, 2006). In contrast to the pilot study, which solely used unambiguous targets (i.e., only one response-related target letter occurred at either the global or the local level), the present investigation introduced several new conditions exerting strong local or global interference. In one of these new conditions (response conflict) the Navon letter contained two targets that were assigned different responses. In another critical condition, the distractors strongly resembled the alternative target (associated with the currently incorrect response). These new conditions enabled us to determine a possible bias towards local targets on free-choice trials and interference exerted from the local level on responding to the global target, respectively. However, here as with the other conditions, no group differences emerged except for overall slowing in patients which, however, was owing to depressive rather than OCD symptomatology. In particular, OCD patients neither preferred local targets in free-choice conditions nor were influenced more strongly by distractor resemblance to current or alternative target.

In view of a large sample size in combination with a low effect size for each single comparison, a lack of power cannot parsimoniously account for the present results.

The findings at first sight contradict results obtained by Yovel et al. (2005) who reported greater local interference for healthy participants scoring high on a measure of obsessive-compulsive personality disorder (OCPD). As we have put forward in more detail before, the two studies cannot be directly compared. OCPD is a personality trait that largely differs from OCD and cannot even be considered a benign or subclinical form of OCD (e.g., in OCPD behavior sets are more generalized and not confined to certain rituals as in OCD; participants mostly share a lack of illness insight). Of further note, an earlier study also conducted with healthy participants assessed for OCPD did not detect any deviance (Maynard & Meyer, 1996).

Regarding the question of a general preference for processing global stimulus features ("global precedence," Navon, 1977), the current study yielded mixed results: Although in the neutral condition responses were faster to global than to local targets and, unlike responses to local targets, responses to global targets were not affected by whether the distractor resembled the current or the alternative response, when given free choice, participants largely preferred responding to the local level. Although we can only speculate about the origin of this surprising dissociation between stimulus-determined and choice conditions, it is worth noting that in the divided-attention task we used, responses had to be given in roughly equal amounts to targets appearing unpredictably at the global or the local stimulus level. Assuming that our stimuli favored processing the global level, it thus seems possible that participants tried to counter this asymmetry by biasing response decision processes towards the local level. Clearly, however, future research is needed to clarify the relationship between target processing, shielding against distractors, and free choice responding.

As expected, the conflict condition (e.g., the capital letter "S" consisting out of small capital letters "H") exerted greatest interference followed by items where distactor items resembled target items (the capital letter "S" consisting out of small capital letters "E"). Items where distractors neither resembled the current nor the alternative target (neutral; e.g., the capital letter "S" consisting out of small capital letters "O") were overall responded to faster, and identical items (e.g., the capital letter "S" consisting out of small capital letter "S") yielded fastest responses.

To conclude, processing of hierarchical stimuli seems to be intact in OCD and does not appear to be a good candidate to explain why patients focus on details while neglecting the full picture. Other explanations should be sought and perhaps biological and cognitive models of OCD may benefit from incorporating biographic information and considering the specific learning history of patients. For example, it remains to be tested whether certain associations and cognitions that are acquired during socialization have for some reason received too much weight in the stream of processing, which in the course of illness are further strengthened by dysfunctional coping (e.g., thought suppression) and avoidance. To illustrate, words like *cancer* or *door* that in healthy participants generate multiple associations evoke very one-sided and illness-related associations in patients (Moritz et al., 2007).

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