Towards improving treatment for childhood OCD: Analyzing mediating mechanisms & non-response
Wolters, Lidewij

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Selective attention for threat: 
No evidence of increased bias in 
children and adolescents with OCD

Lidewij H. Wolters, Leentje Vervoort, Sanne M. Hogendoorn, 
Pier J.M. Prins, Frits Boer, & Else de Haan
Abstract

Selective attention for disorder-relevant threat may play a role in obsessive-compulsive disorder (OCD). However, to our knowledge thus far no studies on selective attention for disorder-relevant threat in childhood obsessive-compulsive disorder (OCD) have been conducted. The aim of the present study was to examine attentional bias, vigilance, difficulty to disengage, and interference in children and adolescents with OCD compared to children with anxiety disorders and to community controls. Selective attention for threat was examined with a dot probe task in children with OCD (8–18 years; \( N = 58 \)), in children with other anxiety disorders (8–18 years; \( N = 58 \)), and in typically developing children (8–18 years; \( N = 58 \)). Participants were matched on age and gender. Stimuli (OCD-related threat, general threat, and neutral pictures) were displayed for 500 and 1250 ms. Results showed no increased attentional bias neither for OCD-related threat nor for general threat stimuli in children with OCD and in children with other anxiety disorders compared to community controls. Furthermore, response times for trials containing threatening information were slowed down in all children, suggesting interference by threat independent of clinical status. In conclusion, results of the present study argue against increased selective attention for threat in childhood OCD.
Introduction

Attentional processes are hypothesized to be related to the development and maintenance of psychopathology, especially anxiety disorders (e.g., Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Puliafico & Kendall, 2006). Obsessive-compulsive disorder (OCD) is a unique category within the anxiety disorder spectrum, and is characterized by repetitive, intrusive thoughts, ideas or impulses and recurrent behaviors or rituals. It has been suggested that increased selective attention for OCD-specific threatening information may be an underlying mechanism in OCD. Patients with OCD may show facilitated detection of potential threat (Foa & McNally, 1986). Additionally, the recurrent character of obsessive-compulsive (OC) symptoms may be explained by difficulties to disengage attention from threatening information (e.g., Bannon, Gonsalvez, & Croft, 2008; Bannon, Gonsalvez, Croft, & Boyce, 2002; Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005; Enright & Beech, 1993a, 1993b; Hartston & Swerdlow, 1999; Muller & Roberts, 2005). In contrast to the substantial amount of studies examining selective attention for threat in anxiety, little research has been conducted in OCD. To the best of our knowledge, so far no studies have examined selective attention for OCD-related threat in childhood OCD. This is surprising, as OCD often starts in childhood or adolescence and influential information-processing strategies may develop during this phase.

The dot probe task (MacLeod, Mathews, & Tata, 1986) is an often used paradigm to examine selective attention to threatening information. In this task, two stimuli are simultaneously presented on a computer screen. In general, one of the stimuli is threatening, the other is neutral. After a short delay, both stimuli disappear and a small dot is presented at the location of one of the preceding stimuli. Participants are instructed to indicate the location of the dot as fast as possible by pressing a response button. When participants direct attention towards threat, the dot is easily detected in trials where the dot appears at the location of the threatening stimuli (congruent trial), resulting in a fast response. The response will be delayed in trials where the dot appears at the neutral location (incongruent trial). A faster response to congruent than incongruent trials is interpreted as an attentional bias towards threat (e.g., Bradley, Mogg, Falla, & Hamilton, 1998; MacLeod et al., 1986).

In the first dot probe study in OCD it was found that patients with OCD
showed a content-specific bias towards OCD-related threat (contamination words) compared to neutral information, in contrast to low trait-anxious controls who showed no bias for threat (Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996). In a second study no bias for OCD-related threat in OCD patients was found, and there were no differences in attentional bias for threat between OCD patients and community controls (Harkness, Harris, Jones, & Vaccaro, 2009). Non-clinical students with high OC scores showed a bias for idiosyncratic OCD-related threat which diminished during the course of the task, in contrast to students with low OC scores who showed no bias for threat (Amir, Najmi, & Morrison, 2009).

An attentional bias for threat can result from vigilance for threat (i.e., facilitated orienting towards threat) or difficulty to disengage from threat (i.e., difficulties with removing attention from threat) (Koster, Crombez, Verschuere, & De Houwer, 2004). Vigilance and difficulty to disengage can be examined by comparing response times for neutral trials (a neutral-neutral stimulus combination) with response times for congruent and incongruent trials respectively. A faster response to congruent trials than to neutral trials suggests vigilance. A slower response to incongruent trials than neutral trials suggests difficulty to disengage (see Koster et al., 2004). Differentiating between specific components of attentional bias may contribute to the understanding of the underlying mechanisms in OCD. Increased vigilance for threat indicates facilitated threat detection, which may occur in early phases of information processing. Difficulty to disengage attention from threat, on the other hand, may result from impaired ability to inhibit an attentional bias for threat, a process that may occur in later phases of information processing (e.g., Moritz, von Muhlenen, Randjbar, Fricke, & Jelinek, 2009). This distinction may have implications for treatment. Recently, attentional bias training procedures have been developed for OCD and anxiety (see for example Cowart & Ollendick, 2011; Najmi & Amir, 2010). If patients with OCD have difficulty to disengage from threat, they may benefit from a training aimed at augmenting the ability to inhibit an attentional bias and redirect attention away from threat.

