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SHORT COMMUNICATION

Attentional bias in individuals with obsessive-compulsive disorder: A preliminary eye-tracking study

Mairead Mullen[a], Donncha Hanna[a], Maria Bradley[b], Dave Rogers[b], Julie-Ann Jordan[b], Kevin F.W. Dyer[a,b,*]

[a] *School of Psychology, Queen's University Belfast, Belfast, Northern Ireland*
[b] *Northern Health and Social Care Trust, Antrim, Northern Ireland*

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Assessment

Abstract Attentional biases have been overlooked as a treatment focus in CBT practice. This pilot study examined patterns of attentional bias in an OCD clinical sample with a view to understanding the key mechanisms in order to inform assessment and intervention. It was hypothesised that individuals with OCD would demonstrate vigilance, delayed disengagement, and maintenance attentional biases towards OCD-related stimuli relative to a matched control group. Participants with OCD ($n = 16$) were compared with healthy controls ($n = 16$) matched by age and gender. Vigilance, disengagement and maintenance biases were measured by recording eye-movements during a free gaze task in which pairs of neutral-OCD and neutral-aversive images were presented. The OCD group demonstrated no evidence of vigilance or delayed disengagement biases toward OCD stimuli but did exhibit a maintenance bias towards OCD and, to a lesser extent, general aversive images. Clinical implications include the assessment of patient attentional biases to aid CBT interventions.

* Corresponding author. Psychological Therapies Service, Northern HSC Trust, Ferrard House, Antrim BT41 4AB, Northern Ireland.
Adresses e-mail : mmcmahon05@qub.ac.uk (M. Mullen), donncha.hanna@qub.ac.uk (D. Hanna), Maria.Bradley@westerntrust.hscni.net (M. Bradley), dave.rodgers@northerntrust.hscni.net (D. Rogers), Julie-ann.jordan@northerntrust.hscni.net (J.-A. Jordan), k.dyer@qub.ac.uk (K.F.W. Dyer).

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Attentional biases refer to the preferential allocation of attention towards certain classes of information, and feature prominently in theoretical models informing cognitive behavioural therapy [CBT] (Corrigan, Hanna, & Dyer, 2020). Individuals with obsessive-compulsive disorder (OCD) are believed to be less able to disregard aversive forms of intrusive thought and imagery. This leads to the disproportionate allocation of attentional resource to these cognitions, which, in turn, provokes compulsive behaviours as a means to neutralise the distress caused by this enhanced mental action (Salkovskis, 1999).

Despite representing a significant maintaining factor in OCD, attentional biases have been relatively overlooked as a treatment focus in CBT practice. Clinical approaches targeting attentional biases have evolved separately in the field of cognitive science. Posner and Peterson's theory of spatial attention hypothesised that attending to environmental stimuli involves orientation ('shift'), holding ('engage'), and then release ('disengagement') mechanisms (Posner & Peterson, 1990). The 'shift' and 'engage' elements are thought to underpin the *vigilance* attentional bias, in which individuals with OCD demonstrate a faster orienting response to threat-related stimuli (MacLeod, Mathews, & Tata, 1986). The 'disengagement' mechanism refers to later stages of processing, with a *delayed disengagement* bias manifesting as slow and effortful release of visual attention from one location to another. Similarly, a *maintenance* attentional bias can also occur after the 'disengagement' process, when an individual subsequently and repeatedly re-'engages' attention towards threatening stimuli (Armstrong & Olatunji, 2012). It is clear that mapping which of these biases are central in perpetuating symptoms in both the wider OCD population and individual patients (e.g., intake assessment) are vital avenues of empirical scrutiny.

Eye-tracking studies investigating spatial attentional biases in OCD have yielded mixed findings on largely non-clinical populations. Armstrong and colleagues found evidence of attentional bias towards threat stimuli amongst individuals with contamination fears (Armstrong Olatunji, Sarawgi, & Simmons, 2010; Armstrong, Sarawgi, & Olatunji, 2012). However, their results relating to the role of vigilance and maintenance in OCD were equivocal, possibly due to study design issues. Bradley et al. (2016) used a free gaze task to present healthy volunteers with pairs of neutral and OCD-related visual stimuli, or neutral and aversive visual stimuli. Overall, the findings provided support for the *maintenance* attentional bias in OCD rather the *vigilance* bias.

This present investigation represents a pilot study into OCD-related attentional biases using a clinical population and the methodology developed by Bradley et al. (2016). A primary aim was to understand the role of spatial attention in OCD with a view to exploring how these biases might be applied to CBT assessments and treatment plans. It was hypothesised that individuals with OCD would demonstrate vigilance, delayed disengagement, and maintenance biases towards OCD-related stimuli relative to a matched control group.

