

## Patients With Obsessive-Compulsive Disorder Check Excessively in Response to Mild Uncertainty

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Patients with obsessive-compulsive disorder (OCD) not only respond to obsessions with perseverative checking, but also engage in more general checking, irrespective of their obsessive concerns. This study investigated whether general checking is specific to OCD and exacerbated when only mild uncertainty is induced. Thirty-one patients with OCD, 26 anxiety- and 31 healthy controls performed a visual search task with eye-tracking and indicated in 50 search displays whether a target was “present” or “absent”. Target-present trials were unambiguous, whereas target-absent trials induced mild uncertainty, because participants had to rely

on not overlooking the target. Checking behavior was measured by assessing search time and the number of fixations, measured with an eye-tracker. Results showed that in both target-present and target-absent trials patients with OCD searched longer and made more fixations than healthy and anxiety controls. However, the difference in checking behavior between patients with OCD and the control groups was larger in target-absent trials (where mild uncertainty was induced). Anxiety and healthy controls did not differ in checking behavior. Thus, mild uncertainty appears to *specifically* promote checking in patients with OCD, which has implications for treatment.

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CHECKING BEHAVIOR IS ONE OF THE MOST COMMON compulsions in obsessive-compulsive disorder (OCD), with 80% of individuals with lifetime OCD reporting this as one of their primary symptoms (Ruscio, Stein, Chiu, & Kessler, 2010). Compulsions in OCD are defined as repetitive behavior or mental acts *in response* to intrusive thoughts or images (obsessions) to suppress anxiety

and prevent future misfortunes (DSM-5; American Psychiatric Association [APA] 2013). It is thus assumed that compulsive behavior is driven by obsessive uncertainty about frightening prospects. The same assumption underlies cognitive theories of OCD (e.g., Rachman, 1997), which view obsessions as the core feature and checking compulsions as the result of preceding frightening obsessions that typically relate to potential personal guilt. For instance, obsessions about harming a loved one (e.g., stabbing someone while doing the dishes) may be misinterpreted as morally offensive (e.g., equivalent to harming someone) or as likely leading to an unwanted sequel (e.g., assault), which needs to be prevented by compulsively checking all knives and scissors in the house. Thus, both the influential DSM and cognitive theories assume that compulsions such as checking are “output” resulting from preceding frightening thoughts.

However, there are indications that patients with OCD also show subtle checking behavior in the absence of obsessive concerns. Recently, Gillan et al. (2011, 2014) demonstrated that patients with OCD have a deficit in goal-directed learning, which causes them to overly rely on their habit system. In these studies, patients with OCD were asked to perform an appetitive instrumental learning task, which induced habits by rewarding certain behaviors (Gillan et al., 2011), or a shock avoidance task wherein they could avoid receiving electric shocks by responding correctly to warning stimuli (Gillan et al., 2014). When the habitual responses were installed, one response was devalued by removing the reward or disconnecting the electrodes of the shock, while another remained valuable. Patients with OCD did not differ from healthy controls in responding for valuable outcomes, but they did show elevated responses towards devalued outcomes, which indicated overactive habits. This suggests that compulsions may be viewed as excessive habit learning, which inhibits OCD individuals to abstain from this behavior even in the absence of prior obsessions.

In a comparable vein, a recent study showed that patients with OCD use more checking behavior than healthy controls in a basic image-comparison task (comparing two images that were presented simultaneously and indicating whether they were identical; Jaafari et al., 2013). Moreover, OCD checkers used increased checking behavior in a delayed matching to samples task (comparing two images that were projected with a delay in between and indicating whether they were identical), which was unrelated to the stimulus-evoked anxiety (Clair et al., 2013). This emphasizes the automated and habitual part of checking that is displayed irrespec-

tive of experienced obsession-related anxiety. Additionally, Harkin, Miellet, and Kessler (2012) examined mental checking behavior in healthy participants with either high or low checking tendencies with an experimental eye tracking paradigm. In their experiment, participants had to perform a memory task that consisted of 3 phases. In Phase 1 participants were presented with 4 letters located randomly in 4 of 6 possible locations on a grid, and had to encode the identity and location of each letter. Then, during the delay period of the memory task the “probe-1 question” requested the location of a specific letter, which had been either part (resolvable trial) or not (misleading trial) of the encoded set. Participants could either answer what the location of the letter was or “skip” the trial if they believed the letter was not present in the encoded set. Finally, in Phase 3 the “probe-2 question” was the actual memory test for each trial and required participants to indicate if a letter was correctly located with respect to the originally encoded set. Results showed that in misleading trials high-checkers checked longer than low-checkers, and specifically that high-checkers spend more time checking and fixated more often in stimulus locations as well as locations that had actually been empty during encoding. This indicated that high checkers are less able to ignore misleading information and that this impaired response inhibition may lead to excessive (mental) checking.

However, impaired response inhibition may not be the only explanation for excessive general checking behavior. Importantly, patients with OCD not only report excessive uncertainty and doubt in the area of their obsessional concerns (Salkovskis, 1985), but also show (mild) uncertainty in unrelated areas. For instance, it was demonstrated that patients with OCD are less confident about their general knowledge (Dar, Rish, Hemesh, Taub, & Fux, 2000), and have less confidence in their perception, attention, and memory (Hermans et al., 2008). Does this mild uncertainty, which is thematically unrelated to extreme obsessive concerns, stimulate general checking in OCD? To examine this issue, a novel, experimental eye-tracking paradigm was developed in which checking behavior could be measured in both certain and mildly uncertain situations (Toffolo, van den Hout, Hooge, Engelhard, & Cath, 2013). In this paradigm participants performed a visual search task, in which they had to indicate whether a target was “present” or “absent” (see Figure 1). The target-present trials were unambiguous; the response “present” was based on straightforward inspection of the target, which therefore reflected

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