Different paradigms are used to examine vigilance and difficulty to disengage in OCD patients, such as the dot probe task and modified spatial cueing paradigms. Results indicated no deviant patterns for vigilance nor for difficulty to disengage from OCD-related threat words in OCD patients relative to controls (Harkness et al., 2009; Moritz & von Muehlenen, 2008).
Moritz and Von Muehlenen (2008) hypothesized that their word stimuli may not have sufficiently caught attention. In a following study, they presented disorder-relevant pictorial stimuli for a longer duration. Again, no differences in vigilance and difficulty to disengage were found between OCD patients and healthy controls (Moritz et al., 2009). In contrast to these results in clinical samples, non-clinical students scoring high on OC symptoms (contamination fear) showed difficulty to disengage from OCD-related threat (disgust pictures) and general threat stimuli (frightening pictures), in contrast to the low OC symptoms control group. Consistent with the previous studies, neither group displayed vigilance for threat (Cisler & Olatunji, 2010).

Results obtained with attentional tasks that rely on behavioral responses may be confounded by interference by threat (e.g., Mogg, Holmes, Garner, & Bradley, 2008; Wolters et al., 2012). Interference occurs when cognitive resources are allocated to threatening information and insufficient resources are available for other processes which are interrupted (Flykt, 2006; Mogg & Bradley, 1998). Applied to the dot probe task, this implicates that throughout the task cognitive resources may be allocated to (task-irrelevant) threatening stimuli and insufficient resources are available for pressing the response button. This will result in a delayed response when participants are exposed to threatening stimuli, independent of the location of the dot (congruent vs. incongruent trials). Interference can be calculated by comparing response times for threat trials with response times for neutral trials. A slower response to threat trials suggests interference by threat.

Tata and colleagues (1996) examined behavioral interference of (OCD-related) threat stimuli with a dot probe task. They found that patients with OCD, similar to high trait-anxious controls, responded slower to trials containing threatening information (contamination and social threat words) than to trials containing only neutral information. Low trait-anxious controls showed no significant difference in response time between threat and neutral trials. These results indicate that threatening information interfered with response time in OCD and anxiety, but not in non-anxious controls. In line with these results, Moritz et al. (2009) reported that patients with OCD displayed slower responses than controls in trials with OCD-related pictures in a spatial cueing paradigm. Cisler and Olatunji (2010), in contrast, found no difference in response slowing for disgust and threat trials between students scoring high and low on contamination fear.
Interference effects can also be measured with the emotional Stroop task. Slower color-naming for OCD-related threatening stimuli in patients with OCD in comparison to normal controls was reported in several studies (e.g., Foa, Ilai, McCarthy, Shoyer, & Murdock, 1993; Lavy, Van Oppen, & Van den Hout, 1994; Rao, Arasappa, Reddy, Venkatasubramanian, & Reddy, 2010; Unoki, Kasuga, Matsushima, & Ohta, 1999 (subliminal presentation)), but not in all (e.g., Kyrios & Iob, 1998; McNally, Kaspi, Riemann, & Zeitlin, 1990; Moritz et al., 2004; Moritz et al., 2008; Unoki et al., 1999 (supraliminal presentation); Van den Heuvel et al., 2005). Interestingly, Van den Heuvel and colleagues (2005) reported differences in neural responses to OCD-related stimuli between OCD patients and controls, but found no significant difference in behavioral response.

In conclusion, there is conflicting evidence regarding an attentional bias for threat in adults with OCD. No studies yielded support for the hypothesis that patients with OCD show increased vigilance for threat. In addition, no evidence has been found for difficulties to disengage from threat in clinical OCD samples, although difficulty to disengage was reported in a non-clinical high-OC student sample. Results regarding interference by threat were also inconsistent.

However, only a limited number of studies have examined selective attentional processes in OCD. These studies show considerable variation in study design, and methodological shortcomings may have further contributed to the inconsistencies (e.g., Summerfeldt & Endler, 1998). For example, several paradigms were used, such as the emotional Stroop task, spatial cueing paradigms, and the dot probe task, and consequently different aspects of attentional processes were examined. Samples differed across studies, as well as comparison groups. Some studies were based on clinical samples whereas other studies used non-clinical samples, and sometimes only specific OCD subtypes were included. There was also variation in the selection of stimuli (words versus pictures), in specificity of the match between the stimuli and OC complaints, and in the exposure duration of stimuli.

Concerning the exposure duration of stimuli, there is some evidence that attentional processes may change over time. Cisler and Olatunji (2010) reported difficulty to disengage in students with OC symptoms for stimuli presented for 500 ms, but this was not found for stimuli presented for 100 ms. Unoki and colleagues (1999) found greater Stroop interference effects for OCD patients than healthy controls in a subliminal condition, but not in
Selective attention for threat in OCD

a supraliminal condition. Unfortunately no other studies have addressed this issue, which further complicates interpretation of the above results. Lonigan and colleagues (2004) proposed a theoretical model for the time-course of attentional processes in relation with anxiety. According to this model, highly anxious individuals display increased automatic attention towards threatening information (vigilance). Some individuals may be able to overcome this automatic bias and disengage attention from threat in a next phase. However, for others these correcting processes fail (difficulty disengaging from threat), and the bias for threat persists which may increase the risk for pathological anxiety (Lonigan, Vasey, Phillips, & Hazen, 2004). Following this model, patients with OCD can be expected to show increased vigilance for threat in an early phase of information processing and difficulty to disengage in a later phase.