Method

Participants

The OCD group consisted of 16 treatment-seeking patients with an OCD diagnosis (American Psychiatric Association, 2013). A control group of 16 healthy volunteers were selected from a previous study (see Bradley et al., 2016), using age and gender as matching criteria. Both conditions were composed of 9 females and 7 males with a mean age of 37.06 years (*SD* = 12.88) in the OCD group and 36.75 years (*SD* = 13.34) in the control group. All control participants reported obsessive-compulsive symptoms in the sub-clinical range of both the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002) and the Yale-Brown Obsessive-Compulsive Scale - Self-Report Severity scale (YBOCS-SR; Baer, 1992). Mean years in education was 15.81 (*SD* = 2.66) for OCD participants and 16.88 (*SD* = 3.32) for controls.

General inclusion and exclusion criteria were: 1) aged 18 or above; 2) normal, or corrected to normal vision; and 3) negative history of a relevant neurological condition (e.g., epilepsy).

Materials and apparatus

The YBOCS-SR (Baer, 1992) comprises 10 items assessing obsessions and compulsions. The OCI-R (Foa et al., 2002) is composed of six OCD-related subscales (washing, checking, hoarding, order, obsessing and neutralising). Both OCD measures have good reliability and validity (Federici et al., 2010; Sica et al., 2009).

Stimuli

From the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008) 230 neutral and 40 aversive images were selected. The Maudsley Obsessive-Compulsive Stimuli Set (MOCSS; Mataix-Cols, Lawrence, Wooderson, Speckens, & Phillips, 2009), was used to select 160 OCD-images, including an equal number of images from four symptom subcategories (washing, checking, hoarding, and order). Images were balanced for luminance and colour. Aversive images were included alongside neutral stimuli as control conditions, to determine the extent to which attentional biases were influenced by OCD-related or general aversive threat-related characteristics.

Each trial (n = 200) comprised two photographic images measuring 40 mm x 60 mm placed 100 mm apart on a white background. Images were one neutral and one OCD-related or aversive photograph, which occurred pseudo-randomly in the left or right position.

Eye-tracking apparatus

Stimuli were presented using E-Prime Software (Version 3.0) on a high-resolution computer screen. Areas of Interest were coded according to the predefined spatial parameters of the on-screen image locations and dimensions. Eye movements were recorded using the iView X Remote Eye-tracking Device (RED 250) from SensoMotoric Instruments. A continuous sampling rate of 250 hz was used. Fixations were detected and measured if gaze remained static to within 100 pixels for a minimum of 80ms.

Measures of attention bias

Eye-tracking measures of attentional bias corresponding to *vigilance*, *delayed disengagement* and *maintenance* were identical or similar to those used in other eye-tracking research (e.g., Armstrong et al., 2012; Bradley et al., 2016).

Vigilance.

Direction of initial fixation. The mean proportion of initial fixations that occurred on each stimulus type — OCD/Neutral/Aversive.

Latency to initial fixation. The mean time (ms) between trial onset and first fixation to each stimulus type.

Disengagement.

Duration of initial fixation. The mean duration (ms) of first fixation on each stimulus type.

Maintenance.

Total number of fixations. The mean number of total fixations on each stimulus type over the course of all trials.

Cumulative duration of fixations. The total duration of fixations upon each stimulus type over the course of all trials.

Procedure

Participants were seated 70 cm in front of the eye tracking device and asked to fixate on a central cross-point for at least 2000ms prior to trial commencement. Participants were instructed to look wherever their gaze was drawn during each trial, which was presented for 2000ms and replaced by a central fixation cross. Fifteen practice trials were run followed by experimental trials presented in ten blocks of twenty. Following the attention task, participants completed the self-report measures.

Results

The OCD and control groups did not differ by age (t (30) = −0.07, p = .947) or years of education (t (30) = 0.99, p = .326). All participants in the OCD and control conditions had symptom scores within their respective clinical and subclinical ranges. Mean OCI-R and YBOCS-SR scores were 31.44 (SD = 11.63) and 21.75 (SD = 4.62) for the OCD group respectively and 5.63 (SD = 3.20) and 1.88 (SD = 1.99) for controls respectively. Table 1 contains the mean scores obtained by the groups on measures of attentional biases.

Primary analyses were 2 × 3 Mixed Analysis of Variance (ANOVA) with Group (OCD, Control) as the between-participants factor and Stimulus (Neutral, OCD or Aversive) as the within-participants factor for all outcome variables (Table 1).