The aim of the present study was to examine attentional bias, and more specifically vigilance, difficulty to disengage, and interference for OCD-related threat in a clinical sample of children with OCD, compared to children with other anxiety disorders and to a community sample of typically developing children. Stimuli were presented for either 500 ms or 1250 ms. Vigilance for threat may rely on early attentional processes and can therefore be best tapped via short stimulus exposure durations (i.e., 500 ms or less; Moritz et al., 2009). A stimulus exposure duration of 500 ms is often used in dot probe studies (e.g., Legerstee et al., 2009; Monk et al., 2006; Waters, Henry, Mogg, Bradley, & Pine, 2010), and although this duration may be too long to provide information on automatic attentional processes (e.g., Mogg & Bradley, 1998), it may provide information on fast orienting of attention (Bradley, Mogg, & Millar, 2000; Schrooten & Smulders, 2010). Disengagement, on the other hand, is assumed to be guided by controlled processes in a later phase of information processing. Disengagement may therefore be best tapped by longer stimulus exposure durations (Moritz et al., 2009). Stimulus presentation durations of 1250 are considered long enough for controlled processes to operate (Lonigan & Vasey, 2009). Selective attention for OCD-related threat and generally threatening stimuli were examined with a dot probe task. We used pictorial instead of word stimuli, as pictures do not rely on reading ability and may be less abstract, more ecologically valid and more attention-catching than words (Moritz et al., 2009; Waters, Lipp, & Spence, 2004). We hypothesized an increased attentional bias for OCD-related threat for children with OCD compared to the community sample, which could be explained by increased vigilance for threat initially (500
Towards improving treatment for childhood OCD

ms stimulus exposure), followed by difficulty to disengage from threat (1250 ms stimulus exposure). Similar results were expected for the anxiety sample regarding general threatening stimuli. In addition, we examined behavioral interference by (OCD-related) threat.

Method

Participants
The OCD sample consisted of 59 children (8–18 years) with a primary diagnosis of OCD who were referred for treatment to an academic centre for child and adolescent psychiatry (de Bascule, Amsterdam, n = 48; Accare, Groningen, n = 5; Curium, Leiden, n = 3), or a mental health care agency (Altrecht, Utrecht, n = 3). Participants participated in a broader study on neurobiological processes and treatment for childhood OCD. Inclusion criteria were a primary diagnosis of OCD according to DSM-IV TR criteria, complaints for at least 6 months, CY-BOCS score (see below) of 16 or more, and age between 8 and 18 years. Exclusion criteria were medication (SSRI) or CBT for OCD during the past six months, IQ below 80, and psychosis. One child was excluded because of extreme response times on the dot probe task. The final sample consisted of 58 children (26 boys, 45%), with a mean age of 12.8 years (SD = 2.5). CY-BOCS scores ranged from 16 to 35 (M = 24.6, SD = 4.3). Forty patients (69%) had one or more co-morbid disorders according to the Anxiety Disorder Interview Schedule for DSM-IV - Child and Parent Version (ADIS-C/P; Silverman & Albano, 1996a, 1996b) administered by trained clinicians. Co-morbid diagnoses were specific phobia (n = 18), social phobia (n = 16), generalized anxiety disorder (n = 10), separation anxiety disorder (n = 5), panic disorder (n = 2), PTSD (n = 1), dysthymic disorder (n = 9), depressive disorder (n = 4), ADHD (n = 6), and ODD (n = 5).

The anxiety sample consisted of 58 participants matched for age and gender with the OCD sample. Participants were children and adolescents with a primary anxiety diagnosis (except OCD or posttraumatic stress disorder) who were referred for treatment to an academic centre for child and adolescent psychiatry (de Bascule, Amsterdam, n = 19; Accare, Groningen, n = 39). They participated in a broader study into mechanisms of change in CBT for anxiety (see Hogendoorn et al., 2012). Inclusion criteria were a primary diagnosis of an
anxiety disorder according to DSM-IV TR criteria, and age between 8 and 18 years. Exclusion criteria were medication (SSRI) or CBT for anxiety during the past six months, IQ below 80, suicidal ideation, psychosis, and drugs or alcohol abuse. The sample consisted of 26 boys (45%), mean age was 12.8 years ($SD = 2.5$). Primary diagnoses according to the ADIS-C/P were Social Phobia ($n = 26$), Specific Phobia ($n = 10$), Generalized Anxiety Disorder ($n = 10$), Panic Disorder with or without Agoraphobia ($n = 7$), and Separation Anxiety Disorder ($n = 5$). Thirty-three children (57%) had one or more co-morbid disorders, including other anxiety disorders ($n = 33$), mood disorders ($n = 8$), and externalizing disorders ($n = 1$).

The community sample (COMM) was recruited from several elementary and secondary schools and a university (first year students) in the Netherlands, as part of a broader study into information processing. Children were excluded if they (had) received treatment for OCD or anxiety or reported high levels of anxiety (state or trait anxiety levels above the mean score + 1 SD of the corresponding reference group described in the manual of the STAI-C or STAI). Written informed consent of parents and children was obtained. The community sample consisted of 58 Dutch children and adolescents (8–18 years) matched with the OCD sample for gender and age. Mean age was 12.9 years ($SD = 2.8$), 26 of the participants were boys (45%).

**Measures**

The *dot probe detection task* consisted of ten practice trials and two blocks of 80 critical trials each, separated by a short break. Each trial started with a central fixation cross for 500 ms, followed by a pair of colored pictures on a white background. Pictures (94 x 70 mm) appeared left and right of the centre of the screen; the centre of the pictures was located at respectively 1/4th and 3/4th of the width of the screen). Half of the picture pairs were displayed for 500 ms and the other half for 1250 ms in random order. The sequence of trials was equal for each participant. Immediately following the pictures, a white dot (5 mm diameter) appeared at one of the picture locations. The dot remained visible until the participant pressed a response button. The intertrial interval was 1000 ms. Response time was recorded as soon as the participant pressed one of the two response buttons (“Q” or “P”) using a QWERTY keyboard.

Pictures were selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005), based on the ratings of all subjects and when
Towards improving treatment for childhood OCD

available children’s ratings. The selection of IAPS pictures in other childhood studies (Waters et al., 2004; Waters, Lipp, & Spence, 2005) was taken into account. Furthermore, a selection of IAPS stimuli was validated for Dutch children (Kolman, 2009). The selected stimuli were considered suitable for children according to experienced child therapists (4th and 6th author). OCD-related pictures (O; n = 20) included disasters, contamination, and dirty or messy scenes (seven pictures of the OCD and threat category were overlapping). These pictures covered different OCD subtypes (contamination fear/cleaning, obsessions/checking, symmetry/ordering; Mataix-Cols, do Rosario-Campos, & Leckman, 2005). Threatening pictures (T; n = 20) had a low valence score (< 4.0) and/or were representative for different subtypes of anxiety, and included animals, medical scenes, disasters (e.g., nature, fire), accidents, violence, and test anxiety. Neutral stimuli (N; n = 50) had medium valence (4.0–6.0) and low arousal (< 4.0) scores, and contained for example household items and mushrooms. Positive pictures (P; n = 20) were also included. Picture pairs consisted of the following combinations: NN, NT, NO, ON, PN and NP. All combinations were displayed ten times per stimulus exposure duration (five congruent, five incongruent trials), NN trials were displayed 20 times per stimulus exposure duration. Pictures were matched on brightness, complexity, and color. Within each block, all trial types were equally represented. Each emotional picture (OCD-related, general threat, positive) was displayed two times, neutral pictures were displayed four times in two different combinations. The dot probe task was presented on a Dell Inspiron 9300 laptop with a 17-inch color monitor, and run in E-prime (version 1). Positive stimuli were not included in the analyses, as this is beyond the scope of the present study.

The State-Trait Anxiety Inventory for Children (STAI-C; Bakker, Van Wieringen, Van der Ploeg & Spielberger, 1989; Spielberger, Edwards, Lushene, Montuori, & Platzek, 1973) consists of a state and a trait anxiety scale. Both scales contain 20 items, answer categories range from 1 to 3. A higher score indicates a higher level of anxiety. For children 15 years and older (16 years for the community sample), the adult version was used (STAI; Spielberger, 1983; Van der Ploeg, 1983). The following IAPS pictures were used: Threat: 1120, 1205, 1525, 1932, 2410, 3210, 3230, 3280, 3550, 5950, 6250, 6312, 6350, 6370, 8485, 9050, 9592, 9910, 9911, 9921; OCD: 1280, 2446, 2720, 2750, 3230, 3550, 4613, 7057, 7360, 7710, 8485, 9008, 9050, 9290, 9301, 9337, 9390, 9910, 9911, 9921; Positive: 1463, 1920, 1999, 2216, 2303, 2339, 2341, 2395, 7390, 7410, 7460, 7470, 8034, 8120, 8200, 8380, 8420, 8461, 8496; Neutral: 2038, 2102, 2191, 2396, 2579, 2593, 2620, 2745, 2870, 2880, 2980, 5390, 5471, 5500, 5510, 5520, 5530, 5531, 5532, 5533, 5534, 5740, 7010, 7025, 7030, 7033, 7034, 7035, 7036, 7038, 7039, 7041, 7050, 7056, 7058, 7059, 7080, 7100, 7140, 7170, 7175, 7192, 7217, 7235, 7242, 7490, 7493, 7546, 7590, 7595, 9360; Practice: 2235, 2393, 2513, 2850, 7000, 7004, 7006, 7009, 7020, 7035, 7055, 7060, 7090, 7150, 7190, 7233, 7235, 7495, 7550, 7705, 7950.
Selective attention for threat in OCD

2000). In the STAI, answer categories range from 1 to 4. To compare both versions of the STAI, scores of both questionnaires were converted to z-scores based on the norm tables in the corresponding manual. Reference groups are primary school or secondary school (boys/girls) for the STAI-C (Bakker et al., 1989), and community sample (inhabitants of Leiden; young; men/women) for the STAI (Van der Ploeg, 2000). Internal consistency for the STAI-C and for the STAI was acceptable to good (Bakker et al., 1989; Van der Ploeg, 2000). Cronbach’s α in the present OCD sample was .88 and .95 for state anxiety, and .98 and .91 for trait anxiety for the STAI-C and STAI respectively. Cronbach’s α in the anxiety sample was .89 and .91 for state anxiety, and .90 and .94 for trait anxiety. Cronbach’s α in the community sample was .80 and .92 for state anxiety, and .90 and .12 for trait anxiety (this low value is probably due to low variance within the present sample).