Vigilance

No significant effects were found for *direction of initial fixation*. For the *latency to initial fixation measure*, only the Group effect reached significance, with the large effect size reflecting shorter mean latencies for the OCD group (M = 131.93, SE = 10.81) than the control group (M = 197.08, SE = 10.81).

Disengagement

For the *duration of initial fixation* measure, the group effect was significant and of large effect size, with shorter initial fixations for the OCD group (M = 73.32, SE = 5.79) compared to the control group (M = 102.02, SE = 5.79).

Maintenance

A significant large effect size Stimulus * Group interaction was observed (Fig. 1) for *total number of fixations*. Pairwise comparisons showed that the OCD group fixated significantly more times upon both aversive, (t (15) = -3.41, p = 002), and OCD stimuli, (t (15) = −2.22, p = .042), relative to neutral stimuli. The control group looked for significantly more time at neutral, (t (15) = −5.01, p < .001), and aversive stimuli, (t (15) = 2.54. p = .023), compared to OCD stimuli. The control group had no significant differences in the total number of fixations upon neutral and aversive stimuli.

A significant large effect size Group * Stimulus interaction was also evident for *cumulative duration of fixations* (see Fig. 2). Pair-wise comparisons showed that the OCD group fixated for longer overall on both aversive (t (15) = 8.22, p < .001) and OCD-related stimuli (t (15) = −2.63, p = .019) relative to neutral stimuli. By contrast, the control group spent significantly less time overall looking at OCD-related stimuli (t (15) = 2.14, p = 049) and more time looking at aversive stimuli (t (15) = 15.68, p < .001) relative to neutral stimuli.

Discussion

The results of the present study were concordant with cognitive models of OCD (e.g., Salkovskis, 1999) and provide new insight into information processing mechanisms relevant to CBT interventions. Contrary to the hypotheses, individuals with OCD were not specifically vigilant to OCD stimuli or less able to withdraw attention from such stimuli (i.e., delayed disengagement). Rather, the evidence of both faster initial engagement and disengagement indicates that individuals with OCD are *generally* more hypervigilant to all stimuli, as opposed to displaying distinct vigilance to any specific type of image. Nevertheless, there was clear evidence of a *maintenance* attentional bias. The OCD group made significantly more fixations upon both OCD-related and aversive stimuli compared to controls, and spent longer overall examining both of these stimuli-types. This suggests that beyond the first fixation, individuals with OCD make repeated brief glances toward threat-related stimuli; disengagement is fleeting, but attention appears to remain broadly engaged with images and other environmental phenomena relevant to their OCD presentation.

The findings have several important implications for CBT practice. Initial assessments of OCD would benefit from including an examination of patient attentional biases, similar to the scrutiny given to more established cognitive concepts (e.g., appraisals). This could take several

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Table 1 Group mean and mixed ANOVA results for each measure of attentional bias by stimulus type.

	OCD Group (*M, SD*)			Control group (*M, SD*)			Effect	ANOVA results		
	Neutral	OCD	Aversive	Neutral	OCD	Aversive		F	df	ηρ2
Vigilance										
Direction of initial fixation (n)	15.80 (4.56)	15.88 (3.80)	15.50 (4.86)	17.11 (1.78)	17.25 (2.76)	18.13 (2.55)	Group X Stimulus	1.10	1.59, 47.73	0.04
							Stimulus	0.27	1.59, 47.73	0.01
							Group	2.50	1, 30	0.08
Latency to initial fixation (ms)	126.71 (43.20)	139.57 (61.65)	129.51 (52.7)	191.07 (32.90)	192.79 (36.33)	207.37 (129.51)	Group X Stimulus	1.87	1.54, 46.30	0.06
							Stimulus	1.23	1.54, 46.30	0.04
							Group	18.19[b]	1, 30	0.38
Disengagement										
Duration of initial fixation (ms)	73.57 (26.25)	74.77 (27.87)	71.63 (28.38)	100.51 (21.62)	102.89 (23.93)	102.65 (23.69)	Group X Stimulus	0.22	2, 60	0.01
							Stimulus	0.20	2, 60	0.01
							Group	12.29[a]	1, 30	0.29
Maintenance										
Total number of fixations (n)	116.31 (41.79)	140.30 (48.02)	152.13 (49.18)	113.26 (17.04)	99.61 (21.29)	118.75 (15.38)	Group X Stimulus	9.03[a]	1.27, 37.99	0.23
							Stimulus	n/a		
							Group	n/a		
Cumulative duration of fixations (ms)	22255.80 (8020.82)	28230.50 (10603.94)	31209.94 (11359.38)	28519.89 (4276.27)	24892.25 (4873.52)	30981.63 (4378.61)	Group X Stimulus	7.70	1.41, 42.16	0.20
							Stimulus	n/a		
							Group	n/a		

Note. n/a denotes non-applicable stimulus and group main effects due to the interaction being significant.
[a] $p < 0.01$.
[b] $p < 0.001$.