The Revised Child Anxiety and Depression Scale - Child Version (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) is a 47-item self-report questionnaire concerning symptoms of anxiety and depression. The questionnaire is composed of six subscales: separation anxiety disorder (SAD), social phobia (SP), generalized anxiety disorder (GAD), panic disorder (PD), obsessive-compulsive disorder (OCD) and major depression disorder (MDD). Items are scored on a four-point scale ranging from 0 (never) to 3 (always); higher scores reflect more symptoms. Internal consistencies of the subscales were generally good (Chorpita, Moffitt, & Gray, 2005). Cronbach’s α in the present study was .72–.90 in the OCD sample, .66–.87 in the anxiety sample, and .62–.84 in the community sample. For the purpose of the present study, the RCADS SAD, SP, GAD and PD subscales were summed up and reported as anxiety sumscore (range 0–93).

The Children’s Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997) is a clinician-rated semi-structured interview describing the severity of OC symptoms. The CY-BOCS is divided into an obsession and a compulsion scale. Each scale contains five items concerning frequency/time, interference, distress, resistance, and control. All items are rated by the clinician on a five-point scale from 0 to 4. The total score, the sum of both scales, ranges from 0 to 40. A total score of 16 or more is considered as clinically significant (e.g., The Pediatric OCD Treatment Study (POTS) Team, 2004). The CY-BOCS demonstrated good internal validity and adequate divergent and convergent validity (Scahill et al., 1997). Cronbach’s α for the OCD sample in the present study was .77.
Towards improving treatment for childhood OCD

Procedure
In the OCD and anxiety sample, children and their parents were informed about the broader studies into mechanisms of change in CBT for OCD or anxiety during the intake procedure. Both studies have been approved by the Medical Ethics Committee of the Academic Medical Center. Written informed consent was obtained from children and their parents. Participants were assessed prior to treatment. During this assessment several questionnaires were filled out and children completed the dot probe task and other computer tasks. The CY-BOCS was administered to the child and parents by a trained clinician in the OCD sample.

In the community sample, children were individually tested in a quiet room at their school or at the university by trained clinical psychology graduate students. After the purpose and procedure of the study were explained, participants filled out several questionnaires and completed the dot probe task and a second computer task.

Samples were matched on age and gender. Each sample contained the same number of participants within the following age groups: 8–9, 10–11, 12–13, 14–15, and 16–18 years. Furthermore, each sample contained the same number of boys and girls 8–12 and 12–18 years old.

Results
Descriptives and Data Preparation
Table 1 shows characteristics (age, gender, OCD, anxiety, and depression) of the participants. Response time (RT), defined as the time from the appearance of the dot until response by pressing a button, was measured in milliseconds. Erroneous responses and outliers (RT < 200 ms, RT > 3000 ms, and RT > 3SD from the individual mean) were excluded from analyses (4.0% of the data). One participant from the OCD sample was excluded (mean RT > 3 SD above the sample mean). Table 2 presents mean RT and standard deviations. Because RT was not normally distributed, data were log-transformed. Only significant effects are reported ($p < .05$).
Selective attention for threat in OCD

Table 1 Age, gender, and measures for anxiety, OCD, and depression per sample

<table>
<thead>
<tr>
<th></th>
<th>OCD sample</th>
<th>Anxiety sample</th>
<th>Community sample</th>
<th>Difference between samples (one-way ANOVA)</th>
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<tr>
<td></td>
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<td>N = 58</td>
<td>N = 58 (one-way ANOVA)</td>
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<tr>
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<td>M (SD)</td>
<td>M (SD)</td>
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<td>12.9 (2.8)</td>
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<td>5.2%</td>
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<td>0.0%</td>
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<td>0.4 (1.0)</td>
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<td>OCD = anx &gt; comm</td>
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<td>(z-score)</td>
<td>-2.3–3.4</td>
<td>-1.8–2.9</td>
<td>-1.8–1.5</td>
<td></td>
</tr>
<tr>
<td>STAI(-C) trait anxiety</td>
<td>0.8 (1.1)</td>
<td>0.6 (1.3)</td>
<td>0.1 (1.0)</td>
<td>OCD = anx &gt; comm</td>
</tr>
<tr>
<td>(z-score)</td>
<td>-1.3–2.7</td>
<td>-2.1–3.2</td>
<td>-2.0–2.0</td>
<td></td>
</tr>
<tr>
<td>RCADS OCD</td>
<td>10.0 (4.3)</td>
<td>3.7 (3.0)</td>
<td>3.8 (3.5)</td>
<td>OCD &gt; anx = comm</td>
</tr>
<tr>
<td>(range 0–18)</td>
<td>0.0–18.0</td>
<td>0.0–10.0</td>
<td>0.0–14.0</td>
<td></td>
</tr>
<tr>
<td>RCADS anxiety sumscore</td>
<td>27.4 (13.4)</td>
<td>26.5 (14.3)</td>
<td>18.3 (12.3)</td>
<td>OCD = anx &gt; comm</td>
</tr>
<tr>
<td>(range 0–93)</td>
<td>3.0–71.0</td>
<td>3.0–54.0</td>
<td>2.0–48.0</td>
<td></td>
</tr>
</tbody>
</table>

Note. Anx = anxiety, comm. = community; n/a = not available. Educational levels: low = primary school/ lower secondary or vocational education, medium = higher general secondary education/intermediate vocational education, high = higher vocational education or university. Sample sizes varied across measures due to missing data: community sample STAI(-C) state n = 57, STAI(-C) trait n = 55, RCADS n = 49; anxiety sample: RCADS n = 57.

Analyses

Attentional bias scores for threat and OCD trials were calculated by comparing RT for congruent trials to RT for incongruent trials for each participant (e.g., Bradley et al., 1998; MacLeod et al., 1986). Vigilance was calculated by comparing RT for congruent trials to RT for neutral trials. A faster response to congruent trials than to neutral trials is indicative of vigilance. Difficulty to disengage was calculated by comparing RT for incongruent trials to RT for neutral trials. A slower response to incongruent trials than neutral trials indicates difficulty to
Towards improving treatment for childhood OCD

disengage (see Koster et al., 2004). Interference was calculated by comparing RT for OCD/threat trials (congruent and incongruent together) to RT for neutral trials. A slower response to OCD/threat-trials than neutral trials is indicative of interference by threat. Effect sizes for the effects of interest were reported as generalized eta squared ($\eta^2_G$). An effect size of .02 indicates a small effect, .13 a medium effect, and .26 a large effect (Bakeman, 2005).

**Table 2.** RT (ms) per sample and condition

<table>
<thead>
<tr>
<th></th>
<th>OCD-related threat</th>
<th>General threat</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500 ms</td>
<td>1250 ms</td>
<td>500 ms</td>
</tr>
<tr>
<td></td>
<td>Congr M (SD)</td>
<td>Incongr M (SD)</td>
<td>Congr M (SD)</td>
</tr>
<tr>
<td>OCD</td>
<td>503 (128)</td>
<td>483 (120)</td>
<td>445 (98)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>541 (127)</td>
<td>530 (133)</td>
<td>499 (110)</td>
</tr>
<tr>
<td>Comm</td>
<td>500 (124)</td>
<td>485 (138)</td>
<td>459 (108)</td>
</tr>
</tbody>
</table>

Note. Congr = congruent, incongr = incongruent.

**Attentional bias**

To test the hypothesis that the OCD sample shows an attentional bias for OCD-related threat, and the anxiety sample for general threat, 2 (exposure duration: 500 ms, 1250 ms) x 2 (congruency: congruent, incongruent) mixed design ANOVAs with sample as between subjects factor were performed for OCD and for threat trials.

Results for OCD stimuli showed a significant main effect of exposure duration on RT, $F(1, 171) = 186.69, p < .001$, a significant main effect of congruency, $F(1, 171) = 12.15, p = .001$, a significant interaction effect between exposure duration and congruency, $F(1, 171) = 9.05, p < .01, \eta^2_G = .003$, a significant main effect of sample, $F(2, 171) = 3.11, p < .05$, and a significant interaction effect between exposure duration and sample, $F(2, 171) = 4.51, p < .05$. There were no significant interaction effects between congruency and sample. To break down the interaction between exposure duration and congruency, we computed separate repeated measures ANOVAs for the 500 ms and 1250 ms condition with congruency as within subjects factor. Results for the 500 ms condition revealed a small significant effect of congruency, $F(1, 173) = 19.97, p < .001, \eta^2_G = .008$. All participants responded slower to congruent than incongruent trials, indicating an attentional bias away from OCD-related threat. Results for the
Selective attention for threat in OCD

1250 ms condition revealed no significant effect of congruency, indicating no attentional bias.

Results for threat stimuli showed a significant main effect of exposure duration on RT, \( F(1, 171) = 183.18, p < .001 \), and a significant interaction effect between exposure duration and congruency, \( F(1, 171) = 6.37, p < .05, \eta^2_G = .003 \). There was a significant main effect of sample, \( F(2, 171) = 3.37, p < .05 \), but sample did not interact with the other variables. To break down the interaction between exposure duration and congruency, we computed separate repeated measures ANOVAs for the 500 ms and 1250 ms condition with congruency as within subjects factor. Results for the 500 ms condition revealed a small significant effect of congruency, \( F(1, 173) = 7.91, p < .01, \eta^2_G = .003 \). All participants responded faster to congruent than incongruent trials, indicating an attentional bias towards threat. Results for the 1250 ms condition revealed no significant effect of congruency, indicating no attentional bias.

**Vigilance**

To test the hypothesis that children with OCD show increased vigilance for OCD-related threat in the 500 ms condition, and children with other anxiety disorders for generally threatening stimuli, separated mixed design ANOVAs were performed for threat and OCD trials (500 ms condition) with valence as within subjects variable (Neutral-Neutral vs Threat\textsubscript{congruent}/OCD\textsubscript{congruent}), sample as between subjects factor, and RT as dependent variable.