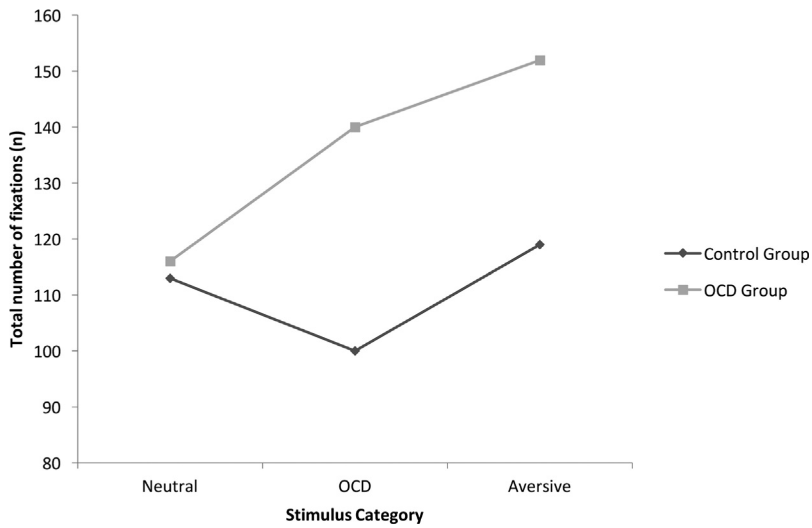

Figure 1 Group means for total number of fixations upon Neutral, OCD and Aversive stimuli.

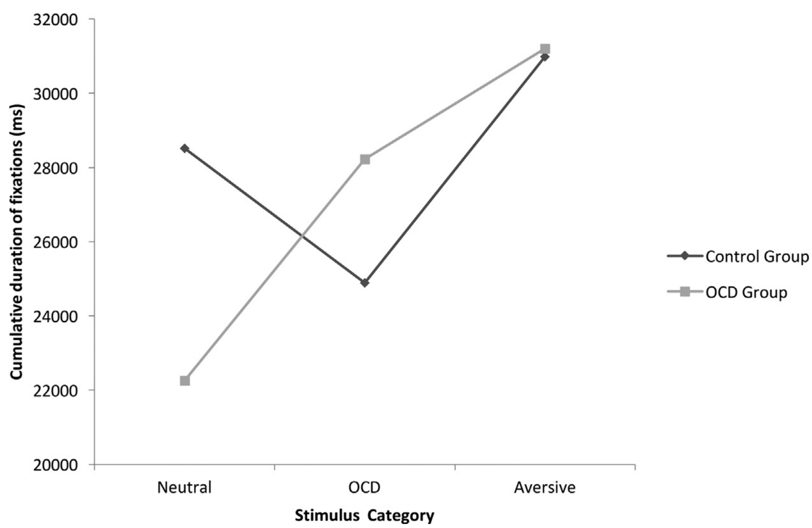

Figure 2 Group means for cumulative duration of fixations upon Neutral, OCD and Aversive stimuli.

forms that do not require bespoke technology, including self-report mapping exercises and in vivo observation. For example, a behavioural experiment might involve exposing a patient to an OCD-related object and documenting their visual engagement with the item and the wider environment to identify the biases at play. The idiosyncratic attention patterns could form part of a bespoke formulation and psychoeducation package. Bias information could also be integrated into CBT treatment plans as targets for exposure and response prevention [ERP] (e.g., habituation to visual stimuli) or attentional bias modification.

Despite the utility of the trends observed, this investigation remains a small pilot study. While most of the non-significant results had small effect sizes and main findings yielded large effects, these analyses need to be replicated in studies with larger OCD samples. Future investigations should also examine the clinical application of attentional bias understanding to CBT. Studying the concordance rate between clinical assessment of attentional biases in therapy and experimental measurement of these constructs would provide important information to improve assessment protocols. Further study of the efficacy of attentional control training interventions compared to ERP would also have clinical relevance as they may represent less aversive treatment options (Rouel & Smith, 2018).

In conclusion, the present pilot study provides promising evidence that the primary form of attentional bias exhibited by individuals with OCD towards OCD-related stimuli is maintenance as opposed to vigilance or delayed disengagement. Incorporation of attention assessment content based on these findings into clinical practice could augment therapeutic approaches. The replication of this type of eye-tracking study in larger OCD samples and further exploration of its applicability to CBT would advance the treatment of this mental health difficulty.

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Disclosure of interest

The authors declare that they have no competing interest.

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