Results for OCD stimuli showed a small significant effect of valence on RT, \( F(1, 171) = 91.80, p < .001, \eta^2_G = .03 \). Participants responded slower to congruent OCD trials than to neutral trials, indicating a negative vigilance effect.

Results for threat stimuli showed a small to medium effect of valence on RT, \( F(1, 171) = 101.60, p < .001, \eta^2_G = .05 \), and a significant main effect of sample, \( F(2, 171) = 3.49, p < .05 \). Participants responded slower to congruent threat trials than to neutral trials, indicating a negative vigilance effect.

**Difficulty to disengage**

With regard to the hypothesis that children with OCD show difficulty to disengage from OCD-related threat, and children with other anxiety disorders from generally threatening stimuli in the 1250 ms condition, separated mixed design ANOVAs were performed for threat and OCD trials (1250 ms condition) with valence as within subjects variable (Neutral-Neutral vs Threat\textsubscript{incongruent}/
Towards improving treatment for childhood OCD

OCD\textsubscript{incongruent}, sample as between subjects factor, and RT as dependent variable. Results for OCD stimuli showed a small significant main effect of valence on RT, $F(1, 171) = 15.90, p < .001, \eta^2_G = .005$, and a significant main effect of sample, $F(2, 171) = 3.67, p < .05$. Participants responded slower to incongruent threat trials than to neutral trials, indicating difficulty to disengage from OCD-related threat.

Results for threat stimuli also showed a small significant effect of valence on RT, $F(1, 171) = 43.75, p < .001, \eta^2_G = .02$, and a significant main effect of sample, $F(2, 171) = 4.30, p < .05$. Participants responded slower to incongruent threat trials than to neutral trials, indicating difficulty to disengage from threat.

**Interference**

To test the hypothesis that (OCD-related) threatening information interferes with behavioral responses, we performed separate 2 (exposure duration) X 2 (valence: threat/OCD vs neutral) mixed design ANOVA with sample as between subjects factors for threat and OCD trials.

Results for OCD trials showed a significant main effect of exposure duration on RT, $F(1, 171) = 198.05, p < .001$, a significant main effect of valence, $F(1, 171) = 95.81, p < .001$, and a significant interaction effect between exposure duration and valence, $F(1, 171) = 7.82, p < .01, \eta^2_G = .002$. There was a significant main effect of sample, $F(2, 171) = 3.30, p < .05$, but no significant interaction between valence and sample. Visual inspection of the results suggested interference by OCD-related threat which decreased from the 500 ms condition to the 1250 ms condition. To break down the interaction between exposure duration and valence, we computed separate ANOVAs for the 500 ms and the 1250 ms condition with valence as within subjects factor. Results for the 500 ms condition revealed a small significant main effect of valence, $F(1, 173) = 77.99, p < .001, \eta^2_G = .02$. All participants responded slower to OCD-related threat trials than to neutral trials, indicating interference by OCD-related threat. Results for the 1250 ms condition also revealed a small significant main effect of valence, $F(1, 173) = 31.93, p < .001, \eta^2_G = .008$. Similar to the 500 ms condition, all participants responded slower to OCD-related threat trials than to neutral trials, indicating interference by OCD-related threat.

Results for threat trials showed a significant main effect of exposure duration on RT, $F(1, 171) = 228.40, p < .001$, a significant main effect of valence, $F(1, 171) = 225.56, p < .001$, and a significant interaction effect between
Selective attention for threat in OCD

exposure duration and valence, $F(1, 171) = 12.62, p < .001, \eta^2_G = .004$. There was a significant main effect of sample, $F(2, 171) = 3.48, p < .05$, but sample did not interact with the other variables. Visual inspection of the results suggested interference by threat which decreased from the 500 ms condition to the 1250 ms condition. To break down the interaction between exposure duration and valence, we computed separate repeated measures ANOVAs for the 500 ms and the 1250 ms condition with valence as within subjects factor. Results for the 500 ms condition revealed a small to medium effect of valence, $F(1, 173) = 195.86, p < .001, \eta^2_G = .06$. All participants responded slower to threat trials than to neutral trials, indicating interference by threat. Results for the 1250 ms condition revealed a small significant main effect of valence, $F(1, 173) = 77.32, p < .001, \eta^2_G = .03$. All participants responded slower to threat trials than to neutral trials, indicating interference by threat.²

Discussion

In the present study, we examined selective attention for disorder-specific threat in children with OCD (8–18 years, $N = 58$), in children with anxiety disorders ($N = 58$), and in typically developing children ($N = 58$). More specifically, we examined attentional bias, vigilance, difficulty to disengage, and behavioral interference for OCD-related threat and general threat stimuli displayed for 500 and 1250 ms using a dot probe task. We expected children with OCD to show an increased attentional bias towards OCD-related threat compared to the community sample, consisting of increased vigilance for OCD-related threat initially (500 ms stimulus exposure), followed by difficulty to disengage from OCD-related threat (1250 ms stimulus exposure). Similar hypotheses were formulated for the anxiety sample regarding general threat stimuli.

No evidence was found for increased selective attention for disorder-specific threat in children with OCD and other anxiety disorders compared to the community sample. All children showed a bias away from OCD-related threat stimuli, and a bias towards general threat stimuli displayed for 500 ms.

² We repeated all analyses with age included as a covariate in the ANOVAs. The same pattern of results was obtained. With one exception: the attentional bias for general threat trials displayed for 500 ms did not reach significance anymore. Although this finding emphasizes the importance for future studies into selective attention for threat in children to take developmental level into account, it has no implications for the present results indicating no increased selective attention for children with OCD or anxiety disorders.
Towards improving treatment for childhood OCD

No bias was found for OCD and general threat stimuli displayed for 1250 ms, suggesting that the attentional biases disappeared over time. In addition, we found no evidence of vigilance for threat displayed for 500 ms. All participants, independent of sample, showed difficulty to disengage from (OCD-related) threat stimuli displayed for 1250 ms.

We also examined whether behavioral interference by threatening information had played a role in the present study. Results showed that response times for trials containing (OCD-related) threat stimuli were slowed down in all children, suggesting interference by threatening information. Interference effects were larger for (OCD-related) threat stimuli displayed for 500 ms than for stimuli displayed for 1250 ms. There were no differences in interference effects between children with OCD, children with other anxiety disorders, and typically developing children. These findings suggest that behavioral responses can be affected by the presence of threatening information, but children with OCD do not seem to differ from other children in this respect.

When exposure to threatening information interferes with response times, vigilance and difficulty to disengage cannot be soundly measured. Vigilance can be masked by interference, and results indicating difficulty to disengage can reflect interference effects (see also Koster et al., 2004; Mogg et al., 2008). The negative vigilance effect that we found for (OCD-related) threat stimuli (i.e., a slower response to congruent threat trials than to neutral trials) can be explained by interference effects. In addition, our findings concerning difficulty to disengage from threat (i.e., a slower response to incongruent threat trials than to neutral trials) may reflect a more general interference effect. This is not per definition true for attentional bias scores. Attentional bias reflects the difference in response time between congruent and incongruent threat trials, without a comparison to neutral trials. As interference can be expected to be similar for both congruent and incongruent threat trials, attentional bias scores may not be affected by interference (e.g., Mogg et al., 2008).

In sum, the present results suggest that children with OCD and anxiety disorders do not show increased selective attention for (OCD-related) threat compared to typically developing children. Although some studies in adults yielded evidence for an attentional bias in OCD (Amir et al., 2009; Cisler & Olatunji, 2010; Tata et al., 1996), results across studies have been equivocal and no increased selective attention has been reported by other studies (e.g., Harkness et al., 2009; Moritz & von Muehlenen, 2008; Moritz et al., 2009).
Unexpectedly, results showed a bias towards general threat stimuli displayed for 500 ms, and a bias away from OCD-related threat stimuli. This indicates that, despite some overlap, the OCD-related threat and general threat stimuli presented different stimulus-categories. A possible explanation of the different direction of the bias is the inclusion of dirty scenes in the OCD category. These pictures may have raised disgust instead of anxiety, and consequently participants may have directed attention away from these unpleasant pictures (e.g., Olatunji, Cisler, Mckay, & Phillips, 2010). However, evidence for the direction of attentional bias for threat is equivocal. For example, although most studies in anxious children found evidence for a bias towards threat (e.g., Roy et al., 2008; Taghavi, Neshat-Doost, Moradi, Yule, & Dalgleish, 1999), some studies have reported a bias away from threat (Monk et al., 2006; Stirling, Eley, & Clark, 2006).

When interpreting the results of the present study, several limitations should be considered. First, the selection of OCD-related stimuli was a complex task. For practical reasons and in order to keep in line with previous research, we decided to use IAPS pictures. Our selection included disasters, contamination, and dirty and messy scenes to cover a broad range of OC symptoms. A disadvantage of this strategy is that only a small proportion of the pictures may have been relevant for each participant. Moreover, as OC symptoms tend to be very specific, it is questionable whether the stimuli appealed to individual concerns. Thus, the absence of increased selective attention in children with OCD may have been due to the selection of stimuli in the present task. In future studies, it would be interesting to examine idiosyncratic stimuli, which could be pictures made by the participants of personally relevant objects or situations that trigger OC symptoms. However, the findings that all children showed a bias away from OCD-related threat stimuli and that response times were slowed down for trials containing OCD-related threat compared to neutral trials, suggest that attention was captured by the OCD stimuli more than by neutral stimuli. Second, 55% of the children in our OCD sample had co-morbid anxiety disorders. We did not exclude children with co-morbid anxiety as high co-morbidity rates are inherent to OCD (e.g., Geller et al., 2000; The POTS Team, 2004), and excluding this subgroup would have limited the generalizability of the results.

To conclude, results of the present study do not provide evidence for increased selective attention for OCD-specific threatening information as an
Towards improving treatment for childhood OCD

underlying mechanism in childhood OCD, nor for increased selective attention for general threatening information in other childhood anxiety disorders. Recently, attentional bias training procedures have been developed for OCD and anxiety (see for example Cowart & Ollendick, 2011; Najmi & Amir, 2010). The results of the present study do not support the addition of attentional bias training to regular, evidence-based treatment for children and adolescents with OCD. However, as this is the first study examining attentional bias to OCD-related threat in childhood OCD the findings should be replicated. At this stage, more research is needed into attentional processes in childhood OCD. For future studies, it would be interesting to use idiosyncratic stimuli, to distinguish between specific subtypes of OCD, to take developmental level into account, and to include subliminal stimulus exposure durations to examine automatic attentional bias.